TEXTILE MACHINERY

Part 3

WOOL COTTON SILK

From FIBRE to FABRIC

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LOOM WORKS

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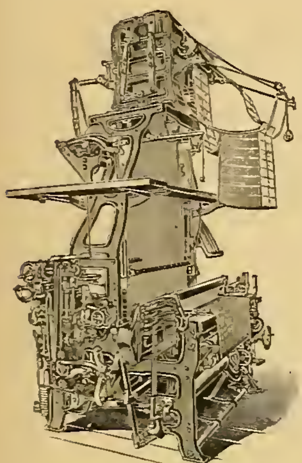

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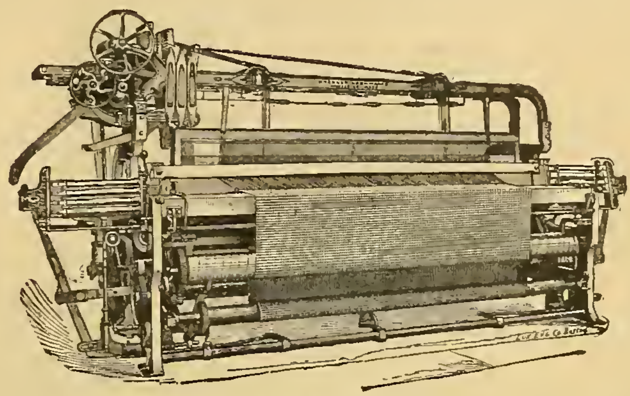

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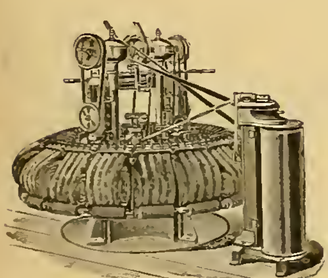
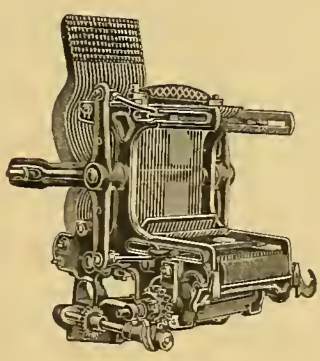


WOOL COMB



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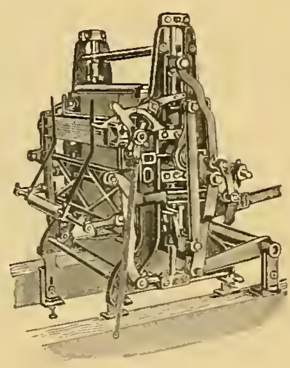

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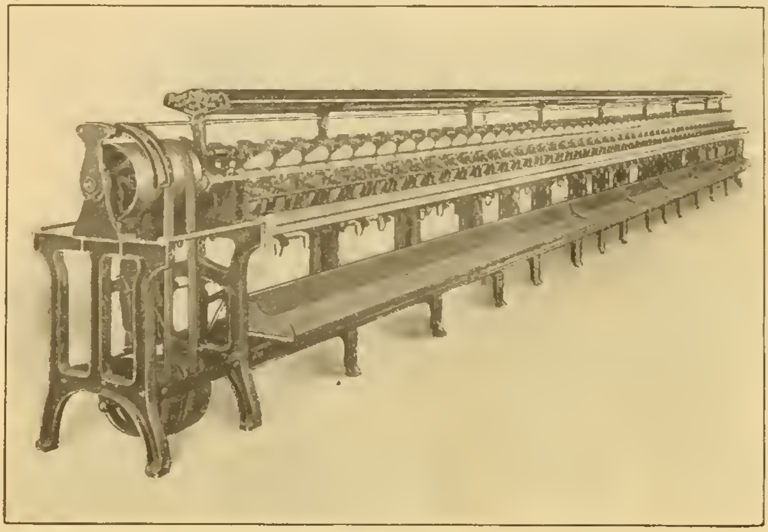

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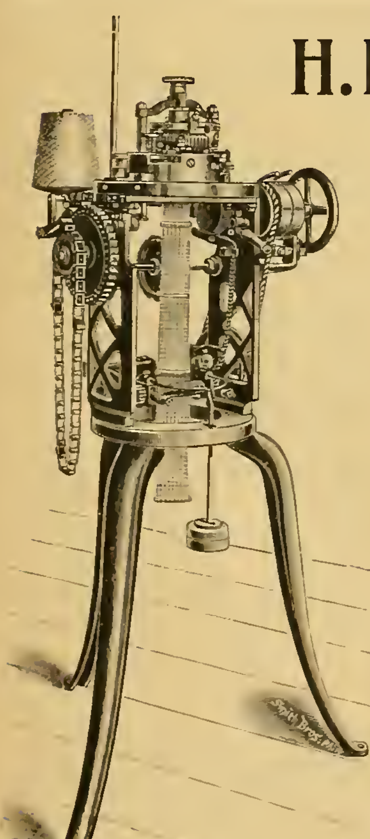

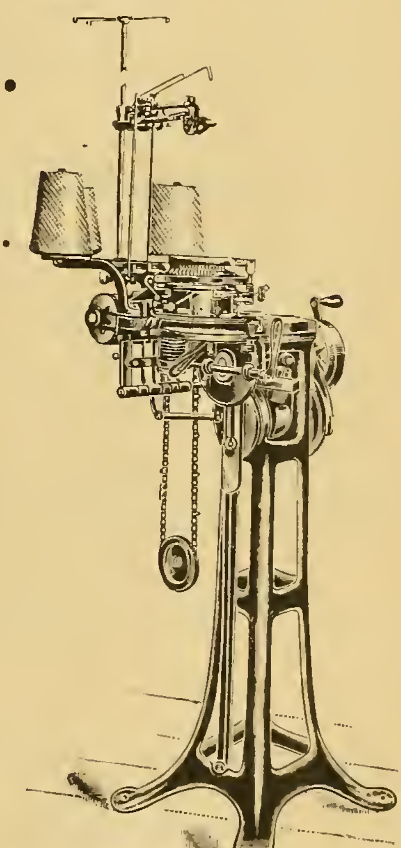

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PREFACE.

The object of this volume is to present to Textile Manufacturers, Mill Managers, Overseers, Commission Merchants and Students, the first illustrated treatise on "Modern Textile Machinery and Processes in use for converting the Fibres into Fabrics, covering Cotton, Wool, Silk, etc."

The book will be of special value, since there are no books in print with reference to some of the various branches of textile manufacturing, like Knitting and Modern Knitting Machinery; Modern Dyeing, Bleaching, Mercerizing, etc., Machinery; Finishing Woolen, Worsted, Cotton and Silk Fabrics.

Due regard, however, has also been paid to Preparatory, Carding, Spinning, Winding and Weaving Machinery; Dyestuffs, Chemicals, etc., as well as the various Auxiliary Machinery, Devices and Supplies for each department of the mill.

Another interesting chapter is the one on Heat, Power, Transmission and Accessories to Mills, with a description of some of the most important items to Modern Textile Plants.

SUMMARY OF CONTENTS.

RAW MATERIALS.

WOOL: Its Characteristics, Classes of Sheep and Wool, Grading and Sorting, Theory of Felting, Chemical Composition, Other Animal Fibres, Wool Scouring, Drying, Artificial Wools, Carbonizing, etc.

COTTON: Its Characteristics, Spinning Properties, Varieties, Grading, Mercerized Cotton, Tests, etc.

SILK: Cultivated Silk, its Properties, Silk Throwing, Varieties of True Silk; Spun Silk, Weighted Silk, Artificial Silk, Tests, etc.

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COTTON: The Revolving Flat Card, Various Improvements to it, Stripping and Grinding; The Drawing Frame, Metallic Drawing Rolls; Flyer Frames, Differential Motion; Improvements to Speeders, Spinning and Twisting Frames; The Mule; Loop Banding Machine; Humidity, Humidifiers, etc.

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Description of Modern Machinery Used for the Various Processes for Dyeing, Bleaching, Mercerizing, etc.; Description of Dyestuffs and Chemicals with Directions for Using.

FINISHING PROCESSES AND MACHINERY.

The First Treatise on the Finishing of Woolen, Worsted, Cotton and Silk Fabrics ever Published, with a Complete Description of the Machinery used.

HEAT, POWER, TRANSMISSION, Etc.

Principles and Calculations on Heat, Power, and Transmission of Power; Explanation of Latest Improved Accessories Relating to Construction and Equipment of Modern Textile Manufacturing Plants.

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RAW MATERIALS.

WOOL.

Wool is the hairy covering of the sheep; it is softer than the actual hair, also more flexible and elastic, and, besides having a wavy character, it also differs in certain details of surface structure. Although wool and hair are found in the fleece of the sheep, yet wool predominates in all cases, hair in the properly bred sheep being practically absent. The covering of certain other animals, such as the Cashmere goat, the Angora goat, the Llama, etc., are also classed as Wool.

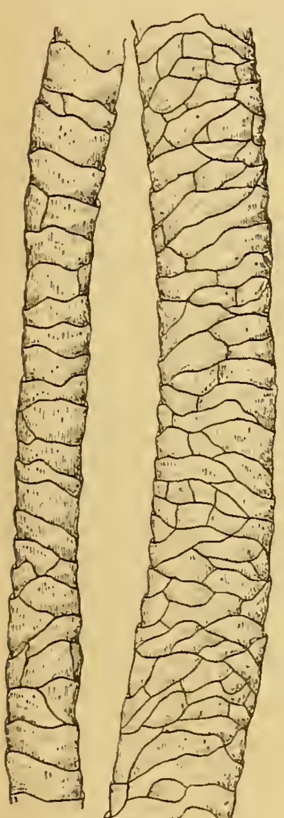


Fig. 1.

No doubt in its original wild state there has been less wool in proportion to hair in the covering of the sheep, but under the influence of domestication the hair has largely disappeared and wool has taken its place.

Wool fibres serve as the protective covering to the hide of the sheep, and are made into woolen fabrics, chiefly for outside garments as well as for underwear. In the latter instance they differ from cotton or linen fabrics in that a cotton or linen fabric, worn next to the skin, conducts heat, becomes moist, and keeps the skin damp and cool, whereas wool does not conduct the heat from the skin, and consequently has the reverse effect.

Under the microscope, wool appears as a solid rod-shaped substance, the surface of which is covered with scales, as shown in Fig. 1, which is a view of two typical wool fibres highly magnified. A transverse section of a good quality wool fibre will show at least two parts, whereas in the poorer qualities a third part will be frequently found.

The first or outer part consists of a circular layer of scales, partially overlapping each other somewhat in the same manner as the scales of a fish, being arranged with more or less regularity, according to the fineness of the wool. The size of the individual scales varies, some surrounding the circumference of the fibre to a greater or less extent than others. The upper edges of the scales are more or less free, the lower being apparently imbedded in the interior of the fibre. Although these scales are also found in hair, yet in that fibre they are more deeply imbedded, lie flatter and present very little free edges, a feature readily seen from Figs. 2 and 3, of which Fig. 2 shows, magnified, a wool fibre treated with caustic soda, and Fig. 3 a human hair, similarly treated, so as to show the serrations distinctly.

These scales are more strongly and regularly developed in proportion to the fineness of the wool, whilst in coarse wools they are small and irregularly placed. Underneath these scales rests the true fibrous material, generally colorless, but sometimes also colored, constituting nearly, and sometimes entirely, the whole internal portion of the fibre, being composed of narrow spindle-shaped cells, which have assumed a more or less horny character.

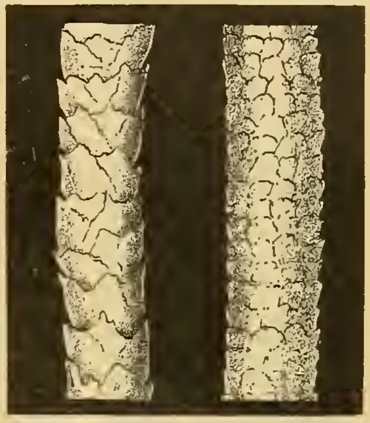


Fig. 2. Fig. 3.

The third or central portion of the fibre, when present, is known as the medullary portion, being formed of several layers of rhombic or cubical cells, which appear as the marrow of the fibre and traverse its whole length or appear only in parts. Under the microscope this substance is dark, but may be rendered transparent by boiling the fibre in glycerine and oil of turpentine. As previously mentioned, in the better classes of wool this medullary portion is entirely absent, its presence or absence depending upon the breed, health and care of the sheep, and also the part of the body upon which the wool is grown. Wool fibres which contain this medullary portion are less suitable for manufacturing purposes than such where this portion is absent. True wool fibres are of equal diameter throughout their entire length, lamb's wool alone tapering off gradually to a point.

Wool fibres, with reference to their general appearance, are characterized by their wavy structure, being another item depending upon the breed of the sheep. Fig. 4 shows such a series of curves characteristic to wool fibres as compared to hair, where it is absent, said curves being technically known as the *wave of the crimp*. While wool fibres grow separately on the body of the sheep, yet, owing to their wavy or crimpy nature, referred to, they form themselves into locks, which are simply a great many fibres more or less adhering to each other, Fig. 5 being a specimen of such a lock.

Fig. 4.

The wool fibres, thus more or less in locks on the sheep's back, would have a tendency to felt or mat and thus spoil their properties for manufacturing into yarn, if it were not for their natural yolk, which is a natural secretion from the skin and protects the fibres, said yolk being most prevalent on the back and shoulders of the sheep, *i. e.*, the places yielding the best fibres.

Wool that is shorn from the sheep while living is termed fleece wool. It has better felting properties than that obtained from the sheep skin after life becomes extinct, the latter wool being known as pulled wool.

Fig. 5.

With reference to the introduction of the sheep into this country, the first of these importations consisted of the common native sheep of Spain, which were introduced by the Spaniards into that part of the American Continent which became subjected to its discoveries, including the West Indies. About the beginning of the seventeenth century the first English sheep were introduced into Virginia (Jamestown). Repeated importations were made during the next two centuries, and thus was founded a very good specimen known as the Virginian sheep, being a long-wool sheep. Leicester, Cotswold and Southdown sheep, etc., have since been imported and crossed with the same. The first merinos were imported by a Mr. Foster, of Boston, who presented the same (two ewes and one ram) to a friend who was in the sheep-raising business; but somehow this friend transferred these costly sheep into mutton. This same friend of Mr. Foster's paid a short time afterward $1,000 for one merino ram. Several importations of merinos were made later on by different parties, but the main effort to firmly establish the merino belongs to the late Hon. W. Jarvis, who was our Consul in Lisbon in 1809 and 1810. In 1809 he bought and shipped to this country 3,850 head of the choicest kind of Spanish merinos, duplicating this shipment with 2,500 head in 1810. In 1851 Silesian merinos, then the choicest sheep of Europe, were imported, and readily became acclimated. The ewes from this kind shear from 8 to 11 pounds and the rams from 12 to 16 pounds of unwashed wool. The length of staple is from 2½ to 3 inches, and the color of the wool dark on the outside, its yolk containing plenty of oil of a white and free, but not a sticky character. The best grade of our merinos at present produce what is acknowledged as the finest wool in the world, the diameter of these fibres being 0.003 inch, with about 6,000 scales per inch.

The fibres of fine wool grow very closely together upon the skin. The pure merino has from 40,000 to 48,000 fibres to a single square inch, while coarse wool breeds contain only from 5,000 to 6,000 to the square inch.

In judging wool, the buyer must take the following points into consideration, all of which directly increase or decrease its value to him: (1) Quality, (2) Strength, (3) Elasticity, (4) Length of Staple, (5) Trueness of fibre (or blood), (6) Cleanliness, (7) Absence of kemp, (8) Lustre, (9) Color, (10) Moisture.

Quality indicates a certain character in fineness of fibre the manufacturer requires for certain fabrics to be made by him.

The two general classes of wool are Clothing and Combing wools. There is no absolute standard, because improvements to machinery are constantly made, enabling by means of them a shorter staple to be combed, however at present it may be considered that any fleece that falls considerably below three inches in length of staple is not used for combing purposes. The grades under the clothing class also refer to the fineness of the fibre without reference to the particular breed of sheep, since a wool grader is, as a rule, not versed about breeds of sheep. A skillful breeder will learn to discern the character of a fleece by its external surface, whereas the wool grader examines a fleece almost entirely from the clipped ends of the fibres. He learns that certain characteristics are almost always associated, so that a skillful grader knows at a glance into what pile a fleece should go, provided it has not a weak fibre.

The merino wools, or clothing wools, are commonly classified as Picklock, XXX, XX, X, one-half blood, three-eighths blood and one-fourth blood.

Picklock is an extremely fine fibre, of which a very little is found in the remaining Saxony flocks of breeders in Western Pennsylvania. Most of these breeders have modified their flocks to obtain heavier fleeces of longer fibre, bringing much more money. There is also very little of the XXX grade, which is only exceeded in fineness by the purest breeding of Saxony merinos.

The mass of high-grade clothing wool is of the XX and X grades. XX is the finest of the standard merino flocks of the country, and includes nearly all merino fleeces not long enough to comb. X is the coarse, uneven merino fleece, such as contain coarse hair that extends beyond the external surface of the fleece. Many of the very heavily wrinkled merinos produce this grade. These include all of the merino wools except the Delaine; that belongs under the head of combing.

The lower grades are made by dealers according to fineness and quality, without a knowledge (which would be impossible to attain) of the precise fraction of merino blood of the sheep producing them. The one-half blood grade largely receives the fleeces from Merino-Southdown and Merino-Shropshire crosses, also some of the fine Southdown fleeces. The three-eighth blood grade takes much of the pure Down fleeces of the families that were originally a cross of the Southdown with some of the long-wool breeds, which is in fact most of them. It also takes them from the more recent crosses of Merino and some of the long wools. The one-fourth blood, or coarse, is a small grade of inferior short wool, too coarse for either of the above grades, a product of mongrel breeding and poor care. All the above grades comprise only the shorter fibred fleeces. The majority of half-blood wool from well-kept sheep and that from highly-kept Down flocks go into combing grades.

The combing wools are of two classes. Formerly they were exclusively of the English mutton breeds, or at least were not of merino origin. The exigencies of wool manufacture, the insufficiency of supply of true combing wool, made it however necessary to adapt machinery for combing the merino carding or felting wools. This rendered necessary a fibre longer than 2½ inches, which is about the length of the finer qualities. A considerable difference always existed in length of fibre of different families under different climatic and nutritive conditions; it was easy, by selection and breeding, to increase the length, a process of modification which has been in progress for many years. This merino division of combing wools known as "Delaine" is classified in three grades—fine, the finest of long staple; medium, not quite so fine, and low, of combing length and a little finer than the combing wool of mutton breeds. Besides length and strength of staple, a fleece to be Delaine must have that character of fibre that spins well. This is indicated by a closely clinging fleece. The opposite character is indicated by a fleece in which the locks are somewhat detached and have a sort of tapering, corkscrew end.

The combing wool of mutton breeds are classed as three-eighths blood, one-fourth blood, common and braid, the last being the long and lustrous wools of the Lincolns, and also of Leicesters and Cotswolds.

The wools intended for worsted spinning are better with latent than strong felting properties, whereas with reference to wools for carding, *i. e.*, clothing wools, felting is a potent factor, especially if required for fabrics where fulling during the process of finishing is essential. In worsteds, wools that have few felting qualities, but otherwise are of good, long and fine staple, are often preferred on account of their lustre.

Besides Clothing and Combing wools we find what are known as *Carpet wools*, they being coarse wools obtained from the Mexican sheep as bred extensively in our Western States, Canadian breeds of sheep, or wools imported from Asia (the fat-tailed sheep), etc., etc., and are considerably intermixed with hair.

The Strength of Staple is the next important consideration. This is determined by pulling a few fibres out of a lock of wool, grasping them at their ends with the thumb and finger of both hands, and when a steady, hard pull will soon show weakness in them, provided any exists. Weakness of the staple may or may not prove a barrier to the use of a wool under consideration, it all depending upon the extent of this defect and whether the material is destined for warp, combing or filling yarn, in the first two instances strength being absolutely necessary.

Elasticity of Staple is also a very essential characteristic and may be described as the facility with which all good wools assume their former proportions after being compressed or stretched. This quality is one of considerable moment, as it practically determines the working quality of the wool, since an elastic fibre will work up with less loss than a non-elastic, as the wool will stretch under strain during its manufacture into yarn and fabric, and thus accommodate itself in the passage through the different processes without breaking the fibre, in turn reducing waste to a minimum.

Length of Staple is a point regulated by the class of yarn for which the wool is required, and as mentioned previously, short staple wools are more adapted for carding purposes, while longer staples will result in less "noil" in combing. For example if required to produce the filling for a lot of face-finished fabrics, as Doeskin, Broadcloth, Beavers, Kerseys, etc., long staple stock would be unsuitable, since in this instance we must produce a yarn with a velvet or nap, as we would technically call it, *i. e.*, a yarn resembling a chenille thread, *i. e.*, a great number of ends of the individual fibres as composing the thread, protruding from the body of the thread so as to assist us during the process of finishing the cloth (gigging or napping) in getting a full nap or pile on its face, produced by the ends of the fibres extending out of the body of the threads, or in other words out the face of the cloth. For warp yarns for these fabrics we may want a longer staple wool, so as to produce a yarn which will weave well, yet on account of the nap required for the finished cloth, we must be careful not to use a longer staple than absolutely necessary. In purchasing it is therefore essential for a manufacturer to keep in view the kind of cloth he is intending to produce. Clothing wools are usually softer, finer and shorter than combing wools; but, on the contrary, short, fine wool is often combed, so that no hard and fast rules can be laid down in these respects. Softness is generally a desirable quality, but if we have to make a cheviot or serge character of fabric it is not very essential, as the property for which these cloths are noted is a certain crispness of handle and touch, which can only be obtained from a wool possessing these properties in its natural state.

Trueness of the Fibre relates more or less to strength of staple, previously referred to. Under true or even fibres, we classify those having a nearly uniform diameter throughout their entire length, whereas, fibres wanting this character are termed untrue or uneven, the latter being characterized by variations in diameter on the same fibre, a feature which will seriously interfere with the working quality of the wool. A specimen of an untrue fibre, highly magnified, is shown in Fig. 6, which will readily show that where these abnormal forms occur, there are changes in the form and size of the outer scales as well as in the diameter of the fibre, consequently the internal structure of the fibre must be equally affected, thus reducing the strength and elasticity of such fibres. It is well known that a chain is no stronger than its weakest link, and, in a similar manner, we may say that the strength of a wool fibre is proportionate to its smallest cross section; so that the buyer, in judging of such a wool would measure its value to him by this very defect.

Fig. 6.

Untrue fibres are found most frequently in the fleece of inferior bred or neglected sheep, or are the result of sickness of the animal. In some instances we find a sudden contraction in diameter of the fibre at certain points, which is frequently sufficient to give the edge of the fibre a decidedly notched appearance, whereas in other cases we find a more gradual contraction.

Cleanliness of Wool means absence of superfluous grease and all dirt, the first being composed of neutral fats and the latter of earthy matter, burrs, etc. The presence of these impurities in some classes of wools—for example, in South American wools—may reach 75% of the weight of the fleece, whereas in connection with other wools it often falls as low as 50% of the weight. Consequently good judgment as to the probable amount of actual wool fibre in a given lot of wool must be exercised by the buyer, requiring an experienced person for this position.

Absence of Kemp. Kemps are another kind of imperfect fibres met with in wool. The characteristics of an ordinary kemp fibre is a hair of dead silvery white, thicker and shorter than the good wool. Kemp fibres do not seem to differ considerably in their chemical composition from the good or true wool fibres, but possess no absorbent power, thus resisting either entirely, or partly, the entrance of dye-stuffs, in the latter case producing a different shade from that imparted to the good fibres of the same lot, hence kemp fibres will be readily detected in dyed lots of wool, yarns or fabrics. The presence of kemp fibres in a lot of wool will also result in poor spinning and poor yarn, since they will not thoroughly combine with the good wool, and will show prominently on the face of the yarn or fabric. Neither will they felt. The accompanying illustrations Figs. 7 and 8, are given to illustrate various degrees of these kempy fibres. Fig. 7, A, is a fibre in which the kempy structure continues throughout the entire fibre, and which looks more or less like a glass rod, yet has short and faint transverse lines which indicate the margins of the scales. When the change is a complete one, even the application of caustic alkali fails to bring out the lamination of the scales with any degree of distinctness. In Fig. 7, B, a fibre is shown in which the change from true wool to kemp is only partial. The lower portion of the fibre shows wool structure (the scales being distinctly visible), whereas the central portion of the fibre shows kemp structure (having the scales closely attached to the body of the fibre, giving the latter the usual ivory-like appearance). The upper portion of the fibre leans again towards wool structure. Both illustrations, Figs. 7, A and B, are representations of fibres seen by reflected light. In Figs. 8, A and B, illustrations are given of kemp fibres seen by transmitted light. In Fig. 8, A, a kempy fibre is seen with transmitted light and where we see again a gradual passage of wool structure into kemp. In this case, with transmitted light, the kempy part retains almost the same transparency as the wool, but exhibits none of the interior arrangement of cells. The fibre shown in Fig. 8, B, is practically kempt structure. In the wild breeds of sheep kemp is plentiful and appears to be part of their nature; and in domestic sheep it may be looked upon as an inherent tendency to reversion to the original and native type of the animal. It is sometimes found in the finest grades of wool as well as in the coarsest. In the fine wool sheep, kemp occurs most frequently in the neck of the fleece and on the legs, whereas in the coarse wooled sheep, it may be found on any part, especially if there is a lack of trueness in the blood. The presence of kemp in a fleece greatly depreciates the value of the lot of wool, and a buyer is always cautious to ascertain if wools contain them.

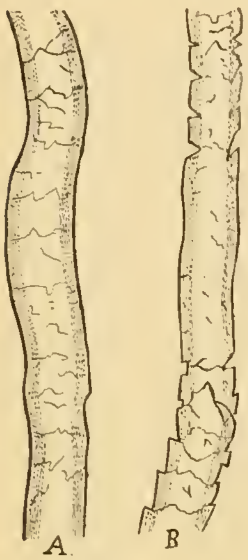


Fig. 7.

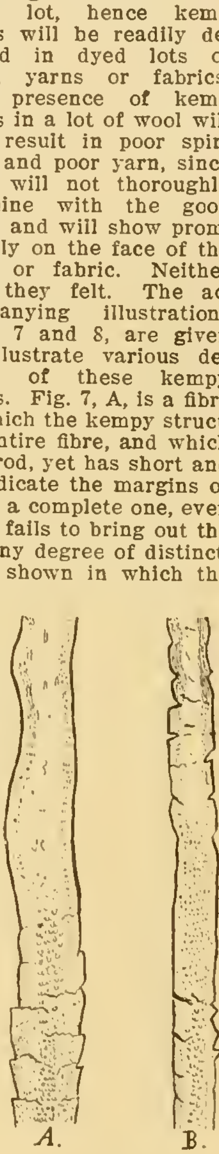


Fig. 8.

The Lustre of Wool varies considerably in the different breeds of sheep, straight, smooth, stiff wool having more lustre than curly merino wool. The amount of lustre of the wool depends partly upon the internal structure of the fibre, but chiefly upon the varying arrangement and transparency of the scales on the surface of the fibre. Some classes of wool are characterized by the lustre of their fibres and in connection with such wool, its presence is a sure indication of a healthy fleece and a good guarantee of its working qualities.

The Natural Color of Wool, and the one in which the same is most generally found is white, in less quantities and in lower qualities, we find brown, black, gray, red, or a faint yellow. White, though not always essential, is a very desirable quality.

The color varies to a considerable extent with the kind of soil on which the sheep pasture, rich grass lands favoring a pure white, whilst a sandy soil usually tinges the wool a faint yellow. This coloration of the fibre is caused by the presence of an organic pigment in the cortical portion of the fibre. For dark shades this natural color of wool is not of great objection, but for light delicate shades of colors it is essential to have a good pure white fleece.

Moisture in Wool as it comes from the sheep's back varies from 6 to 24%, and for which reason attention should be paid that no excess of it is present, since wool loaded with excess of moisture means loss to the buyer.

To ascertain the exact amount of moisture present in a lot of wool, take a sample of it, weigh it, and then subject it for half an hour to a temperature of 212° F. The wool is then weighed and the procedure repeated until the latter weight is constant. This weight subtracted from the original weight gives the moisture in the sample and from which the percentage can be readily ascertained.

No standard of moisture for wool in grease exists, since the amount of moisture in unwashed wool varies with the amount of fatty matter it contains; the more fatty matter, the less moisture; but with reference to scoured wools, the permissible limit of moisture in wool is:

17% measured with perfectly dry wool as a basis for clothing wool; and

18¼% measured with perfectly dry wool as a basis for combing wools.

VARIOUS CLASSES OF SHEEP.

Amongst the breeds of sheep of consequence in this country are:

The Lincoln Sheep, being a breed originating in Lincolnshire, England from crossing the native breed of that part of the country with the Leicester breed.

The Leicester, or what is now called the New Leicester sheep, was originated by crossing the old Leicester with several different species of sheep. The fleece is fine, glossy, white and of moderate length, the external structure of the fibres being shown highly magnified in Fig. 9.

The Cotswold Sheep originated in Gloucestershire, England, and received their name from the hills on which they were raised. These sheep produce a large, white, coarse, long wool, and the breed has become practically native to this country. The structure of the fibres is shown in Fig. 10. In the Cotswold, we find the lines indicating the edges of

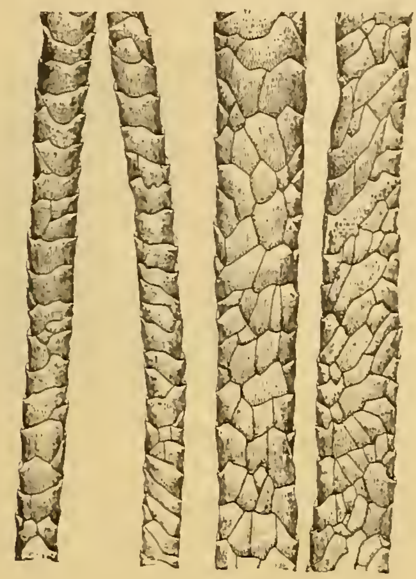


Fig. 9.

the scales more irregular and broken than in the Leicester and Lincoln; and more so in the Lincoln than in the Leicester. In all of them the scales are more or less oblong, but in width they are much larger than in the Downs and Merinos.

If we compare locks of Cotswold and Lincoln wool

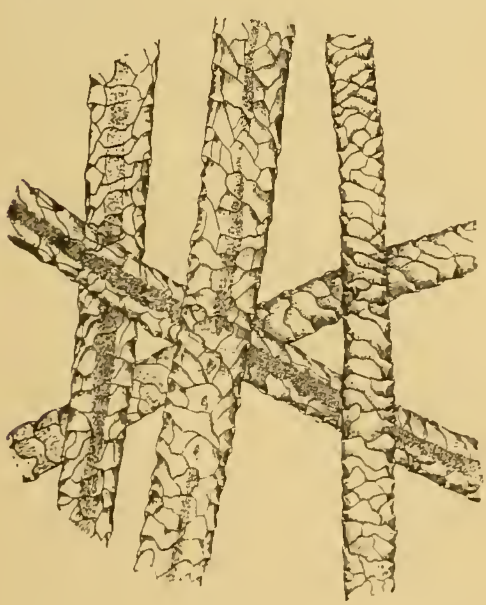


Fig. 10.

we find that a larger proportion of the fibres in the former are more white and opaque than the others, and that the whole bunch has very much less of lustre than the Lincoln wool. When these Cotswold fibres are examined in the natural state with the microscope, we find extending through the centre a band of matter more or less broad, which is very much more opaque than the matter surrounding it.

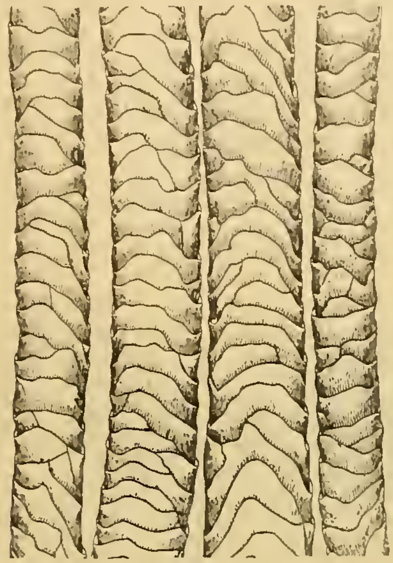


Fig. 11.

The forms of this band are given in the illustration of Cotswold wools. It appears to be of irregular thickness and to allow more light to pass through at certain places than at others.

The Oxford Down Sheep is also of English origin, being a cross between the Cotswold ram and the Hampshire Down ewe. The wool produced by the Oxford Down is finer and firmer than that of the Cotswold and has a staple of from 5 to 7 inches in length, the average weight of the fleece being 9 pounds. Fig. 11 shows typical specimens of these fibres highly magnified. The wool of this sheep, as well as that from the Cotswold, the Leicester and the Lincoln are the most important classes of what we term long staple wools, vice versa the Merino and the Southdown sheep, which are the most important

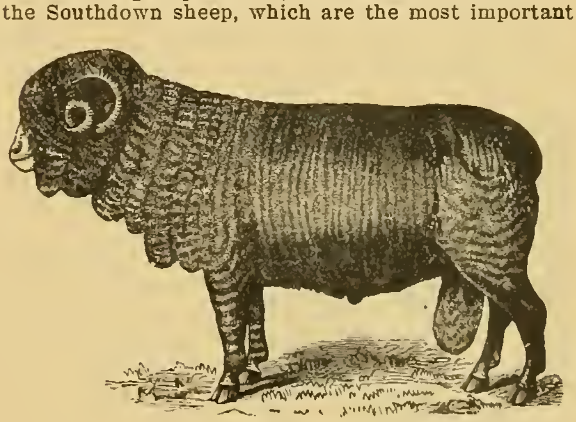


Fig. 12.

breeds of sheep, producing what we term short staple, carding or clothing wools.

The Merino Sheep. The original home of this animal is Spain, from there they have been spread during the last two centuries through every quarter of the globe. The great value of the merino wool consists in the fineness and felting property of their fibres, as well as the weight of the fleece, the average weight of which is 8 pounds from the ram and 5 pounds from the ewe.

In Fig. 12 a specimen of the Saxon merino is shown, being an animal superior in quality of wool produced to the Spanish merino, and is a grade of merino previously referred to as found to a very small extent in the western part of Pennsylvania (and Eastern Ohio), producing what is considered the finest grade of wool (picklock) in the market.

Fig. 13 shows the average American merino, which is a fine white wool sheep of medium size, equally built, the body rather short, round and thick. It has good quarters, stout legs which are short and woolly,

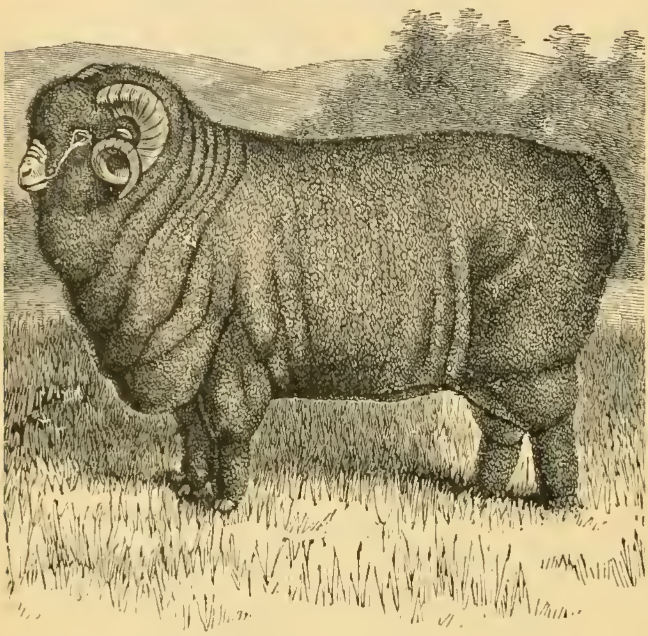


Fig. 13.

short ears; its cheeks and forehead to the eyes being thickly covered with wool, its skin being wrinkled or in folds, and of a rosy color. This sheep produces the XXX, XX and X grades of our wool supply. Typical specimens of merino fibres have been previously given in Fig. 1.

Fig. 14.

The Southdown Sheep, while originating in England, has become also a very important factor in sheep raising in this country. This breed is characterized by the dark faces and compact fleeces of the sheep, the average weight of the fleece being 6 pounds and the wool is well adapted for spinning good grades of woolen yarns.

Imported Wools. Amongst the most important imported wools we find the Australian Merino. Different grades of them are raised according to climate and soil as well as different breeds of sheep crossed with merino, one of the best and most important being the Leicester Botany, typical fibres of which from different portions of the fleece are given in Fig. 14. In these fibres we have the curl and softness of the merino, united with the length and lustre of the best deep-grown English wool. South America, chiefly the Argentine Republic and to a less extent Uruguay, also exports merino wool, which is characterized by its immense amount of screw burrs adhering to the fleece.

Fig. 15.

With reference to coarse imported wools (carpet wools) a most important class is that obtained from the fat-tailed sheep of Asia. These sheep are characterized by their enormous tails, which is one mass of fat. The wool is coarse and freely intermixed with dark colored hair, Fig. 15 being a magnified view of several fibres, showing the structure of fine, coarse and mixed fibres of a fleece from this sheep.

Hog's Wool, is a term applied to wool fibres that are clipped from the lamb during its first shearing. These fibres are characterized by a curly appearance and pliable staple, and are well suited for spinning fine woolen yarns.

Burry Wools. We should always try and obtain our wool as free from burrs as possible. With reference to domestic wools, burrs will not be met with extensively, and when found, are readily removed by means of burr picking. Although now and then, burry lots of wool or individual fleeces may be met with in domestic wool, the name "burry wools" more particularly referring to wools as imported from South America, and which wool is literally speaking a home for burrs, the fleeces being covered with them. These burrs or burr weeds are quite different from ours, and are known as screw burrs, having spiral or conical seed-pods covered with densely-set horny spines, which readily hook into the woolly covering on the sheep's back and are hard to remove, requiring for this purpose an extra efficiently built burrpicker, or if the same is not on hand, or in connection with extra bad cases, carbonizing.

Wool from Slaughtered Sheep. Besides wool as taken from the live sheep, we also come in contact with such as taken from the slaughtered sheep and where the wool is removed from the skin in two ways, *i. e.*, either by cutting or by a chemical process. The first process requires more labor than the chemical process, hence is less practiced, but by means of it the wool fibres will not suffer in their quality. The chemical process, and the one most generally practiced, consists in steeping the pelts for a length of time in lime or in a dilute solution of sodium sulphide, by means of which the fibres become sufficiently loosened at their roots, so that they can be readily removed from the skin. Such wool is known as "pulled wool" and on account of the hurtful action of the lime or sodium sulphide, is inferior in quality to shorn wool.

The process of using sodium sulphide so that the wool may readily be removed from the pelt is as follows:

The skins are placed on tables flesh side up. Care should be taken that they are perfectly smooth on the surface. Apply sulphide of sodium to the skins with a vegetable fibre brush or a swab made of burlap. A sufficient quantity of the solution should be used to cover the skins fairly, but not enough to run off skins. Fold the skins up, wool out, and place in a pile. In cold weather 6 to 8 may be put in a pile together, but in warm weather 2 to 4, and if they are to lay 24 hours or longer in warm weather it will be much better to single them; that is, lay them out so that one will lay over the next and so on.

If possible this operation should take place in a cool, moist room and in winter care should be taken that the skins are not frozen. The wool should start well in 5 to 6 hours after painting. It makes much cleaner work to pull next day after painting. Cleaner and better results are obtained to pull the skins double as they come from the painters, for in this way only the wool side is exposed and there is much less chance for any of the sulphide to come in contact with the wool.

Wool from Diseased Sheep, live or dead, it will be readily understood, is inferior in quality to wool taken from a healthy animal of the same breed. Not only will such wool cause poor yarn, but it also will behave differently in dyeing, as compared to the healthy fibres, it will not dye as full a shade.

GRADING AND SORTING.

The wool after being shorn from the sheep at the ranch or farm, as the case may be, is next folded and rolled up, each fleece in a package and tied up with a string, in order to make further handling easier, any number of these fleeces being then placed in a large sack and in this manner reach either the commission merchants in the East (Boston being the wool centre) or the larger mills which send out their own wool buyers direct.

In the putting up of wool for market there has long been a cause of variance and friction between grower and buyer in all parts of the country. The buyer complains of filthy tags and dirt in the fleeces, and of the use of unnecessary quantities of unreasonably large twine of a fibrous quality that injures the fabric in the manufacture, by means of these vegetable, jute, hemp or waste fibres of every description intermingling with the wool fibres, and in turn being directly the cause of an unnecessary amount of specks in the fabrics, the removal of which requires time and labor and consequently means extra expenses to the manufacturer. The same also refers to the quality of bagging used by the sheep raiser in packing the fleeces. On the other hand, growers say that when they exercise the greatest care in all these respects, the buyers will allow no discrimination in price. There is doubtless some truth in these countercharges, yet a lot of fleeces carefully handled, of even quality, would claim some consideration from a practical buyer, or they could be sent to a reliable commission house and command a price that would pay well for the extra care.

The advisability of washing sheep before shearing has long been a subject for discussion. Its purpose is the better condition and higher price of the wool. The difficulty presented, which appears to be insuperable, is in obtaining a uniform condition of cleanliness. Necessarily some flocks have more foreign matter in their fleeces than others; there is always great difference in the amount of yolk or grease which the ordinary washing does not affect. Facilities for washing are very poor on many farms and ranches, and different methods of washing are very unequal in their results. If a grower is not inclined to be exactly square in his dealings, or if his perceptions of strict honesty are a little confused by the unfairness of buyers in making no discrimination as to degrees of cleanness in buying, he may slight the process or drive the flock through muddy water. Altogether most flock raisers prefer not to wash, and nearly all dealers unite in a preference for unwashed wools. They find so much unevenness, that in buying washed wool, they usually make some deduction from established washed rates, and in some cases pay little more than for unwashed. It is said that much of the country washing is a positive disadvantage in scouring the wool. Therefore the practice of washing is declining; in many districts it has been altogether abandoned. There are many of these scouring mill plants, even as far west as New Mexico. The saving of the freight on the grease and dirt certainly should be a large item in favor of sending only scoured wool (certainly being only partly scoured wool to the manufacturer for his mill) East.

In some instances the fleeces are graded, for one reason or the other, by the commission merchant, but no matter from which source they reach the mill, when arriving there, each and every fleece is graded properly by a competent expert employed by the mill for this purpose, before the fleeces reach the wool sorter. This is done by the mill for the fact that there is no standard or basis or fast rule of grading, and in the nature of wool there never can be. Persons may have what they call a standard grade, but such a standard will be merely an understanding of these people among themselves. For example, what one or more graders might only call a one-half blood, other equally competent graders might term a low three-fourths blood, etc. Certainly with reference to pronounced fleeces, *i. e.*, full grades, no two expert graders would differ, all disputes regarding fleeces chiefly arising when dealing with what are termed "liners," being fleeces which more or less fall between grades, and which one expert might class with the higher and the other with the lower grade. Every mill has its own idea of grades, and it is therefore particular to have its purchases examined by its own grader, in order to be sure that the wool is graded as desired by them.

Sorting and grading are in smaller mills frequently done by one person, but in large mills, especially those large and prominent woolen and worsted mills where wool sorting is not only required but at the same time its value understood, and where division of labor can be profitably made, one person (or two if the mill is very large) grades the fleeces which several others in turn sort. Grading the wool consists in separating a lot of fleeces into various grades, according to the fineness or coarseness of the fibre, and sometimes according to the length of the staple, and this refers to possibly thousands and thousands of fleeces in a certain lot of wool bought by the mill; whereas sorting consists in taking the fleece and separating the finer and coarser parts. It will be readily understood that fleeces graded by an expert in a mill will certainly simplify the work of the sorters considerably, besides resulting in more wool sorted in a given time by each sorter.

The sorter's work is one requiring constant care, a quick eye, and good judgment, which can only come from long experience. To the uninitiated he appears to work without thought, but there is no work requiring more care, especially in mills whose product is yarn which it is desirable to have of a constant uniform grade. Before explaining the procedure of sorting, it will be in its place to refer to the object of sorting which finds its necessity in the fact that wool not only varies in quality with different animals, but also on one and the same sheep.

The character of the breed and the pasturage that is afforded to the animals have an important bearing on the wool fibres of commerce and the structural characteristics of wool produced on the different parts of the body. The uniformity of length and of diameter, and the number of scales per inch, vary in different individuals, even among the same breed of sheep. The best is that from the shoulders, the lower part of the neck, the back and the upper part of the sides, while that which covers the head, breech, tail, belly and legs is of an inferior quality.

A B C D

Fig. 16.

To illustrate the influence of taking care or not of sheep, as well as the variation in fibres on the same sheep, the accompanying illustration Fig. 16 is given, representing:—

A. Specimen of a fibre taken from the shoulder of a sheep which had proper care;

B. Specimen of a fibre taken from the breech of the same fleece as fibre A was taken from;

C. Specimen of a fibre taken from the shoulder of a sheep of the same class from which fibres A and B had been taken but where the animal was poorly-bred, *i. e.*, neglected;

D. Specimen of a fibre taken from the breech of the same fleece as fibre C was taken from.

In some mills, making an average class of fabrics, grading or sorting or both is omitted, the mill in this case running on one or possibly two standard qualities of yarn only and where they rely on the judgment of the commission merchant, with reference to a lot of wool, for their wants, from which it will be seen that by such mills the services of a grader or sorter are not required.

The first task for the sorter when the fleeces reach him, from the grader, is to open the first fleece, *i. e.*, undo the strings placed by the wool grower about the fleece in order to keep the latter compact by itself in the wool bag. The grader was not compelled to cut this string for the reason that he has been able to determine the grade of the fleece in question by pulling out bits of staple here and there from the fleece, thus averaging the whole fleece. After the strings are removed, the fleece is shaken out by the sorter on his sorting table, thus separating from the whole fleece any loose pieces of wool, called "locks," as well as bits of short, coarse, and dirty wool as are occasionally rolled up inside the fleece and which are called "stuffings." These droppings from the fleece must in turn be separately sorted, since coarse and fine fibres are apt to be mixed up together.

The fleece is now spread out by the sorter on his table, so that he can readily separate the coarser and finer parts from the fleece.

Before explaining and illustrating Sorting proper, it is not out of place to refer to what is known as "Clips" or rejections, and which are portions of wool which must be treated entirely different in the mill than the other wool of the fleece. By clips we refer to portions of wool heavily contaminated with burrs, or hardened paint, tar or hard lumps of manure; or possibly to be badly, perhaps irremediably stained. The sorter then clips off the wool containing such hard bits of paint, tar, and hard lumps of manure, and tears out any irremediably stained portions as well as such filled with burrs not easily removable, and puts these various clippings in a sort by themselves, since such wool has to be treated differently during scouring and picking than the wool from the rest of the fleece. It must be mentioned here that the amount of these clippings varies considerably with certain lots of wool, fine, high priced and consequently carefully raised wool having little if any, whereas in connection with cheap grades of wool, carelessly raised, these clippings are of considerable proportions, and consequently increase the cost of such a lot of wool to the mill.

The fleece is now in a condition to be sorted into its different grades. As previously mentioned, two main divisions are fixed for the classification of wools, viz.:

Clothing wools and which are wools to be carded and spun into woolen yarns; and

Combing wools which are wools combed during their manufacture into worsted yarns.

For either kind, a different sorting of the fleece is used, the two diagrams Figs. 17 and 18, showing the procedure as practiced in either case.

Fig. 17 refers to grading clothing wools. In this diagram, 1 indicates the portion of the fleece where the best wool grows, and the other numerals indicate successively lower or coarser portions of the fleece. The different grades on the fleece have regular terms

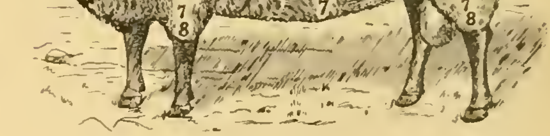


Fig. 17.

and are as follows: 1—Picklock; 2—Prime; 3—Choice; 4—Super; 5—Head; 6—Downrights; 7—Seconds; 8—Abb; 9—Breech.

The grading of the fleece of combing wools, with reference to diagram Fig. 18 is as follows: 1—Fine; 2—Blue; 3—Neat; 4—Brown; 5—Breech; 6—Downrights; 7—Seconds; 8—Abb. The grades 6, 7 and 8 are rarely used for spinning worsted yarns on account of their unsuitability for combing, and hence find their way into low grades of carded yarns.

We will thus see that the finest and most even grown staples are found on the shoulders and sides of the fleece, the lower part of the back yielding a staple of fairly good quality, resembling that from the shoulders. On the loin and the back of the sheep the staple is shorter and of a more tender nature. The upper parts of the legs yield a long and strong wool, which hangs in large, open locks. It is this part of the fleece which comes in contact with the burr plant if such is found on the pasture land,

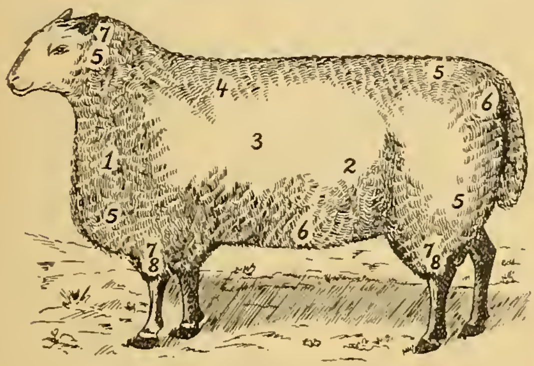


Fig. 18.

and causes the burrs to become entangled in the wool. This item also refers to that portion of the fleece as grown on the lower portions of the sides of the animal. The upper part of the neck gives an irregular staple that is often infested by the spinose leaves of wild prairie plants and seeds. If there is any gray wool in the fleece, it is generally found here. The wool grown on the belly is short and fine, but as a rule, dirty, said wool having been cramped in its growth when the sheep has been lying down, for which reason it is always more or less matted, and besides this, it is apt to be stained by material on which the sheep has lain. That portion of the fleece which is taken from the vicinity of the ears is invariably coarse and of an inferior grade. On the chest and throat, the wool is usually short and apt to be worn from rubbing. The coarsest part of the fleece grows about the hind quarters or breech, and on the tail.

Sometimes, however, the fleece has a dingy brown color, called a "Winter stain," which is a sure indication that the wool is not in a thoroughly sound state. Such fleeces are thrown out by the wool sorter, being suitable only for goods that are to be dyed black or dark colors.

Wool Sorter's Disease (Anthrax) is caused by Bacillus Anthracis, which may enter the system either by the skin or by the internal organs. In the former case it gives rise to pustules, which become painful and cause perspiration, fever, delirium, and other disorders. In the latter case it produces the most serious ailments, such as blood-poisoning and inflammation of the lungs, which often prove speedily fatal.

THEORY OF FELTING IN THE WOOL FIBRE.

When woolen cloth is felted or fulled, it always shrinks in length and width and increases in thickness, the individual fibres becoming more intimately associated with each other, and form as a result a fabric which is very compact in structure. In some instances the process is carried to such an extent, that the yarns in the fabric practically lose their individuality and appear as a solid mass. Naturally what is true of the fabric must be true of the parts of which it is built up, and consequently if the cloth, or yarns shrink or contract, then the fibres composing them must have contracted. This fact may be proved by taking a lock of wool having felting properties and carefully measuring the length and diameter of its staple; then put it in a thin cotton bag and sew the latter to a piece of cloth which is to be fulled. After thus fulling the lock of wool for some time, take it out of the bag and carefully measure its staple again. A comparison of the two measurements will show that after fulling, the fibres have increased in thickness and decreased in length.

Let us first consider what are the conditions necessary for felting, then we may be in a better position to comprehend the causes of felting. The primary and essential requirements for felting are the presence of heat and moisture. The primary qualities of a good felting wool are, a large number of spindle shaped cells with extremely thin and elastic walls, which respond very readily to the influence of water and heat, and permit of its free absorption into every portion of the fibre. The cells must be small, so as to impart the necessary flexibility and elastic nature, in order to enable the fibres to readily intermingle and mat together. Its constitution must be more of the nature of gelatine than horn, so that when submitted to the action of hot water, assisted by acids and alkalies, the cell walls are readily softened. The central or medullary portion of the fibre is absent in wools having the best felting qualities.

A microscopical examination of a cross section of a fibre before and after felting, will show that the form of the cells, composing the inner structure, and the scales composing the outer structure have materially changed. The scales of the fibre in their normal condition are flat and very dense, and the internal cells only exhibit a small cell cavity, while after felting, it will be found that the outer cells have lost their flattened form and become swollen, and in some cases, a distinct cell cavity may be present. The inner cells have also increased in width, and the diameter of the fibre as a whole is greater.

If we take a single wool fibre, measure it, and then moisten it, and then attach a small weight to it, so as to stretch it, its length will be increased; but when released and allowed to dry, perfectly free, it will shrink. This experiment will show that the presence of moisture endows the wool fibre with peculiar properties, and felting, in the true sense of the term, cannot be produced in its absence, no matter how much we agitate wool, or how entangled it may be. The combined action of hot water and acids causes the cell walls to soften, change in form, and adhere more closely together, this becoming more pronounced where pressure is applied as well. Under these circumstances the cells and fibres lose their individuality, and become practically matted together into a more or less homogeneous mass.

The various wools exhibit a diversity in their power of felting, and some scarcely have that property at all, even when apparently suitable conditions are present, and the conclusion which we thus arrivo at is that some inherent difference exists in the structure of the different fibres. This brings us to the point where it is necessary to know the properties of different structures of fibres, that is, of their scales and inner cells. It has been found that those cells, which possess the thinnest and most elastic walls, will yield most readily and receive the greatest modification. This is a characteristic feature of the best felting wools. The extent of the modification is very largely dependent upon the rigidity of the walls of the cells, and it is even found that one portion of the same fibre will felt better than another portion, due to the cells in the first portion of the fibre being thinner and more easily influenced by external agents than other portions in which the cells have undergone a kind of secondary thickening.

We know from experience and observation that the felting may be accelerated by certain conditions, such as heat, pressure and the presence of alkalies and acids, and this is best accounted for on the assumption that these agents produce some change in the cell's fibre itself, rather than only the interlocking of the superficial scales of adjacent fibres.

We have seen that an ordinary felting wool, when treated properly, will shrink, but the process must be carried on under suitable conditions and the wool must be in a certain state in order to get results. It is well known that, although a worsted thread will felt to a certain extent, the property is not present to the same extent as with a woolen thread. The most logical reason, with our knowledge of what produces felting, is in the construction of the thread, which is such in worsted yarn, that it prevents the requisite shrinkage taking place to enable the fibres to felt, since the ends of each fibre are more or less fixed, and practically no decrease in their length can take place, this being also further prevented by their being tightly wrapped around each other. On the other hand, in a woolen thread, the fibres are disposed in a different manner to those of a worsted thread. By means of carding they cross and recross each other in every direction, no attempt being made to impart any regular arrangement to them. All kinds of fibres are utilized, both long and short, curly and straight, entering into the construction of the yarn. Further. since they are not tightly bound down throughout their length by twist in the yarn. the ends are to a great extent free, and hence are more easily acted upon. Thus when much felting is required in a woolen thread, it is made loose and open. so as to admit of all the fibres readily responding to the action of the moisture and mechanical operations.

CHEMICAL COMPOSITION OF WOOL.

Wool fibre that has been freed from foreign matters consists principally of keratin, which is similar in chemical composition to horn and feathers, and which varies somewhat in composition in different wools. The presence of sulphur in wool is readily detected when the latter is burned, and the odor given off is characteristic of all burnt horny substances. This is one of the simplest methods of ascertaining whether a yarn is wool or cotton, since the latter is composed chiefly of cellulose, which is very different in composition from wool, and does not give off that odor. Besides this, the cotton fibre is highly inflammable, while, on the other hand, wool does not burn readily, but frizzles when in contact with a flame, leaving a charred mass.

A quantitative analysis of a good average wool shows it to have approximately the following composition:

Carbon	50%
Hydrogen	7 "
Oxygen	24 "
Nitrogen	15 "
Sulphur	4 "
	100

The presence of sulphur in wool is, in some cases, liable to cause dark stains on the wool, when the fibre comes in contact with either metallic salts in the dye bath or metallic surfaces during processes of dyeing, due to the formation of metallic sulphides. On the other hand. when dyeing with certain basic coal tar dyestuffs, its presence seems to aid in the dyeing, for when wool, mordanted with sulphur, is dyed with these dyestuffs, a darker shade is produced than on unmordanted wool.

The behavior of wool towards certain chemical reagents differs considerably from that of the vegetable fibres. A solution of boiling caustic potash or soda dissolves wool very readily, and if acetic acid be added to this solution, sulphuretted hydrogen is evolved and a precipitate formed. Cold concentrated sulphuric acid does not decompose the fibres but merely loosens the scales, while on boiling the solution it dissolves the wool fairly quickly, and produces a reddish-brown solution. Hydrochloric and nitric acids also dissolve wool.

OTHER ANIMAL FIBRES

used in the textile industry are obtained from the Cashmere goat, the Angora goat, the Alpaca, the Camel, the common Goat, the Cow and the Horse.

The Cashmere Goat is a native of the district of that name in India. The fur of the Cashmere goat is of two sorts, viz.: a soft, woolly, white or grayish

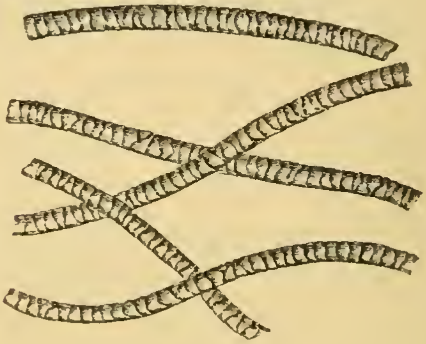


Fig. 19.

undercoat, and a coarse covering of long hairs, that seems to defend the previously mentioned undercoat from the effects of winter. The woolly undercoat, as will be readily understood, is the more valuable fibre and is wool fibre in its structure, as will be readily seen from illustration Fig. 19, which shows, greatly magnified, such fibres, and where the outer scales of the fibres are clearly visible. These fibres vary in length from 1¼ to 3½ inches, and possess no medullary substance. They are plucked from the animal, exported, and used in the manufacture of some of the finest textiles, both on account of the fineness of the fibres as well as its high price.

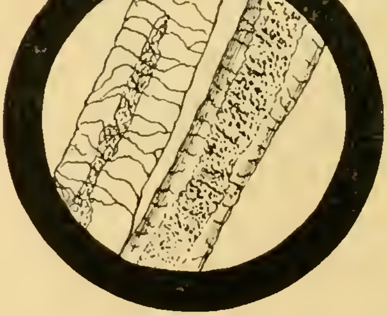


Fig. 20.

However, as a rule, the supply of this fibre is considerably intermixed with those long hairs of the outer fur of the animal, and which according to amount present reduce its value, since they must be separated from it. These outer hairs are of a length of from 3½ to 4½ inches, and possess the central or medullary substance, as seen by examining Fig. 20, which shows two such fibres highly magnified. These fibres are used in the manufacture of cheaper grades of yarns.

Fig. 21.

Mohair is the name given to the hairy covering of the Angora goat, a native of the interior of Asia Minor, but now extensively raised in Cape Colony and also to some extent here. Besides our domestic supply, mohair is also imported. It is of a pure white color (more rarely gray), rather fine, more or less curly, of high lustre, and on an average of from 5 to 6 inches long, although in some cases as long as 12 inches. Fig. 21 shows mohair fibres highly magnified, showing that their outer scales are extremely delicate, giving the fibres a spotted appearance all over their surface.

Besides the mohair, there grows upon the Angora goat a short, stiff hair, which is technically known as "kemp," a relic of the common goat. Its presence depends entirely upon the kind of breed of Angora, being nearly nil in the pure animal. This kemp fibre in mohair always reduces its value, in proportion to the amount that is present, for the same reason as explained in connection with kemp in the fleece of the sheep. Thus it will be seen that care must be taken by the buyer regarding the kempy condition of a lot of mohair under consideration.

The wide range of prices of mohair in the market is due to various causes, but to none so much as the unevenness in quality of fibres, since mohair in a general sense is an expansive term, covering the fleeces of goats of various Angora crosses.

Fig. 22.

After sorting, scouring and drying, mohair is combed, the long fibres being used in spinning the yarns for plushes, fine dress goods, braids, etc., while the noils (which carry all the kemp fibres) go into the manufacture of carpets, blankets, hats, etc.

Alpaca and similar wools are obtained from a group of animals indigenous to the highlands of the South American Cordilleras, where they are met with in a domestic as well as wild state. The group of animals in question comprises the Alpaca, the Llama, the Vicugna and the Guanaco, and of which the one mentioned first is the most important.

The Alpaca is a domesticated animal, furnishing a fine fibre, about 6 to 8 inches long, except when the animal is only sheared once in two years, and when the fibre is then considerably longer. Its color is white, gray, brown or black. It is a lustrous fibre, although this lustre is inferior to that of mohair. The outer scales of the fibre are extremely fine, and the central or medullary substance is present either throughout its entire length or in small elongated masses. Fig. 22 shows Alpaca fibres, highly magnified. The fibre is used in the manufacture of dress-goods, suitings, over coatings, etc.

The Llama, in its native country, is employed as a beast of burden and furnishes a coarse, long unelastic, white and brown wool, mingled with true hair, and which is used in the manufacture of coarse yarns.

Vicugna Wool is seldom met with in commerce, for the fact that the animal is only hunted, and not bred for any domestic purposes. In its fur we also find two pronounced different kinds of fibres, viz.: a fine woolly under hair, covered with scales and free from medulla, and a coarse upper or beard hair, having the medullary substance strongly developed.

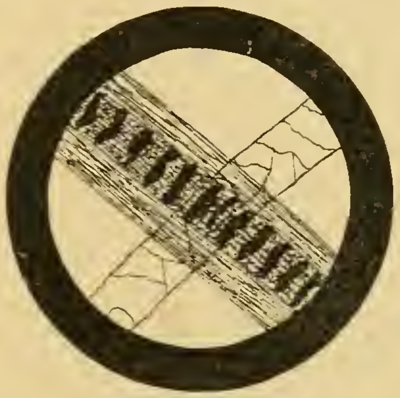


Fig. 23.

The Guanaco is another wild animal of this class, yielding fibres of varying quality, however it is of even less importance than the Vicugna.

Camel Hair is obtained from the Camel and the Dromedary, both animals being natives of Asia and Africa. Their hair is of two kinds, viz.: very fine, curly, reddish or yellow brown hairs, about 4 inches in length and known in commerce as camel wool, and coarse straight, dark brown to blackish body hairs, about 2 to 2½ inches long. Both kinds of hair show, under the microscope, faint scales. The medullary substance always appears in the coarse hair, whereas in the fine hair it is either wanting or appears in insulated masses. Camel wool is used either alone or in connection with wool, in the manufacture of ladies' dressgoods, overcoatings, driving belts, etc., whereas the coarse fibre is used in the manufacture of carpet and cheap backing yarns. It will be advisable to mention, that the fibres from the Alpaca, Llama and Vicugna are frequently referred to, in the market, as Camels hair. Fig. 23 shows Camel hair fibres highly magnified.

The Common Goat, when raised in the open air, has a woolly fur which is shed in the spring and which hair is adapted for spinning, with sheep wool, into coarse yarns.

Cow and Calf Hair is also used for textile purposes, and is the hair removed from the hides of these animals in the tannery, by means of subjecting the pelts to the action of lime, the same as practiced with the pelt of the sheep. They are coarse, stiff fibres, of a white, reddish brown or black color, possessing a slight lustre, and in turn are spun, mixed with low grades of sheep wool, into coarse yarns, used for rugs, horse blankets, and similar coarse fabrics, as well as for backing yarns in cheap grades of overcoating, cloakings, etc. Fig. 24 shows a specimen of the fibre, highly magnified, clearly showing the central or medullary portion of the fibre. The fibre indicated by P in the illustration shows a pointed end of one of these hairs.

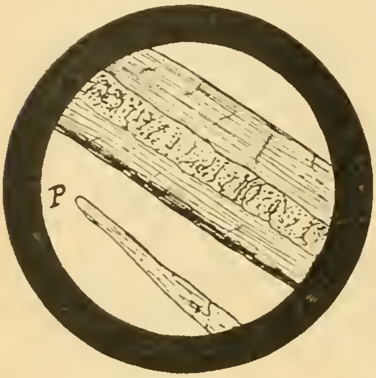


Fig. 24.

Horse Hair. Of this, two kinds are met with in commerce, viz.: tail hair, or the long hair, measuring at least 23 inches, though it occasionally attains a length of 32 to 34 inches, and mane hair, or the short hair, and which rarely exceeds 19 inches in length. White and black are the colors most esteemed, whilst red, gray, etc., hair is less valuable. Both, entire tails and pulled hair are sold. The hair is readily cleansed by simply washing it with soap and water, and is employed as filling in connection with a cotton warp in the manufacture of hair cloth, as used for upholstering furniture, as well as stiff linings for women's wear, etc., etc.

WOOL SCOURING.

Wool, as it comes from the sheep, contains many substances besides the wool fibre itself, and before the latter can be carded or dyed, these substances must be removed from the fibre. It is necessary not only that the processes used for this purpose shall clean the fibre from all adhering matter, but that they also leave the wool in the best possible condition for the further dyeing, carding, combing and spinning processes.

It must be remembered that if we destroy the natural softness of the fibre during scouring, by any kind of harsh treatment, we at the same time destroy its soundness, and may so hurt the fibre that it will be impossible to produce as fine a quality of yarn as should be afforded by that grade of wool under operation.

The impurities adhering to wool in its natural state consist of

First: Matter mechanically adhering to it, and which may consist simply of dirt, pieces of leaves, etc., and which are readily taken out during the process of scouring. But in some cases there are on the wool, burrs which adhere with tenacity, and cannot be entirely removed either by scouring or in the mixing picker, and for which reason the scoured wool has to be subjected to the action of a burr picker, or extracted, *i. e.*, carbonized; the latter being a process liable to leave the wool harsh, and thus is to be avoided whenever possible.

Secondly: A great variety of substances secreted from the sheep and which are mostly potassium salts derived from the soil and assimilated by the sheep through its food. These secreted substances can be divided into two classes, the first of which is the "yolk" or "suint," and which is probably the exudations of animal matter from the pores of the skin, which seems to be a natural provision for the proper lubrication of the fleece, and which substance is soluble in water, while the other substance known as "wool fat," is insoluble in water and can only be removed by alkaline liquids.

Suint or yolk consists mostly of soluble salts of potash, such as the carbonate, stearate, oleate, and probably also salts of palmitic and valeric acids. There are also present varying amounts of other salts of potash, such as the chlorides, sulphates, etc.

If we take a wool rich in these soluble potash salts, and wash it in warm water, and so continue with fresh lots, we soon get a very turbid, soapy liquor which acts as a mild scouring agent, and not only removes the yolk or suint from the fibre, but also some of the wool fat, by forming an emulsion with it. This action of these soluble potash salts would admit of the wool being almost thoroughly and completely washed in a stream of running water were it not for the presence in the fleece of wool fat, uncombined, chemically, with the yolk, which remains attached to the wool fibres, and refuses to pass off by the use of water only.

When applying alkalies to wool we must go carefully to work, for the fact that wool, subjected to the action of strong alkalies, dissolves, *i. e.*, we are taking away so much of the life element of the wool and thus spoil it for future perfect carding and spinning. Heat carried to excess acts upon wool in a similar manner, and if the heat employed exceeds 120° F., the soda acts upon the wool very adversely, as wool is very sensitive to the action of alkalies, especially at high temperatures. By the action of hot water the outer scales of the wool fibre are raised slightly and also the interior cells are penetrated and softened. The action is slightly increased if the water is a little acid, and this accounts for the well known fact that in dyeing wool, it can be boiled much longer in the sweet way than in a sour kettle, without matting. The action is still greater if the water is made alkaline, and in all such cases great care must be used in order not to injure the fibre.

To illustrate the influence of scouring liquor if either too hot or too strong, or both, upon the fibre, the accompanying three illustrations Figs. 25, 26 and 27 are given, and of which Fig. 25 represents a


Fig. 25.


Fig. 26.


Fig. 27.

healthy wool fibre, magnified; Fig. 26 shows a similar fibre, when magnified, after being previously treated in a bath containing five per cent carbonate of soda to its weight and heated to about 100° F.; whereas Fig. 27 shows a similar fibre as visible by being treated in a bath containing only one per cent carbonate of soda to its weight, but being heated to 212° F. These results will clearly show that alkaline carbonates no doubt will hurt the fibre, but that boiling the scouring liquid will be more hurtful. These facts will readily demonstrate that the greatest of care must be exercised in scouring wool, since the latter may be injuriously acted upon by being subjected to too hot a scouring solution, or from being brought in contact with powerful alkalies. No rigid rule as to temperature can be furnished, this being a feature which varies according to the nature of the wool under operation, the best rule being never to have the scouring liquor a higher temperature than is absolutely necessary to cleanse the material properly, a pretty safe temperature being, not to exceed 110° F. for fine, nor 125° for coarse wools.

The substances used to remove the various impurities from wool are but few in number and, as a rule, consist of solutions of various alkaline salts in water. With the exception of a few cases in which volatile liquids are used, water is always the medium employed. It serves the double purpose of dissolving the chemicals to be used, thus enabling us to present them to the fibre in a solution of just the strength desired, and also as a carrier for the wool and the impurities removed from it. For this reason it is of the greatest importance to have good, soft water, for if it is hard, the scouring operation is made much more difficult and also more expensive. The iron, calcium and magnesium salts in such a hard water precipitate the soap used as sticky, insoluble soaps of these elements, and when these are once formed on the fibre they are very difficult to remove. Provided hard water is the only one at our disposal, it must be first softened by the addition of a strong solution of "Granulated Carbonate of Soda" or "Wyandotte Textile Soda," and then make up your soap as usual. The amount of either material required to be added depends on the hardness of the water.

A chemist determines the degree of hardness of water by the amount of soap the water will destroy. An alcoholic solution of soap is dropped carefully into a measured amount of distilled water containing a known amount of a lime salt. The value of a cubic centimeter being determined, the soap solution is dropped from the graduated tube into a measured amount of the water to be tested, and when a permanent lather is produced by shaking, the amount of soap-solution is noted and the hardness of the water calculated.

One grain of Gran. Carb. Soda will precipitate about one and a half grains of sulphate of lime (soluble in water) as carbonate of lime (insoluble in water). Nearly all water contains some lime, and may have as much as fifty grains to the gallon. It is therefore necessary to experiment with the water to be used, and discover the amount of Gran. Carb. Soda required to precipitate the dissolved salts of lime and magnesia.

To test for the presence of lime and magnesia, fill a clean tumbler with hot water and add a few drops of a strong solution of Gran. Carb. Soda. A milky appearance followed by a white precipitate shows their presence.

If water contains five grains of lime and magnesia to the gallon, every 1000 gallons will destroy over ten pounds of neutral soap: and if 10,000 gallons are used in a day, 100 pounds of soap will have been used to kill the mineral salts, when five and a quarter pounds of Gran. Carb. Soda would have done the same work and with no dangerous scum. Once the scum is formed, no amount of soap, Gran. Carb. Soda, Wyandotte Textile Soda, or lye will get rid of it again. The precipitate of the carbonates of lime and magnesia will settle to the bottom of the vat. Have a large tank of known capacity provided with a steampipe to bring the water to a boil, add the proper amount of Gran. Carb. Soda, or Wyandotte Textile Soda, necessary to precipitate the lime and magnesia, and allow to settle. Draw from the tank several inches above the bottom, for the supply to make up the soap-liquor, and for washing and rinsing.

The substances used in connection with water for scouring wool are principally the carbonates of sodium, potassium, and ammonium; Wyandotte Textile Soda; ammonia; sal ammoniac; salt, and finally soap. These substances differ in their effect on the fibre, but so long as the solutions are not too hot or strong there is no appreciable injury to it.

Caustic soda and potash will dissolve wool if strong enough solutions are used, and as even small quantities are deleterious to the fibre, its presence should be carefully avoided.

Sodium Carbonate is a chemical used for wool scouring and is sold in several different forms. Soda ash is an impure carbonate containing about 70 to 95 per cent Na_2CO_3. Among the impurities in this substance caustic soda is of frequent occurrence, and the injurious effect upon wool of even very small amounts of caustic alkali has already been insisted upon. It is therefore very necessary to have a simple means of detecting the presence of caustic soda in carbonate, and what is readily done by dissolving a sample of the soda ash in water, adding excess of barium chloride, filtering, and adding phenol phthalein; when a pink color is immediately developed caustic soda is present, but the solution remains quite colorless in its absence.

There are now, however, several forms of carbonate of soda in the market, which while guaranteed to be absolutely free from caustic alkali, are only slightly more costly than the much more impure soda ash. Such are the so-called "pure alkali" which is a practically pure and anhydrous carbonate, containing 98 to 99 per cent Na_2CO_3, "crystal carbonate," which is a beautiful preparation of the composition $Na_2CO_3H_2O$, and "sesqui-carbonate," which is presented by the formula $Na_2CO_3NaHCO_3$. Any of these products can be highly recommended. The ordinary preparation, known as "soda crystals," or "washing soda," has the composition $Na_2CO_3,10H_2O$, and thus contain no less than 63 per cent of its weight of water.

Potassium Carbonate has a milder effect on the fibre than the soda salt. It is considerably more expensive than the soda salt, and has the disadvantage of absorbing moisture from the air, forming in turn a pasty mass. As the salts occurring naturally in wool are salts of potassium, it is claimed by many manufacturers that only potash salts should be used in wool scouring, since the wool is thereby left softer and in better condition than is the case if soda salts are used.

Ammonium Carbonate has a very mild action on wool; in fact its action is so mild that a higher temperature of the liquor can be employed than if using either of the previously mentioned chemicals. If it were not for its high cost it would be more frequently used, since wool scoured by it is left in an excellent condition. Ammonium carbonate is also used in the form of stale urine or "lant," which contains not only ammonia but a large amount of potash. The potash (as mentioned in connection with potassium carbonate) causes the whiteness, and the ammonia will saponify the animal grease, and when put into the scouring liquor in a warm state, the grease will easily wash off.

Wyandotte Textile Soda is a mild scouring agent, being perfectly free from all caustic alkali, and does not act on the wool fibre injuriously. It is best used in connection with sodium carbonate, or soap.

Ammonia is also sometimes employed, but only in very small quantities, when dealing with wools hard to get clean, since its cost is very high.

Sal Ammoniac is another substance often employed and usually in connection with carbonate of soda. So is also salt often used instead of sal ammoniac, and this at a great saving in expense and with nearly as good result. However, neither salt nor sal ammoniac are alkaline salts, and consequently their action and utility in scouring wool has been questioned.

It is, however, very difficult to remove all the grease with any of the chemicals named, unless there is sufficient soluble yolk in the wool to assist them. For this reason it is necessary that with wool deficient in soluble yolk, more or less soap must be used in order to get rid of all the grease in the wool under operation.

Soap is the scouring agent, above all others, for wool, and in cases where it is used it gives most excellent results. Both hard and soft soaps are used. Chemically speaking, soaps are salts containing fatty acids (oleic, stearic, etc.); "hard" soaps resulting when sodium is the base, while potassium gives rise to "soft" soaps, thus:

$$\underset{\text{Caustic Soda.}}{NaOH} + \underset{\text{Fatty Acid.}}{\text{Oleic Acid}} = \underset{\text{Hard Soap.}}{\text{NaOleate}} + H_2O$$

$$\text{aud } \underset{\text{Caustic Potash.}}{KOH} + \underset{\text{Fatty Acid.}}{\text{Oleic Acid}} = \underset{\text{Soft Soap.}}{\text{K Oleate}} + H_2O$$

Any soap, when unskillfully made, is liable to contain caustic alkali, but potash soaps are, on account of the method adopted in their manufacture, particularly liable to this defect. It is therefore a great mistake to suppose that soft soap is a less severe scouring agent than hard soap, the exact opposite being usually the case.

The value of any soap largely depends upon the amount and correct proportions of fatty acid and alkali. The fatty acid is determined by weighing 50 grains of the soap, and boiling it in a beaker, in distilled water, till dissolved, then adding 10 grains of solid paraffine, and then 0.6103 cubic inch of sulphuric acid, diluted in a little water. The whole is gently boiled until the liquid clears, and the oily matter completely rises. It is then set aside till quite cold, so that the fatty acid can be removed in a cake, then dried upon blotting paper, and weighed. The weight, from which the paraffine added must be deducted, gives the fatty acid, the double of which, if 50 grains of soap had been taken, is the percentage.

A very simple test sufficing to show whether uncombined alkali is present is thus: Pour on to the soap a small quantity of an alcoholic solution of phenol phthalein, when the production of a red color indicates that free alkali exists.

Soap has a much milder action on the fibre than either the carbonate of soda or potash, but it possesses the disadvantage of being decomposed by hard water, forming a sticky, insoluble lime soap. In this way one pound of lime in hard water will destroy ten or fifteen pounds of ordinary soap. For this reason in cases where the water is hard, or the wool contains considerable quantities of lime, magnesia or iron salts, like some of our western wools do, or pulled wool which has been removed from the pelts by soaking them in lime, it is necessary to use other substances before the soap in order to get proper results, *i. e.*, soften the water before the scouring process, or when the water is soft but the wool contains lime or iron salts, by soaking such wool in water previous to scouring and when the larger portion of these troublesome salts are removed, and the wool then can be scoured as usual with soap.

For fine quality wools a well-made soap, quite free from caustic alkali, with or without the addition of ammonia, may be considered the most suitable scouring agent.

The Different Treatment required for scouring different wools will be best explained by means of comparing two different breeds of sheep. Closely examining an unwashed fleece from a fine grade of our domestic sheep will show it to be so full of grease that by handling it the hands become sticky and greasy, and that by twisting a lock between the fingers some grease can be squeezed out. We also find the wool divided into locks, each being composed of a small bundle of fibres held together by a very sticky, fatty substance which contains more or less dirt adhering to it. Examining in turn another fleece from a poorer breed, raised, for example, in a region where vegetation is scant, but where the soil contains much lime, iron and magnesia salts, said wool may scarcely feel greasy, its impurities possibly consisting largely of the salts previously referred to, and which are so detrimental to a soap solution that the attempt to scour such a wool with soap would prove a failure, so that if a wool scourer who had always been used to the first kind of wool was to receive a lot of the second quality mentioned, and should not change his methods of scouring, he would find that what was good for one was not good for all, and that judgment must be exercised for each different class of wool as coming under his care.

Again in the case of very greasy wools there will be found a great difference in the relative proportions of the soluble fatty substances "yolk or suint" and the insoluble substances, "wool fat," so that different classes of wool, although they may contain the same total amount of fatty matter, may require a considerable difference in treatment in scouring, owing to the different proportions of soluble and insoluble fatty matter present.

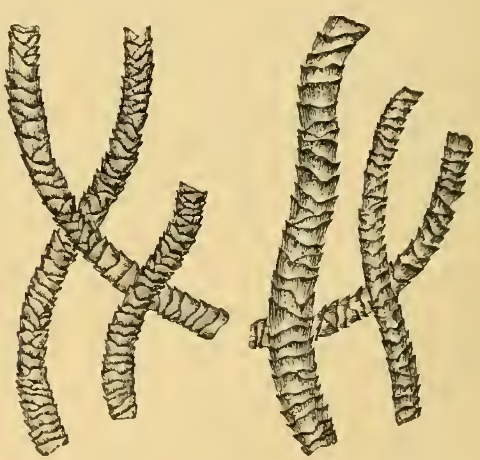


Fig. 28. Fig. 29.

The strength of the scouring solutions to be used depends on several things, and the same is true of the temperature to be employed. The longer the wool remains in the bath, the weaker the solution that can be used, and for a machine that required but four minutes for a passage through the bowl, a stronger solution would have to be used than if eight minutes were required. Also for very dirty wool, stronger solutions have to be used than for fairly clean wool. The temperature for the scouring liquor depends on the quality of the wool under operation and also on the scouring agents used. Many do not take this latter into account, but in fact, with soft water and a neutral soap, the fibre is less injured at 120° F. than is the case when pure alkali and a lower temperature are employed.

Greasy wools, *i. e.*, such in which there is a large amount of "wool fat" and a small amount of soluble fatty matter, *i. e.*, yolk, if washed in water alone, there will be but a very small amount of matter removed. The wool fat retains even the mechanical impurities, and prevents their removal. Pure alkali, salt nor even soap itself will hardly remove all the fat, unless very large quantities are used, and which of course makes it very expensive. In case such wool is encountered, it is necessary to use some oil that is easily saponified, and especially an oil like "red oil." By the use of this oil and pure alkali even the greasiest wool can be cleaned.

To illustrate the external change the fibres undergo during scouring, Figs. 28 and 29 are given, and of which Fig. 28 shows wool fibres, highly magnified, before being scoured, Fig. 29 showing fibres from this wool, magnified similarly, as they appear after having been scoured.

Having decided upon the chemicals and the strength of the solution to be used, the next question is: How can we best apply them?

There are different distinct methods of scouring wool by machinery in use, the machines being constructed to produce the result either by agitation in the scour liquor and then squeezing, or by steeping with the least possible agitation and then squeezing. A thorough description of the construction and operation of modern wool scouring machines is given in the chapter "Preparatory Processes."

There are always more or less patents brought out, having for their object to scour wool by means of volatile liquids, which process theoretically is certainly much simpler and more economical than the ordinary process, and will probably come into general use in the future. At present, however, the mechanical difficulties of applying the large volumes of volatile and usually explosive liquids necessary have not been adequatély surmounted.

DRYING.

The wool on leaving the last bowl in the set of scouring machines, *i. e.*, the rinse bowl, is taken to the dryer. The ideal drying machine should be perfectly calculated to pass the wool forward to the next operation unimpaired in vitality and working qualities. Any form of machine that will accomplish this, and at the same time reduce the moisture to the desired point, may be used. The degree of moisture to be extracted varies according to quality of wool under operation, and whether for carded or combed yarns. A thorough description of the construction and operation of modern Automatic Wool Dryers is given in the chapter "Preparatory Processes."

ARTIFICIAL WOOLS.

The same are re-manufactured products from old or new wool wastes, or recovered from rags, and according to their source are divided into three classes, viz.: Shoddy, Mungo and Extract. Of these

Shoddy is the best, being the wool fibre recovered from worn, but all wool, long staple materials, and which had never been fulled, or if so, only slightly. Amongst these materials, we find, knit goods, shawls, flannels and similar fabrics, also the yarn and fabric waste made in the process of manufacturing them. The fact that these materials, known in the market as "softs," are readily disintegrated, causes the resulting fibres to be comparatively long and sound, they varying in length on an average of from ⅔ to 1⅓ inches, according to the original length of the staple in the fabric from which the shoddy is made.

Shoddy is occasionally worked up alone into heavy counts of yarn, but more generally is mixed with new wool and thus used in the manufacture of a great quantity of good average grades of yarns for all classes of all-wool fabrics.

Fig. 30.

Shoddy fibres are sometimes found to be spoiled by scales being worn off, or the ends of the fibres broken, and which may be caused during the process of rag picking or garnetting (coarse carding). Dyed shoddy can be detected from similarly dyed new wool, for the reason that the color of the former will betray the inferior article compared to wool, since the rags or waste, previous to the re-dyeing, had been dyed different colors, and which will consequently influence the final shade of color obtained from re-dyeing accordingly. Of the accompanying illustrations, Fig. 30 shows specimens of coarse wool shoddy, magnified, and Fig. 31 specimens of a fine wool shoddy, magnified.

Fig. 31.

Mungo is obtained by reducing to fibre pure woolen rags, from cloth originally heavily fulled, and when the natural consequence of the strong resistance to disintegration offered by felted fabrics, results in that short fibres, about ⅕ to ⅘ of an inch in length, are obtained. Mungo, for this reason, is never worked up again alone into yarn, but is generally mixed with new wool or cotton and generally made up into low counts of filling yarn. On account of mungo referring to a fibre once before having been heavily

Fig. 32.

felted, the same has lost its capacity for further felting. Fig. 32 is a typical illustration of Mungo fibres, magnified, showing also the presence of a foreign fibre.

Extract Wool is the product obtained by disintegrating fabrics composed of animal and vegetable fibres, chiefly wool and cotton, instead of pure wool only. The vegetable fibres in this instance are removed by carbonizing when the material has to be used in connection with wool, in the spinning of all wool yarn.

Testing Artificial Wool for Cotton Present. When buying a lot of shoddy, mungo or extract, and we are not positive that it is "all wool," a test should be made to ascertain if any and what percentage of cotton is present, for which reason a sample is taken out of one of the bales, and after weighing, is boiled for ¼ of an hour in an 8° B. caustic soda solution, in which the wool will be dissolved, leaving cotton fibres, if any present, unchanged. These cotton fibres are then collected on a linen filter, and after washing with hot water, until all traces of caustic soda are gone, the fibres are dried and weighed, and the percentage calculated from the original weight. If the artificial wool contains many impurities, the sample must be first washed with slightly acidified water, and afterwards with pure water, in order to remove these impurities, which, otherwise, would have been undissolved and consequently weighed as cotton. This estimation, however, gives only approximate results.

Testing the Presence of Shoddy in Wool. The chief characteristic test for artificial wool, in the presence of new wool, is its color, which is seldom uniform when seen under the microscope, the same always containing fibres of different shades and colors, especially in the cheaper grades, whereas in the better grades, this difference is not so pronounced.

In testing for the presence of shoddy, it is advisable to treat the sample beforehand with warm hydrochloric acid, which will remove from the artificial wool, the color due to the second dyeing and leave the original dye clearly exposed, and as the new wool present was stripped of its color at the same time, leaving it more or less white, the two classes of wool are easily distinguished.

Another microscopical test for shoddy is afforded by the appearance of the ends of the fibres, these being usually unbroken in the case of natural wool, whereas in the artificial varieties they are always torn or ragged.

CARBONIZING.

is used for wool as well as rags.

With reference to wool its purpose is the chemical removal of vegetable impurities, like burrs, with which the wool in question is heavily contaminated, and which cannot be removed successfully or economically in a mechanical way.

The process of carbonizing is based on the different behavior of animal and vegetable fibres in the presence of certain chemicals, such as dilute sulphuric acid, gaseous hydrochloric acid, and certain metallic salts, such as the chlorides of aluminium and magnesium.

The Sulphuric acid process consists in steeping the burry wool in a bath of the acid with the strength of 2° to 4° Tw. until saturated, then squeezing and drying. During the drying, the acid on the fibres becomes more concentrated, and the vegetable matter present is disintegrated or practically burned up, and is afterwards removed in the form of dust by shaking or heating. This process is known as liquid or wet carbonizing.

Dry or Gas Carbonizing consists in treating the burry wool with hydrochloric acid gas in a heated chamber, the action of the acid being the same on the vegetable matter as with sulphuric acid.

Another method of carbonizing is by the use of certain metallic salts, such as magnesium or aluminium chlorides, etc., instead of acid. When using

Chloride of Aluminium, the wool to be carbonized is entered in a chloride of aluminium bath from 6° to 7° B., and carefully handled, and the carbonizing fluid permitted to operate for a few hours. The wool is then taken out, hydro-extracted, and dried at a medium temperature, and entered into the carbonizing chamber, which is heated to 194° F., and in which the wool is left for one hour, during which time the vegetable matter is disintegrated. The remains of the vegetable fibres, *i. e.* dust, is then removed from the wool by beating, after which the wool is washed in soft water with fuller's earth, and when the soluble chloride of aluminium is readily removed. This process is not as liable to be injurious to the fibre as the acid process.

Carbonizing Waste or Rags has for its object the separation, *i. e.* destruction of all vegetable fibres, as found in a lot of woolen material, and thus eliminate them from the wool fibres. The sulphuric acid process is used almost exclusively on account of its comparative cheapness.

The mass of rags or waste is steeped in a solution of sulphuric acid, and then heated in an enclosed chamber (see articles on stock dryers in the chapter "Preparatory Processes"). This drying process evaporates the water, and leaves the sulphuric acid in a very concentrated form, the effect of which is to destroy the vegetable fibre, and leave only cinders or dust, which disappears when the material is afterwards subjected to a thorough washing, any acid on the stock being removed by this process at the same time.

LATE INVENTIONS IN THE CONSTRUCTION OF SHEEP-SHEARS.

Sheep are sheared either by hand or machine shears.

An attachment to regulate the size of "cut" in hand shears. The object aimed at in the construction of the shears shown in diagram Fig. 33 (shown open) is to provide means so that the opening out of the blades of the shears can be set to the required distance to suit the demands of the operator and thus reduce the strain on his hand.

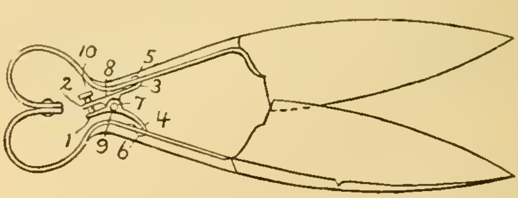


Fig. 33.

Examining this illustration, we find that the new device consists of a pair of spring links 1 and 2, bent at their respective ends 3 and 4 to form the hooks 5 and 6, which fit in the handles of the blades of the shears. The links 1 and 2 are also formed with lugs 7 and 8, through which is passed the fulcrum pin 9. A thumb screw 10 is threaded through the end of the link 2 and regulates the expansion of the blades of the shears by means of the end of said thumb screw 10 bearing on the end of the link 1, preventing the blades of the shears from opening any farther than thus set.

Thus it will be seen that by turning the thumb screw 10 the blades can be drawn more or less together, according to the length of cut required by the operator. At the same time overlapping of the blades is prevented, as well as any jar to the hand of the operator when operating the shears.

A Detachable Hand Shear. The object consists in making the blades of the shears detachable from the bow and in providing drivers which allow of a very secure grip, whereby the open shears may be easily driven into the wool.

Of the accompanying illustration Fig. 34, diagram A is a perspective view of such a pair of shears and diagram B a view showing the method of securing a green-hide pad to the knocker.

The blades B B′ are made separately from the handles A and each blade is secured thereto by two bolts C and D and C′ and D′, respectively. In order to allow of the blade being secured to the handle, there is a short extension of the rear of the blade formed of such shape as to fit neatly within the hollow of the handle proper and perforated with two holes corresponding to two in the handle.

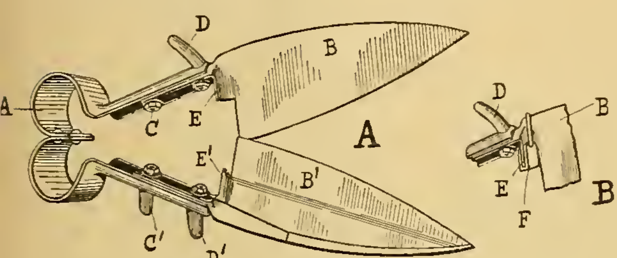


Fig. 34.

The connections of the blades to the handles are made as follows: The top (as the shear is used) blade is secured to its handle by two bolts. The rear one C has a head finished to correspond exactly with the form of the handle, but the forward one D has an elongated and curved head, forming a driver which serves as a stop and fits neatly between the thumb and first finger of the operator. The bottom blade is secured to its handle by two bolts, each of which has an elongated and curved head, forming drivers. The front driver D′ fits between the first and second fingers and the rear driver C′ between the third and fourth fingers. The holes in the blades to take the rear bolts are elongated, thereby permitting of the insertion of packing between the handle and the rear of the extension to widen the blow, or cut, if desired, without increasing the width in the grip. The knockers E E′ of the blades are made sufficiently short in order to allow a green-hide pad F (shown in diagram B) to be securely tied to each blade to lessen the noise and prevent the jar upon the wrist as the blades are closed. With shears made in this manner a shearer will be able to get a bow of exactly the size and strength to suit him that will last for years and can be fitted with successive sets of blades, while in the event of one blade being harder than the other (as is often the case) the best can be kept until perfectly matched with a new blade.

Method of Driving the Cutters in Machine Sheep Shears. The motive power generally used for driving machine sheep shears is from a revolving shaft driven by steam or other power, whereas the motor or driving arrangement for the new shears is contained in the handle or an extension of the handle of the shears, and is operated automatically while shearing by the tension upon a flexible cord which

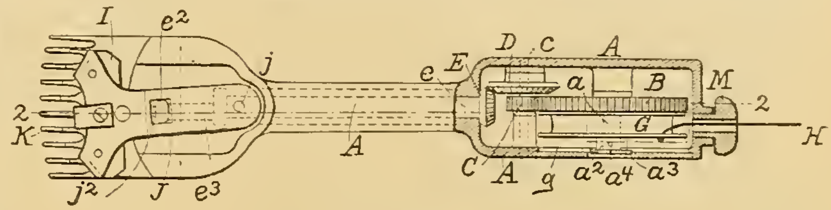


Fig. 35.

is alternately uncoiled from and coiled upon a drum.

Of the accompanying illustrations, Fig. 35 is a plan showing in section the driving arrangement for the shears, and Fig. 36 a longitudinal vertical section taken on the line 2-2 of Fig. 35.

Fixed to the casing A of the shears is an axle *a*, on which is rotatably mounted a spur wheel B, which engages with a pinion C, secured to a spindle *c*, mounted in bearings in the casing A. Secured upon the spindle *c* or to the pinion C is a bevel wheel D, which imparts rotation to another bevel wheel E, secured upon a longitudinal shaft *e*, by means of which motion of the driving mechanism is conveyed to the reciprocating cutter I.

The spur wheel B is provided with a ratchet wheel F, secured to the wheel B by screws *b*, and mounted so as to revolve upon the axle *a*. Adjacent to the wheel B is a drum G, within which is a spiral spring *g*, which has one end secured to the drum G and the other to a sleeve a^2, which enables the spring to be readily wound up. The sleeve is provided with a milled head a^3, by means of which it can be partly wound up and the said milled head be afterward secured to the axle *a* by a pin a^4, so as to maintain a permanent tension on the spring. Motion is conveyed from the drum G to the spur wheel B by a pawl g^2, which is secured to the said drum and is kept in contact with the ratchet wheel F by a spring g^3.

How the shears are worked: A cord H is wound upon the drum G and has its inner end secured to the flange of the said drum; its outer end, passing through a tubular guide M, is secured to a fixed point outside the machine when in use, so that on moving the shears away from the said fixed point,

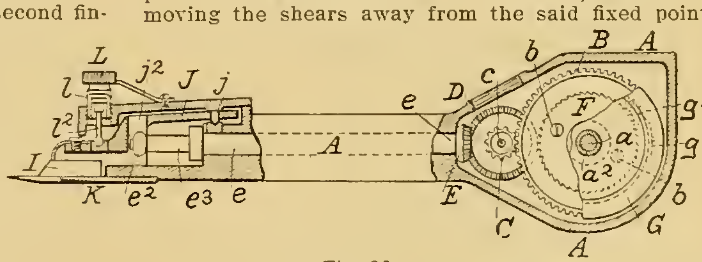


Fig. 36.

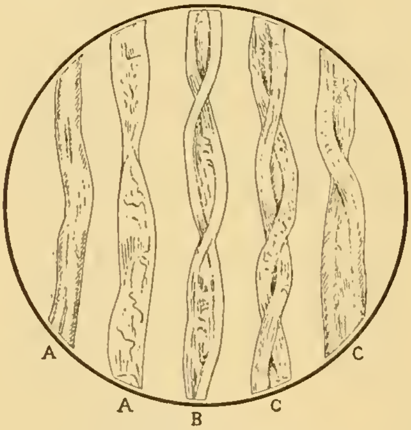
the drum G is rotated by the cord being unwound therefrom, and the reciprocating cutter operated, the spring *g* being at the same time wound up. On the backward movement of the apparatus the spring unwinds and rewinds the cord H upon the drum. The reciprocating cutter I is attached to a lever J, which is centred at one end on the pin *j*, the lever J being also provided with a slot or recess f^2, in which fits an antifriction roller e^2, the said roller being mounted upon an eccentric stud or crank pin e^3, carried by the shaft e, so that as the said shaft is rotated the reciprocating cutter I is oscillated to and fro over the stationary cutter K.

L represents a tension device by which the pressure of the reciprocating cutter I on the stationary cutter K can be regulated, the said tension device consisting of a screw l with a milled head, which bears on a thrust piece l^2 with a ball end bearing in a recess in the reciprocating cutter.

COTTON.

The cotton fibre is the filament which grows around the seeds of the various species of the cotton plant.

The fruits of the cotton plant known as "bolls" (of about 1 inch diameter) are divided by membranous walls into three or five cells containing three or four seeds each, and from which the thin transparent cylindrical filaments known as cotton, grow, said filaments being pressed against each other in a more or less matted condition. Towards maturity of the boll, these filaments are changed from their cylindrical form to a compressed or ribbon shape, by means of the collapse of their walls; each fibre simultaneously twisting more or less on its axis, causing in turn a sufficient pressure on the inside of the boll, to burst the latter at the junctions of the compartments in the casing, which by this time has become dried up. After being left on the plant for a few days, so as to properly ripen the fibres, the cotton is picked. During the time the cotton thus remains on the plant, exposed to the direct influence of the air (if the weather is unfavorable) great damage to the fibre



COTTON FIBRES MAGNIFIED.

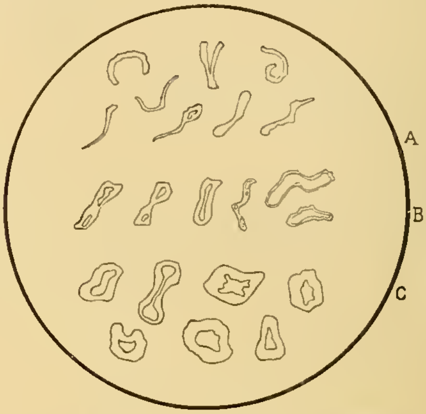
A—Unripe or Dead Fibres,
B—Half Ripe Fibres,
C—Matured or Ripe Fibres.

may be done either by rain which stains the cotton, excessive heat which renders the fibres harsh and brittle, or by storms which fill the exposed cotton with leaves, dust and sand.

The Length of the cotton fibre varies from about ¾ inch to 2½ inches, and upon this length, commercially known as "staple," the value of a respective lot of cotton depends.

The Color of the cotton fibre is not always what we practically term white, but is sometimes creamy, as in Sea Island, or of a light and varying golden tint, as in brown Egyptian.

A Microscopical Examination of cross sections of the various cotton fibres will reveal considerable individuality amongst them, some exhibiting thick cell walls with a very small central cavity, while in others the hollow tubular space is greatly enlarged. Some fibres also retain much of their original cylindrical form, while others are completely flattened, exhibiting only a mere line instead of a central cavity, the latter change in structure indicating what is known as unripe or dead fibres, by which is understood that such fibres have not attained full maturity.



SECTIONS OF COTTON FIBRES MAGNIFIED.

A—Unripe or Dead Fibres,
B—Half Ripe Fibres,
C—Fully Matured or Ripe Fibres.

Their detection is very important, since their presence is very detrimental to yarn and fabric. They are recognizable by the very thin transparent filaments, which, though ribbon shaped, are not twisted, and do not exhibit the slightest trace of lumen in the cell.

Half ripe fibres are a medium between ripe and dead fibres, and in conjunction with the latter, according to amount present in a lot of cotton, depreciate its value to the manufacturer, such fibres being the result of the cotton being removed from the pod before fully matured, a feature readily explained by the fact that the stages of maturity vary considerably even on different parts of the same seed, since the germination of cells does not begin simultaneously at every point on the surface of the seed, and the absorption of the parts of the cell walls in contact throughout each linear deposit is not effected at the same moment, and that the secretive and suctorial powers of each individual tube are not all of the same force and energy.

The proportion of half ripe and unripe fibre is also more or less dependent on the character of the season and the health of the plant. Again, fibres produced on the crown of the seed are always more advanced compared to those on the base; and it is by the removal of this undergrowth, in the process of ginning, that so much immature fibre exists in the general cotton supply.

Ripe Cotton Fibres are hollow nearly throughout their entire length, with the exception of the end which had not been attached to the seed. This hollowness of the ripe fibre allows the dyestuffs to penetrate, and produce evenly dyed yarns or fabrics, whereas unripe or dead cotton which practically has no central cavity, is very difficult to dye, and frequently appears as white specks on dyed pieces, particularly in such as are dyed indigo blue or turkey red.

The Diameter of the Cotton Fibre, which varies from 0.0004 inch in the best of Sea Island to 0.001 inch in the lowest of Indian, is, in the average, somewhat less than that of wool, the latter ranging from 0.0005 to 0.002 inch; but a comparison of the thickness is of absolutely no value in distinguishing between the fibres. In this respect silk also is similar, having a diameter of about 0.0007 inch. Comparing silk, wool and cotton fibres of equal diameter, silk is much the strongest fibre, wool the weakest, while cotton holds an intermediate place. In respect to elasticity, however—apart from that due to the spiral character of the fibre—both wool and silk are much superior to cotton.

The Spinning Property of cotton fibres largely depends upon their spiral character, which feature greatly facilitates the interlocking of the fibres and largely increases their grip upon one another. This spiral character of the fibre—its natural twist—is due to unequal or irregular drying of the cell walls. The direction and the amount of twist varies, increasing as the plant is cultivated. No turning of the axis takes place in the formation of this twist, the same being the result of the action of natural laws acting externally, and is not an inherent feature or essential part of the life of the plant. Owing to this presence of natural twist, cotton can be distinguished from other fibres, and can be readily detected by means of the microscope in yarn or cloth, whether in a rough, dressed, dyed or undyed condition. Wild silks however have frequently a very similar flattened and twisted fibre, and may frequently be mistaken for cotton, if the microscopic appearance alone is relied upon, but the two fibres can be readily distinguished by chemical tests. Mercerized cotton presents an entirely different appearance to ordinary cotton, due to the chemicals used in this process.

Impurities and Moisture. There are always several kinds of foreign impurities met with in raw cottons, and which include sand, broken seed, leaf, motes, etc. Sand, when present in the cotton, is termed "Dead Loss," whereas an excessive amount of moisture present in a lot of cotton is termed "Invisible Loss."

The amount of moisture contained in cotton varies from 6¾ to 12½ per cent over absolute dryness, anything over 10½ being considered excessive, and for which claims can be made. Raw cotton, after being exposed for several days during its process of manufacture to the working temperature of a mill, which ranges on an average from 70° to 90° F., will, if placed for twenty-four hours on the ground floor of the mill, open to the outer air, absorb from 1.6 to 3.6 per cent of moisture, the amount varying with the state of the weather and climatical conditions, a feature which will indicate that cotton will lose about 5% of moisture in the course of its manufacture, and afterwards regain from 2 to 4 per cent of said moisture by proper conditioning of the yarn.

Acids have a very destructive effect on cotton fibres, so that their use in the cotton industry is generally dispensed with, since alkalies, such as soap, borax, ammonia, and phosphate of soda, can be employed for scouring and cleaning cotton fibres without materially injuring them. In boiling cotton with caustic alkalies the air ought to be excluded and the goods kept well under the surface of the liquid, otherwise defects will be caused in the subsequent bleaching of the goods.

Mercerized Cotton. Cotton in the form of yarn or fabric, when immersed in a solution of caustic soda of a density of 28 to 30° Beaumè, undergoes an important change. The cell wall of the fibres will swell out, and acquire a glossiness that causes the yarn or fabric to have a silky appearance, the process being known as mercerization. The swelling of the fibres during this process causes a shrinkage in their length, the fibres become more transparent, and gain something in strength and in weight, their capability for taking up certain dyes being greatly increased.

VARIETIES OF COTTON OF IMPORTANCE TO US.

Sea Island Cotton is the best grade of cotton in the world; such as raised on the islands off the coast

COTTON BELT OF THE UNITED STATES.

of South Carolina and Georgia or directly on the coast, having a staple of from 1¾ to 2½ inches. The fibre closely resembles silk, being extremely fine, strong and clean, permitting it to be spun readily into 150's, and, if required, can be spun up to 400's for ply yarn. Such of this cotton as grown further away from the coast of Georgia and South Carolina averages from 1½ to 2 inches in length of staple and closely resembles the actual Sea Island cotton, from which it is grown, permitting, if required, its spinning into 150's and up to 200's for ply yarn. Florida Sea Island Cotton is grown on the mainland of Florida from Sea Island Seed. It has a white, glossy, strong fibre, a little coarser than strict Sea Island, varying from 1¼ to 1¾ inches in length, and is not as carefully handled during cultivation. It is suited for lower grades of Sea Island yarns spun up to 100's, and 150's for ply.

American or Mainland Cotton is the typical cotton of the world, grown in what is considered the "mainland cotton belt" which extends from southeast Virginia to Texas, its distribution being mainly between the tide water district and the foothills of the Appalachian Mountain System. The deep alluvial soils of the Mississippi Valley favor extension of cotton growing much farther northward, from the sugar district of southern Louisiana to the southern border of Missouri, including most of Arkansas and western Tennessee, while the higher elevation of central and eastern Tennessee limits culture and diverts sharply the line of limitation around the foothills of northwestern Georgia.

This cotton is suited for all numbers of yarn up to 50's warp and 80's filling, being clean, regular in length of staple and well graded. On account of these features, as well as the fact that the quantity raised is greater than that in all other parts of the world together, the price of American cotton regulates the price of cotton throughout the world.

Of this American cotton, the Gulf (or New Orleans), Benders or Bottom Land Varieties are the most important, varying as to length of staple from 1 to 1⅜ inches (1⅝ in special instances), permitting spinning up to 50's warp and 80's filling. Cotton brought in the market as Mobile, Peelers and Allan Seed, belong to the same variety and are next in importance, while Mississippi, Louisiana, Selma, Arkansas and Memphis cottons, also belonging to this variety, are slightly inferior. Texas cotton varies from ⅞ to 1 inch in length of staple, and is well suited for warp yarns up to 32's. Next in importance are the Uplands cotton, having a length of staple from ¾ to 1 inch, permitting ready spinning into 30's filling. Cottons as brought in the market under the name of Georgia, Boweds, Norfolk, or Savannah cottons also belong to the variety of Uplands.

Egyptian Cotton stands high in the estimation of the commercial world, the success of growing being largely due to the equability of the climate in the delta of the Nile. Of the different varieties grown there, the one known as brown Egyptian is the best, although requiring combing on account of its irregularities of staple. The color itself varies from dark cream to a brown tint, according to soil in which it is grown. The length of its fibre varies from 1⅛ to 1½ inches, and is spun in 50's to 80's warp, up to 100's for filling and up to 120's for ply yarn. It is not as fine as Sea Island cotton, and of course does not bring so high a price, but is better than our mainland cotton, especially for goods requiring smooth finish and high lustre, at the same time giving to fabrics a soft silk like finish, a feature which makes this cotton very desirable for use in cotton mixed silk goods.

Cotton Crops of the United States. The following table, compiled and copyrighted by Alfred B. Shepperson of New York, and covering a record of the yearly cotton crops from 1827 to 1904, will be found of interest by the reader.

Season.	Bales.	Season.	Bales.
1827-28	720,593	1866-67	2,233,000
1828-29	857,744	1867-68	2,599,000
1829-30	976,845	1868-69	2,434,000
1830-31	1,038,848	1869-70	3,114,592
1831-32	987,477	1870-71	4,347,006
1832-33	1,070,438	1871-72	2,974,351
1833-34	1,205,324	1872-73	3,874,000
1834-35	1,254,328	1873-74	4,130,000
1835-36	1,360,725	1874-75	3,831,000
1836-37	1,425,575	1875-76	4,632,313
1837-38	1,804,797	1876-77	4,474,069
1838-39	1,363,403	1877-78	4,773,865
1839-40	2,181,749	1878-79	5,074,155
1840-41	1,639,353	1879-80	5,761,252
1841-42	1,683,574	1880-81	6,605,750
1842-43	2,378,875	1881-82	5,456,048
1843-44	2,030,409	1882-83	6,949,756
1844-45	2,394,503	1883-84	5,713,200
1845-46	2,100,537	1884-85	5,706,165
1846-47	1,778,651	1885-86	6,575,691
1847-48	2,423,000	1886-87	6,499,585
1848-49	2,840,000	1887-88	7,046,833
1849-50	2,204,000	1888-89	6,939,000
1850-51	2,415,000	1889-90	7,297,000
1851-52	3,126,000	1890-91	8,674,000
1852-53	3,416,000	1891-92	9,018,000
1853-54	3,075,000	1892-93	6,664,000
1854-55	2,983,000	1893-94	7,532,000
1855-56	3,665,000	1894-95	9,837,000
1856-57	3,094,000	1895-96	7,147,000
1857-58	3,257,000	1896-97	8,706,000
1858-59	4,019,000	1897-98	11,216,000
1859-60	4,861,000	1898-99	11,256,000
1860-61	3,849,000	1899-1900	9,422,000
1861-62		1900-01	10,339,000
1862-63	CIVIL WAR;	1901-02	10,768,000
1863-64	NO RECORD.	1902-03	10,674,000
1864-65		1903-04	10,002,000
1865-66	2,278,000	1904-05*	12,162,000

*Government estimate Dec. 3, 1904.

MAP OF THE COTTON GROWING COUNTRIES OF THE WORLD

(Shaded According to Importance).

Peruvian Cotton. Peru produces a considerable amount of cotton, three varieties being brought into the market, called respectively, Sea Island, Rough and Smooth. The "Rough Peruvian" is the only important variety, having a strong, rough, woolly, crinkly staple, about 1¼ to 1½ inches long and is usually very clean and well handled. Its chief use is for mixing with wool in the manufacture of Merino yarns, for which reason it is called "vegetable wool," and when carded, its resemblance is so close and its characteristics so strikingly similar to wool that it would readily be sold as wool, even to a dealer. When woven into goods along with wool, the cotton fibres cannot be determined with any certainty except by using chemical tests. When mixed with wool, it reduces the tendency of the goods, in which it is used, to shrink, makes them more durable, lessens their cost of production, besides giving them a better lustre and finish; hence it is frequently used in the manufacture of underwear and hosiery. For dyed goods it is equally suitable.

GRADING OF COTTON.

There are several principal factors in a good cotton, length of staple, uniformity, strength, color, cleanliness, and flexibility. The first can be found by the gradual reduction of a tuft by the hand until individual fibres are drawn from the tuft, so as to enable their length to be ascertained. To do this well requires practice. In grading cotton from samples not only should its length be ascertained, but at the same time its uniformity of staple. If the staple is uneven, the cotton is of less value than if it were a little shorter, but of greater evenness. The color of the cotton also must be carefully considered, because of the necessity of keeping an even shade of yarn. The cleanliness of a lot of cotton under consideration affects the amount of waste made later on in the mill, being an item of great importance. The amount in a sample is best ascertained by shaking the sample of cotton over a paper, and when it will be seen if said cotton contains much dirt or sand. The flexibility of the cotton is best ascertained by the feel, which will show if it is soft or harsh. Flexibility does not necessarily imply a lack of strength, which some might regard as a more essential factor, but rather includes it. A weak fibre would not be a flexible but a brittle one, and without considerable strength, flexibility in the true sense cannot exist. On the other hand, a fibre might be strong and harsh and yet not flexible, being, therefore, not so suitable for spinning.

Warp yarn has to stand considerable strain during weaving, a feature not required by the filling, hence the strongest cottons have to be used for warp yarns. Filling, although required to be made from fibres of proper length and strength, in order not to influence the strength of the fabric, yet requires a soft and flexible fibre. Any attempt to determine the average strength of single fibres in a lot of cotton necessitates the testing of an enormous number of fibres, since a pound of cotton contains at least one hundred million fibres, and the strength of the fibres varies widely.

The classification of our Mainland Cottons is generally done by means of 7 full grades, which if required are divided in half or quarter grades, thus giving a chance to grade either by 7 full, 13 half, or 25 quarter grades as the case may warrant.

The full grades are Fair, Middling Fair, Good Middling, Middling, Low Middling, Good Ordinary and Ordinary. "Fair" is considered the best quality, the other varying downwards in proportion, so that "Ordinary" becomes the lowest, or perhaps has the shortest staple, and will chiefly lend itself for the spinning of inferior counts of yarns.

The half grades are designated by the prefix "Strict."

The quarter grades are designated by the prefixes of "Barely," meaning the mean point between the half grade and the next full grade above, and "Fully," meaning the mean point between the half grade and the next full grade below.

Sea Island cottons are graded as follows: Extra Fine, Fine, Medium Fine, Good Medium, Medium, Common and Ordinary which is the lowest priced staple.

Egyptian cottons are as a rule quoted under four or five grades, viz.: Good, Fully Good Fair, Good Fair and Fair, which is the lowest quality. Between the grades Good and Fully Good Fair there is often an intermediate grade adopted, called Extra Fully Good Fair.

Highest and Lowest Prices of Middling Upland Cotton. The following table, compiled and copyrighted by Alfred B. Shepperson of New York, covers the highest and lowest prices in New York, of the bulk of our cotton supply, quoted in calendar years, since 1831.

Year.	Highest.	Lowest.	Year.	Highest.	Lowest.
1831	11	7	1868	33	16
1832	12	7	1869	35	25
1833	17	9	1870	25 3/4	15
1834	16	10	1871	21 1/4	14 3/4
1835	20	15	1872	27 3/8	18 5/8
1836	20	12	1873	21 3/8	13 5/8
1837	17	7	1874	18 5/8	14 3/4
1838	12	9	1875	17 1/8	13 1/16
1839	16	11	1876	13 3/8	10 5/8
1840	10	8	1877	13 5/16	10 13/16
1841	11	9	1878	12 3/16	8 13/16
1842	9	7	1879	13 3/4	9 1/4
1843	8	5	1880	13 1/4	10 15/16
1844	9	5	1881	13	10 7/16
1845	8 3/8	5	1882	13 1/16	10 1/4
1846	10	6	1883	11 1/8	10
1847	12	7	1884	11 15/16	9 3/4
1848	8	5	1885	11 1/2	9 3/16
1849	11	6	1886	9 9/16	8 13/16
1850	14	11	1887	11 7/16	9 7/16
1851	14	8	1888	11 3/8	9 3/8
1852	10	8	1889	11 1/2	9 3/4
1853	11	10	1890	12 1/4	9 3/16
1854	10	8	1891	9 1/2	7 3/4
1855	12	8	1892	10	6 11/16
1856	13	9	1893	9 15/16	7 1/4
1857	15 7/8	9	1894	8 5/16	5 9/16
1858	13 1/2	8 7/8	1895	9 3/8	5 9/16
1859	12 3/4	10 3/8	1896	8 7/8	7 1/16
1860	11 5/8	10	1897	8 1/4	5 13/16
1861	38	11 1/2	1898*	7 13/16	5 3/4
1862	69 1/2	20	1899*	6 5/8	5 5/16
1863	93	51	1900*	10 1/4	6 1/4
1864	1.90	72	1901*	12	8
1865	1.20	35	1902*	9 7/8	7 13/16
1866	52	32	1903*	13 1/2	8 30
1867	36	15 1/2	1904*†	17 1/4	9 1/2

*For year ending August 31. †Supplied by The S. Blaisdell Jr. Co.

In many instances Cotton can be distinguished from Wool, Silk, Flax or Hemp by means of the naked eye, again in other cases the microscope will readily reveal its presence, and it will only be necessary to rely on Chemistry in extreme particular cases, or when the exact percentage of cotton in a mixture of it with other fibres is required to be known.

TESTS FOR DISTINGUISHING COTTON FROM OTHER FIBRES.

To Determine the Presence of Cotton in Connection with Wool or Silk, by means of a chemical analysis, the sample must be thoroughly boiled with water in order to extract the sizing and color. When this is done, about 0.1 gram is put in a test glass with 1 c.c. of water and two drops of an alcoholic solution (15—20 per cent) of a-naphthol, and as much concentrated sulphuric acid as there is liquid already. Cotton (as well as other vegetable fibres), if present, is readily dissolved, and the liquid assumes a deep violet color when agitated; wool or silk gives a more or less yellow to reddish-brown coloration.

To Ascertain the Percentage of Cotton in a Sample Composed of Wool and Cotton, boil the cleaned, dried and weighed sample gently for two hours in 8° B.

caustic potash, then wash it well and re-dry it. During boiling add from time to time a few drops of water so as to prevent the alkali from becoming too concentrated. After drying at 212° F. the residue is weighed, the result giving the weight of cotton, and the loss, that of wool. Instead of potash, 7° B. caustic soda may be used, boiling being in this case restricted to a quarter of an hour.

To Separate Wool from Cotton, remove any size or dye by boiling the sample in dilute hydrochloric acid, dilute lye, or by extraction with alcohol, ether, etc., and dried at 212° F., and placed in four parts of sulphuric acid and one part of water for twelve hours, then mixed with three volumes of absolute alcohol and water and filtered. The residue is washed in absolute alcohol until the washings are colorless, and afterwards with water, being finally dried and weighed to ascertain the weight of wool present.

Another method is thus: After freeing the sample from dye and sizing as before, and washing, the same is dried and weighed, and then immersed in ammoniacal copper oxide for twenty minutes, after which water is added. The residue left after filtration is thoroughly washed, dried and weighed, the result giving the amount of wool in the mixture.

To Separate Silk, Cotton and Wool in a sample containing these three fibres, remove the size and dye, as previously explained, and in turn treat the sample with ammoniacal nickel oxide, which dissolves the silk at once. The cotton in turn is then dissolved from the remaining portion of the sample by means of ammoniacal copper oxide, leaving the wool behind.

To ascertain the percentage of each in a sample composed of Silk, Cotton and Wool, two samples of yarn, each weighing 2 grams, are dried, weighed and boiled for a quarter to half an hour, in 200 c.c. of 3° B. hydrochloric acid, to remove the size and dye, and are then thoroughly washed and pressed. One sample is then immersed for a short time in a boiling solution of basic zinc chloride, then washed thoroughly, first in acidified, afterwards in clean water, then dried and weighed, the difference in weight giving the amount of silk. The second sample is then boiled for fifteen minutes in 60 to 80 c.c. of caustic soda (sp. gr. 1.02), and then washed, dried, and weighed, the difference in weight representing the proportion of wool. The residue is cotton, the dry weight of which must be augmented by about 5 per cent to compensate for the corrosion of the fibre during the operation.

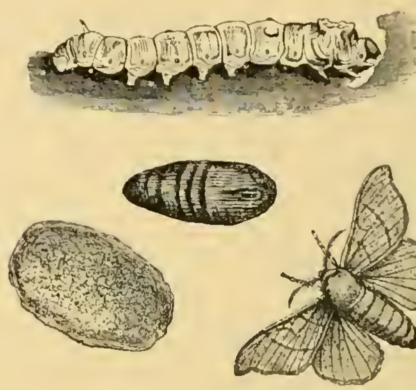
To Separate Silk, Tussah Silk, Wool and Cotton in a sample, have the sample first acted on by boiling half a minute with concentrated hydrochloric acid, which immediately dissolves the silk, the tussah silk being dissolved at the end of two minutes' further boiling. On treating the remainder of the sample with hot caustic potash, the wool will then be dissolved, and the cotton left.

To Determine the Presence of Cotton and Flax in a sample, the same is dyed by immersion in alcoholic fuchsine solution (1 gram fuchsine in 100 c.c. alcohol), then washed with clean water until the color ceases to run, and steeped in ammonia for about three minutes. The flax fibres or threads will then have been dyed rose color, whereas the cotton fibres or threads will be decolorized.

For the purpose of quantitative separation, the sample after having been freed from any size or dye, by a suitable boiling in dilute hydrochloric acid or distilled water, followed by a thorough rinsing, is then dipped for one and a half or two minutes in concentrated 66° B. sulphuric acid, then rinsed out well, rubbed between the fingers and neutralized by steeping in dilute ammonia or sodium carbonate solution. After washing over again in water the sample is pressed between blotting paper and dried and when flax fibres or threads will, as a rule, be found to have retained their structure whilst the cotton fibres or threads have dissolved after passing through a gelatinous stage in which they will tear like tinder.

SILK.

Silk is the simplest, and in its properties the highest and most perfect of all spinning materials. It differs from other textile fibres, both as to its nature as well as the machinery used in preparing it for the loom, the machinery used being much simpler and less cumbersome than the processes employed in preparing other fibres.



THE SILK WORM.
Larva,—Cocoon,—Chrysalis,—Moth.

The countries that produce silk are in the temperate zone. Starting from Japan to China and the belt of Central Asia, including a part of India, the silk-producing belt runs westward through Persia, the Caucasus, Syria, Asia Minor, Turkey, and the countries of South and Western Europe. Silk is divided into three main groups: (1) Cultivated silk, (2) Wild silk, (3) Artificial silk; the most important by far to the textile industry being

CULTIVATED SILK.

The same is imported in the form of "raw silk" *i. e.* in skeins, which are carefully packed in linen, with an outer covering of rush matting. The bales are square shaped, and as a rule contain 9 or 10 compound bundles of 9 or 10 skeins each. These bales, thus received by the manufacturer, on account of the high price of silk (it takes from 2250 to 3000 cocoons to make one pound of reeled silk), are carefully weighed and their contents subjected to a critical examination.

New York City, the only raw silk market in America, now holds the first place among all the raw silk markets of the world, Shanghai alone excepted; more raw silk being annually sold here than is consumed in France, which is still the largest raw silk consuming country in Europe.

The standard sizes of swifts in American mills are twenty-two and twenty-four inches, that is, the skein to measure fifty-six to fifty-eight inches in circumference. The reelers of Japan silks conform more nearly to this standard than do the reelers of Canton and Italian silks. The reelers of China steam filatures are quite uniform in the diameter of their skeins, but are apt to put too little silk in their skeins, which makes them, in throwsters' parlance, too "skinny;" by this is meant too little yardage, or weight of skein. There is absolutely no uniformity in the length and size of Canton skeins. Many Italian reelers are approaching uniformity in size or diameter of skein.

The annual supply of raw silk throughout the world is approximately thus:

China	40 per cent.
Japan	20 per cent.
Italy	20 per cent.
Levant	10 per cent.
France, Austria, Spain, and Portugal	10 per cent.

Of the total silk supply of the world, this country consumes about one third, and of which about 46% is furnished by Japan, 30% by China and 24% by Europe.

The sizes of silk most in demand in this market are 13-15 deniers. Low grades and fine sizes, as 10-12 or even 11-13 deniers, are not much used by our broad silk and silk ribbon manufacturers, although the tendency is undoubtedly toward the use of finer counts.

Cultivated silk, also termed "true silk" is the lustrous, fine, but comparatively strong thread spun by the silkworm (the larva of the silk moth Bombyx mori) at its entry into the chrysalis stage. Its cultivation dates back to about 2640 B.C. in China, and from where its culture has spread to Japan, India, Central Asia and Europe, until in 1838 a Mr. Samuel Whitmarsh made the first attempt to introduce silk culture here (Penna.) which affair however turned out a failure. Several attempts made since then, which, although not as complete failures as the first, have met and are meeting with little success, although considerable stimulants from states, societies as well as individual parties are constantly given the matter here.

The silkworm exists in four stages—egg, larva, chrysalis, and adult.

The silkworm feeds on the fleshy parts of leaves (leaving the veins almost untouched) of plants, more particularly on those of the mulberry tree, and requires a dry climate, pure air and continued moderate warmth. The mulberry tree presents several varieties, the most important of which are the white, the black and the variegated, and of which the first mentioned variety is the best, since it develops without much care and can be easily cultivated. It reaches maturity more quickly than the other species, and the silkworms take to it more kindly, producing in this instance also the best quality of silk. The practice is to strip the leaves, as are used for feeding the silkworms, once in every two years, as it has been noticed that the tree lives much longer than when deprived of its leaves annually. When the leaves are gathered they are placed for eight or ten hours in a cool and well ventilated room in order that a good portion of the moisture may evaporate before giving them to the worms.

The eggs are hatched artificially by means of incubators, because if allowed to proceed naturally, the caterpillars would be produced at unequal and at long intervals. The temperature of the incubator is allowed to rise gradually to from 70 degrees to 75 degrees F., thus imitating the process of nature. Incubation lasts from 20 to 30 days.

When the eggs are hatched, the caterpillars are covered with small branches of the mulberry tree, and in a very short time, stimulated by hunger, they climb on the leaves, and are then removed to the rearing house, a closed room, where the worms are sheltered from the wind and cold. This room is filled with shelves about a foot apart, made of wickerwork. The object of these shelves is to furnish a large surface to the insects, where they can move about freely, eat, breathe and moult. About 1,600 pounds of leaves are necessary for 35,000 silkworms produced from one ounce of eggs. When first hatched the worm is blackish and hairy, barely more than a quarter of an inch in length; then brownish-yellow, and finally milk-white. It lives about 30 days, during which period it sloughs its skin four times, increasing in length to 3 or 3½ inches, and in weight from 4,000 to 6,000 times its weight at birth. An increased temperature of between 75° and 80° F. must be maintained, and the greatest of care bestowed to the worms, on account of their impressionability to change in weather or improperly given food. A storm, a sudden lowering of the temperature, or feeding with damp leaves or some other apparently trifling accident would be sufficient to destroy the best breed of silkworms. In order to prevent overcrowding by the worms, they are covered with clean sheets of paper, perforated with a series of holes corresponding to the size of the insects, the food being placed on the top of the paper. The worms then pass through these holes, and climb upon the leaves. When a sufficient number is thus collected, the paper is removed to one of the vacant shelves and the same operation repeated, until all the worms have been removed from the place they first occupied, when the shelves are cleaned. This latter operation is also repeated after each moulting period. About the sixth day of the last period, the spaces between the shelves are lined with twigs of briar, broom or oak, placed in an upright position at a distance of about a foot apart, and disposed in the form of an arch or vine trellis. On the ninth day the silkworms climb up these branches in large numbers and choose a place for spinning their cocoons.

Meanwhile the two internal spinning glands, known as the sericteria in the worm's body, had become filled with a clear, transparent sap about as thick as honey, and which then is ejected from the glands through openings underneath the mouth in the shape of two delicate threads, see Fig. 1, which unite on issuing and form a single thread that quickly hardens in the air; hence it follows that silk exhibits no definite structure, but consists of two cylindrical, sometimes flattened, or, more rarely, helical (twisted round the axis) compact fibres or brins, consisting of homogeneous lustrous matter (fibroin) surrounded and cemented together by a substance resembling gelatine (sericin or silk-gelatine) technically called "gum," which enables the worm to fasten the silk where it wants it, and which substance contains the coloring matter in the case of colored silk, and is the cause of the rough, hard and stiff character of raw silk, a condition, however, suitable for the manufacture of certain fabrics in which this quality is of importance, such as lace and gauze. It loses this property, though, and becomes soft, supple, lustrous and a brilliant white when the coating of sericin is removed by the aid of an alkaline solution, such as hot soap and water, the silk then becoming changed into scoured silk.

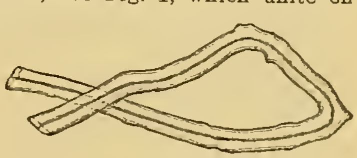


Fig. 1.

In the course of three days the larva envelops itself in a loose, coarse, transparent external covering of this doubled thread, termed the husk or knub, a kind of fluffy silk (florette or floss silk), followed by a second or internal casing of "cocoon," which being a strong and compact mass, composed of a firm and continuous thread, which is not wound in concentric circles as might be expected, but in a short figure 8, resembling loops (Fig. 2), first in one place and then in another, hence in reeling, several yards of silk may be taken off without the cocoon turning around. The cocoon when completed, is of an oval, or a more cylindrical shape from 1¼ to 1½ inches long and ⅘ to 1 inch wide, the first-named shape of cocoon yielding female moths, the other males. Fig. 3 is a cross section of a cocoon, clearly showing its two divisions. The weight of the individual cocoons varies from 16 to 50 grains. The cocoons which have a hard and firm covering are regarded as the most valuable, as they contain the greatest quantity of silk, while those which are soft and thin are regarded as inferior in quality. The total length of thread composing a cocoon is about 4,000 yards, but only from 300 to 1,000 yards can be recovered by reeling, neither the external floss silk nor the innermost parchment-like layer being obtainable by this means, and which, as will be explained later on, are used in the manufacture of waste silk. In the cocoon the larva then changes into a chrysalis (pupa) about 1 inch long and ⅓ inch thick, by casting its skin; and from the pupa, if undisturbed, develops the dirty-white silk moth, which, in a short time (two or three weeks) after the change, bores its way out through the apex of the cocoon—the threads having been previously softened by an excreted juice—and immediately begins to pair in order to maintain its species. This exit of the moth from its cocoon interferes with the commercial qualities of the silk, and to avoid it, such of the cocoons as selected for fibre are subjected to a temperature of about 145° F. for 12 hours, which has the effect of killing (stifling) the chrysalis or pupa. Although other processes are also practical to obtain this result, the one quoted is the quickest procedure.

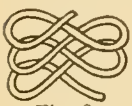


Fig. 2.


Fig. 3.

In connection with cocoons selected for reproducing purposes, and which must be only the best, the moth is permitted to leave the cocoon, as explained before, in turn spoiling the latter for reeling, *i. e.* true silk, being worked up in what is known as spun or waste silk.

The maximum amount of cocoons which one ounce of eggs (comprising 35,000 worms) furnishes, is 130 pounds, but a return of 80 pounds is considered very satisfactory. From 625 to 1,100 cocoons are required to make one pound of silk, and the price of a pound of cocoons is about 84 cents. The moth is yellowish-white in color, with dim cross markings, and a pale brown lunar spot on the upper wings, which are cut away below the tip, and measure about 1½ to 2 inches from tip to tip. There are three kinds: white, yellow and green moths. The moths are allowed to couple for from six to eight hours, and then the females are removed and enclosed in little sacks made of gauze, called cellules, where they lay their eggs and die. Later on, the dead insects are examined under the microscope to discover if any traces of any disease detrimental to the worm are present, and if so the eggs from the moths that are affected are destroyed. The average production of each female is about 400 eggs.

The eggs are very small and exceedingly light, generally from 30,000 to 40,000 to the ounce, and in size and shape of turnip seeds. The best breeds of silkworms go through their changes but once a year, yielding in return large cocoons, and being of little trouble to the silk grower, whereas other breeds (apparently not of the same species, but of the same genus) go through these changes two, three, four or more times a year, yielding in turn an equal number of crops of cocoons. These silkworms are classified as polyvoltines, such as yielding two crops are known as bivoltines; three crops as trivoltines, etc., etc. The silkworm yielding the greatest number of crops (8) is known as dacey and is found in Bengal.

Chemical Composition. As previously mentioned, the silk fibre is composed of fibroin ($C_{15}H_{23}N_5O_6$) and sericin ($C_{15}H_{25}N_5O_8$). Besides these two bodies proper others occur in smaller proportions. Two samples of silk submitted to the successive action of hot water, alcohol, ether, and acetic acid gave the following results:

	Yellow Italian Silk.	White Levant Silk.
Silk fibre	53.35	54.05
Matters soluble in water	28.86	28.10
" " " acetic acid	16.30	16.50
" " " alcohol	1.48	1.30
" " ether	0.01	0.05
	100.00	100.00

Examining in detail the substances which each solvent had extracted, gave the following results:

	Yellow Italian Silk.	White Levant Silk.
Silk fibre	53.37	54.04
Gelatin	20.66	19.08
Albumen	24.43	25.47
Wax	1.39	1.11
Coloring matter	0.05	0.00
Resinous and fatty matter	0.10	0.30
	100.00	100.00

The proportion of fibroin here given is probably too low, and the albumen too high, owing to acetic acid having a solvent action on fibroin, and thus the percentage given for albumen, must be too high, owing to the altered fibroin it contains.

In practice during the "boiling off" process there is about 30 per cent. of loss. When boiled for some considerable time with water, raw silk loses its gum but not the fatty or other matter it contains, and the tenacity of the fibre is somewhat reduced. All hot liquids exert a similar solvent action on the gum, and for this reason it is necessary to carry on any mordanting or dyeing operations at as low a temperature as possible. Dilute mineral acids have no appreciable action on silk, but they have the property of imparting to it a peculiar "scroop" or crackle, the cause of which has not been ascertained. Strong mineral acids act readily upon silk.

Concentrated sulphuric acid reduces it to a brown solution, from which, when diluted with water, the fibroin can be precipitated by tannic acid.

Concentrated nitric acid also destroys silk, but moderately dilute nitric acid gives it a yellow color, due to the production of xanthopreteic acid, the silk being considerably weakened by the operation. This reaction with nitric acid can be used to distinguish silk from cotton.

Concentrated hydrochloric acid dissolves silk even when used cold.

Sulphurous acid, either in a solution or as gas, destroys the color of raw silk, and is therefore made use of in bleaching silk.

Organic acids when used in the form of hot dilute solutions, simply remove the sericin, and have very little action on the fibroin; weak solutions of such acids as acetic, tartaric, and oxalic are largely used for restoring the lustre of silk after it has been boiled in soap, or dyed, this being the basis of the brightening operation.

Strong solutions of the caustic alkalies, potash or soda, completely and rapidly dissolve silk, especially if applied warm, while very weak solutions simply remove the sericin from raw silk, and although they have no appreciable solvent action on the silk fibre, yet they destroy its brilliancy or lustre, and more or less affect its color, hence the use of the caustic alkalies in the treatment of raw silk is very undesirable.

The carbonates of potash or soda act in a similar manner, completely dissolving the silk when used in a concentrated form, but when weak, their action is not so energetic, and is therefore more under control, though their use is not advisable on account of the risk of damaging the silk fibre.

Soap is almost the only alkaline substance that can be safely used for boiling off or degumming silk. Hot soap solutions readily and completely remove the gum and leave the fibroin elastic and strong. Being cheap and easily obtainable, soap is the boiling off agent usually applied in all silk mills.

Borax is a weak alkaline salt that has no action on silk, but while very useful as a mordant for some colors that require an alkaline bath, it is not useful as a boiling off agent.

Lime water first causes the silk to swell, if the latter be steeped in it, and has an apparently softening action on the silk gum; if, however, the action of the lime water be too prolonged, the silk fibre has a tendency to become brittle.

If silk be allowed to steep in a solution of potassium bichromate, it is slowly oxidized, the silk acquiring an olive green tint due to the formation and deposition of chromium oxide in the fibre. This is useful in mordanting silk which is to be dyed with the alizarine dyes. However, the action of the salt is not very great, silk differing from wool in this respect; on this account, bichromate is rarely used as a mordant for silk dyeing.

Silk, when immersed in neutral or basic solutions of many metallic salts, such as alum, sulphate of alumina, nitrate of iron, chloride of tin, acetates of iron, alumina, lead and chromium, etc., has the peculiar property of attracting to itself the oxides of the metals. This property is a very valuable one and much used in mordanting silk for blacks and those colors which require a mordant. In some cases, as in those of nitrate of iron and perchloride of iron, the quantity of oxide absorbed from the solutions greatly increases the weight of the silk, a property which is taken into consideration by silk dyers.

Silk is soluble in strong solutions of chloride of zinc, from which it is thrown down as a precipitate on diluting the solution with water. It is also soluble in strong solutions of stannic chloride, 70° Tw.; in an ammoniacal solution of copper; in an alkaline solution of copper sulphate and glycerine. This property serves as a means to distinguish silk from wool, and cotton, since the solution has no action on these latter fibres. The solution is made as follows:—Dissolve 16 grams of copper sulphate in 150 c.c. water, add 10 grams of pure glycerine, then add a solution of caustic soda until the precipitate which first forms is just dissolved; much excess of caustic soda is to be avoided.

Hygroscopicity. Silk can absorb moisture from the air without becoming noticeably damp, the quantity of moisture thus absorbed may attain as much as 30%. The normal or standard weight of silk in silk conditioning establishments is calculated by allowing 11% of moisture to the dry weight of the sample. In yarns composed of silk and wool the permissible limit of moisture is 16%.

Important properties characteristic to silk. Amongst these we find:

Color. Cultivated or true silk is generally white, although some are of a yellow color, varying in shade from pale canary to a deep gold yellow, whilst reddish, bluish or green silks are rare.

Fineness. The smaller diameter of silk fibres varies from 0.00052 inches, to 0.00104 inches.

Strength. The breaking strain of raw silk is considerable, a feature contributing largely to its usefulness as a textile fibre.

Lustre. This property is superior in silk to other textile fibres.

Elasticity is also one of the chief characteristic properties in true silk.

Scroop. Silk (especially after immersion in weak acid), when compressed and rubbed, gives out a peculiar rustling sound, which is known as scroop.

Reeling. This process is always done in the countries where the silk is raised. Before starting the reeling, the cocoons are first sorted, in order to obtain silk of uniform character and value. White and yellow cocoons are put aside in separate lots; whilst spotted (or rusty) cocoons, dead cocoons, (containing putrefying dead pupa) mouldy cocoons and cocoons that have been gnawed by insects, etc., or are in holes or otherwise defective, as well as double cocoons (which are very troublesome to wind), are thrown aside and worked up as waste (floss) silk.

The outside or loose silk of the cocoon is then removed as this cannot be reeled, after which the cocoons are immersed in hot soapy water to soften the gum which sticks the threads together. The operator brushes the cocoon with a small broom, to the straws of which their fibres become attached, and then carefully unwinds the loose silk until each cocoon shows but one thread. The silk filament as formed by the worm is so fine that if the strand from each cocoon were reeled separately, it would be totally unfit for the purpose of the manufacturer, besides being difficult to handle; and consequently in reeling, the ends from several cocoons are united and reeled off together, so as to form one thread, which in turn can be handled. From 3 to 20 ends from a corresponding number of cocoons are reeled together and the thread thus formed is twisted a few times with a similar thread in their passage to the reel, and afterwards separated before reaching it, the object being to thus wring the water from the threads, consolidate the cocoon threads more solidly and make the resulting thread smooth and round. When one of the cocoon filaments breaks or the limit of good fibre is reached, the operator takes a fresh end of a cocoon filament, and with his thumb and forefinger, twists it onto the running compound thread, of which from that moment it becomes a constituent part. Different methods of reeling prevail in different countries, but the most careful are practiced in France and Italy. The fibre of the cocoon is somewhat finer in the floss or outside part on the cocoon, and thickens at the point of forming the more compact part, and gradually diminishes in diameter until it becomes so fine as to be incapable of standing the strain of reeling. The decrease in the diameter results from one of the worm glands becoming exhausted, leaving only one-half of the original fibre.

The standard American skein calls for the following specifications:

Length: Skein to measure 56 to 58 inches in circumference.

Width: Width on reel to be three inches.

Traverse: Threads to make 33 complete crossings across the skein and back in 50 revolutions of the skein.

Size: Skeins to contain silk to the weight of $2\frac{1}{2}$ to 3 ounces, the lighter for fine sizes, the heavier for coarse sizes, but in no case to exceed three ounces.
Skeins: Always single skeins laced through in two places directly opposite each other.

SILK THROWING.

When the hard or raw silk is received by the manufacturer, it has to undergo more or less processes, in order to get it in proper condition for manufacturing into fabrics. There are several different classes of silk yarns that are made by the different systems of doubling and twisting, the process in either case being known as silk throwing.

The first process to which the silk, as received in the form of skeins, is subjected, is transferring it onto bobbins on a winding machine, after which the silk goes through a cleaning process in order to rid the yarn of any irregularities or imperfections, which would otherwise cause bad yarn during throwing. It consists in passing each thread between two fixed, upright, parallel plates, of a series of plates, placed close together, so as to catch any knots or other imperfections in the thread, and arrest its passage until said imperfections are removed. The silk is then ready to be thrown, *i. e.* made into "singles," "tram," or "organzine," which are the three classes of silk yarn made.

Singles also termed "dumb" singles, is made by simply doubling two or more raw silk threads and winding, without twisting, them together. This silk produces a very soft and lustrous silk fabric which cannot be equalled with twisted yarns.

Tram silk is composed of two or more single threads without individual twist, and which are united into one thread by slightly twisting them together, for the more the twist, the less the lustre, and harder the feel; also a very slight twist enables the yarn to "cover" better when woven into cloth. If two threads are used it is termed two thread tram; if three, three thread tram, etc. Tram silk is made from the poorer qualities of fibre and is used principally for filling yarns.

Organzine consists of several single threads which are first individually twisted in one direction, after which they are doubled and twisted in the opposite direction to the first twist. The twist thus imparted to the yarn adds strength to it, however an excess of twist is a disadvantage, since it reduces the glossiness of the yarn. It is made from the better qualities of cocoons and is used chiefly for warp yarns.

Boiling off. The next process which the silk undergoes is that of boiling and dyeing. The hard silk, as it reaches the dyer, contains the natural gum and color from the worm, and other impurities, some of which have been necessarily added in reeling and throwing it, and which have all to be discharged in order to obtain what is known as "soft" silk; in the case of Souple and Ecru silks, this discharging of the impurities is less fully done. The silk during the process of boiling off will, of course, lose in weight, the amount depending on the character of the silk; China silk losing the most, while European and Japan silks lose the least; and also upon the class of silk, as previously mentioned, required to be produced. The boiling off or ungumming of silk is performed by means of hot soap solutions. Boiling the silk repeatedly in these soap baths deprives the former of its gum and leaves it soft and lustrous, qualities which are so highly prized in silk fabrics.

Soft Silk. In this case the boiling off or ungumming of the silk is made complete, the silk losing by this process from 24% to 30% of its weight.

Souple silk, is silk from which only a part of the gum has been removed, this silk in this instance losing only from 5% to 12% of its weight. This silk is not as soft after the process as in the case of the completely ungummed silk.

Ecru silk, is silk which has had only a small portion of the gum removed, the loss in weight of the silk, due to the removal of the gum, being from 2% to 5% of its weight.

After the silk has been thus scoured of its gum, it is ready for bleaching, in connection with white, or light shades, or dyeing if calling for dark colors.

WASTE OR SPUN SILK.

The product, known as Spun, Waste, Floss, Chappe, or Filosella Silk, is obtained from various sources, amongst which we find: First, the coarse, loose, outer layers surrounding the true cocoon; Second, defective cocoons, *i. e.* such as have been used for breeding purposes and from which the moth has emerged, and which are therefore difficult or impossible to reel, also double cocoons and those from diseased worms; Third, the parchment like skin left behind in reeling the sound cocoons; Fourth, the waste made in reeling the cocoons, as well as such as made in silk throwing mills. This waste silk fibre, after being properly prepared, *i. e.* boiled off, in turn is carded, combed, drawn and spun into a yarn partaking of some of the qualities of raw silk, although it is not as bright as the latter, its lustre varying largely according to the amount of gum retained on the fibres. The more the gum has been boiled out, the greater will be the lustre of the fibres. Again, spun silk is weaker than thrown silk, both in strength and elasticity.

The boiling is usually extended for about two hours, after which the silk is dried and then placed in a damp place to better enable it afterwards to be worked. After being garnetted or carded, *i. e.* torn up into short workable lengths, the silk is dressed—a proceeding somewhat similar to combing. The process results in a lap which is gilled, drawn and then passes to the roving frames, preparatory to spinning and doubling.

Lately a process for waste silk spinning has been patented in this country, the gist of which is to spin the yarn in the gum, and afterwards subject the yarn or fabric, as the case may be, to the boiling off process, the inventor claiming that in this manner the spinning operation can take place with less waste being made, besides producing a smoother thread, owing to the influence of the gum which causes the fibres to adhere more closely to each other, and consequently the singeing of the yarn is unnecessary.

The best kinds of spun silk yarns (mostly two threads united by doubling) are used as filling for various silk fabrics and velvets, also as warps for many half silk goods, and as embroidery and knitting silk; whilst the lower grades are made up into ribbons and cords, and the poorest are used in cheaper knit goods and other fabrics. Floss or chappe silk, with the exception of yarns for zephyrs, are generally doubled and in turn gassed, for which purpose they are passed quickly through a gas jet about a dozen times, and when they lose about 5 per cent of their weight.

The waste made during spinning these spun silk, waste silk, floss or chappe silk yarns is afterwards used either by itself or in connection with better stock in spinning still lower qualities of silk waste yarns. In this instance the yarn is spun after the woolen yarn system. These yarns are then used as filling for dress goods, upholstery fabrics, polishing cloths, coarse grades of knit goods; also for packing material, and as insulating lagging for steam pipes, silk being a bad conductor of heat.

Silk Shoddy is prepared from silk cuttings and remnants by a similar treatment to that employed and explained with wool shoddy, the short staple product being worked up as an adjunct to waste silk in the cheapest grades of yarns, or for other purposes previously explained.

WILD SILKS.

The same are the products of the various species of wild silkworms as found principally in India, China and Japan, although found also more or less in other localities. Like cultivated silk, wild silks consist of two filaments which, however, instead of being structureless are composed of individual fibrils, readily recognized under the microscope by decided, parallel, longitudinal striations. They are also less circular in cross section than cultivated silk. Only very few of the wild silkworms produce cocoons of the same regularity as those of the cultivated silkworms, owing to the worm interrupting the spinning of its cocoon, and what will mix up the filaments composing the cocoon; again small portions of leaves and twigs will get entangled with the cocoon, on which account the majority of wild silks are difficult if not impossible to reel, and for which reason they are chiefly used for the production of yarns corresponding to spun or waste silk of the cultivated variety.

Among the advantages of wild silk are its greater durability, by reason of the larger diameter of the filament, which is about 0.002 of an inch; its cheapness, since the worms thrive in the open without attention and yield two, three, and with some species more crops of large cocoons in the year; absence of loss of weight in dyeing, since wild silk does not require to be scoured.

However, it must be mentioned that wild silk has a darker color, which cannot be removed except by means of a powerful bleaching agent; its lustre, softness, and elasticity being inferior to those of cultivated silk. The most important varieties of wild silks are: Tussah, Eria, Fagara, and Yamamai.

Tussah Silk is the most important variety of wild silk and is the product of the Tussah moth which is widely distributed throughout India and Southern China. The cocoons are of a large size and vary in color from silver gray to brown. They are hard and difficult to reel, unless specially treated, for which reason they are mostly worked up in the same manner as defective cocoons of cultivated silk in connection with spun silk. Tussah silk has a vitreous lustre, and is somewhat stiff compared to cultivated silk, the fibres being more or less irregular and measuring on an average of 0.002 of an inch in cross section. It is used chiefly in the production of plushes, upholstery fabrics, draperies, and similar other fabrics. Fig. 4 shows a magnified view of these fibres.

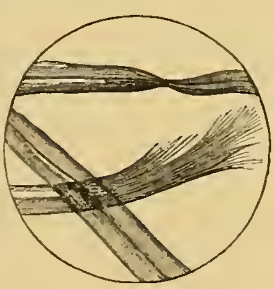


Fig. 4.

Eria Silk, is closely related to Tussah silk, being produced from the recinus moth, a native of India.

Fagara Silk, is the product from the Atlas moth, the largest nocturnal moth known, and a native throughout Eastern Asia. The cocoon is light brown in color, being open at both ends, so that the moth can escape without injuring the cocoon filaments. This silk also resembles Tussah silk.

Yamamai Silk, is obtained from the Japanese oak leaf moth of this name, and compared to the other wild silks most nearly resembles cultivated silk, though it is somewhat coarser than the average cultivated silk, its diameter being about 0.001 inch. This silkworm spins an unusually regular cocoon of a beautiful pale green color, and from which the silk can be readily reeled.

In California, a wild silk-moth is found thriving on the poisonous species of Rhamnus californicus. It produces a silk nearly as good as that of the cultivated silkworm, and owing to the favorable nature of the climate, without the frosts or rains of China and Japan, has great prospects.

WEIGHTED SILK.

The weight taken from the silk during the boiling off process is a considerable item, and to compensate for this loss, the practice of artificially adding weight to some silks received its start, the amount of weighting done having been continually increased above the original weight of the silk, until now from 3 to 4, or more, times its weight is thus added. Different methods are employed for this process, depending on the color of the silk, that is, whether it is white, light, or heavy colored.

For dark colored or black silks, nitrate of iron in combination with tannin matters, like catechu, galls, logwoods, etc., is used for weighting, this being easily and readily effected by alternate treatments with the iron salts and tannin matters; and by the addition of tin salt it is possible to increase the weight of the silk to three or four times its original weight. As iron tends to color silk, it cannot be used for weighting silk when the latter is to be dyed in light colors, for which reason recourse is had to perchloride of tin, which weights silk in a satisfactory manner, and at the same time permits the dyeing of such weighted silks in any color. Tin perchloride comes in the market in two forms, viz., either as a strong and somewhat corrosive liquid, or in the form of white solid lumps of a hygroscopic nature. It also can be made by the dyer himself in the following manner: 1 pound of tin crystals is dissolved in 1 pound of hydrochloric acid. Next add 3 ounces chlorate of potash in small quantities at a time, since there is a considerable amount of chemical action going on, for which reason caution must be exercised in mixing the ingredients. Stoneware jars are the best to use in carrying on the work. Whether bought ready made or prepared, as described, the tin chloride liquor is prepared by making it up to a strength of 50° Tw. The solution should not be made stronger, since tin chloride liquors of over 60° Tw. tend to act upon, and in turn disintegrate the silk fibre. The silk is well immersed in this liquor and left for about two hours, after which it is taken out, the surplus liquor wrung out and allowed to run back into the jars, since the said liquor can be used over and over again, only replenishing the solution with new strong liquor from time to time, in order to keep the same up to its proper required degree of strength. After the silk has been wrung, it is well washed in water, then passed through a prepared bath of 4 ounces of soda per gallon of water. These two operations of immersing the silk in the tin chloride liquor and in turn washing the silk thus treated, are repeated as often as is necessary to produce the required weighting. After being thus weighted, the silk is ready for dyeing. By alternating baths of tannic acid with the tin, it is possible to add considerably to the weighting power of the tin baths. This weighting does not add anything to the color of the silk, so that, as mentioned before, silk thus treated can be dyed in the most delicate colors, as, for example, light shades of blue, yellow, red, green, etc. In order to show the apearance of loaded silk fibres, Fig. 5 is given, showing magnified views of different amounts of weighting: A shows weighting from one and one-half to twice the weight of the silk, B shows this weighting

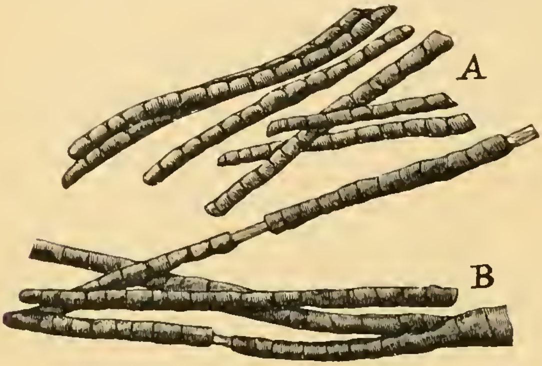


Fig. 5.

increased to from three and one-half to four times the weight of the silk. The weighting of silk is confined to raw, *i. e.* reeled silks, for the prices of waste or spun silks would not make it worth while extending the system in that direction.

ARTIFICIAL SILK,

is made by treating cotton or other cellulose material with a mixture of nitric and sulphuric acid at a low temperature, which converts it into nitro-cellulose, which is then dissolved in a mixture of acetone, acetic acid and amyl alcohol, equal volumes of each of the three components giving the best results. This substance is expressed from capillary orifices, and instantly solidifies on contact with the atmosphere, by reason of the evaporation of the acetone, and forms solid, silky, lustrous threads, which in turn are reeled, doubling two or three ends. Artificial silk in this state is an inflammable and explosive product, due to the presence of the nitro-cellulose, and this has to be remedied to render it safe for use. For this purpose suitable reducing agents, such as hydrosulphurous acid, ammonium sulphydrate, etc., are employed in order to reduce the nitro-cellulose, to totally or partially denitrated cellulose, according to the length of the reaction. The banks of threads are immersed in the solution for several hours, then washed in pure water and suitably dried. The coloring of the threads is done when preparing the mixture for making the thread.

Artificial silk has not met with that success that was predicted for it, but it has found some uses in the manufacture of braids, etc. Since it thus has become, to some extent, an article of commerce, the following methods for detecting its presence, when employed in combination with natural silk or other fibres in the construction of fabrics, may be used: Natural silk dissolves in an alkaline solution which remains white, while with artificial silk the solution turns yellow. Another method is thus: Artificial silk is not soluble in an alkaline copper solution when glycerine is present, while natural silk dissolves in it at ordinary temperature. This test is so sensitive, that by means of it, the relative quantities of natural and artificial silk in a tissue can be readily ascertained. The solution is prepared by dissolving 10 parts of sulphate of copper in 100 parts of water. To this are added 5 parts of glycerine and potash in sufficient quantity to again re-dissolve the precipitate that has been formed.

MODES OF ASCERTAINING THE CHARACTER OF SILK.

To test the quality of silk, as used in the construction of a fabric, tear the latter both lengthwise and crosswise. If it gives way readily in either direction, it shows that either the dye used has destroyed the strength, or the threads are composed of inferior material. Pure silk, if not weakened in dyeing, is the strongest of fibres. Nearly all the cheaper dyes, particularly the dark and black ones, have metallic salts as a basis, which weaken the fibres. The construction of the fabric, *i. e.*, its texture and weave, is tested by scraping diagonally across the fabric with the thumb nail, and if the fabric in question is durable, the threads will not slip, otherwise the thumb nail will soon make a space of loose threads, indicating too loose a texture. The quality of the warp and filling is determined by ravelling out the fabric, and examining carefully the threads. Sometimes a pure silk warp is used in connection with a heavily loaded filling; at others, the filling which comes on the face of the fabric is of pure silk, while the remainder is inferior silk, etc. Weighting or adulteration of fibre is readily ascertained by burning the thread. If it is pure and properly dyed, it will take fire with difficulty, and the flame will go out as soon as the fire is withdrawn, in turn leaving a nearly jet black mass, the same as wool, but since silk contains no sulphur, no pronounced smell of burnt horn is evolved. Weighted silk takes fire readily, and once burning, will smoulder, leaving a refuse, retaining the shape of the yarn or fabric tested, and is of a light yellowish red color.

TESTS FOR DISTINGUISHING SILK FROM OTHER FIBRES.

Silk can be distinguished from cotton by alkalinizing a solution of fuchsine, by adding drop by drop a liquor of potash or caustic soda. The moment the liquor gets discolored, the threads to be tested are immersed and lifted after half an hour and carefully washed. Under this treatment silk threads or fibres become red, whereas cotton threads or fibres remain colorless.

A solution of zinc chloride of 1.7 specific gravity dissolves silk, but has no action on wool, and therefore is a simple procedure for ascertaining if wool fibre is present.

When flax, hemp, cotton, and jute are mixed with wool and silk, the sample may then be boiled in an aqueous solution containing 10 per cent. of hydrate of soda; the wool and silk dissolve, while the vegetable fibres remain unacted upon. The whole is thrown upon a cotton filter, and the undissolved matter is then washed with hot water and afterwards acidulated with 5 per cent. of hydrochloric acid, to which, if the residue is black or dark colored, a few drops of chlorine water are added. Meantime the original alkaline filtrate can be tested for wool with acetate of lead. If a white precipitate is formed, which dissolves on stirring, silk alone is present. A black precipitate indicates wool. The nitro-prusside of sodium gives a violet color if wool is present. If the tissue is deeply colored, it may be cut up and steeped for from fifteen to twenty minutes in a mixture of two measures of concentrated sulphuric and one of fuming nitric acids. Wool, silk, and coloring matters are destroyed, while the cellulose is converted into gun-cotton.

FLAX.

The flax fibre of commerce is obtained from the stem of the flax plant (Linum usitatissimum), which is grown here, Canada, as well as all over central and northern Europe.

The portion of the flax plant as used in the manufacture of linen yarn is the bast tissue, situated between the bark and the hard or woody tissue. The characteristic features of the flax fibres are their length, strength, fineness and color. The fibres of flax vary with the tapering character of the stem, and the natural ends are sharp pointed and generally long drawn out. Good flax should average about 20 ins., and be free from fibres 12 ins. long.

SPECIMENS OF FLAX FIBRES, MAGNIFIED,
Showing also Cross Sections.

Pulling and Rippling of Flax. The farmer who aims at the production of a good fibre, must pull the plant before it has attained its full maturity; namely, when the lower portion of the stalk, to the extent of two-thirds of its height, has become yellow, and while the bolls or seed capsules are just changing from green to brown. At this stage the plants are pulled in handfuls, and these are laid across each other diagonally until a sheaf is complete, when the whole is carefully bound. Stems of a different length should be pulled separately and kept in separate sheaves.

The next process to which the freshly pulled flax is submitted is rippling, which has for its object the separation of bolls from the stems, this process as a rule being carried on in the same field where the flax was grown. The ripple is a kind of a large comb composed of large teeth about eighteen inches long, made of half inch square iron, placed $\frac{3}{16}$ of an inch apart at the bottom and tapering slightly toward the apex, being screwed down to the centre of a nine-foot plank and resting on two stools. This comparatively great length and smallness of the iron teeth allows them to spring lightly, and so yield to the pull of the stalk, instead of presenting a rigid surface, which would act too roughly upon them. The operation of rippling is performed by hand by drawing successive bundles of flax through the upright prongs of the ripple. The bulbs on the stems, being greater in diameter than the distance apart of the rods, are therefore stripped off in the process.

Retting. The adhesion of the hard tissue to the bast fibres of flax necessitates the stems being macerated in slow running, almost sluggish waters, from 10 to 14 days, so as to produce fermentation, which aids to separate the bast fibres from the cortical layer. When it is found that the woody portion separates freely from the fibre on breaking the stem about every six or seven inches along its length, the operation is complete, and the flax is then removed and allowed to drain and dry for a few hours, preparatory to being spread evenly and thinly on a meadow and left there for from 5 to 6 days, in order that by the action of the air and sun, the drying process may be completed, as well as the fibres bleached. This process of "grassing" also renders the wood part short and brittle, and easily crushed and broken. When dried, the flax is ready for lifting, tying in bunches and storing for the scutch-mill. Another method in use for retting flax is what is called dew-retting, and by which process the flax is spread on a meadow without steeping, and simply exposing it to the action of the weather for six or eight weeks. Damp weather is the most suitable for this system of retting, since all fermentation ceases if the flax becomes dry.

As will be readily understood, the methods of retting flax thus explained are slow work, and can be carried on only in sections of the world where labor is cheap, hence since years chemists have tried to solve a quicker process for it. By means of one of the latest processes, the pulled and rippled flax is placed in vats and kept immersed by a strong framework. Steam is admitted until the temperature of the water is raised to about 194° F. Acetous fermentation is developed, which causes the gummy cortex of the stem to be decomposed. About sixty hours' maceration is sufficient for the retting. The flax is afterwards dressed in the open air.

Scutching. This is the next process to which the flax plant after retting is subjected, and can be done by power or hand work, and consists in breaking up the woody part of the stem, and in turn eliminating it from the fibres.

In hand scutching, the flax stems are first broken by placing them across a set of hard wooden slats arranged in a frame and having a similar set pivoted so as to descend between the first set of slats. The outer ends of the pivoted slats are connected by a wooden piece, which is struck with a mallet in order to break the stems as placed between these two sets of slats. During this procedure the flax stems are held by hand by means of two short rods, connected to each other by a short wire, the operator gripping the two rods in one hand with the flax stems firmly held between them. The breaking process must always be begun with the root ends of the stems. After thus breaking the stems, a convenient amount of them is placed, and held with one hand, through a cut out portion in an upright board, the projecting ends of the stems then being struck several times with the blade of a scutching knife, as handled with the other hand, until that portion of the stem is completely separated from its woody part, and when the next portion of stem is treated in a similar manner until the entire length of the stems has thus been dealt with.

In connection with power breaking and scutching, although a variety of machinery is built, their principles of operation are identical to those just explained. We thus find breaking machines built with crushing rollers, between which the stems are passed; whereas in another style of machine we find one set of stationary horizontal iron bars having a similar set of bars working between them, so that when the stems are laid across the stationary set and the other set is lowered onto them, they are broken by this action. The machines for scutching consist principally of a board for holding the broken stems on, and having the ends project over and into the path of blades as carried by arms fast to a revolving piece, said blades taking the place of the scutching knife in the hand process. Since these blades revolve at a high speed (about 1000 strokes per minute), they must be carefully set.

A competent scutcher aims to thoroughly separate the fibre from the woody part with as little waste as possible. No doubt there will always be more or less short fibre removed along with the unworkable matter, the percentage of loss being greater when the retting process has been slighted. These short fibres, called tow, when removed from the woody droppings, are afterwards manufactured (by means of carding) into an inferior grade of yarns known as tow yarns.

When scutched, a good flax fibre is of a bright silver-gray color, (resembling silk) in its appearance. When dark in color or of a greenish tint, the fibres are either of an inferior quality, or have been imperfectly treated during the previously explained manipulations. After scutching, the flax is ready for the market, *i. e.* the spinning mill.

Chemical Composition of Flax. The flax plant is chemically composed of about:

42.0 per cent Organic Matter.
56.5 per cent Water.
1.5 per cent Ash.

100

To Ascertain whether a Yarn is Cotton or Linen, examine the threads carefully and remember that cotton threads appear of regular form throughout, whereas flax threads are irregular. When quickly torn across, cotton threads curl up, but flax threads remain smooth, this test however requiring more or less practice.

To Detect Cotton in Linen Yarns or Fabrics, treat the sample submitted with a solution of caustic potash (1 : 6). The flax will become more curly than the cotton, and the latter finally turns grayish white, whereas the flax is dyed orange.

Another procedure calls for treating the sample with a stronger solution of caustic potash (1 : 2) and boiling for two minutes, then washing, and drying between blotting paper, and when flax becomes of a deep yellow color as compared to the cotton which assumes a whitish or straw color.

By means of another process, the sample is boiled in water and then steeped in concentrated sulphuric acid for two minutes and when the cotton is dissolved, while the flax remains white and unaltered, and can be separated by washing with a weak solution of caustic potash.

HEMP, JUTE AND RAMIE.

Hemp. The character of this fibre as well as its method of production from the plant is very similar to that of flax, although hemp is inferior in delicacy and fineness. It is very much stronger than flax and equally susceptible of bleaching.

The average height of the hemp plant is from 6 to 18 feet, according to the soil, climate, etc., a mild and humid atmosphere being most favorable to its growth.

America and Russia produce the best hemp, but the former possesses greater flexibility, and can be dressed finer, although the Russian hemp is more equal in length. Manila hemp is also well known, being one of the chief products of the Philippine Islands.

The various operations through which the hemp stalk is passed in obtaining the bast fibres, which is the spinning material, are nearly the same as those used for flax, and may be divided into the same two important classes thus: (1) A chemical treatment and (2) a series of mechanical treatments.

The chemical treatment comprises retting, which is carried on in stagnant or running water, in the same manner as with flax. After the retted stalks have been rinsed clean, and dried, they are subjected successively to breaking, crushing, cutting and hackling, in order to separate the bast fibres and prepare them for the market.

The hemp fibre is whitish, silver or pearly gray, and sometimes greenish or yellowish in color, and as a rule, the paler the color, the better the quality. The length of the fibres varies from 40 to 80 inches, depending on the growth of the plant; it is very strong, and in the best hemps, the same have a silky gloss nearly equal to that of flax. Hemp absorbs moisture up to 30% of its own weight, although the maximum permissible limit is 12%. The male hemp is employed for making best hempen cloth, the coarser kinds being used for weaving canvas (for sails, shoes, etc.), hose-pipe, carpets, etc. The female hemp is preferred for making string, cord, rope, hammocks, fishing nets, etc.

SPECIMENS OF HEMP FIBRES, MAGNIFIED,
Showing also Cross Sections.

Hydrochloric acid and caustic soda give a brown color to hemp, and sulphuric acid gradually dissolves it.

Jute. This textile fibre is also obtained from the jute plant in practically the same manner as flax is obtained from its respective plant, that is by separating the bast fibres from the woody portion, by a series of operations explained in connection with flax. Jute is largely cultivated in India and China. Examining the illustration, it will be seen that the fibres consist of bundles of stiff, lustrous, cylindrical fibrils, having irregularly thickened walls and comparatively large central openings.

The best grades of fibres in the raw state are of a light brown to silver-gray color, while the more inferior grades are brownish or greenish. The fibres are rendered pliable previous to spinning by immersing them in the raw state in a solution of oil.

SPECIMENS OF JUTE FIBRES, MAGNIFIED,
Showing also Cross Sections.

In medium qualities, the fibres measure from 7 to 10 feet in length, the better kinds attaining a length of as much as 13 to 14 feet.

Jute takes up as much as 24 per cent of moisture, the permissible maximum allowed when buying being 14 per cent. It is fairly lustrous in the better grades, and very strong, although its wearing qualities are deficient. The fibres are as a rule uniform in the good varieties, and their capacity for absorbing dyestuffs is good. When bleached with bleaching powder, jute can be dyed and printed a number of handsome bright colors.

Under the continued influence of light, air and moisture, the fibre is easily decomposed, turns black and becomes rotten, which is found to occur in jute fabrics exposed to light, and more particularly at the folds, which in a short time exhibit holes. It is also essential that jute should be packed in a dry state, otherwise it is liable to spontaneous combustion.

The material is used in connection with the manufacture of carpets, rugs, upholstery fabrics, etc.; also for the manufacture of gunny-bags, burlaps, etc.

When treated with dilute chromic acid, to which a little hydrochloric acid has been added, jute turns blue, while iodine and sulphuric acid produce a dark yellow stain, which may be used to distinguish jute from flax.

To distinguish jute from flax and hemp, the threads are placed in a solution of nitric acid and a little potassium chromate and warmed, then washed, and introduced into warm alkaline water, and washed again; when the water is evaporated from the slide, a drop of glycerine is added, and after a short time the characteristic structure of the jute will be seen, under the microscope, if jute is present.

Ramie. This fibre is synonymous with China grass, since the character of both fibres is practically the same. The method for obtaining the fibre, as practiced in India, China and Japan where it is chiefly grown, is splitting and scraping the plant stems and then steeping them. The ordinary retting process, as used for flax, etc., is not sufficiently effective, since the succulent nature of the stem and the great amount and acridity of the gummy matter causes it to rapidly coagulate and become insoluble on exposure to the air.

The ramie fibre in the raw state has a soft, silky feel, but by pulling the staple, this quality becomes reduced and gives way to more or less harshness in the feel. The fibres are about 4¾ inches in length and are snow white.

The ramie fibre is used for making fabrics resembling silk and linen goods, the products being characterized by a peculiar transparent appearance and fineness to the touch, and are known as grass linen and Canton cambric. The fibre is also made into yarns for curtains, table cloths, lace, cord, and is used chiefly in Europe.

SPECIMENS OF RAMIE FIBRES, MAGNIFIED,
Showing also Cross Sections.

Sulphuric acid and iodine stain the pure fibres blue.

THE MICROSCOPE.

When required to determine the nature of the raw material used in the construction of a yarn or fabric, and no chemical test wanted, the naked eye being insufficient, then the compound microscope is employed for solving the question.

Yarns or fibres can be examined under a lens either by bringing them within or beyond focal length; in the first instance obtaining an enlarged picture on the side next the object, whereas in the other case, the enlarged picture is formed in an inverted position on the opposite side of the lens. In order to obtain high magnifying power, these two conditions are combined in the compound microscope, which consists in its main parts of a tube some six or seven inches in length, closed at the upper end by a large glass lens (of greater focal length — placed nearest the eye, hence termed "eye piece") and at the lower end by a smaller glass lens (of smaller focal length—placed nearest the fibres to be examined, hence "object piece"), both pieces being capable of vertical movement, and blackened on the inside to exclude extraneous light. The total magnifying power of a microscope is thus the sum of the powers of the "object" and the "eye piece." The tube carrying the "eye" and the "object" piece, for adjustment in the regular microscope, is raised or lowered by a rack and pinion motion, while in connection with a high class microscope, an extra, *i. e.* fine adjustment is afterwards made by the micrometer screw, as provided to such microscopes. On the stand of the microscope we find fixed an arrangement for supporting the stage (pierced with a small circular aperture for the passage of the reflected light), as well as a small circular concave reflector, which is movable in any direction.

The most important quality of a good microscope is, that its lenses produce a well defined, clear picture, distinctly showing every detail of structure in the object under examination.

The best source of illumination for carrying on investigations by means of the microscope is diffuse daylight, with a sky evenly covered with a white veil of clouds. In connection with artificial light, a glass bulb, filled with a dark blue solution of ammoniacal copper oxide, interposed between the source of light and the condenser, will be found of advantage.

For copying microscopic researches, the "Camera Lucida" is used, projecting the image either by means of glass prisms or reflectors on to an adjacent sheet of paper, placed on a level with the microscope stage, and when the outlines of the object then can be reproduced by pencilling. In order to get pictures free from distortion, the drawing surface should be inclined at an angle of 25°.

For measuring the diameters of fibres under the microscope, the glass micrometer is used, it being a fine scale engraved on glass, and the measurement is performed either on the object itself (objective micrometer) or on the image (ocular micrometer).

Yarns to be examined under the microscope, after proper removal of all dirt (in connection with undyed fibres it is advisable to previously steep or boil them in water, in the case of wool, not scoured, and where the fibres are contaminated by adherent fat, remove the latter by boiling with alcohol or treating them with ether, etc.), coloring matter (which should be removed by boiling in an alkaline or weak acid bath, or by extraction with alcohol, ether, etc.), so that the passage of the light will be unrestricted, are then untwisted by hand, in order to transfer the yarn back into a loose mass of loose fibres; selecting then a proper amount of these fibres for testing. Immersing the fibres thus to be tested in boiling water, or, better still, in glycerine or Canada balsam, will increase their transparency. In connection with vegetable fibres, boiling for a few seconds in nitric acid containing a little potassium chloride is claimed as of advantage. The fibres thus prepared are then separately laid, side by side, on a glass slide, and covered with a small cover glass of from 0.15 to 0.2 mm. in thickness.

PREPARATORY PROCESSES.

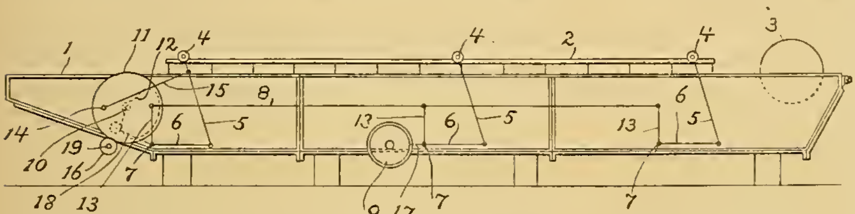
WOOL.

THE HUNTER WOOL WASHER.

The improvement of construction of the new washer over former makes more particularly refers to the means for supporting and operating the rake or harrow by means of which the wool is caused to travel from the feeding end of the bowl of a wool washer to the discharging end of said bowl.

The accompanying illustration is a diagram of this wool washer.

A description of the machine is best given by quoting letters of reference, of which 1 designates the bowl of a wool washer. 2 is the rake working in the said bowl. 3 is the rotary ducker employed at the feeding or receiving end of the bowl; however a basket ducker may be substituted if preferred.



At intervals the rake 2 has connected therewith cross rods 4, the ends of which project laterally beyond the sides of the bowl 1. The said ends are fitted to eyes in the upper ends of side arms 5, each cross rod being thus connected with a pair of the said side arms. The number of cross rods and pairs of side arms employed varies with the length of the bowl and rake, our illustration showing a rather long machine, in which three cross rods and pairs of side arms are employed. In the case of a shorter machine only two cross rods and pairs of side arms would be required. Each side arm 5 is pivoted at its lower end to the horizontal arm 6 of a lever mounted pivotally upon a stud 7 projecting from the exterior of the bowl. Each of the said levers has an upwardly extending arm 13, and the arms 13 of all the levers on each side of the bowl are connected together by a rod or rods 8, so as to compel all of the levers to move in unison.

The weight of the rake is counterbalanced by weights 9, applied to arms 17, with which the levers of one or more pairs of the side arms 5 are provided, the said arms 17 projecting oppositely with respect to the arms 6 of the said levers.

The actuation of the rake is thus: At 10 is a stud projecting from the exterior of the howl, adjacent to one end of the latter. 11 designates a gear wheel mounted to rotate on the said stud, and 12 is a cam at the side of the gear 11, fixedly connected with the latter and rotating in unison therewith. The acting face of the said cam engages with a roller mounted on a stud carried by the arm 18 of the adjacent lever, arm 18 projecting oppositely with reference to arm 6 of the said lever. A crank pin 14, carried by the gear 11, is connected by a rod 15 with the adjacent side arm 5. The rake supporting and actuating arrangements are also duplicated at the opposite sides of the bowl. For the purpose of causing the gear and cam at one side of the bowl to rotate in unison with the gear and cam at the other side thereof, a cross shaft (driving shaft) 19 is provided, it carrying pinions 16, meshing with the respective gears. The crank pins 14 transmit to the rake or harrow through the rods 15 movement in the direction of the length of the bowl, while the cams 12 act through the lever arrangements described to control the position of the rake vertically as it travels. The cams are shaped so as to co-operate with the cranks in causing the rake to advance horizontally while its tines are immersed in the contents of the bowl, then rise nearly vertically at the extreme of its advancing movement, then return along a substantially horizontal slightly curved course, and then descend in a nearly vertical curved course.

To enable the adjustment of the rake vertically upon the cross rods 4, each cross rod has fitted thereto haugers which are attached to the rake and are formed with vertically elongated eyes through which the cross rods pass. Adjusting screws are applied to the upper portions of the said eyes, their lower ends resting upon the cross rods. By turning the said screws in or out more or less the required adjustment of the rake relative to the cross rods is effected.

The vertical components of the movement of the rake are derived from the cam 12, while the horizontal components of the said movement are derived from the crank 14. The burden of sustaining the rake and imparting vertical movements thereto devolves wholly upon the cam, and the crank is relieved therefrom. The connections are direct and simple, and the possibilities of wear are minimized. (The James Hunter Machine Co., North Adams, Mass.)

SARGENT'S WOOL WASHING MACHINE.

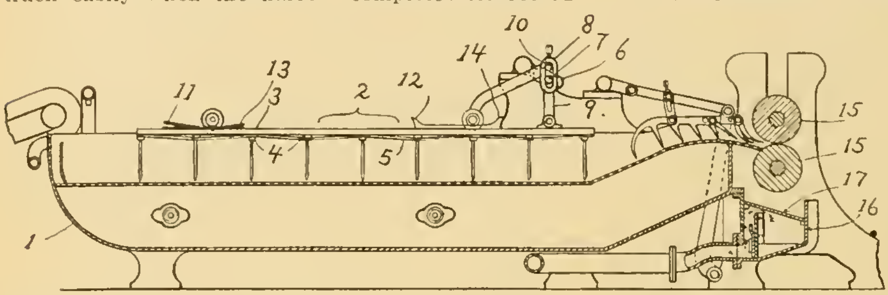
One of the latest improvements to this well known wool washing machine is to prevent sagging of the harrow which carries the rake teeth, at the same time improving the actuating mechanism for said harrow, so as to obviate any jar or shock to the same.

The accompanying illustration is a longitudinal vertical section of one of these wool washing machines, having the improvements above referred to added.

In the bowl 1 of the machine is located a harrow 2 made up of side bars 3, which support a series of rake heads 4. In order to support this harrow 2 and prevent it from sagging, a tie strap 5 is run along beneath each side bar 3, said tie strap extending alternately under and over the successive rake heads 4. To the side bars 3 of the harrow are secured two cross rods, the ends of which project over and beyond the sides of the bowl. With these ends are connected a series of weighted arms, which serve to counterbalance the weight of the harrow, and thus keep it horizontal throughout all its movements.

The harrow is actuated by means of a rotating crank 6, the pin 7 of said crank working in the slot 8 of stand 9, as fastened to the side frame of the machine. During the lower half of the revolution of this crank, its pin acts simply to advance the harrow, but when the crank pin reaches the upper end of slot 8, the harrow is carried upward, backward and downward. This sudden contact of the crank pin with the upper end of the slot occasions shock and wear, and for which reason the slot is provided with a rubber cushion 10.

In order that the trucks of the harrow strike their track easily when the harrow completes its return movement, the forward ends of said tracks are upturned as at 11 and 12; again, to assist the crank 6 to more easily raise the harrow, the opposite ends of the tracks are upturned as at 13 and 14.



Beneath the squeeze rollers 15 there is placed a tank 16 to receive the scouring liquor, which also contains such refuse of fibres as fall from said squeeze rolls. A screen 17 is located in said tank, being so placed that it is immersed below the water line of the liquor in the tank, the screen thus being kept more or less from becoming clogged by said refuse of fibres, thus consequently fewer stoppages of the machine, for cleansing the tank from said fibres, being required. (C. G. Sargent's Sons, Graniteville, Mass.)

THE McNAUGHT WOOL WASHERS.

There are two types of this prominent wool washer in the market, one more particularly designed for the scouring of medium and fine wools, the other for coarse and long wools.

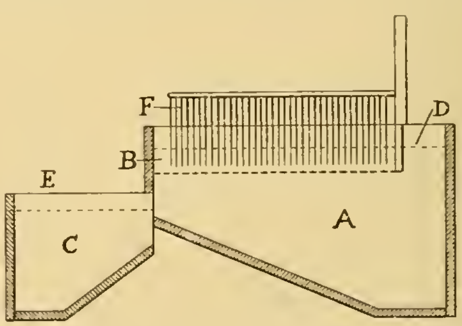
With reference to their wool washer for medium and fine wools, the same has several new features in its make-up, well worthy of an extended investigation by any woolen or worsted manufacturer or wool scouring establishment. The same as in connection with any other wool washer, the wool to be scoured may be passed through one machine two or more times, or what is preferable, the machine being used in sets of two, three or four bowls, the latter combination (4-bowl) being the ideal arrangement and the one which gives the best results in production, economy of use and quality of work produced. In this 4 bowl arrangement, the size of bowls used are, one each of 30, 24, 18 and 12 feet length respectively.

The chief advantage of the machine, as claimed for it, is its principle of operation, which is a radical departure from others theretofore put on the market, and will be readily understood from the accompanying diagram, by means of which it will be seen that the machine itself is divided, or rather composed of two compartments, viz.: the main washing bowl A, in which a washing trough B, having a perforated bottom (see heavy dotted line) is placed, and the settling tank C, in which the scouring liquor is prepared, as well as into which the scouring liquor which falls from the squeeze rolls is delivered and its good portions in turn re-used.

The action of the washer is as follows: The scouring liquor is placed in tank C, from which it is delivered, by a centrifugal pump, in quantities as required, into compartment A. The wool is placed in the washing trough B, the scouring liquor entering said trough B through its perforated bottom previously referred to, and in turn mixes thoroughly with the wool. Dotted line D indicates the height of the scouring liquor in the washing trough B, and dotted line E that of the liquor in tank C. The rakes F drop into the scouring liquor and the wool as in trough B, and at the same time have imparted to them a slow forward motion, which in turn moves the wool gently along, allowing its locks to open out as the liquor soaks into them and the natural refuse matter in the wool to drop out, and this without matting the fibres or swashing them about. The motion given to the rakes is a slow even forward one, one which is calculated to give the best results. The refuse matter, previously referred to, meanwhile drops to the bottom of the trough B, and thence through its perforations to the floor of the bowl A, which is slanting (as shown), and thus allows it to fall into one corner, from which it is then easily removed when the liquor in the bowl A is run off, having from extensive use become devoid of its scouring properties, etc., etc.

The saturated wool is then carried to the squeeze rolls, outside the trough, the liquor squeezed out and the wool passed forward to the washing bowl of the next machine in the series, and the squeezed out liquor returned to the settling tank C, as previously referred to. The composition of the scouring liquor in tank C is then: the mixture of sud and grease floating lightly on the top, dirt falling to the bottom and resting at the lower corner, leaving the middle portions of said composition comparatively clean, and which in turn is then drawn by the centrifugal pump, before mentioned, into the bowl A.

The squeeze-head of this machine is also of a most ingenious construction, in that the wool does not actually float into the nip of the two squeeze rollers, but it is washed forward by such a flow of water, that the fibres never lie in a sodden mass, as on an apron, and they are partially separated from each other by the water they contain, so that it is easy for sand and other dirt to escape. Once away from the fibre the sand and dirt can never come again to the rollers, for, instead of falling back into the washing trough B, which contains the wool, the stream of sud from the trough B, where the wool is washed, washes the sand through perforated plates into a trough, from which it is pumped to the settling tank C. Here there



is no agitation, and the sand and other heavy impurities quickly settle to the bottom of the tank, which, as shown in the diagram is so shaped that everything falls toward the outlets, and when the cocks are opened, all sediment is readily flushed clear away.

In the case of a series of bowls being used, the first bowl, *i. e.* where the greasy wool enters, will contain the strongest scouring liquor, and which naturally becomes dirty very fast; the second a less strong liquor, the same having less tendency to be polluted; the third a still weaker liquor; the fourth being used as a rinsing bowl in connection with clear water. In this 4-bowl set, it is customary to fill the settling tank of the fourth bowl with clear water, which when squeezed by the rolls is returned to the settling tank of machine No. 3, while in the same manner, that from No. 3 goes to No. 2, and that from No. 2 to No. 1. The scum and froth (*i. e.* all insoluble oily and soapy matter) from settling tank C of the No. 1 machine is allowed to overflow through specially provided drains.

The chief advantages for this wool washing machine are: (1) The scouring liquor is heated in tank C, which precludes the necessity of any steam jets in the washing bowl A. (2) The rakes having a *slow gentle* motion forward, consequently move the wool along without unduly disturbing it and matting it, allowing the locks to open out, the grease to mix with the scouring liquor, and the dirt to drop to the bottom instead of being piled forward at the delivery, as is often the case when the contents are violently forked forward. (3) The bottom of the trough B is full of fine perforations, which, with the absence of violent swashing, has the advantage of letting the dirt drop through easily without the fibres also being driven with it. (4) The floor of the washing bowl A being inclined, allows the dirt to fall to one side, so that when the bowl is to be cleaned, the liquor is simply run off, the attendant meantime stirring up the dirt with a broom, a space being left between the side of the trough B, and the bowl A for that purpose. This obviates the necessity of removing the perforated bottom as has to be done in connection with some of the other wool washing machines. (5) The continuous use of the scouring liquor, allowing only the grease and scum to be run off, makes a saving in materials as used for scouring, and this with a minimum expenditure of heat.

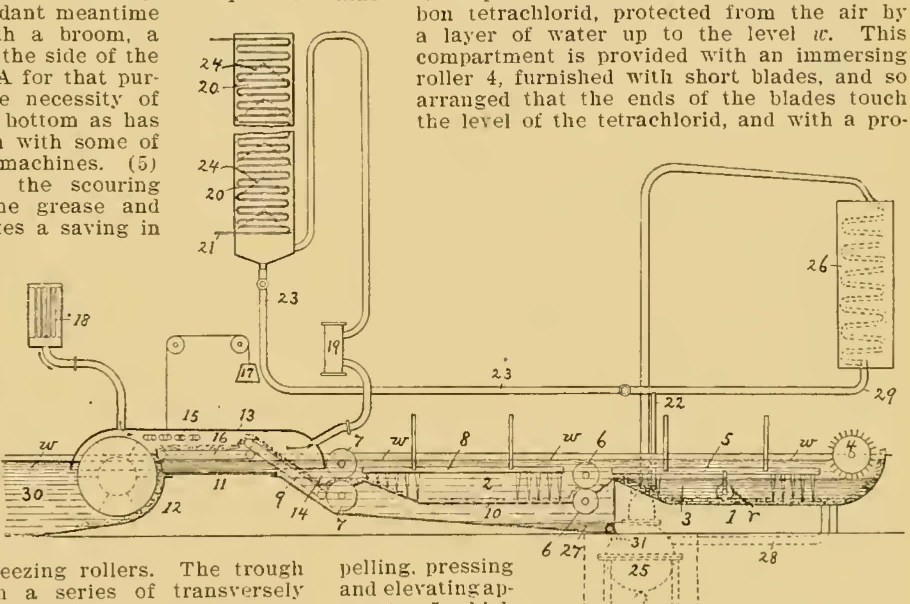
For coarse and long wools, and especially where a large production is required, the machine for doing this work consists of a long trough, in which the scouring liquor is placed. At one end is an endless band or feeding apron, and at the other a pair of squeezing rollers. The trough is fitted internally with a series of transversely situated swinging rakes, which have a synchronous motion and not an alternate one, as in the case of other machines, being supported upon a framework, capable, by means of suitable mechanism, of being moved horizontally forward, raised clear of the trough, moved backward, and again dropped into the trough. The same framework supports a perforated plate which serves to immerse the wool, and a sort of fork scoop to transfer the wool from the trough to the squeezing rollers. The greasy wool is spread more or less evenly upon the traveling feeding apron and is immersed in the liquor by the action of the perforated plate. The fibre is then caused to slowly traverse the trough by the intermittent action of the swinging rakes, and, arriving at the delivery end, passes between the squeezing rollers and is thrown off by the flyer.

A single passage through such a machine is usually not sufficient to thoroughly cleanse the wool, since after being in use for a short time, the liquor becomes very dirty. It is a frequent practice, therefore, the same as with other wool washers, to have two or three machines combined in a set, through each of which the wool passes. The second trough is filled with clean scouring liquor, and the third with water. When the liquor in the first trough becomes saturated with yolk or too dirty for use, it is run out and the trough filled with that from machine No. 2; the latter being supplied with clean liquor. The troughs are fitted with perforated false bottoms, underneath which most of the dirt collects, and from where in turn it is removed. (Stoddard, Haserick, Richards & Co., Boston, Mass., agents for the machine in the United States.)

WOOL SCOURING WITH CARBON TETRACHLORID.

This apparatus for extracting fatty matters from wool by the solvent action of carbon tetrachlorid, is so arranged that the tetrachlorid, being of greater specific gravity than water, acts under water, and is thereby protected from exposure to air and consequently against loss by evaporation.

By reference to the accompanying illustration, which is a diagrammatic longitudinal section of the machine, compartment 1 of a tank contains at 3 carbon tetrachlorid, protected from the air by a layer of water up to the level *w*. This compartment is provided with an immersing roller 4, furnished with short blades, and so arranged that the ends of the blades touch the level of the tetrachlorid, and with a propelling, pressing and elevating apparatus 5 which keeps immersed in the water and serves to advance the wool along the tank. A roller *r*, suspended from 5 has a squeezing effect on the wool below it, pressing out from it tetrachlorid highly charged with fat. Another compartment 2 of the tank contains water at the same level *w* as in the first compartment, and it has two pairs of pressing rollers 6 and 7, a propelling and elevating apparatus 8, and a perforated plate 10, on which the material travels, also an endless apron 9.



In continuation of the compartment 2 is a gutter 11, filled with water up to the level *w*, and leading to a washing tank 12, also filled with water to *w*. This gutter 11 is covered by a cover 13, making hydraulic seal by dipping at the same time into the tank 12 and at 14 into the compartment 2. Under this cover are placed steam-pipe coils 15, for maintaining a constant temperature in this section of the machine, an endless apron 16 being also placed under said cover 13. In order to give easy access under this cover 13 in case of accident, it can be raised by a set of pulleys with counterweight 17 after moving the pipe joints. The cover 13 is connected by pipes, on the one hand, to an apparatus 18 for heating air, and, on the other hand, to an exhausting and compressing air pump 19, which is connected to a condensing apparatus. This latter consists of a chamber or column 20 filled with water, kept cold by a serpentine pipe 21, in which cold water circulates. This chamber communicates with compartment 1 of the tank by pipes 23, 22. In the column 20 are baffles 24 of perforated plates, having for their object to subdivide the air as much as possible, so as to separate the air and the carbon tetrachlorid.

The first compartment, 1, of the tank is connected by a pipe 28 to a distilling apparatus 25, which is connected to a condenser 26, communicating with the bath of tetrachlorid of this compartment by the pipe 29, 22.

The apparatus operates as follows: Previous to the entrance of the wool into this machine, a common single bowl wool scouring machine is used for removing the salts soluble in water and the earthy matters from the wool, which then in turn is, by means of the feeding roller 4, introduced, dry or wet, directly into the bath of the carbon tetrachlorid (cold or slightly heated) in the compartment 1 of the new apparatus. The wool thus immersed in the tetrachlorid is subjected to the action of the propelling, pressing and elevating apparatus 5, which, without taking it out of the water (thus preventing evaporation), pushes it towards the squeezing rollers 6, which squeeze out part of the tetrachlorid containing fat extracted from the wool. The wool then enters the bath of water, pure or slightly soapy (cold or hot), of the compartment 2, in which, by the propelling, pressing and elevating apparatus 8, it is pushed onto the perforated plate 10 and toward the pressing rollers 7, which squeeze out most of the remaining tetrachlorid. The wool is then led by the endless aprons 9 and 16 to the feeder of an ordinary washing tank 30. During its passage on the aprons 9, 16, under the hermetically-closed cover 13, the wool impregnated with tetrachlorid is subjected to a draft of hot air moving in a direction opposite to that of the material. This air, already heated, is kept at a suitable constant temperature by the serpentine steam pipe 15, and its circulation is insured by the pump 19. In its passage under the cover 13, the wool rapidly gives up all its tetrachlorid and retains the water with which it is impregnated. The air charged with tetrachlorid passes through the cold water in the column 20 and deposits its tetrachlorid, which being denser than water is condensed and precipitated to the bottom of the chamber 20, whence the pipes 23, 22, lead it back to the compartment 1. The tetrachlorid, which in the compartment 2 in presence of water is already separated from the wool, passes through the perforated plate 10 and deposits at 27, where also collects the tetrachlorid squeezed out by the pressing rollers 6, and thence it is conducted to the distilling apparatus through pipe 31.

The carbon tetrachlorid charged with fat is led to the distilling apparatus 25, where it is separated from the fat. Its vapor is led to the condenser 26, and the condensed liquid is led back by the pipes 29, 22, to the compartment 1. (George Peltzer, Verviers, Belgium.)

THE HURRICANE AUTOMATIC STOCK DRYER.

The older systems of drying wool, etc., might be divided into two classes, in the first of which the material was dried at a very low temperature, which necessarily implied a considerable length of time for the operation. The second method implied a considerably higher temperature, than the first system, thus resulting in much more rapid drying, but which was frequently objectionable on account of the feeling of harshness which the higher temperature and lack of circulation of air imparts to the material under operation.

The "Hurricane" Automatic Dryers are so designed as to overcome the objections just named and at the same time include whatever tends to make this class of machinery most efficient. These dryers are divided into a series of compartments, two or more as the case may be, and in each successive compartment the temperature is gradually reduced below that of the one immediately preceding it. In this way the wet material is subjected to the greatest heat just as it enters the machine and, when it finally reaches the delivery end of the dryer, it is thoroughly dry and cool and in a first class condition for further handling in the mill.

The best and most economical drying results are obtained by recirculating large volumes of air alternately through the wet materials and then over steam coils, a sufficient quantity of damp air being at the same time discharged from the machine through an exhaust pipe. This exhaust pipe is located near the feed end of the machine, so as to remove the steam and damp air as near as possible to the point where the greatest volume of dampness is created and prevent the damp air from working along further into the dryer portions of the machine.

The machine is adapted for drying wool, cotton, hair, etc. When drying wool, a very convenient arrangement is to have the scouring machines located immediately ahead of the self-feed and the dryer. In this way, after the stock has been thoroughly scoured and the water afterwards extracted as much as possible by means of a hydro-extractor or squeeze rolls, a conveying apron carries the material forward and delivers the stock into the hopper of the self-feed.

A cross section of this automatic dryer, with a self-feed attached, is given in Fig. 1, showing also the passage of the stock through the machine, the latter having two compartments in this instance. The self-feed is of the usual construction and consists principally of a hopper 1, one end of which is formed by a slatted apron 2, from the slats of which, spikes project for carrying the stock forward and upward on the apron. A comb 3 is located in the hopper, near the top, to comb back into the hopper any surplus stock from the spiked apron, and thus insure a practically even feed of the material to the dryer. The spiked apron is endless, and passes over four suitable rollers, it being positively driven by the top roller 4. Situated on the delivery side of the self-feed is a beater 5 for brushing off the stock from the spikes of the apron and delivering it to the wire cloth apron 6 of the dryer proper.

The style and arrangement of the self-feed vary somewhat according to the class of material which is to be handled, as it will readily be understood that different classes of stock, such as wool, cotton, hair, etc., require different adjustments of the feed in order to get the best results from the dryer. For example, when the stock under operation has a short staple, as with cotton and hair, a flat blade paddle is used, and when a long stapled stock like wool is under operation, a comb is used, as previously explained.

The Automatic Dryer consists of a series of compartments 7 and 8, through which the wire cloth apron 6 is caused to travel, and heating compartments 9 and 10 are arranged along the side of the compartments 7 and 8, the former being fitted up with the required amount of steam pipes 11 and 12. Situated in the partitions between the steam and conveying compartments are fans 13 and 14, two for each compartment shown. These fans circulate the air alternately through the steam compartments and conveying compartments, thus resulting in great steam economy. The action of the fans is to give the air a circular and, at the same time, an advancing movement, similar to a point traveling on the outside of a screw thread. The air starts in its circulation at the delivery end of the dryer where it enters the machine and gradually passes through towards the feed end, being successively blown over the steam coils and through the wet stock until it finally approaches the feed end. Naturally, as the air advances toward the feed end of the machine, it becomes more and more saturated with water and by the time it reaches the first compartment 7, can no longer be used successfully for drying purposes and consequently should be gotten rid of, which is accomplished in this dryer by having an exhaust pipe located at 15, a small exhaust fan in some cases being provided to aid in the escape of the saturated air.

The elimination of this saturated air is a very important advantage, since a dry air at a comparatively low temperature will act as a better drying agent than a damp air at a high temperature and hence better results are obtained by getting rid of the saturated air at the proper time. When using three or more compartments in the dryer, the last compartment frequently contains no piping.

In operating the dryer, the speed of the wire cloth apron should be regulated to suit the character of the stock, for it will be readily appreciated that stock which has been put through a hydro-extractor or squeeze rolls will contain much less water and will consequently dry much more rapidly than stock which has been merely allowed to drain before entering the dryer. This change in the speed of the apron, however, does not affect the speed of the fan or other working parts of the machine. For ordinary wool drying, from 7 to 10 minutes is about the proper time for the stock to travel through the dryer, whereas when the affair refers to future worsted spinning from 3 to 5 minutes will be all that is required, since in this instance it is advisable that the wool leaves the machine not perfectly dry. The apron used in this machine is composed of wire cloth which has been galvanized after weaving, so as to prevent any contraction in the width of the apron when the latter is under tension. The outside selvages are also reenforced by several wires so as to further strengthen the wearing edges of the apron. These selvages of the apron run in guides prepared for them on either side so that the stock on the apron will not fall over the edges of the apron. The apron is endless and passes over large drums 16 and 17, one at each end, and over iron tube rollers 18, located at different points along its travel, to keep said apron level. Sharp curves are avoided in its travel, to prevent excessive bending of the apron and consequent wear and final breakage.

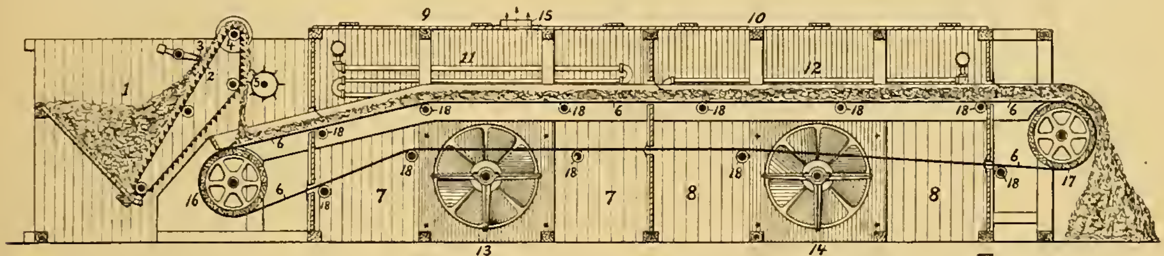


Fig. 1

The fans are reversible in their rotation by simply crossing the driving belt and in this manner may be made to either draw the air down through the stock on the apron or blow it up through the stock, depending on the direction of rotation of the fans. When drying wool, it is better to have the first fan 13 blow the air up through the stock, so as to loosen it up and allow the air to act upon it more readily, but by the time the wool is in the last compartment, it is in such a fluffy condition that the air must be drawn down through it, in order to keep it on the apron.

It was mentioned that the first compartment maintained a higher temperature than the second, and it will be seen that this can be safely done because the stock in the first compartment contains more moisture and consequently can stand a higher temperature without injury to the fibre than afterwards when not so wet. The stock is in this manner dried and delivered in a comparatively cool state and this with the greatest economy in the use of steam.

The temperatures of the different compartments are ascertained by means of thermometers, hung in front of small glass windows, in each compartment. The amount of steam in the coils can be easily regulated by valves to get the required temperature for each compartment.

When these machines are intended for carbonizing wool, noils or rags, it is important to bear in mind that as the carbonizing acid is very corrosive, the machinery should be built so as to resist the corrosive action, and in this connection, brass or bronze spikes are used on the spiked apron instead of steel. It might be well to emphasize one of the fundamental principles of carbonizing,—that if the best results are to be obtained, they will be accomplished by using a high, dry baking heat. In an automatic machine of this character, therefore, by dividing the machine up into compartments, the damp air can be readily confined to the end of the machine where the material enters wet. The special exhaust fan (not shown in the illustration) as placed in this instance at 15, therefore, fulfills its mission of removing the dampness from the first compartments and maintaining the dry heat necessary for carbonizing in the remaining compartments of the machine. In order to facilitate the process of carbonizing, the compartments should be air tight. When the material finally enters the carbonizing compartments, it is thoroughly dry and consequently it is possible to maintain a high temperature free from moisture, thus securing the best results. By this time the carbonizing acid has become concentrated and has destroyed all vegetable fibres that have been mixed in with the wool. The dryer shown in the illustration Fig. 1, if used for carbonizing, should have more steam pipes put in the second compartment than shown, so as to be able to produce the heat required for that purpose.

The fans used in connection with these dryers are designed to produce the best circulation of air at a minimum expenditure of power. Ring Oiling Bearings, as shown in Fig. 2, are provided for the fans, thus securing a positive lubrication at all times to the horizontal fan shafts. As seen in the cross section portion of the illustration, spring rings of tem-

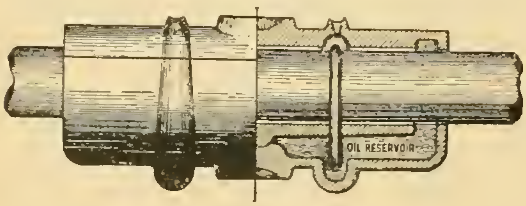


Fig. 2.

pered steel, of considerably larger diameter than the shaft, revolve constantly in a reservoir of oil. A constant oil supply is thus obtained, and there are also means provided for guiding the oil back into the reservoir and preventing waste. These dryers are also designed with the special object in view of making all the parts accessible and easy to keep clean. From the construction adopted, it is also possible to lengthen out the machines at any time, thus increasing their capacity whenever desired.

After the stock has been dried, and it is delivered from the apron of the dryer, it is frequently found economical to collect it in a hopper, and by using a blower, carry it through galvanized sheet iron pipes to bins or machinery located in another part of the mill. This pipe system can be arranged with proper gates, so that the wool can be delivered at any one of a number of different points, as desired. (Philadelphia Drying Machinery Co., Phila., Pa.)

SARGENT'S CONTINUOUS WOOL DRYER.

The object aimed at in this dryer is to divide the air that is forced into the drying chamber into two currents, one passing directly through the wool, while the other is made to re-enter the drying chamber (after being condensed), in turn acting onto the opposite side of the wool, thereby obviating any tendency of the fibres to mat.

The accompanying illustration, Fig. 1, is a vertical cross sectional view of this dryer, clearly showing the process of drying the wool. The machine itself is formed into two compartments, extending the entire length of the machine, being separated by a partition 1. The hot air is forced by two fans (situated, one towards each end of the air chamber 2; one of these fans 3 only can be shown in Fig. 1) from said air chamber 2 into the drying compartment 4, in which the wool is carried through the entire length of the machine on a traveling apron 5.

At each end of the drying compartment 4 is an opening 6, through each of which the hot air is fanned, part of it passing directly through the wool, the remainder passing through respective openings 7 into the passageway 8, where it is moistened, passing in turn through the lower opening 9 into the lower compartment of the drying chamber 4. This feature of passing this moistened air current beneath the traveling apron reduces the downward pressure as exerted by the other current onto the wool under drying, at the same time assisting to also partially dry the wool from beneath.

For regulating the proportion of air which is made to pass through each passageway 8, an automatic damper 10 is provided, and which by adjustment of a weight 11 is made to swing outward more or less, in turn regulating the amount of heated air to enter the moistening chamber 8. The means for moistening or condensing the air current thus referred to consist of a coil of heated pipes 12, and a condensing screen 13, occupying an inclined position in order to enable the drops of water condensing thereon to run off more readily through a drip pipe 14. One of these condensers is provided for each passageway 8, one of said passageways being situated at each end of the machine. In order to loosen the wool while being transported through the drying chamber, one or more revolving tedders or beaters 15 are provided, and which serve to stir up the wool as it travels through the drying chamber.

By reference to Fig. 2, which is a vertical section of a part of a dryer, we find that in connection with the heated air for drying the wool, a pair of perfo-

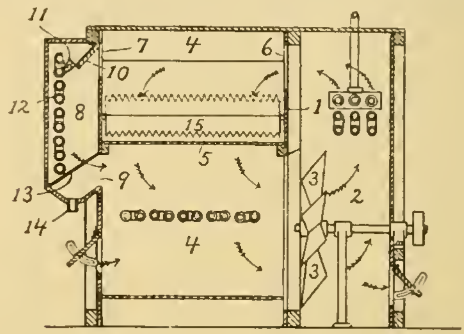


Fig. 1

rated metal plates 16 and 17 may be used in the drying chamber, one of said plates being placed above, and one below the traveling apron 5. These plates, in operation, soon become thoroughly heated by the hot air passing through them, and thereafter radiate a large quantity of heat directly and continuously upon the wool, thereby greatly facilitating the drying process. However, in this construction the tedders

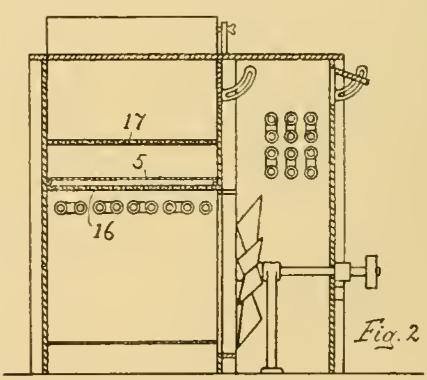
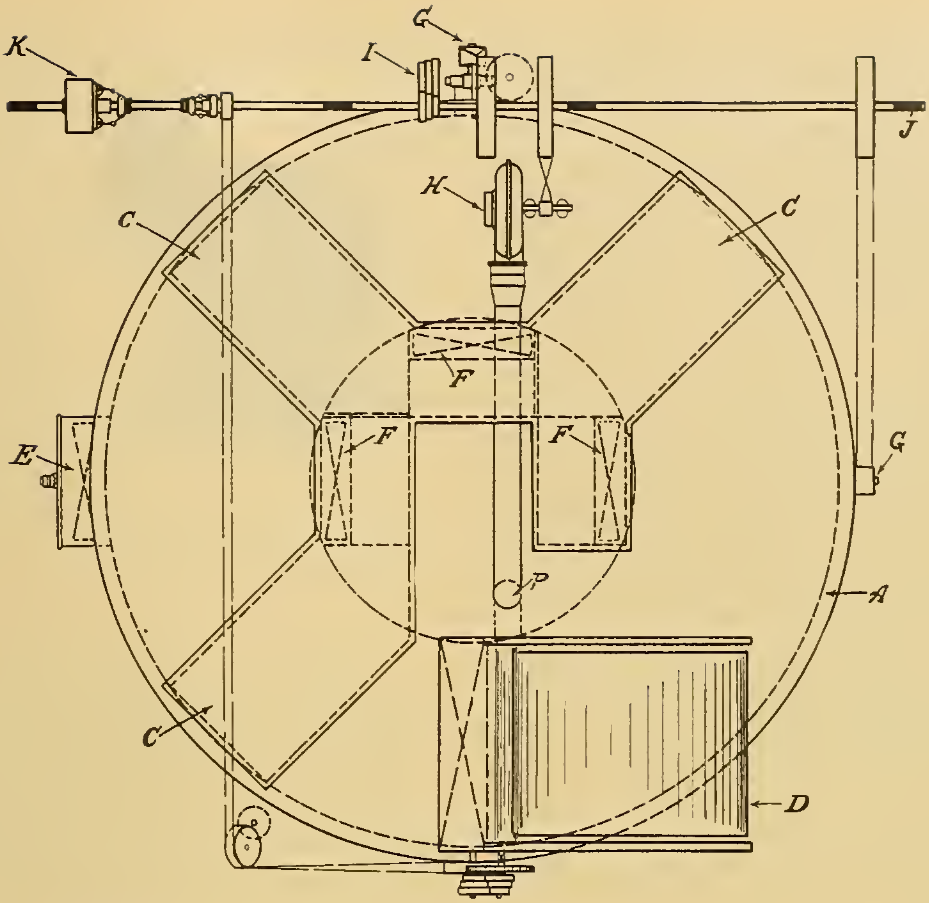


Fig. 2

or beaters 15, previously referred to, cannot be used. The perforation of these plates 16 and 17 permit free passage of the heated air through the wool under drying. (C. G. Sargent's Sons, Graniteville, Mass.)

THE "STONE" WOOL DRYER.

This dryer is constructed on a different line than any other dryer, and has many new features, as will be readily seen from the accompanying illustrations, showing plan and elevation of the machine. Letters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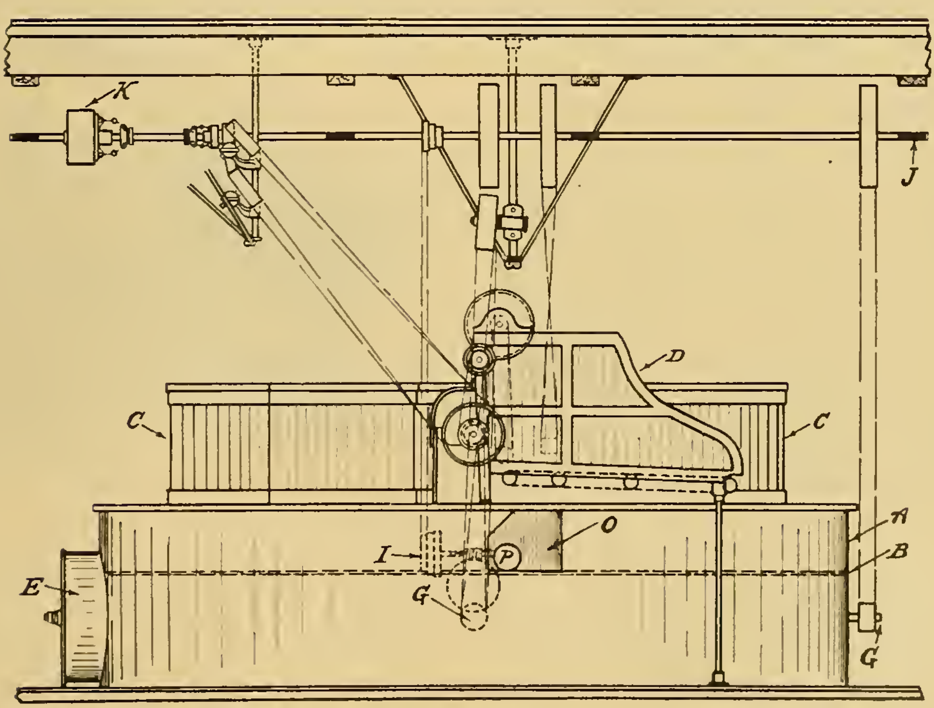
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of reference accompanying the illustrations indicate thus: A shows sheet steel cylinder, lagged with pine wood, forming outer casing of dryer, being provided with angle iron runs for supporting the perforated steel table B, which is rotated by pinion gear engaging rack under side of drying table. C are hot air chambers or boxes, containing steam coils. D is a self feed for introducing the stock to the machine. E is an exhaust fan for removing moisture, and F are three fans for circulating hot air. G are two fan pulleys for driving the three fans previously referred to. H is a blower for blowing stock from table, at O, after being dried. I is a cone pulley for driving the table, J a countershaft, and K a receiving friction pulley from main line. P indicates the blower pipe.

The operation of the machine is as follows: The stock is put into the self feed D, and by it is fed upon the perforated iron drying table B, which revolves slowly from right to left. The stock is subjected first to the action of the current of air from exhaust fan E, which at once removes the excess of moisture through opening at the side of cylinder A. The stock under operation then passes on and is subjected successively to action of currents of hot air from the three fans F, and then passing on goes in front of the blower pipe P, where it is ejected from the machine onto the floor, or into a proper receptacle.

This dryer may also be used for carbonizing purposes, by reducing speed of the drying table and simultaneously increasing the temperature of the air, *i. e.* subjecting the stock to a greater heat and this for a longer time. The machine is built in sizes for drying from 1000 to 15,000 pounds of wool in ten hours. (The James Hunter Machine Co., North Adams, Mass.)

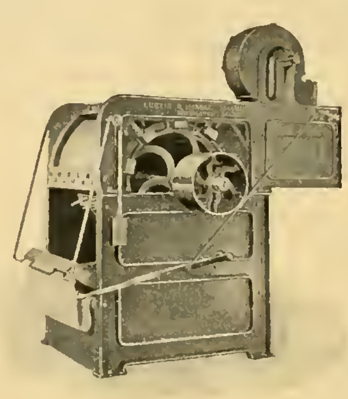
THE CURTIS & MARBLE SHAKE WILLOW.

The object of this machine is to open, dust, and thus clean wool, cotton, waste or shoddy, from loose dyestuffs, dirt, etc., previous to mixing and picking; as well as for preparing dirty and burry wool for the burr picker, and thus increase the efficiency of the latter.

The accompanying illustration is a perspective view of the willow. The same has in its interior, conveniently placed, four stationary bars containing double rows of strong steel pointed teeth. One of these four bars is clearly seen (its back view) in the illustration, the same forming the upper partition of the opening for feeding the machine. The cylinder, which is 3½ ft. in diameter, is covered with ten lags, also containing double rows of teeth, which, as the cylinder revolves, work between the teeth in the stationary bars. Around the circumference of the cylinder extends a heavy wire screen.

To receive the wool or other material to be cleaned, the front apron part of the machine is lowered, as shown in the illustration, and after a sufficient amount of the stock to permit proper handling by the machine, has been deposited upon this, the curved screen with its outside apron is then drawn up and held in its place (the machine thus being closed), by balancing weights on either side of the machine.

The machine is then set in motion, the cylinder revolving downwards in front. When the stock has been sufficiently opened and cleaned, a door at the back side of the machine is then opened by means of a lever, and the stock blown out of the machine. A powerful exhaust fan, situated on top of the machine, carries off the dust and fine dirt from the stock, by means of suitable pipe connections to wherever directed, leaving the heavy and coarser dirt to fall through the wire screen under the cylinder, from where in turn the same is from time to time, removed by the operator.

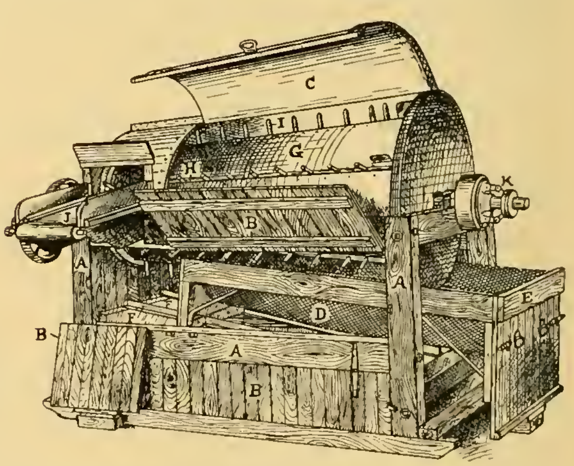


After one lot of stock has been cleaned and blown out at the rear, another lot is fed in without stopping the machine, and the process, as explained before, is repeated. The machine is built in various sizes, with capacities of from 2000 to 8000 lbs. stock cleaned per day. (Curtis & Marble Machine Co., Worcester, Mass.)

THE HUNTER CONE DUSTER.

The accompanying illustration shows in its perspective view a cone duster brought out recently by the James Hunter Machine Co. The main object in the construction of this machine, has been to produce a duster which will thoroughly clean the stock without injury to it, and one which at the same time is very accessible for cleaning. The machine as designed will remove an excessive amount of dirt and foreign matter from the stock without rolling or pilling it or injuring the fibre in any way.

In its general plan of construction, the new machine follows closely the lines of the well known cone dusters, but differs from them in certain details



as follows: The main frame A of the machine is a skeleton held together by means of girts, and provided with doors B and covers C, so that by opening these doors and raising the covers, as shown in the illustration, the machine is accessible at every point for cleaning.

The screen D is made of perforated sheet steel, secured to a framing E, and can be slid into and out of the duster, as required, from the right hand end, as shown in the illustration, and where said screen is shown partially pulled out. F are two angle irons, provided as a track for sliding the screen into place and holding it when in. This makes a more satisfactory construction of a screen than the ordinary type which is parted longitudinally through the centre and withdrawn from the machine on either side. The cylinder G is fitted to an excessively large shaft, being formed of cast iron spiders, provided with hard wood rails H into which the pins I are fitted, this in turn being covered with sheet steel, so that the surface of the cone or reel is smooth and true.

An exhaust blower (not shown in the illustration) of exceptionally large capacity is situated at the left hand side, outside of the machine, and which blower removes any dust and foreign matter which falls through the screen, the same being carried off by suction through the blower, and from there delivered by suitable pipe connections, to wherever required, the dust room or outside the building.

J is the feed end of the machine, the outlet being in rear at the right hand side of the machine (not shown). The machine is driven by means of a friction pulley K in place of tight and loose pulleys commonly used. The machine is of a strong heavy construction, in order to stand up to the work indefinitely. (James Hunter Machine Co., North Adams, Mass.)

THE BRANDY WOOL DUSTER.

Of the accompanying drawings, Fig. 1 represents a longitudinal vertical section of this wool duster, and Fig. 2 a perspective view showing one end of the rotary perforated cylinder.

a represents the end pieces of the frame, provided with bearings *a'*, supporting the rotary shaft *b* which supports and rotates cylinder *c*, made of perforated sheet metal or wire-cloth. This cylinder is supported on the shaft *b* by means of a series of spiders c^1, c^2, c^3, which have hubs affixed to the shaft and peripheral portions affixed to the cylinder *c*. The cylinder *c* is provided with a series of rows of radiating spikes c^4.

On the frame *a* is mounted a fixed top cover a^2, the same being continued below the cylinder by two segmental plates provided with numerous small apertures a^3, which permit the escape of the foreign matter separated from the wool, into removable receptacles a^4 below the cylinder.

The supporting-frame is provided with rigid longitudinal side beams extending between the end pieces *a* of the supporting-frame, and which beams are provided with rows of spikes which project into the space between the casing a^2 and the cylinder *c*, and are arranged so that the spikes c^4 on the cylinder pass between the spikes on said beams.

The body portion of the casing a^2 is concentric with the cylinder *c*, so that an annular space or cleaning-chamber is formed between the casing and cylinder, the spikes c^4 on the cylinder projecting outwardly nearly to the casing a^2, while the fixed spikes on the beams (not shown) project inwardly nearly to the periphery of the cylinder, so that any wool introduced into the said annular space and carried around by the rotation of the cylinder will have its fibres loosened and separated by the conjoint action of these two sets of spikes.

e represents a fan blower which is connected by conduit *e'* with the casing, said conduit delivering the blast of air from the blower *e* at one end of the casing at such point that the blast passes through openings c^6, Fig. 2, in one end of the cylinder into the interior of the latter, said opening c^6 being formed by the arms and perimeter of the spider c^3. The opposite end of the cylinder is closed against any appreciable escape of air.

The jets of air thus entering the cylinder, act forcibly upon the fibres of wool, which are being operated upon by the spikes, thus effectually separate therefrom the dirt and foreign matter loosened or detached by the action of the spikes.

The matter detached from the wool by the action of the spikes passes through the perforations a^3, the heavier portions of such foreign matter lodging in the receptacles a^4, and from where they are occasionally removed, while the lighter portions are drawn away through conduits *f'*, by means of an external exhaust-fan *f*.

To equalize the air pressure within the cylinder. and give a practically equal force to all the jets issuing therefrom, fan-blades *g* are provided, and which are attached to the shaft *b* within the cylinder, said blades being obliquely arranged so that both by their position and by the rotary motion they receive from the shaft, each blade deflects a portion of the air entering one end of the cylinder through the conduit *e'* outwardly toward the periphery of the cylinder.

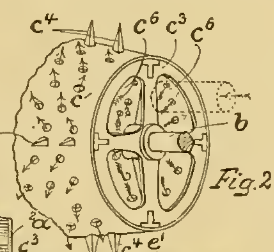


Fig. 2

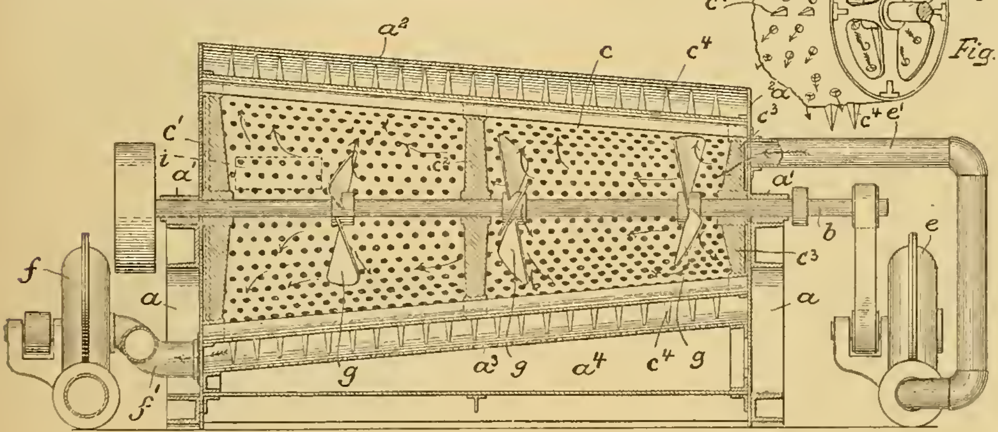


Fig. 1

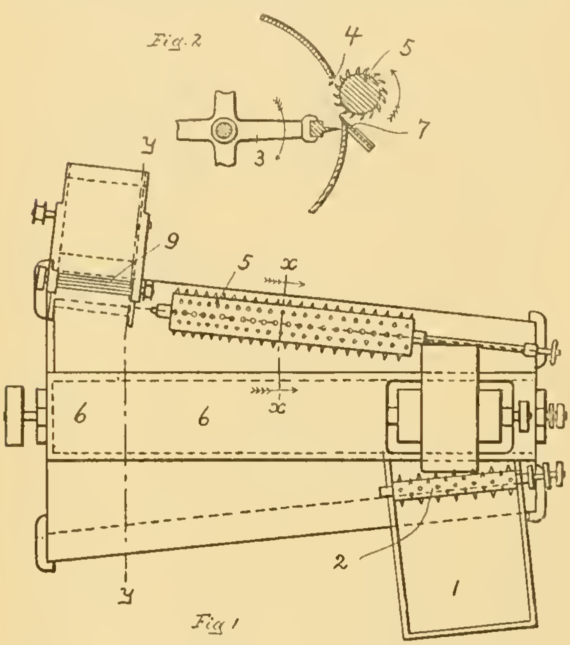
The wool to be cleaned is supplied to the annular space between the casing and the cylinder by means of an endless feed-apron which delivers the material to a pair of crushing-rolls, which in turn deliver it through an opening in the casing to the annular space between the casing and the cylinder, the point of delivery being at or near the smaller end of the cylinder. The wool fibres, while being loosened and separated by the spikes in the annular space, are gradually carried along from the smaller to the larger end of the cylinder, and when they reach the outlet *i* are forced through the latter by the air pressure. (Samuel Smith Machine Co., Lawrence, Mass.)

SARGENT'S COMBINATION WOOL CLEANING AND BURRING PICKER.

The object of this machine is to thoroughly open the wool and also remove part of the burrs from it in its passage from the feed to the discharge end of the machine, the remaining burrs being removed by a separate burring device on its passage out of the machine.

Fig. 1 is a plan view of this combined cleaning and burring picker, Fig. 2 being a vertical section taken on line *x-x*, Fig. 1, and Fig. 3 a vertical section taken on line *y-y*, Fig. 1.

The construction and operation of the machine is thus: The wool is fed to the machine at one end (see Fig. 1) by the feed apron 1 and its toothed feed roller 2, when it is engaged by a beater 3 and in turn

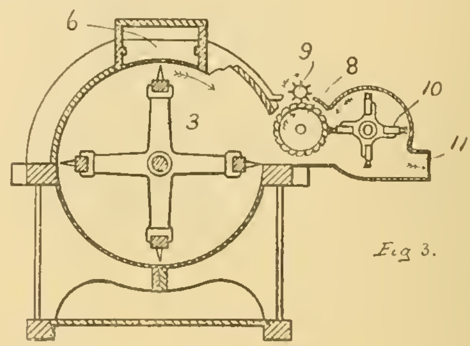


travels spirally around with the beater towards the discharge end.

In order to prevent the wool from matting during this operation and at the same time remove part of the burrs, an opening 4 (see Fig. 2) is made in the casing of the beater chamber, and in said opening is set a toothed roller 5, which engages the wool carried around by the beater and acts to open it by means of holding the tufts of wool against the beater blades.

A continuous draft of air is set up through the opening 4 by an exhaust fan (not shown) connecting with the chamber 6, and the wool is thus doffed or stripped from the roller 5, and when it again falls on the beater. In order to vary the force of the draft, plate 7 is provided (see Fig. 2), which can be so adjusted that the force of the draft will cause the fibres as presented at the opening 4 to be carried back into contact with the beater, while the burrs or other heavy impurities, detached by the roller 5, pass out of the machine at said opening 4.

The wool as it is thus gradually worked to the discharge end of the machine is more and more opened up and cleaned, the dust being discharged through the passage 6 which connects with the exhaust fan previously referred to.



At the discharge end of the machine is located a burring cylinder 8 (see Fig. 3), to which the wool is delivered from the beater chamber, any remaining burrs being knocked out of the wool by the rotating toothed guard 9. The cleaned wool is doffed from the burring cylinder 8 by a rotating brush 10 and discharged through the spout 11. (C. G. Sargent's Sons, Graniteville, Mass.)

THE CURTIS & MARBLE BURR PICKER.

The object of this machine is to remove from the wool previous to picking and carding, with the least possible injury to the staple, burrs, shives or other vegetable impurities, then adhering more or less, tenaciously to it.

Fig. 1 is a perspective view of this burr picker, showing countershaft, hangers and pulleys, and manner of belting. Fig. 2 is a sectional view, given more particularly to show the construction of the machine, which consists of the following essential parts: The feed apron A and feed rolls B in front of the machine,

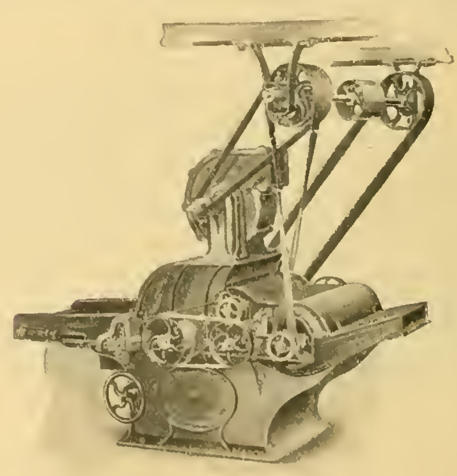


Fig. 1.

and of which the bottom feed roll is stripped by the picker cylinder C, and the top roll driven faster than the bottom one, to prevent its winding or filling up. Feed apron and feed rolls have an independent stop motion, and can be quickly stopped and started by means of a lever, while the other parts of the machine are in motion. The picker cylinder C has sixteen bars filled with pointed steel teeth, so arranged in the bars as to cover at each revolution of the cylinder every sixteenth of an inch of the entire width of the machine. Above the picker cylinder is a perforated brass screen D, fastened to an iron frame, and held in place by buttons, so that it is easily and quickly removed for cleaning, or giving access to the picker cylinder. This screen is of ample size for the removal, through its perforations, of all the dust and fine dirt from the wool, by means of a powerful exhaust fan E, discharging through suitable pipe connection to wherever directed.

Back of the picker cylinder are the two burr cylinders, F and G, composed of an inner cylinder which is ground perfectly true, and then packed with alternating steel toothed rings and brazed packing rings. They are made with different numbers of rings to the inch, according to the grade and quality of the stock and the kind of refuse matter to be removed. The second, or cotter burr cylinder G, revolves slowly backward like a worker on a card, so that cotted or tangled locks, too small to be opened at the feed rolls, may be harmlessly combed apart by the varying speeds of the two burr cylinders. These burr cylinders are so situated that they are easily accessible; by simply lifting a hinged cover, the operator has ready access to the burr cylinders, guards and brush, and any of them can be removed at will. The burr cylinders are provided with two burr guards or beaters H and I, the upper one of which, I, counteracts the action of the lower one H, so as to prevent the refuse matter from being carried over onto the brush cover by the larger guard H. Back of the burr cylinders is the stripping brush cylinder J, which strips the wool from both burr cylinders F and G, and delivers it through outlet K, into the room partitioned off for this purpose.

Below the picker cylinder is a grate rack L, having sufficiently fine apertures between its bars that loss of wool is avoided, while it allows the heavy dirt, shives, etc., to drop beneath. An adjustable sliding rack is attached so that the spaces between the grate bars may be partly or entirely closed, as required, when burr picking different grades of stock. The grate rack is hinged at the back side so that the front may be lowered, and all material cleaned from the picker cylinder and grating between different batches of wool, thus saving any intermixture of colors or qualities of wool that should be kept separate. An automatic oiler may be attached to the picker outlet K when so desired.

The operation of the machine is as follows: The wool is fed upon the endless apron A and delivered to the feed rolls B, the curved teeth of which firmly hold the stock so that it may be thoroughly opened, and the dirt and burrs loosened by the action of the teeth of the picker cylinder. The picker cylinder C carries the stock around under the screen D to the burr cylinder F. The strong current of air to the exhaust fan E, draws the fine dust and dirt through the holes in the screen D, and discharges it wherever desired. The first burr cylinder F, is of large size, and takes the stock from the picker cylinder C, drawing the wool fibres into the spaces between its toothed rings, while the burrs and other refuse matter remain upon its surface, and, when coming in contact with the guards H and I are thrown back. The wool fibres, together with the cotted locks held upon the teeth of the burr cylinder F, are carried under the guards H and I to the point of contact with the second burr cylinder G, where the cotted and felted locks are loosened and combed apart. The brush J strips the wool from both burr cylinders, and delivers it through outlet K into a room provided for it. The burrs and other refuse matter, which are thrown back by the guards, are carried down to the grate rack L by the current of the picker cylinder, the heavier impurities passing through the narrow spaces in the grate rack, while the fibres of wool on the burrs, uplifted by the current of air to the exhaust fan, are caught by the teeth of the cylinder and carried around to mingle with the body of wool at the feed rolls. The large burrs, swept along over the grate rack, and stripped of their wool, find an outlet under the feed rolls, and are deposited in the burr box outside the machine proper, while the inrushing current of air prevents the wool fibres escaping with the burrs. In this way the burrs are stripped cleaner of their wool than on any other style of burr picker, causing in turn less waste of stock.

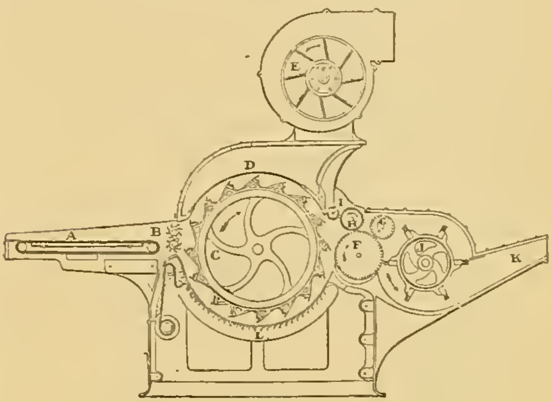


Fig. 2.

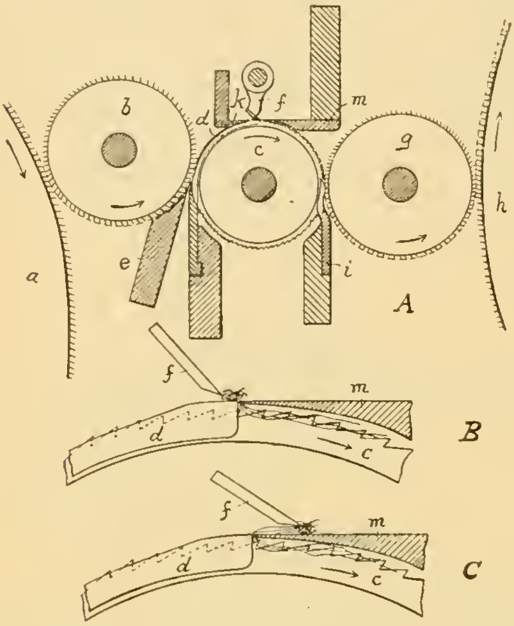
The stock, entering the feed rolls as a mass, is thus separated into several distinct parts: (1) The wool, thoroughly cleaned and opened, is delivered into the wool room. (2) The fine dust and dirt, drawn out by the exhaust fan, is discharged outside the building. (3) The small burrs, heavier dirt, kemp, straws, etc., are deposited below the grate rack. (4) The large burrs, free from other refuse, are carried around to the burr box under the feed rolls, whence they are readily removed as occasion requires. (5) All the wool fibres, therefore, except the few which are too tightly wound around the burrs to permit their separation, pass into the wool room, so that there is no loss of fibre of any consequence; the wool being delivered from the machine in a loose, opened condition, and in excellent shape for, future picking and carding. The machines are built in different sizes, varying in capacity of work done of from 1200 to 7000 lbs. per day. (Curtis & Marble Machine Co., Worcester, Mass.)

DEVICE FOR REMOVING BURRS FROM WOOL.

Fig. A is a vertical sectional view of this device, showing the construction and operation of the same in connection with a carding engine. Figs. B and C are detail sections (enlarged compared to Fig. A) showing the operation of the clearer.

The wool, as removed from a preliminary opening cylinder *a*, by a brush transfer roller *b*, is in turn passed to the drum *c* of the burr removing device, which is formed of a series of toothed rings, between which are placed spring bars *d*, their ends projecting beyond the teeth of drum *c*, so that any burrs in the wool will thus be raised off said teeth, while the wool fibres will be held by the teeth and drawn over the ends of bars *d*. To increase the hold of the drum *c* on the fibres a bar *e* engages the wool before it is transferred to drum *c*, and a brush *k* presses on the top of said drum, pushing the fibres more closely yet into the teeth of drum *c*.

A barrier *m* is arranged above the drum *c*, the space between the ends of the bars *d* and said barrier being sufficient for the wool to pass, while the burrs



will be retained by said barrier (see Fig. B) and in turn released by a vibrating clearer *f*, which pushes the burrs alternately in opposite directions, thus gradually removing said burrs as seen in Fig. C from the wool. From the drum *c* the wool passes to a roller *g*, a comb *i* acting to lift the wool from drum *c* so that it can be readily removed by roller *g*, and transferred onto the main cylinder *h* of the carding engine proper. (Leopold Offermann, Leipsic, Ger.)

THE BRAMWELL PICKER FEED.

The tendency in woolen mills in recent years has been more and more to put greater thoroughness into the process of preparing the stock before it reaches the card room. It has been found that if the stock is thoroughly opened, cleaned and mixed before it is put on the card, the result is (1) that the cards are relieved of a good deal of work that was formerly done by them and (2) are enabled to handle a larger quantity of stock and with much finer results. The up to date manufacturer is coming more and more to recognize the wisdom of having his picker room brought up to the highest possible state of efficiency.

One of the improvements which is being widely adopted is the use of the Bramwell self feeds to replace hand feeding of burring machines, willows, lumpers, mixing pickers, fearnaughts and other machines of this character. The Bramwell Picker Feeder is built in various sizes and styles to meet the special conditions in every case and to handle every variety of stock and not only saves labor but greatly assists in the process of opening and preparing the stock, and further by securing even feeding enables the machine fed to do much more satisfactory work both in quantity and quality.

The main features of the machine are (1) a box or hopper to receive the stock, (2) the spike apron carrying the stock to the required height, (3) the reciprocating comb which knocks the surplus stock off the spike apron, prevents unevenness and helps in opening the stock, and (4) the beater or stripping cylinder which strips the stock off the spike apron. There is also a slat apron in the bottom of the box which is always moving the stock toward the spike apron, and a rack which assists in the same process. All the above features are varied to suit the particular sort of stock and the quantity to be handled and the sort of machine to be fed.

Modifications of this machine are being installed quite generally to feed automatically such machines as dryers and washers, the size and style of machine and the kind of spike apron and other features being adapted in each case to suit the conditions of the particular place as to quality and quantity of stock. (Geo. S. Harwood & Son, Boston, Mass.)

THE CURTIS & MARBLE FEARNAUGHT.

This machine is designed for opening, mixing and preparing stock of all kinds, whether wool, cotton, shoddy or hair, for the carding engines, in place of the common wool pickers heretofore used. The action of the Fearnaught upon the stock is similar in principle to that of a coarse clothed wool card, the machine being supplied with feed rolls, main cylinder, workers, strippers and a fan doffer, and in turn opens the stock by a kind of preparatory carding process. The feed rolls, main cylinder and workers are filled with cock spur teeth, and are firmly driven into place, permitting the very hardest work to be done by the machine without affecting its teeth. Underneath the cylinder is a grating, through which dirt may fall, and over the top of the machine are placed iron covers to prevent the stock from flying out.

Fig. 1 is a perspective view, and Fig. 2 a section of the machine, the operation of which will be readily

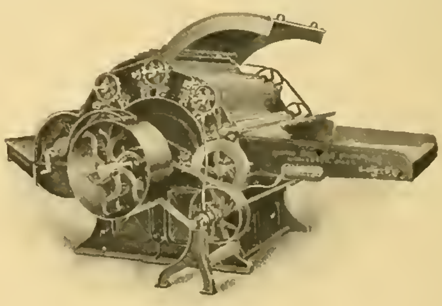


Fig. 1.

understood by quoting letters of reference given in connection with the sectional view. The stock is fed either by hand or a self feeder upon the endless apron A, and delivered by it to the feed rolls B, which hold it with their curved teeth, so that it may be thoroughly opened by the teeth of the main cylinder E, in taking it from them. This main cylinder is thickly filled throughout its entire surface with cock spur teeth, which follow each other in quick succession as the cylinder revolves, so that a constant opening and combing process on the stock is obtained at the feed rolls. The stock is then carried up by the teeth of the main cylinder and acted upon successively by the various workers D, and strippers C, whose action is similar to that of the workers and strippers on a wool card, although as these rolls on the Fearnaught are filled with teeth instead of being covered with card clothing, the opening or carding process is coarser than on a card, which however has to be the case, since the object of the Fearnaught is to prepare the stock for the cards. At the rear of the machine, the doffer F, which runs at a greater surface speed than the main cylinder,

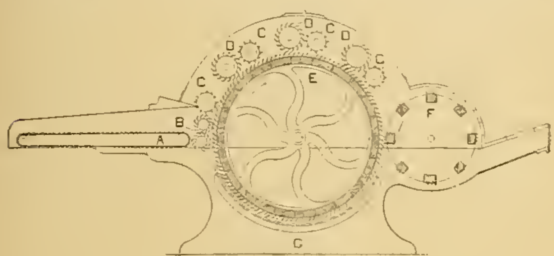


Fig. 2.

strips the stock from the teeth of the main cylinder and delivers it out of the machine. A large amount of dirt and other refuse matter falls out from the stock while it is being thoroughly opened, and this refuse matter drops through the open spaces of the grate rack G, underneath the main cylinder, and is easily removed from the bottom of the machine through panelled openings in the frames.

The boxes which hold the upper feed rolls are held down by heavy springs, so that in case there is any unusual strain or pressure in feeding, the springs allow the top feed roll to raise enough to relieve it. There is also a stop motion, operated by a friction clutch, for the feed rolls and feed apron, so that these parts may be stopped and started while the other parts are in motion—a very desirable and convenient feature. In passing through the Fearnaught, the stock is thus acted upon several times by the various rolls, viz.: the feed rolls, main cylinder, workers, strippers, and doffer, and this by a steady, combing like, process, and when consequently a much more thorough opening and mixing of the stock is secured than in any of the ordinary wool pickers where the stock is acted upon only once, at the feed rolls, and this by a harsh, tearing like process, and then at once thrown out through the outlet of the machine. The stock is thus prepared in fewer runs than by the common pickers, and less labor is required in the picker room. Danger from fire, inherent in pickers with rapidly revolving cylinders, is also largely done away with. The capacity of the Fearnaught is from 800 to 2000 pounds of stock per hour, according to size.

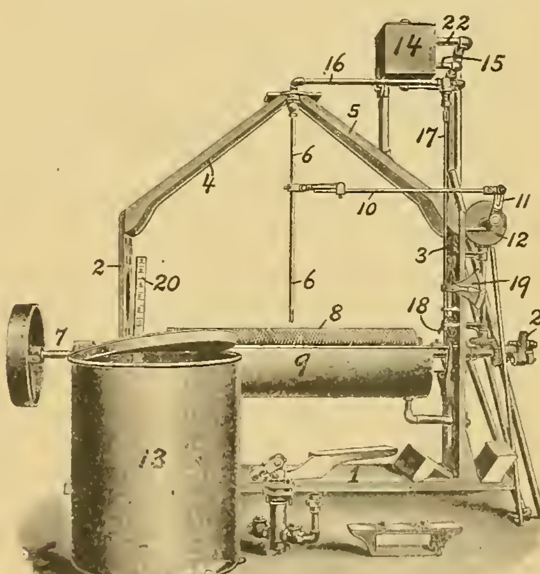
The stock may be delivered from the Fearnaught into a gauze room in the usual manner, or a pipe and exhaust fan may be connected to the outlet of the machine, so as to deliver the stock over the top of the machine to wherever required, thus doing away with the gauze room, giving in turn more room in the picker room, besides saving a large amount of labor otherwise required in sheeting up and handling the stock.

The work of cleaning the Fearnaught between lots is practically no more than on any of the ordinary pickers; by allowing the machine to run a few minutes after you stop feeding in, in most cases it will clean itself sufficiently; where special care is necessary the covers of the machine are readily raised and the cylinders brushed clean in a few moments. (Curtis & Marble Machine Co., Worcester, Mass.)

THE SPENCER AUTOMATIC STOCK OILING MACHINE.

The adoption of the Bramwell self feeder on mixing pickers and fearnaughts, thus securing even and continuous feeding, has made possible the adoption of another improvement in the picker room which is being rapidly adopted in all up-to-date woolen mills. Until recently the regular method of oiling the stock was by spreading it on the floor and then sprinkling the oil over it by hand with a watering can. This method was crude, wasteful and gave unsatisfactory results, some parts of the stock receiving no oil, some too much, again oil was wasted by falling on the floor, the walls of the picker room and considered all around, the whole process was wasteful of labor and oil. Since evenness in feeding has been secured by the use of the Bramwell picker feed, economical and perfect oiling of the stock is done best by attaching to the picker or fearnaught the Spencer automatic oiler.

The machine, which is bolted to the sides of the picker feed apron, is simple and effective, consisting principally of a revolving brush on which the oil or emulsion is dropped by a vibrating pipe which leads from a small tank at the top of the machine. The brush strikes against a metal blade and thus converts the oil or emulsion into a spray which is thrown



evenly on the wool as it passes over the picker feed apron from the feeder to the picker. It thus penetrates the stock thoroughly and reaches the individual fibres effectively and with a perfect uniformity.

The construction and operation of the oiler is best given by means of the accompanying illustration, which is a front view of this automatic oiler, as detached from its working position on a picker, the lower oil tank from which the oil is pumped to the small tank above, being also shown in the illustration but not connected to the oiler. In attaching the oiler to a picker, the base 1 of the former is bolted to the feed table of the picker and is as near to the feed rolls as practicable. This base carries upright pieces 2 and 3, to which are connected the arms 4 and 5 at the top ends, said arms being placed to converge and meet each other at the centre between the pieces 2 and 3, and thus form a support for the swing pipe 6 and the small tank 14. Fitted in bearings in the pieces 2 and 3, at a sufficient distance above the base 1, is a shaft 7, carrying the oiling brush 8, which is supplied with oil across its entire length by means of the swing pipe 6, and which oil is converted into a fine spray by having a spraying knife set to said brush so as to cause vibration of the bristles and thus throw the oil off and onto the wool in a finely divided state. The drain pan 9 is placed under the brush, as shown, having a pipe connected to return the oil back into use. The swing pipe 6 receives its vibration back and forth across the length of the brush by means of a rod 10 connected to it at one end and having its other end pivotally secured to a revolving arm 11, as secured to the same shaft as carrying the gear 12, said gear being positively driven from the brush shaft 7 through the gearing shown.

The oil or emulsion is pumped from the tank 13 when connected up properly by means of a pump (shown disconnected in the illustration) to the top or overhead reservoir 14 through the pipe 15, the pipe 16 in turn delivering it to the swing pipe 6. The regulating device for the flow of oil through the pipe 16 consists of a rod 17 having its top end connected to a valve in said pipe 16 and having its lower end screw threaded to receive a thumb nut 18 by which the flow of oil may be regulated. Secured also on this rod 17 is one end of the dial needle of the dial 19 so that any movement of said rod 17 will be shown on the dial and by this means the amount of oil passing through the pipe 16 ascertained. By this means the proper amount of oil required for different classes of wool, as found by experience, may be easily and accurately regulated.

A gauge 20 on the outside of the lower oil tank 13 will show at a glance the quantity of oil in the tank. The pump is connected to the shaft 7 at 21 and thus works when the machine is in operation and remains inoperative when the machine is stopped, and is driven from the Bramwell feeder so that the oiler and feeder are operated as a unit, in this manner saving a useless expense of power. An overflow pipe 22 is provided for the overhead tank so as to prevent any possibility of an accident due to a surplus of oil being forced into the overhead reservoir.

Referring to the operation of the automatic oiler, the pump for transferring the oil or emulsion from the tank to the overhead reservoir can be adjusted to pump from one to one hundred gallons per hour, as required; a half-inch to an inch stroke being generally sufficient to supply the demand. Ordinarily eighteen inches of space is required from centre of feed rolls to front of feed bonnet for the oiler. In order to keep the quantity of oil to each hundred pounds of stock uniform, keep the hopper of the self feed as uniformly full of stock as possible. Do not let it run down at any time and keep the oil tank and screen as clean as possible from all kinds of foreign matter. It will be advisable not to raise the oiler more than absolutely necessary in order to allow sufficient room for the stock to pass clear under the drip pan at all times. Where emulsion is used some mills have dispensed with the drip pan altogether as it is not considered necessary, but the value of this can be decided by practical experience in each case.

In connection with using this automatic oiler be sure to have the cylinder of the picker well balanced so as to avoid excessive vibration when running full speed, since such excessive vibration of the picker cylinder would destroy the pipe unions and cause leakage and waste of oil. Also be careful to have the brush and knife blade as level as possible, each with the other, so that the oil will not run off to the side of the knife blade, which should be set at an angle of forty-five degrees into the brush to throw a fine spray of oil. The speed of the brush should not be less than sixty revolutions per minute nor more than ninety; however, this item depends a great deal upon the character of the stock under operation or character and quality of the spray desired.

A good plan to regulate the quantity of oil per hundred pounds of stock is to place only the amount of oil in the tank required for the batch you desire to run through and set the supply valve so that when one-fourth of the batch is run through the tank gauge will show that one-fourth of the oil is gone, and when one-half of the batch is through one-half of the oil will be used; and so on in like proportions until you ascertain by experience just where to set the pin in the dial valve with arrow on dial to bring the oil and stock out even at all times. The float and gauge on the tank will always correctly register the amount of oil in the tank. (Geo. S. Harwood & Son, Boston, Mass.)

COTTON.

THE WORLD'S COTTON SPINDLES AND CONSUMPTION.

The progress of the cotton spinning industry in the various countries of the world since 1900 is illustrated in the table below.

Number of Spindles Operated in Various Countries, 1900 and 1903.

Countries.	Number of spindles. 1900.	Number of spindles. 1903.	Number of mills. 1903.
Germany	8,100,000	8,434,601	390
Russia and Poland	7,000,000	6,940,869	304
France	5,500,000	6,150,000	420
Austria	3,200,000	3,250,000	125
Spain	2,650,000	2,614,500	257
Italy	2,100,000	2,435,000	500
Switzerland	1,700,000	1,558,000	72
Belgium	900,000	936,138	36
Sweden and Norway	450,000	459,932	44
Holland	290,000	300,000	12
Portugal	230,000	160,000	15
Greece	80,000	97,000	......
Roumania		40,000	1
Smyrna		25,000	......
Total European Continent	32,200,000	33,401,040	2,176
Great Britain	45,600,000	49,727,107	2,077
United States	19,008,000	22,300,292	1,197
East India	4,946,000	5,006,965	192
Japan	1,250,000	1,332,600	64
Canada	670,000	773,538	22
China	565,000	600,000	15
Mexico	491,000	500,000	153
Brazil		300,000	100
Total	104,730,000	113,941,542	5,996

It will be seen that with the exception of Spain, Switzerland, Portugal, and Russia, every country has increased its number of spindles.

The World's Consumption of Cotton, 1890-91 to 1902-3.

[*Bales of 500 pounds.*]

Date.	Great Britain.	Continent of Europe.	United States.	East Indies.	Japan.	Canada and Mexico.	Total.
Year ended Sept. 30:							
1890-91	3,384,000	3,631,000	2,367,000	924,000	100,000	107,000	10,513,000
1891-92	3,181,000	3,619,000	2,576,000	914,000	203,000	110,000	10,603,000
1892-93	2,866,000	3,661,000	2,551,000	918,000	191,000	110,000	10,297,000
1893-94	3,233,000	3,827,000	2,264,000	959,000	284,000	110,000	10,677,000
1894-95	3,250,000	4,030,000	2,743,000	1,052,000	360,000	130,000	11,565,000
1895-96	3,276,000	4,160,000	2,572,000	1,105,000	412,000	120,000	11,645,000
1896-97	3,224,000	4,368,000	2,738,000	1,019,000	495,000	120,000	11,964,000
1897-98	3,432,000	4,628,000	2,962,000	1,161,000	645,000	140,000	12,968,000
1898-99	3,519,000	4,784,000	3,553,000	1,314,000	747,000	140,000	14,057,000
1899-1900	3,334,000	4,576,000	3,856,000	1,139,000	706,000	130,000	13,741,000
1900-1901	3,269,000	4,576,000	3,727,000	1,059,000	536,000	130,000	13,297,000
1901-2	3,253,000	4,784,000	4,037,000	1,383,000	743,000	149,000	14,349,000
1902-3	3,185,000	5,148,000	4,015,000	1,350,000	439,000	202,000	14,339,000

How greatly the world has increased its use of cotton in recent years may be judged from the above figures, and yet they do not include the consumption of all countries, but represent only the cotton brought into commercial channels. Large quantities of cotton are grown in India, Brazil, and China, and smaller quantities in other countries which are consumed by hand or domestic establishments, and of which no account is taken commercially. For instance, in addition to the consumption of the mills in East India, as shown in the above table, it is estimated that from 400,000 to 415,000 bales are worked up by native appliances or by hand, "chiefly for wadding and quilting, in connection with clothing, upholstery, etc." In Brazil cotton manufacturing by modern machinery has increased so greatly that from 200,000 to 250,000 bales are taken by her mills. No allowance for this is made in the above table. As to the production and consumption of cotton in China, little or nothing is known, but considering its enormous population and the almost universal use of cotton clothing the amount must be very large.

So far as the consumption of the cotton of commerce is concerned, it has gradually increased on the Continent of Europe, in the United States, the East Indies, Japan, Canada and Mexico, since 1890-91, Great Britain alone showing a decrease. It appears almost anomalous that Great Britain should have more than twice as many spindles as the United States and yet consume much less cotton and can only be explained by the fact, that the average count of yarn produced in Great Britain is much finer than in the United States.

American Cotton Consumed by Foreign Countries.—The amount of cotton taken by each foreign country in 1901, 1902, and 1903, with its value, is given in the table below. As the exports contain small bales of sea-island cotton, as well as light-weight round bales, all bales are reduced to the uniform weight of 500 pounds.

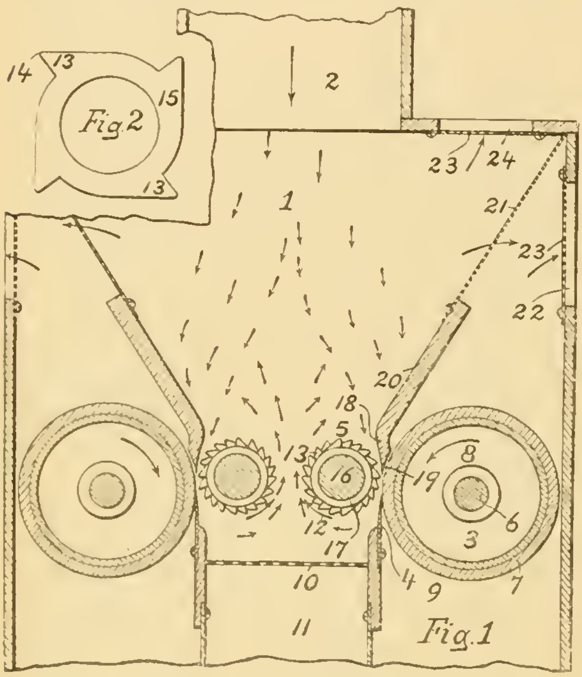
Exports of cotton from United States to foreign countries, expressed in bales of 500 pounds.

Countries.	Year ended June 30, 1901.		Year ended June 30, 1902.		Year ended June 30, 1903.	
	Bales.	Value.	Bales.	Value.	Bales.	Value.
		Dollars.		*Dollars.*		*Dollars.*
Austria-Hungary	37,042	1,685,220	39,757	1,642,382	39,912	1,774,158
Belgium	151,063	7,302,960	132,232	5,469,847	157,351	6,968,912
Denmark	26,395	1,177,048	39,129	1,685,190	34,062	1,500,048
France	729,332	34,954,658	775,773	31,771,969	806,673	35,564,079
Germany	1,601,462	76,234,319	1,705,815	70,416,199	1,915,094	84,824,284
Greece	100	4,700	1,645	72,602	1,201	55,830
Italy	361,627	16,825,300	445,437	18,472,796	444,950	19,792,253
Malta, Gozo, etc.	....	....	....	....	96	4,080
Netherlands	51,919	2,422,092	22,418	936,531	42,542	1,846,237
Portugal	13,102	631,997	9,360	407,224	15,773	668,832
Russia, Baltic	51,928	2,498,823	73,446	3,218,897	181,938	8,170,060
Spain	239,104	11,204,979	270,602	11,408,504	266,336	12,139,900
Sweden and Norway	12,416	599,771	11,545	491,949	31,112	1,392,600
United Kingdom	3,022,112	147,158,409	3,132,324	128,323,241	2,799,095	124,789,602
Dominion of Canada	102,309	5,104,197	129,016	5,669,956	127,640	5,932,429
Mexico	34,104	1,750,674	27,500	1,273,741	66,507	3,183,430
West Indies, French	5	238	10	434	....	....
Chinese Empire	....	....	6,110	290,669	2,613	122,780
East Indies, British	350	16,100	153	6,493	254	11,400
Japan	73,722	4,086,317	178,505	9,058,290	152,827	7,434,718
All other countries	358	15,641	780	34,905	110	4,797
Total	6,508,450	313,673,443	7,001,557	290,651,819	7,086,086	316,180,429

THE McPHERSON ROTARY ROLLER GIN.

There are two distinct types of Cotton Gins in use, viz.: the Roller and the Saw Gin. The claim for the latter is production, accomplished however only by deteriorating the quality of the staple, by more or less breaking the individual fibres, as caused by its rough action on the seed cotton under operation; hence if we can bring the output of the roller gin up in quantity, as is the case in connection with the McPherson Gin, this machine cannot help but prove of the greatest of interest to Cotton Growers, Merchants and Manufacturers. It is the object of this Cotton Gin to prepare, at the southern ginneries, a staple as perfect as it is possible to make it, and this, in connection with a large output at no extra cost of preparation.

The McPherson gin follows the approved English practice (the Macarthy Gin) and combination of a ginning roll against a polished steel bed plate, the bed plate being fixed, the rolls being adjustable thereto, either by springs, set screws, or turnbuckles,



to supply the necessary friction to draw the cotton lint between the roll and the polished plate. But here the parallel ceases, for instead of employing the reciprocating movement of a beater blade as is the case with the Macarthy gin, a rotary comb is used for combing the seeds out of the lint, this comb, with its rows of blunt teeth, revolving so smoothly that there is no vibration, and much more rapidly than is possible with a reciprocating beater. The rapidity of the comb rolls allows a corresponding increase in the revolutions of the ginning rolls, and the result is an immense increase in production over former makes of roller gins, and one close up to that of the saw gin, while at the same time, the quality of its work is greatly superior.

A description of the construction and operation of this gin is best given by means of the accompanying illustrations, of which Fig. 1 is a vertical central section of the working portions of the gin, and Fig. 2 a face view of one of the disks (shown enlarged compared to Fig. 1), forming part of the rotary combs.

The hopper 1 of the gin has an opening in its upper wall through which the seed-cotton from the shute or conduit 2 is automatically delivered. Located within the hopper 1 is the ginning mechanism, which is in duplicate (two rotary roller gins combined in one machine—only one of these two gins being supplied with numerals of references), consisting of the ginning rolls 3, the bed plates 4, and the rotary combs 5. The ginning rolls 3 are mounted upon the shafts 6 and are provided with a felt or other soft, non-metallic covering 7, which has a soft brush like effect upon the fibres, leaving them smooth and straight, uncut and unbroken and free from nepiness. These ginning rolls 3 are rotated in opposite directions, as indicated by the arrows 8, and thus draw the lint from the seed-cotton down into the lint chambers 9. The rotary combs or clearing members 5 coöperate with the ginning rolls 3 and serve to dislodge and separate the seed from the cotton.

Located in a substantially horizontal position below the rotary combs 5 is a screen 10, the said screen being of such mesh as to enable the cotton-seed from which the lint has been completely removed to pass therethrough into the chamber 11, but to catch and retain such seed which has passed through the ginning mechanism without having all of the lint completely removed therefrom.

The combs 5 are rotated in opposite directions, (see arrows 12) and this at a high rate of speed, creating in turn an upward draft of air from the screen 10 through the space between said combs and up into the hopper 1, and which draft serves to elevate any cotton-seed with lint adhering thereto from the screen 10, as previously referred to, and cause the same to reënter the hopper 1 to be again acted upon by the ginning mechanism. Said draft also serves to divide the mass of seed-cotton in the hopper, and to deflect the same laterally in opposite directions, so as to cause it to pass into the spaces between the rolls 3 and the combs 5, and which is an important feature of the invention.

The teeth 13, of each rotary comb 5, have blunted or rounded ends 14, as clearly shown in Fig. 2, and are formed upon disks 15, a series of them being secured to each shaft 16 of the gin. Said disks 15 are arranged in parallel relation to each other, and are separated from each other by spacing blocks or washers 17. These disks 15 are so arranged on each shaft 16, that the teeth of each disk are located in advance of the teeth on the next adjacent disk.

For the purpose of guiding the seed-cotton to and between the rotary combs and coöperating ginning rolls, and to assist in preventing the seeds from being crushed by the teeth of the rotary combs, the stationary deflectors 18 are provided, the same extending from side to side of the hopper 1, and having their lower ends formed with tapering edges 19, extending downwardly to a point as close as practicable to the periphery of the ginning roll, and the outer edges of the teeth 13 on the rotary combs. These deflectors serve to automatically guide or deflect the seeds contained in the seed-cotton laterally, relative to the teeth on the rotary combs, so as to enable said teeth to force the seeds away from the lint and conduct them into the seed chamber 11 without being crushed. Secured to, or formed integral with the deflectors 18, and extending across the ginning chamber, are the inclined deflector-plates 20.

The seed-cotton is ordinarily delivered into the hopper 1 by air pressure, and for the purpose of facilitating the feed of the seed-cotton and the delivery of the same to the ginning mechanism, the hopper is provided with means to allow a portion of this compressed air to escape therefrom, while at the same time preventing the seed-cotton from escaping. To effect this ventilation, the upper ends of the deflector-plates 20 have secured to them screens 21, which extend up to the top of the hopper, and are provided with openings 22 in the side walls of the casing of the device, and which openings are covered by the screens 23, which however can be dispensed with; again screens 21 and 23 as well as opening 22 may be dispensed with, using in place of it screens 23 in connection with openings 24, in the top or upper wall of the hopper.

It has been stated that one of the prime objects of the new giu is to quickly and effectively gin any quality or variety of seed-cotton, and this without crushing the seed. In effecting this result the rotary combs 5, and particularly its rounded or blunt ends 14 of the teeth 13 thereon, play a very important part, since when said combs 5 rotate, their teeth 13 strike against the seed and thus dislodge or disconnect the same from the lint, allowing the same to drop down into the seed-chamber 11. The rounded or blunt ends 14 of the teeth 13, enable said teeth to pass freely over the seed without crushing the same and without cutting or tearing the lint, which in turn is blown away by a current of air to the condenser and to any form of baling press. The seeds drop to the floor or to any receptacle.

Some of the other advantages of the machine, besides its quality and quantity of work, are the small amount of power needed to run it; its absolute immunity from fire—for instead of saws to strike fire, its felt rolls immediately smother out a fire—; its simplicity and consequent easy understanding by unskilled help; its absolute freedom from danger to the operator, as there are no saws nor gears nor other dangerous devices to injure him; its smooth, quiet running and lack of vibration, which saves wear on the machine as well as the building; its ability to gin damp cotton as easily and as well as dry cotton, something the saw gin will not do. (American Cotton Improvement Co., Bostou, Mass.)

HOWARD & BULLOUGH'S HOPPER BALE OPENER.

The object of this new machine is to thoroughly open cotton without damage to the staple preparatory to making mixings or being fed to the Openers which follow. This type of machine has found great favor in England and on the Continent and the mills

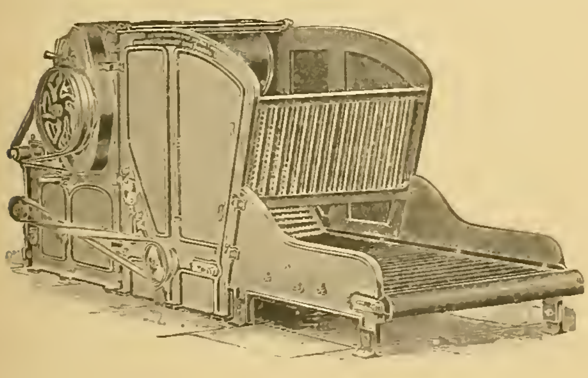


Fig. 1.

in this Country are just beginning to realize its possiblities in the line of labor saving, and large production. No manager who has under his charge a cotton mill of large output can afford to be without such a machine if he desires to keep down the cost of manufacture. Its productive capacity is very great, since a bale of cotton can be put through in six to ten minutes, or 150,000 to 200,000 pounds per week.

The machine is made with different kinds of feed and delivery arrangements. Generally a short feeding lattice is supplied, as shown in Fig. 1 which is a perspective view of the machine; again sometimes a much longer lattice is used, from either side of which cotton can be taken from as many different bales as

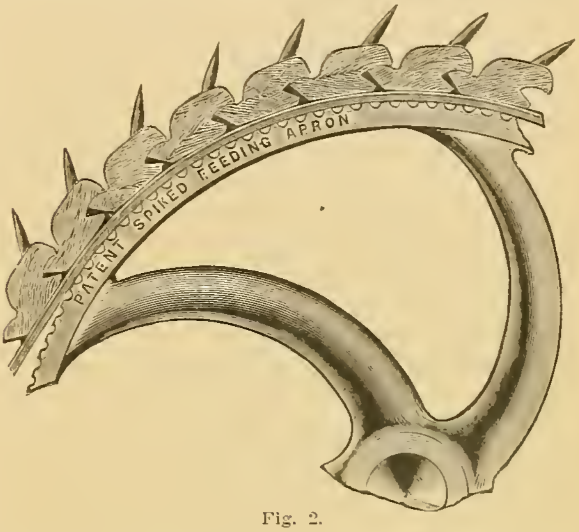


Fig. 2.

desired, thus ensuring even and thorough mixing. Waste can be evenly mixed with the cotton in any desired proportion. Owing to the thorough mixing the variously shaded colors of different cottons are no longer traceable in either yarn or cloth.

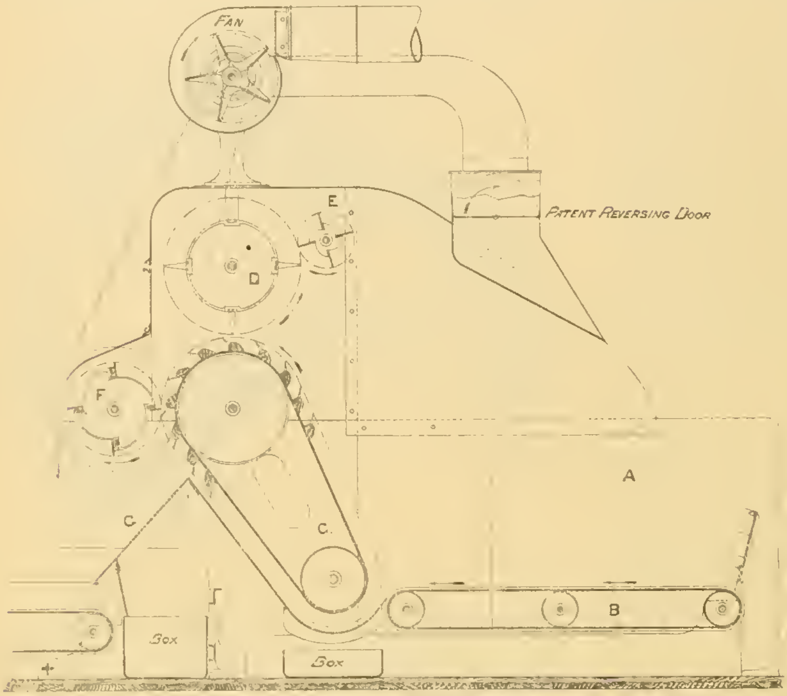
The ordinary delivery is intended to drop the cotton on to the floor or into a mouthpiece of a conveying system. Other arrangements are made, by which the cotton is carried upwards from the machine either by pipes or traveling lattices and delivered at any desired point. The machine is heavy and strongly built, and is provided with an extra large Hopper. The Spiked Elevating Lattice in Hopper, and of which a portion is shown in Fig. 2, is made on the new improved patented system without any canvas backing. The slats are made of heavy selected wood, intersecting, and very strong. The spikes are of suitable length and strength, ensuring great durability. The object of the patented intersecting form is to prevent the accumulation of cotton under the slats.

The amount of opening can be regulated by the setting of the Patent Stripping Cylinder, the Adjusting Arrangement of which is conveniently placed on the outside of the machine. The floor space of the machine with short feeding lattice, as shown in the illustration Fig. 1, is 13 ft. 2 in. x 6 ft. 10 in. (Howard & Bullough American Machine Co., Pawtucket, R. I.)

PLATT'S HOPPER BALE BREAKER.

The first operation in cotton spinning is to open the heavy compressed cotton bales and feed the cotton in large pieces to the hopper bale breaker, in order that it may be opened and loosened as much as possible before being either made into a mixing or passed direct to the blowing machinery where mixings are dispensed with, as is now the case in many mills. Mixings should, however, be used for long stapled cotton such as Sea Islands, Egyptian, etc., for spinning fine counts of yarn, whereas the direct arrangement (without mixings) is used for all classes of cotton with the exception of Sea Islands and fine Egyptian.

The accompanying illustration is a view in section of this bale breaker. The cotton taken from the



bales is put in the hopper A, the horizontal lattice B carrying it forward and pressing it against the spikes of the inclined elevating lattice C, where it is subjected to a sort of combing action, and is then carried upward to the spiked roller D, which further combs the cotton, and throws back into the hopper any large or unopened pieces, thus securing more perfect opening and mixing of the cotton before it leaves the hopper.

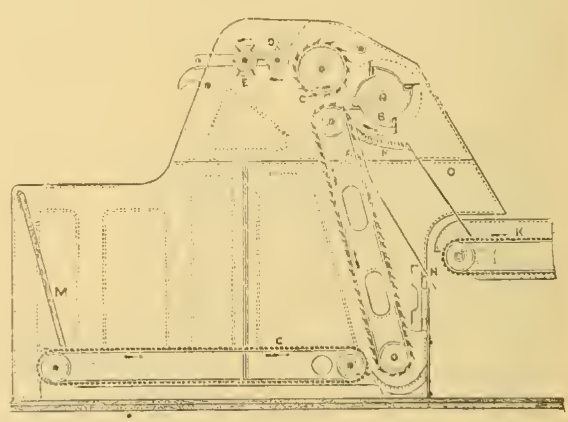
The spiked roller is stripped and kept clean by the stripping roller E, the surplus cotton falling back into the hopper. The cotton after passing the spiked roller is stripped from the inclined lattice by the beater F, and falls on the grid G in the delivery sheet, and is conveyed either to the mixing or to the filling lattice of the hopper feeding machine, which not only dispenses with carrying the cotton long distances, but keeps the hopper regularly charged, the lattice being governed by an automatic arrangement fixed to the end of the hopper. (Platt Bros. & Co., Ltd., Oldham, Eng.)

PLATT'S HOPPER FEEDER.

This machine has come during the past years into general use as an auxiliary machine to pickers. There is no doubt as to the usefulness of the hopper feeder, for, when properly applied, it certainly prepares the material in the best form possible (more or less already opened) for the picker, feeding it at the same time evenly and regularly to it, in order that the same may pass the cotton on in like manner to the scutchers, permitting an even lap to be formed. At the same time the action of the picker is more effective and greater cleaning power obtained. Both items, the even feed and greater cleanliness will be the reason for a stronger yarn and better production. Since heavy objects, nails, etc., cannot pass the feeder, the risk of fires in the picker room is lessened. Another item in favor of the hopper feed is economy in wages, as one operative can tend easily to three machines. The accompanying illustration shows this hopper feeder in its section.

In the arrangement shown, the cotton as taken either from the mixings, the hopper bale breaker, or as the case may be from the bale, is deposited in the hopper of the machine as formed by back wall M and aprons G and A.

After the cotton is deposited in the hopper it is carried forward by the lattice G against the face of the inclined lattice A, traveling in the direction indicated by the arrows, and thence up to the combing cylinder C (running in the opposite direction), which gives the important combing action, characteristic to this machine, and allows only small pieces of cotton to pass forward. The cylinder C takes off the surplus of the feed and carries round a charge of small pieces, the large pieces having in the meantime been removed by the action of the strippers D and E, and returned into the hopper (well away from the lifting lattice A), thus the lifting lattice A, and the combing cylinder C, take forward only small pieces of well combed cotton, which is stripped by the cylinder B, and



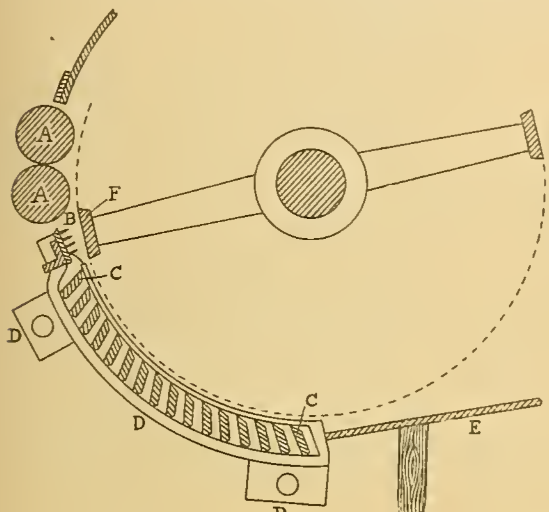
passed down the shute O on to the lattice feeder K, all loose refuse passing through the bars at N and out at H.

Ample space is provided between the lattice G and the lifting lattice A, thereby allowing any hard substance which the spikes will not take up to pass out through the bottom grid. (Platt Bros. & Co., Ltd., Oldham, Eng.)

THE SCHAELLIBAUM PATENT GRID FOR COTTON OPENERS AND SCUTCHERS.

The object of this attachment is to increase the cleaning action of cotton picking machinery and thus furnish a superior lap to the carding engine, and at the same time save cotton from picker waste and sweepings.

The accompanying illustration is a sectional view of this grid, showing also those portions of an opener or scutcher with which the same comes more



closely in contact, viz.: A the feed rolls, B a special comb to work in connection with the new grid, and of which its first and last bar are indicated by C. The bracket for holding the comb and the grid bars in place is indicated by D, the bottom plate of the machine by E, and the beater blades by F.

From this illustration it will be seen that the distinctive features of this grid, as compared with other grids, consist of a comb, and a greater number of bars of a special design.

The comb consists of a steel plate in which are inserted four rows of steel pins set at a certain angle pointing upward against the cotton, when the latter enters the machine, *i. e.* is fed to the machine by means of the feed rolls A. These pins vary in size and distance apart from coarse, for use on openers, to medium and fine for scutchers, to insure a most thorough separating and cleaning of the cotton under the operation. The action of this comb on the cotton fibres is mild and gentle, and does not injure the staple in the least, yet it thoroughly loosens up the bunches of raw cotton and by this more thorough opening and loosening up of the fibres it allows more dirt to go out through the Grid Bars and thus away from the cotton than common grids will permit.

The bars C of the grid, of which from 15 to 18 are used on Scutchers, and on some styles of Openers a larger number, are made of rolled steel and unbreakable. Under extreme strain they will give, and then return to place instantly, thus eliminating all danger of their breaking and the fragments damaging the machine. This Grid can be easily applied to any style of opener or Scutcher except openers of the Crighton Type, and is as equally adapted to one grade of cotton as to another.

For colored goods, the cotton is now usually dyed in the raw, and for such dyed cotton the advantages of the new grid are fully double as great as for white cotton. (The Rob. Schaellibaum Co., Providence, R. I.)

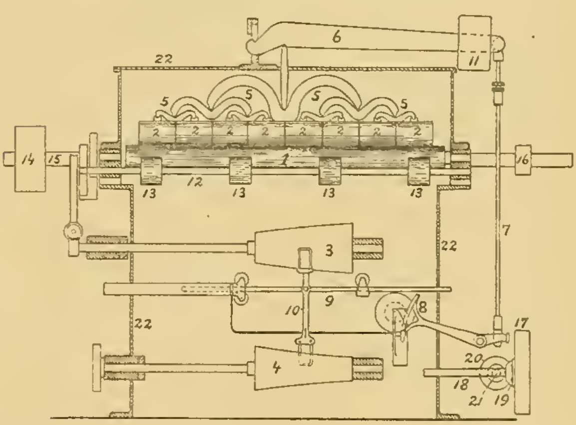
HOWARD & BULLOUGH'S IMPROVED EVENER FOR INTERMEDIATE AND FINISHER SCUTCHERS.

This Evener, as shown in the accompanying illustration, is an improvement brought out after considerable experimenting and many tests. The feed roll 1 and evener plates 2 are arranged on the same principle as the well known "Lord" System, which gives great cleaning capacity, owing to the bite of the roll and plates being close to the beater. The plates are on top of a 3″ steel feed roll which gives a very rigid support and makes sure that all the variation in the thickness of the laps will affect the position of the evener belt on the cones 3 and 4. These cones are conveniently placed under the feeding apron or lattice of the machine. The lower cone 4 works in an adjustable cradle, allowing the belt to be made endless and kept at an even tension at all times in any position on the cones.

The mechanism is what might be called a direct connected evener, as any motion of the evener plates is communicated directly to the cone belt through the yoke arrangement 5, large lever 6, vertical rod 7, toothed segment 8, and rack 9, secured to the cone belt guide 10.

Any change in the thickness of the sheet of cotton passing between the feed roll and the evener plates is thus communicated to the belt. The lever 6 has a large weight 11 resting on it near its outer end, which assists the movement of said lever 6, when the latter is operated. The arrangement is very sensitive and the cone belt at once takes its proper position when a variation in the weight of the cotton sheet occurs.

Other numerals of reference, not directly connected with the evener mechanism of the machine are thus: 12 is the apron shaft on which are fastened the apron driving blocks 13. The machine is driven from a countershaft by means of driving pulley 14 fast to shaft 15, the latter carrying on its other end



a pulley 16, which in turn drives pulley 17 fast to cross shaft 18, the latter carrying also a bevel gear 19 which through another bevel gear 20 drives the side shaft 21 driving the calender rolls in front of the machine. 22 indicates in section, the side and top framing of the machine.

The evener is so simple that it can be understood by the most ordinary picker hand, there are practically no parts to get out of order, and the breakages are reduced to a minimum. The results from this evener are very satisfactory and the evenness in the weight of whole laps and individual yards of laps is appreciated by the many mills which already have the improved arrangement in operation. (Howard & Bullough American Machine Co., Pawtucket, R. I.)

PLATT'S IMPROVEMENTS TO PICKERS AND SCUTCHERS.

Fig. 1 shows an improvement in the cleaning arrangement, having for its object to extract a greater amount of foreign matter from the cotton, than was formerly possible to do. The illustration shows an

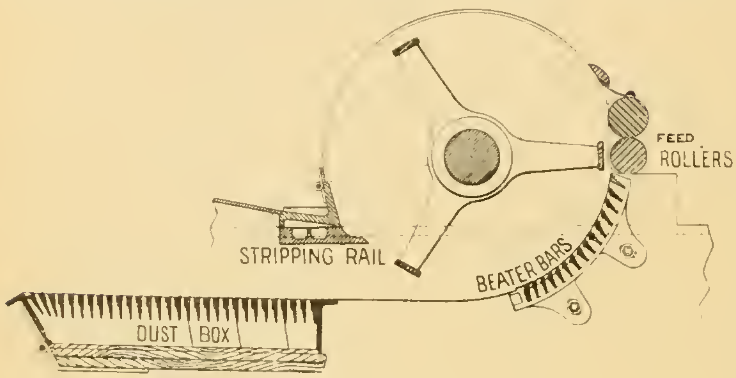


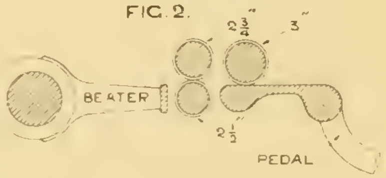
Fig. 1.

arrangement of improved bars under the beater, and a long dust box in connection with loose bars between beater and cages, also showing the improved stripping rail.

It is important that the beater bars, *i. e.* the bars under the beater, and against which the cotton is more or less thrown with force by the action of the beater, should be so shaped and adjusted as to allow a maximum amount of leaf and dust to be thrown out, and this with a minimum of cotton. There are fifteen bars, which are numbered respectively by the builders, and must be placed consecutively in the machine, starting with No. 1 at the bottom and ending with No. 15 nearest the feed rolls.

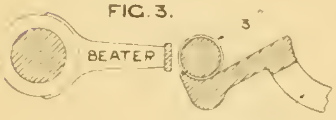
3 ROLLER ARRANGEMENT

FIG. 2.



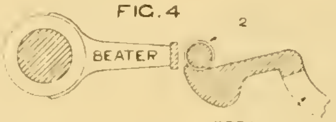
SINGLE 3" ROLLER

FIG. 3.



SINGLE 2" ROLLER

FIG. 4



These bars can be adjusted to suit different varieties of cotton, by means of screws on the end of each bar, and, as will be seen from the illustration, the openings should be narrowest at the bottom, gradually widening as they near the feed rollers, the long face of each bar being uppermost.

The illustration also shows an effective and simple method for adjusting beater and stripping rail, permitting them to be set just so close as to allow the beater to pass the rail, and which is done by making the stripping rail in two sections. The lower section is fixed to the beater pedestal, which allows the stripping rail to be kept at the required distance from the beater by means of screws which can be readily adjusted to meet the wearing of the beater blades. When the stripping rail is to be correctly set to the beater, the two can be moved simultaneously and set to or from the feed rollers at such distances as may be desired.

Fig. 2 shows the three roll feeding arrangement as used in connection with long staple cotton, viz.: using a 3″ pedal roller to feed in connection with the nose of the pedal to a pair of feed rollers (2¾″ upper and 2½″ lower roller) which in turn feed to the beater.

The single roll feeding arrangements shown in Figs. 3 and 4 refer more to be used in connection with short staple cotton, the nose of the pedal of the feed regulator being used in this instance for feeding the cotton, either with a 3″ or 2″ single pedal roller direct to the beater, the nose of the pedal being shaped differently for either size of pedal roller, *i. e.* feed roller in this instance. (Platt Brothers & Co., Ltd., Oldham, Eng.)

SILK.

EVERTZ'S HOT AIR SILK REELING MACHINE.

The purpose of the machine is to reel silk from wet cocoons direct to the spool, through which course the strand is packed and rounded, and the silk thread comes off from the spool dry and free. The machine will be explained with reference to "foot power" driving, but may also be arranged to be driven by "belt power."

Fig. 1 is an elevation of a side view of the machine; Fig. 2 a front view of it, and Fig. 3 a perspective view of the strand in its course from the cocoons *a* to the cleaning arrangement *b*, around reel *c* and guide *d* onto spool *e*.

1 indicates a stand, upon which is placed the drying chamber 2, which holds the reels. The front of said chamber 3 is removable, being fastened to the chamber by means of latches 4 (one on each side), the chamber itself being subdivided in four (or more) sections, according to size of machine, *i. e.* number of reels used. Small holes are placed in this front side of the chamber and also in the top part, respectively, for the purpose of enter and exit of the silk thread in its travel onto and from its reel 5, a series of which (four or more) are arranged free to turn on an axis. To avoid complication in the illustration only one of such reels is shown.

Above chamber 2 is placed a frame for supporting a series of three pulleys (only two, 7 and 8, being visible in the illustration, Fig. 1, the third pulley being placed on the other end of the machine), and also spool spindles 9 and its spools 10. Each spindle carries a pulley 11, resting on an endless cord 6, which connects those pulleys previously referred to and the driving pulley 14. A side pulley 12, over which this same cord passes entirely around, is supported on a short shaft or pin. Pulley 14 is a double

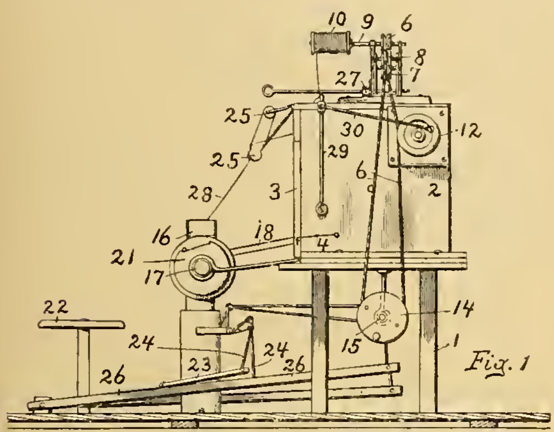


Fig. 1

pulley secured to a crank shaft 15, which is operated by the treadles.

A basin for water and for the silk cocoons is indicated at 16, being located directly over the hot chamber 17, which is provided with tubes 18 (the same number as reels used in the machine—only one tube being shown) for delivering hot air into the respect-

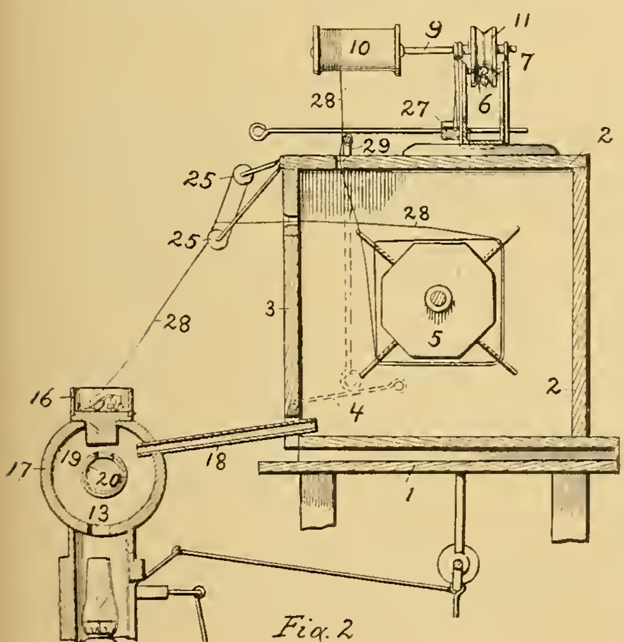


Fig. 2

ive sections of the drying chamber 2. Chamber 17 has an opening at 13, being directly over the heating apparatus, in this instance a lamp, the heat of which passes up through opening 13 and heats the water in the basin 16. This opening 13 and the lamp (a stove, or a charcoal furnace can be made to take the place of the lamp) are used only when the machine is operated by foot power. A tube 19 is for shutting off hot air when desired, and it extends into the tube 17 and has a tube 20 within it. This tube 20 is for receiving hot air when the lamp is not employed for such purpose, a valve or opening coinciding in these tubes 19 and 20. The turning a little on this exterior tube serves to open or close at will both of these valve openings. At the end of tube 19 is provided a notched disk 21, by which it may be properly turned for closing or opening, a pin limiting this movement.

22 is a stool or seat for the operator. Small treadles 23, with brace rods 24, are for the purpose of pushing the cranks of the crank shaft 15. Upon pushing fully down a long treadle and then pressing its small treadle down, the crank moves over the dead centre, in turn insuring practically a uniform movement in effecting the compactness and rounding of the twisted strands at the points between the pulleys 25. The long treadles 26 are provided with connecting rods attached to a crank shaft 15.

A key or cam 27 serves for lowering into action or for raising out of action by turning it partly around the spool spindle 9 and its spool 10. When raised, its pulley 11 no longer rests on the cord 6, and ceases to be driven by the friction of the cord.

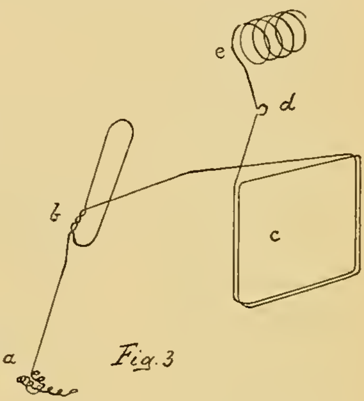


Fig. 3

The procedure of reeling in connection with the new machine is thus: A strand (marked 28) of several — say four or five — filaments, cocoons respectively, is passed from the water basin 16 first over the two guide pulleys 25, supported one above the other at proper distance from each other above the basin, the filaments passing once over around these pulleys, as shown. Then this strand is twisted some thirty or forty times upon itself midway between these guide pulleys. In the illustrations, to avoid confusion, only a few of these twists are shown. The twisting of the silk between the pulleys 25 is of the greatest importance, and when properly done, compactness and roundness of the thread is effected. After leaving the pulleys 25, the thread, having passed through its respective hole in the front wall 3, passes one or two times around its respective reel 5; thence up and through its respective hole in the top of the chamber, and thence once around a transverse bar 29 (which in its traverse or swing is operated by its link 30, reciprocated by pulley 12) and in turn is wound on its respective spool 10.

As a foot power machine, it can be run with one, two, three or even more strands, as any person can conveniently handle. As a belt power machine, there may be more—say ten—sets of devices running. When foot power is used, *i. e.*, heating as thus explained, the tube 20 must be closed at its ends by means of corks. In connection with belt power driving, any heating apparatus can be connected with the tube 20, the treadles and its connections being in this instance omitted and suitable connections for belt power driving substituted. (John P. Evertz, San Diego, Cal.)

SERRELL'S SILK REEL.

This reel is shown in Fig. 1 in its side view, partly in section. Fig. 2 is a plan view of a portion of the table, the water basin, a pair of cocoon holders, feeding drums, and filament attaching devices, with pulleys and belts for rotating the drums and filament attaching devices. Fig. 3 is a sectional elevation of the parts shown in Fig. 2. Fig. 4 is a diagram illustration of the electric devices and connections of the apparatus. Fig. 5 is a sectional plan, showing the ratchet wheel upon the shaft of the cocoon holder, and the devices at one end of the chain for turning said wheel and shaft.

In practice, two threads are wound upon the same reel, hence two cocoon holders and two sets of apparatus, in conjunction with each basin and with one reel, are used; but as these are similar only one is described. In most of the reeling establishments there are several basins, side by side, each being provided with two sets of devices, as previously alluded to, and the reels for each set of devices are situated in a frame common to all, with but one driving shaft to rotate all the reels. Letters of reference in all four illustrations are selected to correspond.

The operation of the machine is as follows: The operator places a cocoon in each compartment of the cocoon holder or magazine H, and leads the filaments of each of the cocoons up over the upper plate, attaching them in any convenient manner, as shown in Fig. 3. The filaments of several other cocoons are then passed through the attaching devices, or cylinder *i*, to form the beginning of a thread. The thread thus formed is passed one or more times around the feeding drum D, so as to secure sufficient adhesion to prevent slipping, and the thread, after making the crossings, is carried over the small pulley at the end of the lever F, and under the pulley at the end of the lever F′, and thence to the reel B. The counter weight of the lever F is adjusted by trial to the position required for the count of thread which it is desired to reel, and the reel is allowed to revolve. The thread is delivered from the drum D, at a speed about five per cent. less than that at which it is wound in by the reel B, which will result that in the process of winding, the thread is uniformly stretched this percentage or a fixed proportion in relation to its length, being the proportional difference in winding speed between the drum D and the reel B. The passing thread thus stretched acts upon the lever F with a force which varies according to the strength of the thread to resist the elongation. Now the force which is required to stretch a silk thread a given proportion in relation to its length, is practically in direct proportion to its diameter, and from this it follows that the forces tending to depress the lever F, being in proportion to the resistance to elongation, are proportional to the size of the thread which is passing at any given moment. The lever F, having been adjusted for the desired count of thread, is held down at the end nearest the reel as long as the passing thread is sufficiently strong, and therefore of the required count; but as soon as the thread becomes too weak, the resistance diminishes and the lever F rises and touches the contact point c^1. An electric circuit is thus closed, and the magnet G attracts its armature, releasing the latch lever S. The spring now causes the pawl *p* to engage with a tooth of the ratchet wheel *l*, and the cam case *o* begins to make a revolution. This allows the spring T to contact, causing the ratchet wheel X to advance one tooth through the action of the pawl t^2. The shaft N revolves with the ratchet wheel X sufficiently to advance the magazine H, by one compartment, because the magazine contains the same number of compartments as there are teeth in the ratchet wheel X. In thus partly revolving the cocoon holder H, brings a cocoon filament within reach of one of the hooks upon the rapidly revolving cylinder *i*. The filament so brought within reach is seized by the hook, and the revolution of the latter causes the newly caught filament to be wrapped around those which are already paying out at a point between the lower end of the cylinder *i*, and the water in the basin E. The filament so wound around the running thread adheres, because of the glutinous matter with which heated and wet cocoon filaments are naturally coated, and becomes attached to and a part of the thread being reeled. The thread being thus strengthened, is usually of sufficient size, and in consequence strong enough to draw down the end of the lever F, and break the electric circuit before the cam case *o* has completed its revolution with the shaft J. When this is the case, the lever F no longer touches the contact point c^1, and the magnet G, not being excited, the hook of the armature retains the latch lever S, and the pawl *p* being withdrawn from the teeth of the ratchet wheel *l*, the filament supplying mechanism comes to rest until the thread becoming again weakened, the operation is repeated and another cocoon filament added. Should however the first cocoon not be sufficient, or should the cylinder *i* fail in seizing and attaching it, then the lever F is not drawn down, the contact remains closed at the point c^1, and the cam case *o* continues to revolve, thus progressively advancing the magazine, and causing to be added as many cocoon filaments as may be necessary to bring the thread up to the desired strength and size. The lever F′ is used in combination with the magnet G′, the armature *r*′, the lever *x*, the spring U, the slide rod V, to stop the reel when the

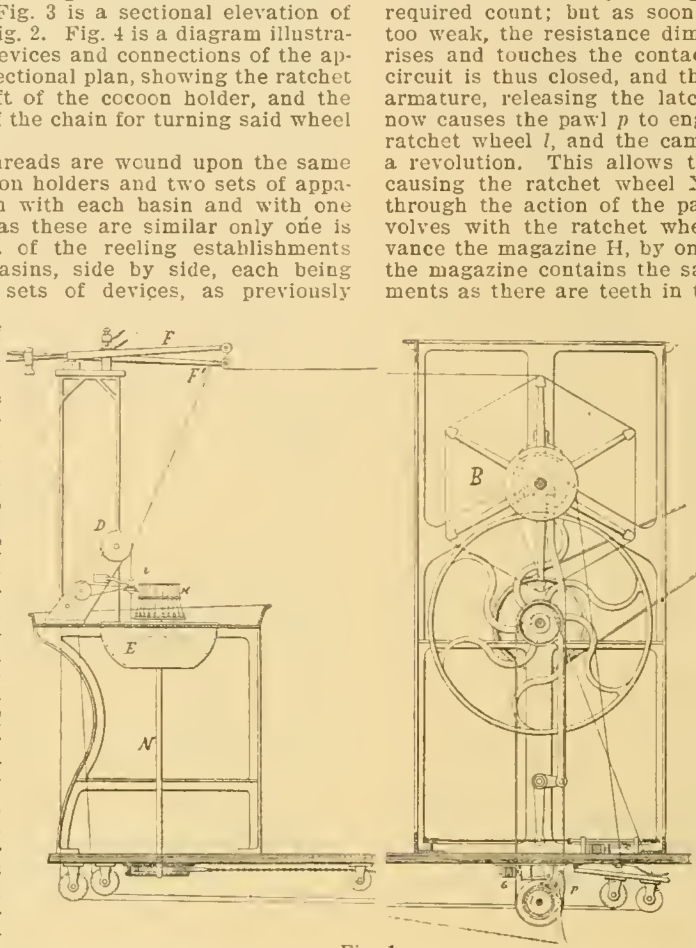


Fig. 1.

thread breaks, and the operation of the device is as follows: As long as the thread is unbroken, the

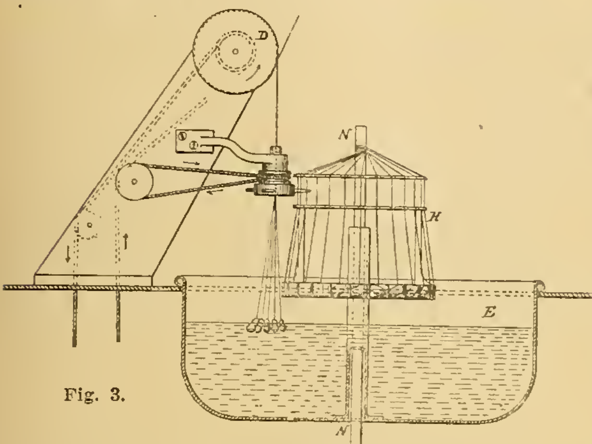


Fig. 3.

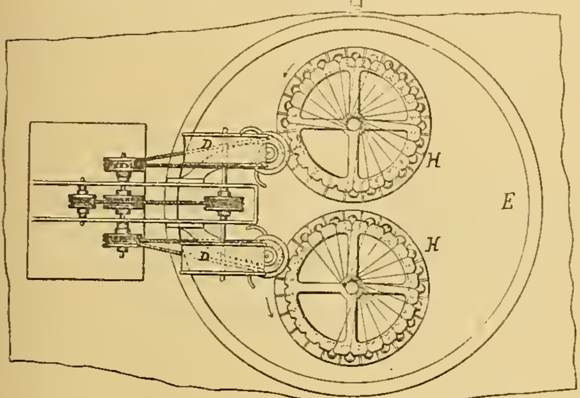


Fig. 2.

lever F′ is held up and does not touch the contact point c^2, but as soon as the thread breaks, the lever F′ falls and makes contact at the point c^2. The elec-

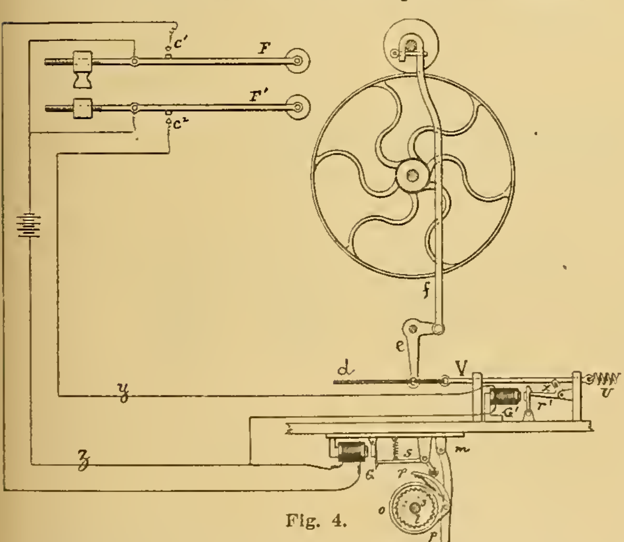


Fig. 4.

tric circuit is completed through the magnet G′, and the wires *y*, *z*. The magnet G′ is thus excited, and the armature *r*′ is attracted, thus releasing the lever *x*, allowing the spring U to lift the friction wheel of the reel off from the main friction wheel by means of the rod V, lever *e*, and rod *f*. This causes the reel B to stop. To put the reel in motion, the cord *d*

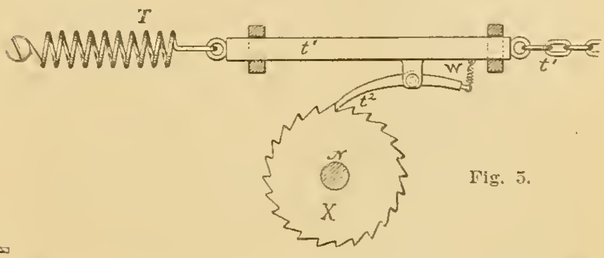


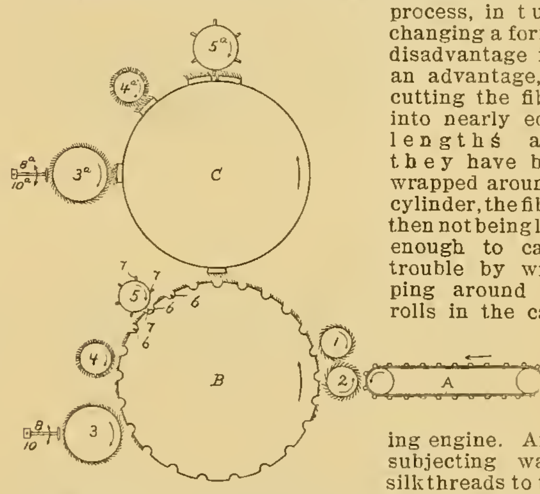
Fig. 5.

is drawn upon by means of a pedal, or otherwise, which again latches the armature *r*′, and moves the lever *e*, and this extends the spring U, and allows the friction wheel of the reel to bear upon the main friction wheel which is constantly in motion.

PREPARING WASTE SILK THREADS FOR RE-MANUFACTURE IN SILK YARNS.

The improvement has reference to a machine which prepares silk waste by straightening and cutting it in convenient lengths, so that the material in turn can be handy carded on a common carding engine.

In carding silk waste direct, one great trouble is that the silk wraps more or less around the rolls on account of its great length and cannot be removed without trouble and loss of time. The same trouble is found in combing it after the carding process has taken place. This principle of the material winding itself around the rolls is made use of in the new process, in turn changing a former disadvantage into an advantage, by cutting the fibres into nearly equal lengths after they have been wrapped around a cylinder, the fibres then not being long enough to cause trouble by wrapping around the rolls in the card-



ing engine. After subjecting waste silk threads to this process, they can be spun on what is termed either the worsted or woolen plan.

The accompanying illustration is a vertical section, partly in side elevation, of the system of cylinders, rolls, and cutters as used in the machine for thus preparing silk waste.

In the same A indicates an endless apron which feeds the silk waste into the feed rolls 1 and 2, provided with teeth, and which in turn feed the waste gradually into the teeth of the large cylinder B, which revolves as indicated by the arrow, and has sections of card clothing and cutter knives arranged over its circumference at distances equal to length desired to have the waste silk cut. 5 is the rotary cutting wheel, which carries knives 7 on its circumference, the cutting edges of which mesh with knives 6 of cylinder B.

4 is a "fancy" placed there for the purpose of bringing the silk onto the surface of the teeth of cylinder B, so that the same, in turn, can be readily taken off by the doffer cylinder 3, which pulls the silk waste from off the large cylinder B, due to the fact that the latter has a greater surface velocity than the doffer, and carries it around to the doffing comb 8, which oscillates on pivot 10 and scrapes off the silk waste which now has been straightened out.

C is another large cylinder, like and for the same purpose as B, whose surface is very close to cylinder B. 3a, 4a and 5a, respectively, are rollers corresponding in construction and operation to rollers 3, 4, and 5 previously referred to in connection with the large cylider B. 8a is a doffing comb which oscillates on pivot 10a and is placed there for the same purpose as comb 8 in connection with doffer cylinder 3.

The same process takes place in this upper set of rollers as in the lower set of rollers, previously explained, and the purpose is to remove the surplus waste and straighten out all knots and kinks from same, a feature done by the action of the teeth of cylinder C upon the teeth of cylinder B, since their teeth point in opposite directions at point of contact.

The silk as thus combed off doffer cylinders 3 and 3a is now straightened out, cut in proper lengths, and ready for re-manufacture of yarn, either by the regular worsted or woolen yarn process. (F. W. Midgley, Phila., Pa.)

CARDING, DRAWING, SPINNING AND TWISTING.

WOOL.

THE BRAMWELL CARD FEED.

This feed, as now universally used for feeding the wool to first breaker cards, consists principally of a hopper in which the wool to be fed is placed by the operator, said hopper having a grating at the bottom for the removal of dirt, etc., dropping from the stock. An elevating spiked apron is provided at the front end of the hopper to which the stock adheres, and is thus taken up out of the hopper. Situated near the top of the hopper and sufficiently close to the apron is a reciprocating comb, having a slow but long sweep in front of the apron, the object of said comb being to carry off the surplus wool adhering to the spikes on the apron, and brush it back into the hopper, thus leaving the proper amount of wool evenly distributed over the apron so as to produce an even feed. The stock remaining on the apron is carried over the top roller and there meets another, but shorter, apron running at a higher speed, being also provided with flexible leather strips, which brush the wool off from the teeth of the apron, and convey it into the trough of the machine, which is used as a scale to weigh the stock and deliver the correct amount at intervals to the apron of the feed. The scale or trough is formed of two covered wings, held together by suitable weights, and the mechanism, suspended on steel knife edges, being balanced with movable weights, which can be fixed to allow any weight of wool desired to be collected in the scale, before the same is emptied onto the endless feed apron of the feeder. When the scale has received the required amount of stock, a small trigger is automatically liberated, which action causes a projection to catch on one of the teeth of a revolving disc connected with an automatic clutch, and this in turn disengages the driving mechanism of the spiked apron of the hopper, thus instantly stopping further delivery of stock to the scale, which now remains at rest, that is, closed.

At the proper time, that is, when the feed apron has traveled sufficiently far to enable the next lot to fall properly on said apron, the wings of the scales are automatically opened apart and the wool is deposited onto the feed apron. The scale is now closed again for receiving the stock, and the spiked apron is started, thus delivering stock again to said scale.

The success of the Bramwell Card Feed and the practical universal use of the machine is largely owing to the fact that the builders have spared no trouble or expense in the development of the machine for a wide range of uses.

To illustrate: The Worsted Bramwell Feed built to feed modern worsted cards is the standard machine of its kind in the world. It has a specially designed stripping device to throw stock into the scales from the spike apron, and this device is the result of careful test and many years of experiment. It does not roll, wind or injure the staple of the stock. The builders of the Bramwell Feed have also perfected machines to feed the finest rabbit's fur to fur blowers for hat cards, also a special feed for cotton batt machinery, a special feed for jute cards, also a recently perfected feeder for flax tow and asbestos stock. (Geo. S. Harwood & Son, Boston, Mass.)

THE MODERN APPERLY FEED, WITH KEMP POSITIVE GEARED TRAVELER.

The object of this device is to make the delivery of the sliver from the second breaker of a woolen card, and the feeding of said sliver to the finisher card, a continuous operation, to be performed automatically; said sliver having to be fed in such a manner as to produce an even and uniform feed across the whole working width of the card. In some instances this feed is also used between first and second breaker cards, besides being used between second breaker and finishers, the feeding in this instance being a continuous operation between first breaker and finisher. To accomplish the even and uniform feeding previously referred to, the delivered sliver has to be laid diagonally back and forth across the width of the feed on the feed table, thus making a continuous layer of sliver which then corresponds to a regular lap.

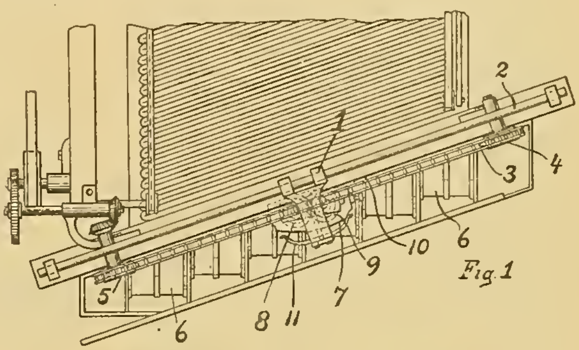


Fig. 1

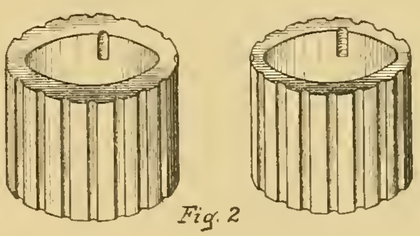


Fig. 2

The machine consists principally of a delivering mechanism for the preceding card, and a mechanism for laying the continuously delivered sliver diagonally on the feed table of the succeeding card. The delivering mechanism consists of a trumpet and pair of calender or delivery rolls, situated at the side of the front end of the card, and by which the film of carded wool is condensed and passed from the card. It is then guided upwardly to an overhead guide pulley, then to a similar one, suitably located, so that the sliver in passing from it is in a convenient position to be fed through the laying mechanism. As will be readily understood, this laying mechanism or traveler, constitutes the principal part of the feeder, and its construction and operation are best shown by means of the accompanying illustrations, of which Fig. 1 is a top view of the laying mechanism, showing also the disposition of the sliver on the feed table of the card, and Fig. 2 is a perspective view of two feed rolls of different external diameter.

It will be seen that the mechanism is placed diagonally to the feed table, and consequently the travel of the carrier back and forth across the table will be at the same angle. The carrier has a pair of feed rolls provided on it, which are driven by the movement of said carrier back and forth, the sliver in this manner being positively laid on the table, rather than simply guided, which requires a gripping device for the sliver on the table to hold the sliver in place.

Referring to the illustrations for the details of the mechanism, 1 indicates the carrier or traveler, which travels back and forth on the guide rod 2, said carrier being actuated through the chain 3, which passes around the sprockets 4 and 5, the latter being positively driven through the gearing shown. The feed table consists of a number of endless aprons 6, which travel slowly towards the licker in of the card, taking the diagonally placed sliver along with them to be fed to the card.

The carrier or traveler is the principal part of the mechanism and consists essentially of a rocking plate 7, carrying a pair of gears 8 and 9, which are in mesh with each other and one of which is always in contact with a stationary rack 10 of the mechanism. On the same studs with the respective gears 8 and 9 are the feed rolls of the carrier, between which the sliver passes to the feed table. From the fact, that one of the gears is in contact with the rack and the two gears are in mesh with each other, when the carrier is moved by the traveling chain 3, the gears will receive a rotation and consequently the feed rolls will also receive a similar rotation. In order that these feed rolls will always revolve in the same direction, whether the carrier is moving in one direction or the other, at the end of each traverse of the carrier, the rocking plate is moved, so that the gear which is in contact with the rack will be moved out of contact, and the other gear thrown in, in this manner the reverse direction of travel not changing the direction of rotation of the feed rolls.

It is very important to have the feed rolls feed the sliver correctly under all conditions, and in some cases different diameters of rolls are necessary in order to meet the requirements of the sliver. To provide a convenient way of changing these rolls, hubs are provided and different outside diameter rolls, as shown in Fig. 2, can be easily attached to them.

The studs carrying the gears are pressed toward each other by means of springs and therefore they immediately adapt themselves to any change made in the diameter of the feed rolls. The rocking plate 7 is kept in one position during a traverse in either direction, by means of a retaining spring 11.

Among the advantages claimed for this feeder are:—

An improved sliver, in turn resulting in a more even and stronger roving and yarn.

An increase of production, and saving of labor in the card-room.

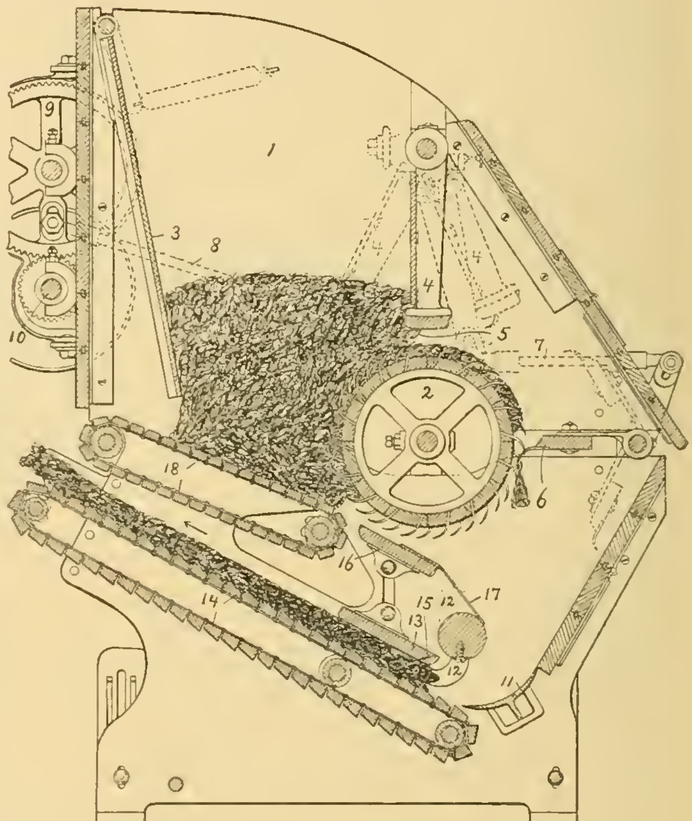
Waste in the card-room, as well as in the spinning-room is reduced to a minimum, since all side-drawing waste between the cards is prevented, as well as that from the creels and at the spooler.

The "Kemp" traveler lays the stock down on the table of the feed without strain, and so it goes to the feed rolls so evenly that fine ends are avoided.

There is as a rule a saving of space effected by the use of this "Feeder," and the card-room will be lighter, and improved in appearance. (Geo. S. Harwood & Son, Boston, Mass.)

THE FISHER CARD FEED.

The object of the machine is to make a uniform lap of the wool, which in turn is fed to the breaker card. The machine consists principally of a feed box for the stock and a device for delivering it uniformly into a receiving chamber of the machine, and from which it is compressed into a lap or mat of uniform thickness, and in this form delivered to the breaker card. The details of the construction and operation of the machine are best shown by means of the accompanying illustration, which is a cross



section of the machine, showing the position of the various parts.

Referring to the illustration, the stock is placed in the feed box 1 and is kept pressed against the spiked transfer roller 2 by a pressure board 3, which exerts this pressure from a spring through an arm, both being shown in dotted lines near the top of the illustration. Besides pressing the stock against the roller 2, the board 3 also produces an even feed from the chamber at all times, *i. e.* with any amount of stock in the feed box, by means of its connection to the driving mechanism of said roller 2. This roller may be driven at two speeds by throwing either of two gears into action through a clutch. The board 3 controls this clutch through a lever and when the stock is low in the box, the board is in a forward position, which causes the large gear of the clutch arrangement to be thrown in and thus drive the roller 2 faster. When the feed box is full, the clutch puts the small gear in working contact and thus drives the roller slower.

Above this roller 2 is hung an opening comb 4, provided with teeth 5, said comb being oscillated to and fro, as indicated by dotted lines, and thus serves to even off the material on the transfer roller 2. This comb has four adjustments, up and down, backward and forward, and can thus be set as the different grades of stock may require. If short stock is to be fed, the comb should not be set low, so as not to push the stock back into the feed box and strip the roller 2. When using long stock, the comb must be lowered far enough so as to strip the cylinder sufficiently to prevent the stock from being brought around faster than required.

As the material is carried around on the roller 2, it is next engaged by a doffer comb 6, which is vibrated by shaft 7 through rod 8, connected to a gear wheel 9 as driven from shaft 10. The comb 4 also receives its oscillation from that mechanism through a lever shown in dotted lines. The material is thus removed in small quantities from the roller 2, said material dropping down onto a curved plate 11, where it is engaged by the revolving blades 12, and in turn deposited by them between the compressor board 13 and the endless delivery apron 14. The blades 12 also control the feed by automatically stopping the revolutions of the roller 2 when sufficient stock is in the receiving chamber to make the lap heavy enough. The roller 2 is driven from a worm with a clutch arrangement, which is thrown out through levers from the revolving blades when sufficient stock has been fed.

As the stock is taken away by the apron 14, the worm previously referred to is returned into working position with the gear on the roller 2 and is not again revolved until sufficient stock is fed to the receiving chamber. This allows an even feed at all times, no matter how much stock there may be in the feed box 1.

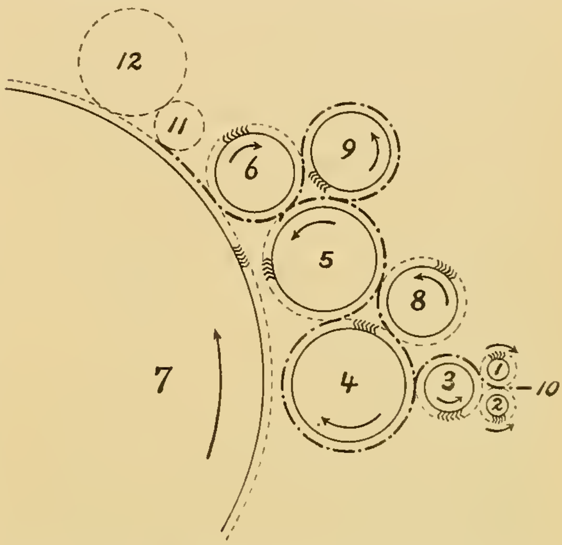
The compressor board 13 is provided with pins 15, which, in connection with the inclined bars of the delivery apron 14, keep the material from moving back. A board 16 and plate 17 prevent any material from dropping from the transfer roller 2 on the delivery apron 14. A traveling apron 18 keeps the material in contact with the roll 2 by traveling toward it. (Woonsocket Machine and Press Co., Woonsocket, R. I.)

BARBER'S FEED FOR WOOLEN CARDS.

The gist of the novelty refers to a special carding —on a small scale—of the stock previous to its delivery to the main cylinder, *i. e.* carding proper in the regular manner; the new attachment, although no doubt more particularly designed for the first breaker card, is applicable both to first and second breaker as well as finisher cards.

The object of the improvement is to thus provide a feed to woolen cards, by means of which more stock can be handled by a machine in a given time, and this at the same time in connection with an improved quality of the sliver if used in connection with breaker cards, or roving with the finisher card. The increased production results from the accelerated speed which it thus is possible to give a card, whereas the improved quality is brought about by working the lumps out of the material as fed, and getting the same into good condition before its delivery to the main cylinder. It is also claimed for the new attachment, that its use in connection with the first breaker, the first or second breaker, or all three engines of a set of cards, will permit the handling of a lower grade of stock for a given count of yarn, and thus lowering the price of production. The new attachment can be readily applied to old as well as new sets of cards, and in itself only slightly increases the length of the carding engine, to which it is applied, both being also two most valuable features for it.

The accompanying illustration is a diagram in outline, showing the new feeding attachment as applied to a carding engine, however only so much of the



latter being shown as is necessary to show its relation to the feed. A description of the construction and operation of the new attachment is best given by quoting numerals of reference accompanying our illustration, and of which:

1 and 2 indicate the two feed rolls between which the stock, or the sliver, as the case may be (first or second breaker or finisher) is entered to the machine, and from where it is, by means of the leader or transferrer 3, delivered to the tumbler 4. From here instead of delivering the film of stock, which is now (especially if dealing with a first breaker card) lumpy, coarse, and uneven, directly to the main cylinder, the tumbler 4 delivers it to an auxiliary cylinder 5, which has a much more rapid surface speed than said tumbler 4. Cylinder 5 in turn delivers the web to the faster running doffer and feeder 6, and from which it is taken off by the rapidly revolving main cylinder 7. From this point on, the web takes the usual course and receives the usual treatment. By the time the web reaches the main cylinder, the lumps have been pretty thoroughly worked out and it is finer and more even, thereby adapted to produce a better grade of yarn than if carded without the attachment, owing to the additional treatment of carding the new attachment provides. Furthermore, the time required to produce this improved yarn is reduced by the new feed. In order to still further assist in preparing the stock in the best possible condition for the main cylinder, the two workers 8 and 9 are provided, and which in their turn split the web twice between the tumbler 4 and the doffer and feeder 6. The worker 8 takes the web, or a portion of it, from the auxiliary cylinder 5 and returns it to the tumbler 4, which delivers it again to said cylin-

der 5, and the worker 9 takes from the cylinder 5 and delivers to the doffer and feeder 6, which delivers the now united splits to the main cylinder 7. The slow running workers 8 and 9, operating with the comparatively fast running members 4, 5 and 6, augment the effectiveness of the latter and enhance the efficiency of the feed. The heavy dotted line 10 indicates the course of the web, through the attachment, thus explained.

The dotted circles 11 and 12 indicate the positions of the first worker and its stripper, respectively, of the carding engine proper, being referred to merely for the purpose of showing that the new attachment can be applied without disturbing such members when they are located as usual. In short, the only alteration required to apply the new attachment to an old carding engine, is the providing of suitable bearings for the new parts, *i. e.* to move back the tumbler, leader and feed rolls about an inch, or replace the old tumbler with one which is an inch or so smaller.

With reference to revolutions per minute and surface speed of the various members of the attachment, the following are a fair average:

Assuming that the:

Main cylinder......	(7)	= 125 r. p. m.	×	18095'	surface speed.
Auxiliary cylinder..	(5)	= 260 " " "	×	7351'	" "
Tumbler	(4)	= 130 " " "	×	4084'	" "
Doffer and Feeder..	(6)	= 450 " " "	×	9896'	" "
Worker	(8)	= 12 " " "	×	226'	" "
Worker	(9)	= 8 " " "	×	175'	" "
Leader	(3)	= 150 " " "	×	1484'	" "

Feed rolls (1 and 2) revolve very slowly, the speed varying according to the weight of stock per yard which is to be run between them.

Although speeds quoted are relatively correct, at least approximately, it is to be distinctly understood that such speeds must vary considerably in different machines and for different grades of stock.

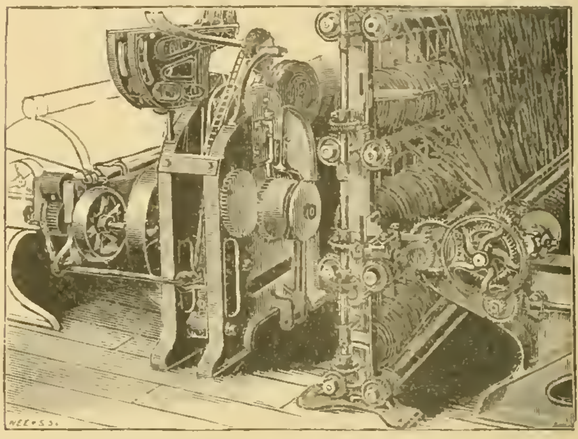
The arrangement of the card clothing, with reference to direction of pointing, on the various cylinders and rolls, is clearly indicated (exaggerated for the sake of clearness). When the arrangement is such that the points of two adjacent teeth upon associated members have the same direction, the teeth are said to be point to point, and when the arrangement causes the points of such teeth to assume different directions, the teeth are said to be point to back, the object of this being to so arrange the teeth as to handle the stock to the best advantage. The teeth on the tumbler 4 and the cylinder 5 are arranged point to back, and the same is true of the teeth on said cylinder and the doffer and feeder 6. The teeth on the cylinder 5 and each of the workers 8 and 9 are arranged point to point, while the teeth on the worker 8 and the tumbler 4 are point to back, as are those on the worker 9 and the doffer and feeder 6. The arrows associated with the cylinder 7 and other rotary members, in the illustration, indicate the directions in which said cylinder and members are adapted to revolve. (Moses Barber, Monson, Mass.)

THE TORRANCE AUTOMATIC BALLING MACHINE FOR WOOL CARDS.

This device, as its name indicates, is used in connection with wool cards for the purpose of automatically winding the sliver, as delivered from the first breaker card, onto spools, making a smooth and compact ball or spool, and at the proper time discharging the filled spool and replacing it with an empty one, all of the operations being performed automatically. These filled spools are afterwards placed in a suitable creel at the back of the next card for the purpose of feeding the slivers to this machine.

The balling machine consists principally in means for rotating the spool by frictional contact, an arrangement for giving a traversing motion to the sliver as it is being wound on to the spool, a mechanism for inserting and withdrawing the spindle from the spool, on which said spool revolves while being filled, a device for tearing or severing the sliver from the spool at the completion of said spool, and which at the same time starts the end of the sliver on to a new spool, a mechanism for discharging the spool after it has been filled, and an arrangement for entering an empty spool to replace the full spool.

A perspective view of the machine is given in the accompanying illustration, showing its position in relation to the card, and also showing a creel filled



with spools from this balling machine, said creel being located in back of the second breaker card to which the slivers are fed.

The winding arrangement is made up of a drum which is positively driven, being on the main shaft with the driving pulley, and on which drum the spool to receive the sliver rests, said drum being located between the two side frame plates of the machine, and a little higher than the centre of said frame plates.

The guiding arrangement for the sliver consists of an arm, pivoted near the bottom of the machine and extending upwardly toward the spool, its top end being provided with a slot through which the sliver passes. The arm is given a back and forth motion across the width of the spool, by means of a cam arrangement, and the sliver is thus laid smoothly on the spool.

At the completion of filling a spool, the spindle, on which the spool had been revolving and which had kept it in the machine, is automatically withdrawn by a lever and cam arrangement shown in our illustration on the outside of the frame plate. The lever is pivoted near the bottom of the machine and is actuated at the proper time by a cam, shown secured to the central gear on the frame plate, which gives it an outward and then an inward motion. The spindle is loosely secured in the slot at the top of the lever and consequently receives a corresponding motion to that of the lever.

The severing and starting arrangement for the sliver at the completion of a spool, is composed of a specially shaped breaker arm which is actuated through a lever from a cam, said motion causing said breaker arm to rise and engage the sliver and break the same, in turn wrapping the loose end around the new spool which replaces the full one. In order to give the breaker a more positive and quicker return impulse after it has performed the two operations, a spring actuated return presser is provided, being arranged on one of the frame plates.

As soon as the spool is full, which is regulated by the setting of a screw on the retaining lever, and the spindle withdrawn, the discharging mechanism is brought into action and the spool removed. This motion consists principally of a bat, shown near the top of the machine, which is attached to a shaft carrying a sprocket. The chain as passing over this sprocket, also passes around a similar one situated between the two frame plates, said sprocket being on the same stud with the gear on the outside of the frame plate. This gear, as shown, is in mesh with another gear which is loosely collared on the main shaft, and has a pawl pivoted on its side, a lever from said pawl extending upwardly, and is engaged by the vertical retaining lever which is connected to the vertical slide, carrying the spindle, and in this manner the pawl is held out of contact with a ratchet which is secured to the main shaft, the arrangement receiving no motion while said pawl is held up. As the spool becomes larger, due to the winding on of the sliver, the slides carrying the spindle raise gradually, and at the completion of a spool, it has risen to such a point that the retaining lever moves out of contact with the lever extending from the pawl, so that the latter drops into contact with the revolving ratchet, which action carries it around with it and consequently also the gear on which it is pivoted. This motion is transferred through the other gear and sprockets to the shaft carrying the bat and this is in turn given a revolution, during which it forces the full spool out of its place. As soon as this happens the two slides drop down to their original position, as at the beginning of a spool, so that when the lever, extending from the pawl, is brought around by the pawl still being in contact with the revolving ratchet, said lever comes in contact with the lowered retaining lever and the pawl is taken out of contact with the ratchet, which of course stops the motion.

Just as soon as the full spool has been pushed out, an empty one takes its place, it being placed in position by a special mechanism, situated at the left hand side of the machine. The spools are held in reserve in a trough, shown at the upper left hand corner of the machine, and are fed from it by the mechanism referred to.

The spools, after being taken from the balling machine, are placed in a special creel at the back of the second breaker card, and the sliver fed directly from the spools to the card. The creel is known as a bank creel and is shown in the right hand side of the illustration. It consists of five horizontal pairs of rolls placed vertically over each other in the creel and sufficiently far apart to accommodate the spools on said rolls, dividing rods being placed vertically to separate the spools, said rods being oval in cross section to prevent accumulation of flyings about them. The rods are positively driven through gears shown, thus producing a positive unwinding of the slivers.

Among the advantages of the machine is a saving in waste, since the spools cannot be "run over" and made too large by the operator's negligence or while attending to other duties. More doublings can be made at the second breaker card, and consequently more even yarn afterwards produced. The old style creel and lap system are dispensed with, saving in turn labor, waste and room.

Less flyings are made where the creel is located, and the positive unwinding motion on the creel prevents strain and breakage to the slivers. (Torrance Manufacturing Co., Harrison, N. J.)

RUBBING MECHANISM FOR FURBUSH CARDS.

In this condenser, two sets of rubbing mechanisms are employed, viz.: A primary set for acting upon the narrow webs of fleece as they come from the doffer, and rubbing the same into the form of crude slivers or rovings, and a secondary set for acting upon these crude slivers or rovings and rubbing them into their final form, the two sets being independently driven, so that the second set may, if desired, be given a shorter stroke and a higher speed than the primary set.

Two different constructions of the primary set of rubbing mechanism are shown in our illustrations, viz.: In the arrangement shown in Fig. 1 a set of rub rolls is employed, whereas in the arrangement shown in Fig. 2 a pair of aprons is made use of for said primary set of rubbing mechanism of the condenser.

Examining the rubbing mechanism as shown in Fig. 1 (being a sectional plan view of the same, together with sufficient of the operating mechanism shown to convey a proper understanding of the improvement), we find used, as mentioned before, for the primary rubbing mechanism a set of rub rolls, having three rolls in each element of the set, both upper and lower, and as the secondary rubbing mechanism, we find used a pair of aprons, the primary set of rub rolls having sufficient control of the fleecy webs to properly form the crude slivers or rovings therefrom, and the aprons, owing to the fact that they grip the slivers from end to end of the run and exert no drawing action upon them, are well adapted for condensing said slivers by means of a short, quick rub.

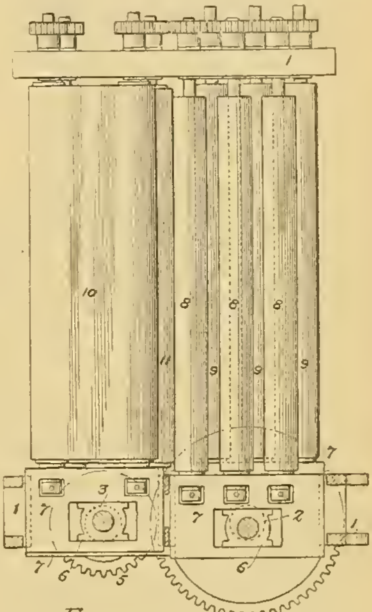


Fig. 1

1 represents the fixed frame of the rubbing mechanism, and 2 and 3 eccentric or crank shafts vertically mounted in bearings at one end of said framework, the shaft 2 imparting reciprocating movement to the primary set of rubbing devices, and the shaft 3 imparting reciprocating movement to the secondary set. The two shafts are geared together by spur wheels 4 and 5, which are so designed that the shaft 3 will rotate at a higher speed than the shaft 2, and the eccentrics or cranks of said shaft 3 have a shorter throw than those of the shaft 2, so that in connection with this higher speed of reciprocation of the secondary set of rubbing mechanism, there is a shorter stroke or lateral reciprocation of the same. The cranks or eccentrics of each shaft act upon boxes 6, which are free to slide laterally in yokes, each forming part of a frame 7, carrying one of the elements of one of the sets of rubbing mechanism, there being one of these frames for each element, upper and lower, of each set of rubbing mechanism.

The upper frame of the primary set of rubbing mechanism carries three rub rolls 8 and the lower frame carries three rolls 9, the upper frame of the secondary set of rubbing mechanism carrying the rolls for supporting and driving the upper apron 10 and the lower frame carrying the rolls for supporting and driving the lower apron 11.

In Fig. 2 the other construction (as previously referred to) of the primary rubbing device is shown, comprising in this instance a pair of rubbing aprons 8, 9, which take the place of the two sets of rubbing rolls 8, 9, shown in the former construction. Thus in the arrangement shown in Fig. 2, two pairs of aprons are employed in the rubbing mechanism, the primary pair being so driven as to form the desired crude sliver and the secondary pair being independently driven, whereby they are adapted to rub this crude sliver into a finished sliver of any desired degree of fineness. The first pair of aprons rub the narrow webs of fleece without any drawing action thereupon, and hence have no tendency to break even a fine and delicate fleece, and in the second pair of aprons also there is a lack of draft upon the partly-rubbed sliver, while, owing to the fact that the aprons grip the sliver from end to end of the run, they are well adapted for condensing the sliver by means of a short quick rub, being essentially the same in construction and action as the second pair of aprons, as shown in the rubbing mechanism previously explained and illustrated by Fig. 1.

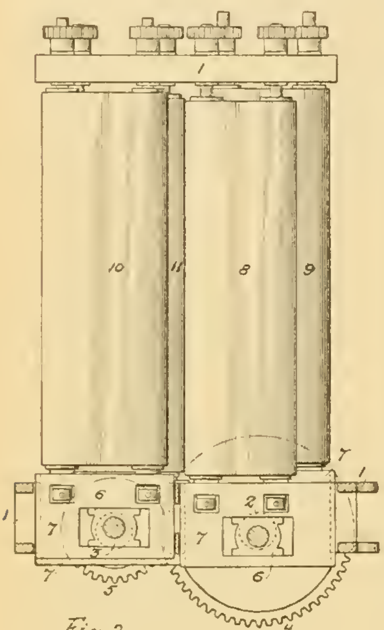


Fig. 2

The construction of the other parts of the rubbing mechanism is the same as the first explained mechanism, corresponding numerals of reference being used. (G. Barber, Phila., and J. Cromie, Camden, N. J.)

CHOQUETTE'S WASTE SAVER FOR CARDS.

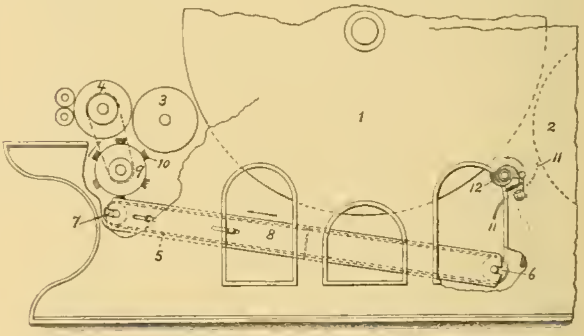
This device is used in connection with woolen cards, its object being to recover the good fibres from the waste as falling from the cylinder of the card, and return said recovered fibres to the feeding mechanism of the card.

The device consists principally of an endless apron, equal in width to the width of the cylinder, and passing around a guide roller at the front end and near the bottom of the machine, and another guide roll near the back of the machine, but which is sufficiently high as to make the apron travel at an angle toward the back of the machine. A brush cylinder is provided at the rear end of the machine at the point where the apron starts to pass around the guide roll. A shield is provided at the other end of the apron to prevent any waste from collecting on any braces, projections, etc., under the working part of the machine.

The details of the construction and operation of the device, as well as its application to the card, are shown in the accompanying illustration, which is a diagram giving a partial side elevation of the card with the waste saving device attached.

Referring to the illustration, 1 indicates the card cylinder, 2 is the doffer, 3 is the tumbler, and 4 the burr cylinder. 5 indicates the endless apron passing around a guide roll 6 at the front of the card and passing around another guide roll 7 near the rear of said card. On each side of the apron is placed a board 8 extending slightly above the level of the apron to prevent any of the waste from dropping off at the sides. Situated above the rear guide roll 7 is a wire brush cylinder 9, revolving in the direction of the arrow, being made up of parallel strips of straight wire teeth 10, similar to the teeth on a "fancy," said cylinder being just sufficiently high above the apron as to have its teeth just miss touching the apron, but which enables it to catch any fibres lying on said apron, without taking up the dirt which is also on said apron, and the relation of the speeds of the wire brush cylinder and apron is such that the dirt on the apron will be discarded. It will be seen that this wire brush cylinder is really the main point to attend to, to get good results, besides the arrangement of the teeth 10 on the brush cylinder is an important item.

In these cards, there are often braces or other stationary parts under the working part of the machine, and on which waste is apt to collect. To prevent this, a vibrating shield 11 is provided, the same as shown, being vibrated by a cam 12 and thus throws any waste collecting on it, down onto the traveling apron.



In the practical operation of the device, the apron is given a traveling motion in the direction of the arrow; and as the card continues to work, the waste and dirt will drop down on said apron and pass toward the revolving wire brush cylinder. The action of this brush will take the fibres up off of the apron and deliver them to the tumbler 3, to be again fed by it to the cylinder of the card, without taking the dirt, etc., along with it; the latter, as mentioned before, being discarded from the apron by the combined action of the brush and said apron. (Torrance Manufacturing Company, Harrison, N. J.)

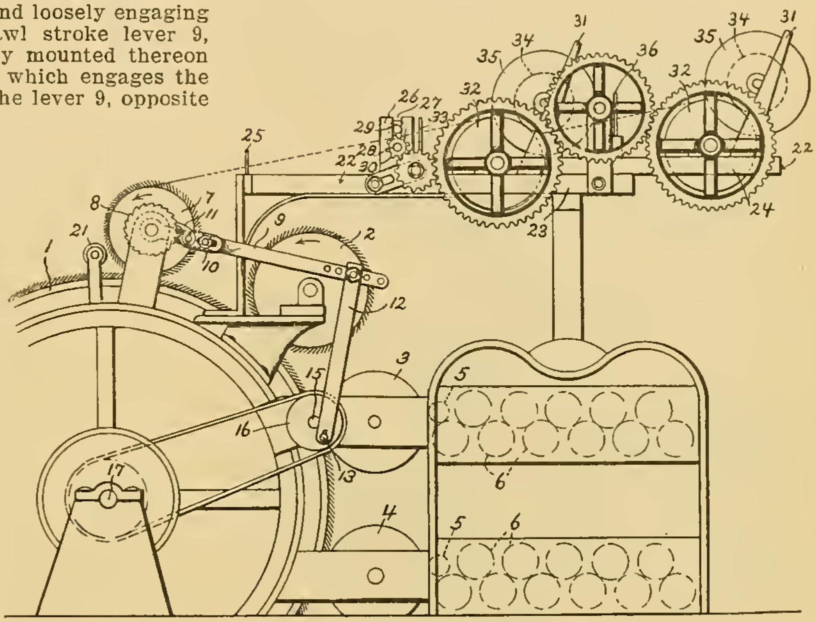
ATTACHMENT TO CARDS FOR MAKING FANCY—SPOTTED—YARNS.

This attachment is used for making fancy spot or random roping on finisher cards, which when spun, and in turn knitted or woven into cloth, gives a varied or fancy effect to the goods. The object is to produce one or more spots of any length or size on roving, of the same or different colors, and to have said attachment readily applicable to or removable from any make of finisher card.

The accompanying illustration is a side elevation of a portion of a finisher card, showing the attachment applied in operative relation thereto.

Examining this illustration, we find that the cylinder 1 is provided with a fancy 2, an upper ring doffer 3, a lower ring doffer 4, wiper-rolls 5, and rub rolls 6. In advance of the fancy is a supply roller 7, the teeth of which point away from the fancy 2 toward the feed end of the carding engine. By this arrangement the teeth of the supply roller 7 are disposed in the best position for carrying the roving or spotting yarn to the cylinder, and offers the least resistance when delivering it to the latter. Fixed to the roller 7 is a ratchet wheel 8, and loosely engaging the shaft of said roller is a pawl stroke lever 9, having a pawl plate 10 adjustably mounted thereon and movably carrying a pawl 11, which engages the ratchet wheel 8. To the end of the lever 9, opposite that engaging the shaft of the roller 7, the upper end of a connecting bar 12 is adjustably attached, and is also movably secured at its opposite end to a crank 13 on a pulley 16, held by a stub shaft 15, projecting from the frame of the carding engine; said pulley 16 being driven by a belt from the cylinder-shaft 17. It will be seen that the up-stroke of the bar 12 will elevate the lever 9, and thus the pawl 11 will be caused to throw the ratchet wheel 8 around the distance desired to produce a step-by-step feed of the roller 7, and the adjustment of the bar in relation to the lever 9 can be quickly regulated to increase or decrease the stroke of the lever and the movement of the roller to produce different results. Adjacent to the roller 7 is a guard 21, so placed that the spotting material, which is brought forward by the supply roller to the cylinder, is properly guided and is not broken or otherwise irregularly disturbed, when taken away by the cylinder, and a proper feed of the said material is thus produced. The roller 21 serves to prevent the spotting material rising above the surface of the roller 7 when pieces of spotting material are removed by the cylinder 1.

The main portion of the new attachment for producing the fancy effects to the yarn comprises a frame 22, bolted to the frame of the cardipg engine. This frame 22 includes a bed 23, with an extension 24, provided with bearings for the working parts of the attachment. One end of the bed 23 is located adjacent to the roller 7, and on said end are a plurality of the transversely-aligned upright guides 25. On the bed are opposite bearing-standards 26 with slots 27 opening out through the upper extremities thereof, and engaging said standards are lower and upper guide rolls 28 and 29, the lower guide roll 28 remaining at all times in the standards, and having at one end a driving pinion 30, the upper roll 29 being freely removable and normally held in operative position by its own weight. At opposite sides of the bed 23 and extension 24 are rearwardly inclined uprights 31, arranged in pairs, and mounted in suitable bearings adjacent to the lower ends of the uprights are iron cylinders 32, one in the bed proper and the other in the extension, both cylinders being transversely disposed in relation to the parts supporting the same and extending fully across the same. In front of the forward cylinder 32 is arranged a series of transversely-aligned guides 33 for directing the spotting material from the cylinders to the front guides 25. Between the front and rear cylinders are a plurality of transversely-aligned guides 36, similar to the guides 25, for directing the spotting material that comes over the rear cylinder to the front cylinder, as shown. Over the cylinders 32, at a rearward inclination in relation thereto, are spools 34 for the spotting material or roving, the said spools having flanged heads 35 at such distance apart as to be capable of embracing or moving downwardly over the ends of the cylinders.



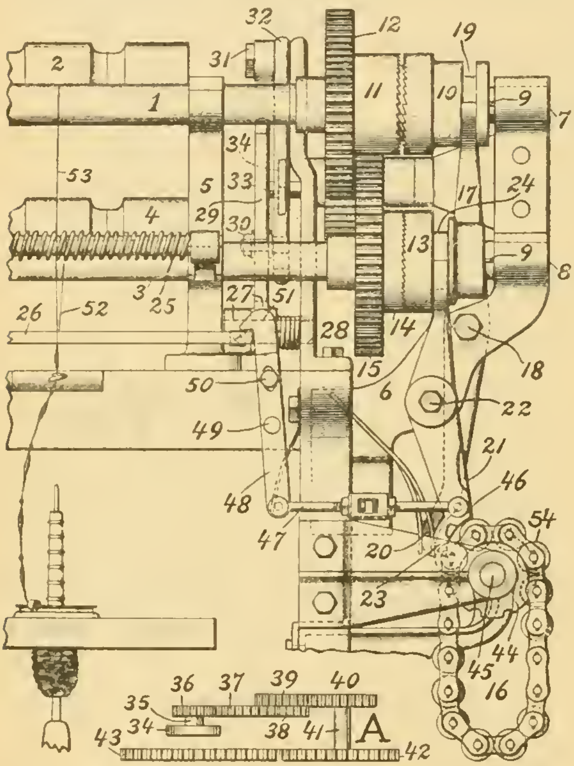
The spotting material from the rear spool is brought forward over the rear cylinder under the forward spool, and the strands from the two spools then caused to move together over the forward cylinder between the guide rolls 28 and 29, and from the latter the strands move between the guides 25 to the roller 7. By this arrangement it will be seen that the spotting effect can be produced in two colors, as the spotting material on the rear spool may be of one color and that on the forward spool of another color. Again either one of the spools may be used alone on account of the easy detachment of the one not desired for operation, and the spot may thus be produced in one color. (J. B. Platt and T. F. Marr, Ashland, N. H.)

TWISTER FOR FANCY YARNS.

The purpose of this machine is to produce fancy yarns technically known as knob, bunch, spiral, variegated, or loop yarns, in a more economical manner than heretofore practiced, at the same time enabling a change in the variety of the fancy effects more readily to be made.

Previous to the introduction of this machine it had been customary to employ for this purpose two sets of delivery rolls in the twister, and to run one set of said rolls at a faster speed than the other set, using in connection with said rollers, a vibrator for controlling the slack thread as delivered at the faster speed, said vibrator by its change of position, causing the slack thread which is delivered at the faster speed to be wound on the slower delivered body or core thread, to either form a bunch or knob or wind itself more or less spirally about the body thread. Another way of obtaining a similar result was to temporarily arrest, by means of a mutilated gear (mutilated according to effect in the fancy yarn required), the movement of one set of said rollers, so as to cause unequal delivery of one or the other threads, so that one of the threads will be wrapped about the other.

The mechanism employed in the new twister, for producing the fancy effect to the yarn, consists in a system of clutches which may be made to engage the rolls and drive the same, or may be disconnected therefrom to leave the rolls at rest, the engagement and disengagement of the clutches with the rolls being controlled by a pattern chain, similar to those as used in connection with the shedding motion of a fancy loom, the risers of which may be changed at will to adapt the action of the twister for the production of any desired pattern of knob, *i. e.* fancy effect in the yarn.



The accompanying illustration Fig. 1 is a partial front side elevation of a twister, having the attachments for producing the fancy effects to the yarn applied thereto. Fig. 2 is a diagram in detail, showing the gearing for moving the vibrator.

The twister is supplied with two series of delivery rollers 1, 2 and 3, 4 respectively, as carried in the roller stands 5 (one on each side of the machine and one or more throughout its length, in order to properly sustain said delivery rollers). The end of the frame of the machine has bolted to it a stand 6, having bearings 7 and 8 to sustain the extremities of the under rollers 1 and 3, the top rolls 2 and 4, of the delivery rolls being sustained by the under rollers. Each of the under rolls 1 and 3, is splined at its ends at 9. The splined end of the under roller 1, receives upon it the movable member 10 of a clutch, the coacting member 11 extending from a gear 12, loose on said roller. The front roller 3 of the lower set of delivery rolls has applied to its splined end a loose member 13 of a clutch, the coacting member 14 of which forms part of, or is extended from a gear 15, loose on said roller. The gears 12 and 15 are, by means of a suitable arrangement of gears, rotated continuously at a desired speed.

It will thus be seen that when the clutch parts are in mesh, as shown in the illustration in connection with clutch 13 and 14, then the under roller, with which said clutch coacts, 3 in this instance, will be rotated, again that when the clutches are separated, as represented by the clutch 10 and 11, then the rotation of their under roller, 1 in this instance, will be arrested.

From explanation given, it will be seen that by means of either throwing these clutches in or out of contact, the rotation of either under roll 1 or 3 is arrested, and consequently in connection with it the supply of the respective thread, a feature readily accomplished from lever connections shown in the illustration by means of raisers or sinkers in the pattern chain 16. In the illustration, the lever 17 as fulcrumed at 18, and which lever, by means of its forked-end working in groove 19, controls the clutch 10 and 11, is shown with its heel 20 to be acted upon by one of the balls or rolls, *i. e.* risers of the pattern chain 16, with the result that the clutch parts 10 and 11 are disengaged, and consequently the rotation of the thread delivery rollers 1 and 2 arrested. At the same time the lever 21, as fulcrumed at 22, is shown with its heel 23 resting against a tube, *i. e.* sinker of the pattern chain 16, with the result that its mate clutch parts 13 and 14 through the forked-end of the lever as working in groove 24, are engaged, and consequently the delivery rollers 3 and 4 to be rotating, *i. e.* delivering thread or yarn.

25 indicates a novel thread guide (a rod surrounded by a spiral spring) to keep the individual threads as delivered by sets of rolls 1 and 2, and 3 and 4 separate until past vibrator bar 26. This bar 26 is carried by elbow levers 27, connected with a rock shaft 28, extended lengthwise of the machine. Upturned arms 29 of said levers are slotted and have connected therewith, in a slot thereof, a stud 30, that may be adjusted in said slot according to the amount of movement it is desired to impart to the vibrator bar 26, that depending upon the variety or pattern of knob yarn to be made. To move the vibrator levers, a stud 31 is mounted on a lever 32, slotted to receive the stud 30 in any adjusted position in which it may be placed, said lever carrying a roller 33 which in turn is acted upon by a cam 34, mounted on a shaft 35 (see Fig. 2), to which is connected a gear 36. This gear is driven by a changeable intermediate gear 37, that derives its motion from a pinion 38, fast to the shaft, to which is attached the intermediate 39, said intermediate deriving its motion from a pinion 40 on a shaft 41, having at its opposite ends a gear 42, that derives its motion from the intermediate gear 43. The gears 36, 37, 38 and 39 are change gears, and their selection regulates the rotation of the cam 34. The pattern chain 16 is sustained by a barrel 44 as carried by a shaft 45, to which by means of a suitable arrangement of gearing (not shown in the illustration) and of which two are change gears, any speed desired can be imparted to the pattern surface.

A lever 46, of the same shape as the lower end of clutch mover 21, is connected by an adjustable link 47 with the lower end of a latch 48, fulcrumed at 49, the upper end of the lever 46 having adjustable therewith through a clamp screw 50 a hoop 51, which in one position engages and locks the vibrator 26 in its lowermost position, and thus guides the thread as is delivering, 52 in this instance, so as to wrap itself around the thread, the delivery of which is arrested, *i. e.* the core thread 53 in this instance, in the shape of a knot, the size of this knot depending upon the time that the vibrator is held locked. A knot having been formed, the roll or riser on the pattern chain 16 passes the lever 46, and immediately the vibrator 26 is released and put under the control of the cam 34, which thereafter controls the speed of movement of the vibrator according to length of knot desired.

It will be readily understood that by a change of position of the rolls or risers in the pattern chain, it is possible to make any desired pattern of knob yarn, and either thread may be made to envelop and conceal the other at will, *i. e.* knobs in one color (the knobs formed by one of the threads) to alternate with knobs in another color (the knobs formed by the other thread) may be produced. If the rolls or risers 54 are temporarily omitted, then a variegated effect yarn can be produced which will present either thread enveloping the other as the core for any desired distance. As previously explained, the movement of the vibrator 26 is timed with relation to the movement of the pattern chain 16, and the cam 34 is always rotated one or more times with each complete rotation of the pattern chain 16.

It will be understood that the rotation of one or the other set of delivery rolls 1 and 2 or 3 and 4, is arrested only when the knob or knot is being produced, and that both sets of rolls are rotated while the yarns are twisted together between the knots. (Davis & Furber Machine Co., North Andover, Mass.)

TRAVERSE GRINDING MOTIONS.

There are two methods of traverse grinding, viz.: the Hardy and the Roy motion, both being used in the grinding machinery as built by B. S. Roy & Son. A description, illustrated, is herewith given of these two systems.

The Hardy Traverse Motion. This motion was the first internal traverse motion for grinding cards invented. As will be seen from the accompanying illustration, Fig. 1, which is a sectional view of this motion, the grinding wheel, while revolving, is traversed by means of a right and left hand screw, which is connected to the grinding wheel by a small "dog" or finger, as is shown in the central portion of wheel. The shell of this grinder must necessarily be small, as the right and left hand screw inside the shell must be nearly as large as the inside diameter of the shell to hold the "dog" in position against the shell. These shells are made from 2¼″ to 3″ diameter. The chief improvement to this grinder, since being invented, is to make the traversing end with a sleeve, where the screw end goes through the head, so that the screw itself does not make a bearing at that end, the bearing being the sleeve. The grinding wheel reverses instantly at each end.

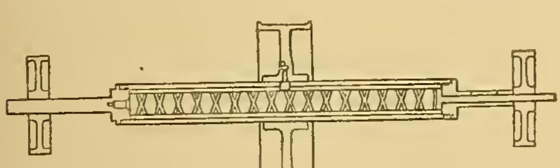


Fig. 1.

The Roy Traverse Motion. In response to the demands for a traverse grinder which (1) could be made with a larger shell (the shells then in use being so small that they were easily sprung, especially for wide cards); (2) could be traversed faster, so as to grind the card wire more on the sides thereby making a better point; and (3) one where the grinding wheel would momentarily stop or dwell at each end before reversing, so as to grind the ends of the roller, cylinder, etc., then grinding as much as the centre, and where the grinding wheel did not clear the card wire at each end before reversing, there were several traverse motions invented, the only successful one, which contained all of the requirements demanded, being the Roy or internal chain traverse motion, of which a sectional view is given in the accompanying illustration Fig. 2. The shells of this grinder are made from 3½″ to 5″ diameter. Owing to the light weight of the traverse motion, the shells can be made large without greatly increasing the weight. The endless chain is driven by a sprocket, the sprocket being driven by a bevel gear (see right hand end of shell) on the journal which runs through the head. At the opposite end is a flange pulley over which the chain runs, which flange pulley is adjusted by a suitable screw for keeping the chain tight. The chain is guided its entire length by a steel plate. On one of the chain links is a stud (see, about, central portion of grinding wheel) which engages the fork or "T-piece" which is connected to the grinding wheel, causing it to traverse back and forth. When this stud reaches either end it has to run over the sprocket or flange pulley before reversing, causing the grinding wheel to momentarily stop or dwell on the card wire, thereby causing the ends of the clothing to be ground as much as the centre, without being compelled to clear the grinding object before reversing. For cards wider than 36″ this motion is almost exclusively used. (B. S. Roy & Son, Worcester, Mass.)

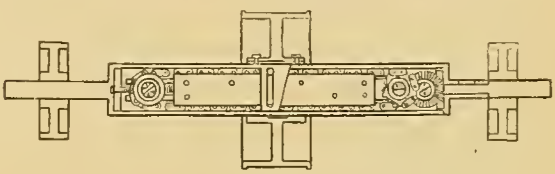


Fig. 2.

THE ROY BALANCING HEADS FOR ROLLERS.

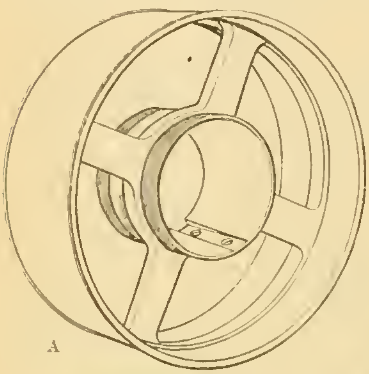
These heads (see Fig. 1) are made with chambers or pockets in which are placed small lead balls. When a new emery cover is put on the roller, this as a rule will throw the roller slightly out of balance, thereby causing the same to grind only on one side. To remedy this trouble, the lead balls are then transferred from the heavy to the light side of the roller

Fig. 3. Fig. 2. Fig. 1.

until the roller is perfectly balanced, a procedure which only will take a few moments. The illustration also shows how the clamps are arranged for holding the emery fillet. At one end, where the fillet is started (see Fig. 2), there is but one clamp and at the opposite end, where the fillet ends (see Fig. 3), there are three or more clamps, so that different widths of fillet may be used. (B. S. Roy & Son, Worcester, Mass.)

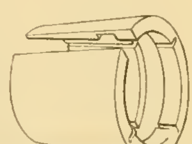
ROY'S PATENT ADJUSTABLE GRINDING WHEEL.

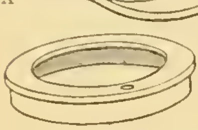
Ever since the traverse grinder was invented, it has been the constant aim of grinder builders to invent a successful adjustable grinding wheel. The ordinary grinding wheel soon became loose from constant traverse on the shell, and then perfect grinding was impossible. When this occurred, the old wheel had to be thrown away and a new wheel, bored smaller to fit the shell, fitted on.



A

B

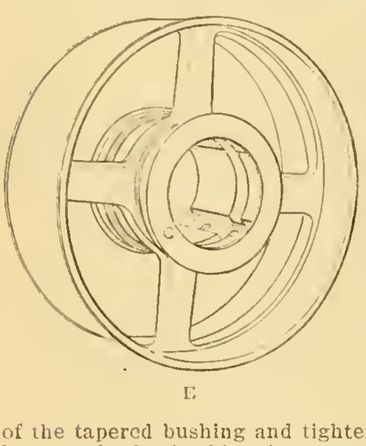




C

D

There have been many different adjustable grinding wheels made, but the only successful one is herewith illustrated. Not even a nut or set screw is used in its construction, besides it is exceedingly simple. Instead of the hole being bored straight, *i. e.* in the usual way, it is bored tapered (see diagram A), and a tapered split bushing (see diagram B) with a chamber in same for a felt oiler, making it self-oiling, is inserted. Then a collar (see diagrams C and D — outside and inside views of it respectively) is screwed on each side of the wheel up to the tapered bushing (see diagram E). By loosening the collar at the small end of the tapered bushing and tightening the one at the large end, the bushing is pressed into the tapered hub of the wheel, and, being split and tapered, it contracts around the shell until a proper fit is obtained. The wheel can be taken up until the shell is worn out, and then, by putting a new bushing into it, it is as good as ever. The adjustment, being in the hub, can be put on wheels as small as 6½" for 3½" shells. The usual method followed in making adjustable wheels was to split the hub in quarters and adjust each quarter by means of adjustment in each spoke, consequently it could be applied only to large wheels, and, unless adjusted very carefully in a lathe, it was impossible to get the wheel true. The adjustable wheel with tapered split bushing, as shown complete in diagram E, will always run true, no matter how much it is taken up, as the adjustments aud grinding wheel always remain in the same relative positions. (B. S. Roy & Son, Worcester, Mass.)



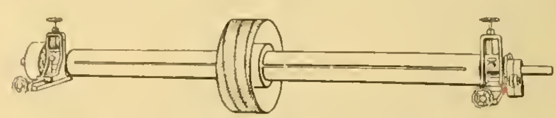
E

ROY'S TRAVERSE GRINDER FOR WOOLEN AND WORSTED CARDS.

The variety of traverse grinders made for woolen and worsted cards is almost unlimited. Most all of the different makes of cotton cards require the same diameter grinding wheel (usually from 6½" to 7") while woolen and worsted cards require different diameters of grinding wheels, the same ranging from 7" to 30". The cause for this is that the main cylinder and doffer of the card are, as a rule, ground at the same time, thereby requiring different sizes of grinding wheels, according to the sizes and positions of the cylinders and doffers. The usual method of grinding main cylinder and doffer together, is to run the grinder, set in suitable adjustable brackets and boxes, on the stands of the Fancy, although some are run in the poppett heads or extension bearings.

For grinding woolen and worsted cards the chain traverse motion is almost exclusively used owing to the large diameter of shell and fast traverse. Grinder shells have increased in diameter until the size now used is 5". This is because of the fact that they are less likely to get sprung, and, owing to the increased area and the larger traverse motion which can be put inside, they wear much longer. The chief improvements for traverse grinders for woolen and worsted cards are the adjustable grinding wheel, the differential motion, and large steel shells.

The accompanying illustration shows a perspective view of one of these traverse grinders which is now almost exclusively used where a nice point is required, the roller grinder being used only for truing and touching up the card clothing a little when time cannot be spared to properly grind with a traverse grinder. (B. S. Roy & Son, Worcester, Mass.)



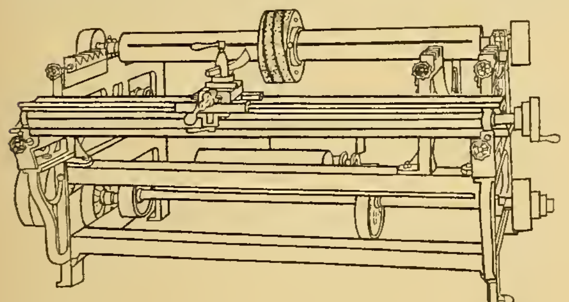
ROY'S ROLLER GRINDER FOR WOOLEN AND WORSTED CARDS.

The accompanying illustration shows one of these roller grinders in its perspective view. This grinder, when used, which however is very seldom, is set on the card in the same manner as the traverse grinder previously explained. These rollers for this grinder are made either of wood, sheet metal, cast iron, or steel tubing, the last ones giving the most satisfaction. They are covered with the ordinary emery cover, glued on, or with emery fillet, same as for cotton cards. They are fitted with a reciprocating motion to traverse them back and forth while revolving, and the latest style is fitted with balancing heads.

As these rollers are made in rather large diameters —from 7″ to 14″—they are easily thrown out of balance—the usual cause being a new emery cover,—causing them to grind only on one side. To remedy this, the balancing heads, previously referred to, are applied thereto. These heads, as explained in the special article on their construction, operation and advantage, have a series of pockets in which are small lead weights. When then the grinder becomes out of balance, these lead weights are then simply transferred from the heavy to the light side of the roller until it is perfectly balanced. (B. S. Roy & Son, Worcester, Mass.)

ROY'S FLOOR GRINDER FOR WOOLEN AND WORSTED CARDS.

This floor grinder, and of which a perspective view is given in the accompanying illustration, is used for grinding the small rolls of the card, such as workers, strippers, etc.—two at the same time. It consists of a suitable frame fitted with V bearings (to accommodate shafts of different diameters) in which the rolls to be ground are placed, and either a traverse or roller (usually a traverse) grinder set between the rolls. One roll is set in the V bearings on each side of the grinder, and which bearings are adjustable so that the rolls to be ground can be adjusted to the grinder roll. The frame is of iron and made sufficiently heavy and rigid to insure true and even grinding. When different widths of cards are used in one mill, they are all ground on the same machine by using a crosshead, or intermediate head, which can be adjusted for any width narrower than



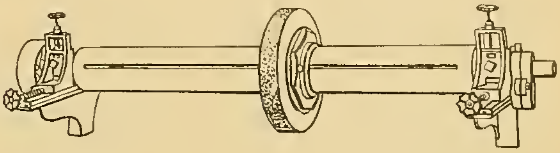
the extreme width of the machine. As this machine must be very accurate, care is taken in the construction of the frame that all the girths, heads, bearings, etc., are planed to a level so that there will be no variation in the heights of the rolls grinding, thus preventing any uneven grinding.

A turning rest, or straight edge is also provided for turning and truing the rolls before they are reclothed. This turning rest is portable, so that it can be placed on the card, for turning and truing the main clyinder as well as the doffer before they are re-clothed. This lathe is sufficiently heavy and rigid so that it will not sag or spring, since otherwise it will turn uneven, it being also fitted with adjustable stands to adjust the ends parallel.

When a traverse grinder is used, the same can be fitted with an extra solid emery wheel, about 12″ diameter and 2″ face, to permit grinding Burr Cylinders, Garnett machine clothing, etc., in the frame. (B. S. Roy & Son, Worcester, Mass.)

ROY'S GARNETT MACHINE GRINDER.

The accompanying illustration shows this traverse grinder, as used for grinding the cylinders of Garnett machines, in its perspective view. Suitable brackets are fastened to the arches on which are set the adjustable stands and boxes in which the grinder is run. By means of these adjustable stands the grinder



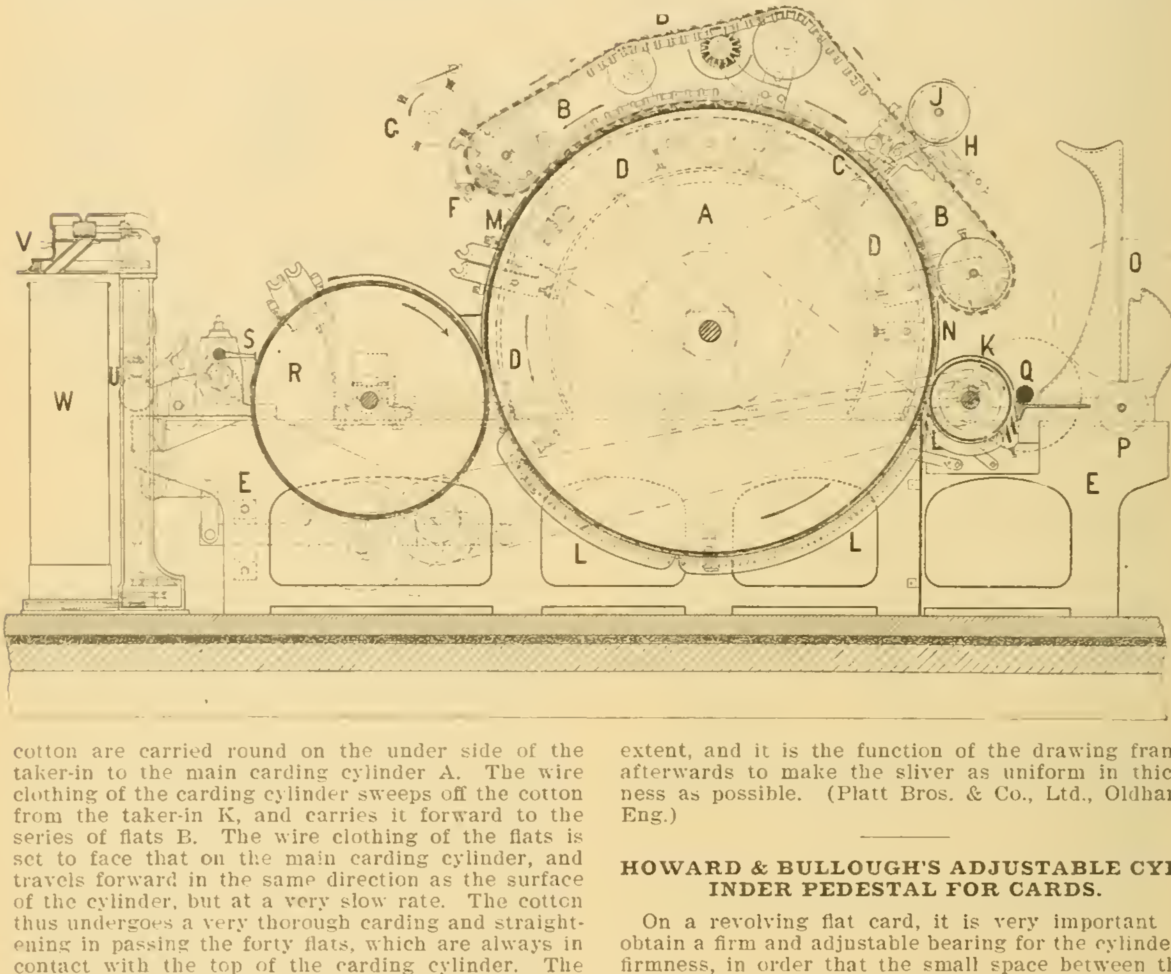
can be adjusted horizontally and perpendicularly, while running, to suit. The traverse grinder is fitted with a 2″ face, solid emery wheel, of the proper diameter, and with a special slow, positive, differential motion for slowly traversing the emery wheel, while revolving. This traverse grinder must be made with an extra strong steel shell, not less than 5″ diameter. (B. S. Roy & Son, Worcester, Mass.)

COTTON.

PLATT'S CARDING ENGINE.

The carding process is, in the opinion of many experts, the most important operation through which the cotton passes. It is at this point that the final cleansing takes place by the elimination of the impurities that have not been removed by the opening and scutching machinery, and the fibres, which are at this stage crossed in every conceivable direction, require to be placed in parallel order. The Carding Engine which accomplishes this the most successfully will give the most satisfactory results in the spinning; or, in other words, lead to the production of the best yarn. The premier position has now been unanimously assigned to the present form of the self stripping revolving flat card. Such a card is shown in section, in the accompanying illustration, and consists of a main carding cylinder A, and on its circumference the flats B—which are made in the form of cast iron ribs faced with card clothing—are seen connected, so as to form an endless traveling lattice, those at work resting upon flexible semicircular rings C, which are accurately fitted upon the fixed bends D, the whole being carried from the frame sides E. The flats when out of action—*i. e.*, when quitting the cylinder A—are stripped of any fibres or impurities adhering to them by the action of the patent vibrating comb F and the revolving brush G. The flats then pass over guide rollers to the grinding apparatus H, whereby the faces of all the flats are successively ground from their working surfaces by the grinding roller J, and the points of the wire leveled and sharpened while the card is working. The extra cleaning facilities afforded by this type of carding engine have been still further augmented by the arrangement of the casings and knives applied to the cylinder A and the taker-in K respectively. A simple form of adjustment has been devised to give any desired result, and being regulated from the outside of the frame, it makes what was formerly a laborious duty into the simplest that the attendant has to perform. The casings and the covers are adjustable, to allow for any wearing of the wire on the respective parts they enclose, so as to prevent the formation of accumulations, which in older systems were the main cause of inefficient work. The unlapping of the fleece of the lap O is performed by the roller P, on which the lap rests, and it is then drawn forward under the feed roller Q, and delivered to the taker-in roller K, revolving in the direction of the arrow. At this point the carding or combing action commences, the fleece being held by the feed roller Q. The fibrous tufts of cotton are carried round on the under side of the taker-in to the main carding cylinder A. The wire clothing of the carding cylinder sweeps off the cotton from the taker-in K, and carries it forward to the series of flats B. The wire clothing of the flats is set to face that on the main carding cylinder, and travels forward in the same direction as the surface of the cylinder, but at a very slow rate. The cotton thus undergoes a very thorough carding and straightening in passing the forty flats, which are always in contact with the top of the carding cylinder. The fleece of cotton after its passage through the flats is taken off in a continuous sheet by the doffer R, the wire clothing of which faces that on the cylinder, but runs at a much slower speed. The fleece thus receives a further straightening and stretching on leaving the carding cylinder, and is carried on the under side of the doffer to the vibrating comb S, which describes a short arc of 1¼ inches vertical movement, and is driven from a self-oiling oscillating motion which runs at 2,000 revolutions per minute or upwards without the slightest inconvenience. This comb strips the fleece from the face of the doffer in its down stroke and clears itself in rising. The thin fleece of the full width of the machine is then gathered in lateral guides to a width of about 6 inches, and finally into a smooth bell-mouthed funnel having a hole only ½ inch in diameter, through which the contracted ribbon or sliver is drawn by the calender rollers U, whence it passes to the coiler V and can W. The sliver is coiled by this arrangement until the can is filled, and then taken to the drawing frame.

The lap produced on the scutcher, and placed behind the carding engine, is made of such a weight per yard as to produce a sliver of the average thickness required, the doffer of the carding engine being arranged to run at a suitable speed for the purpose. There is, however, a varying amount of waste in the carding, consequently the thickness of the sliver, as deposited in the coiler can, may vary to a certain extent, and it is the function of the drawing frame afterwards to make the sliver as uniform in thickness as possible. (Platt Bros. & Co., Ltd., Oldham, Eng.)

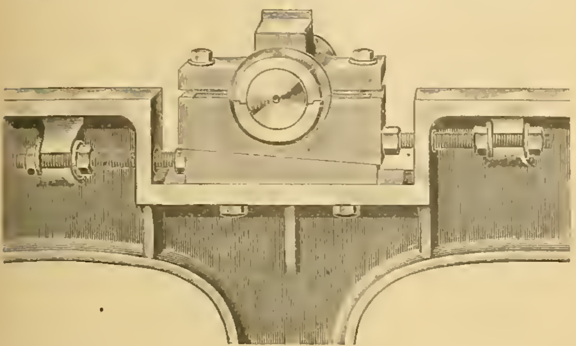


HOWARD & BULLOUGH'S ADJUSTABLE CYLINDER PEDESTAL FOR CARDS.

On a revolving flat card, it is very important to obtain a firm and adjustable bearing for the cylinder; firmness, in order that the small space between the teeth of the flats and the clothing on the cylinder may remain constant at all times and thus produce even carding and also avoid the liability of the clothing being injured by contact with the flats; and adjustability, in order that any wear in the bearings may not interfere with the proper position of the cylinder in the machine.

The adjustable pedestal for holding the cylinder bearing is shown in the accompanying illustration, which is a side view of a portion of the card framing, showing the application of the pedestal. As will be readily seen, the pedestal is designed so that both vertical and horizontal adjustments can be easily made.

The vertical adjustment is obtained by having the pedestal made in two pieces, the two sides which fit against each other being cut at an angle, so that by sliding one on the other, the bearing is raised or lowered, according to the direction of the movement.



Each piece of the pedestal has a threaded rod connected to one end, the two rods being on opposite sides as shown, and through which the proper adjustment is obtained. If a vertical adjustment is required without any horizontal movement, the lower piece is either moved inwardly or outwardly, according to whether the bearing is to be raised or lowered.

A horizontal movement is obtained by simply moving the two pieces bodily in either direction.

A combination of these movements will produce any desired adjustment of the bearing.

The construction of the card sides is such, that a firm bearing, free from vibration, is provided. The steps of the cylinder pedestal are made of phosphor bronze, which is very durable. It will be understood that one of these pedestals is used on each side of the card to hold the bearings for the cylinder shaft. (Howard & Bullough American Machine Co., Pawtucket, R. I.)

MACHINE FOR APPLYING CARD CLOTHING TO CYLINDER.

The improvement consists principally in the method of moving the carriage of the mechanism across the width of the card cylinder to be covered, and its object is to reduce the strain on the vital parts to which they were previously subjected.

The whole mechanism for applying the clothing to the card cylinder consists of a traveling carriage which is movable across the width of the card cylinder, and is made for guiding the fillet or strip of card clothing which is being applied to the cylinder. Means are also provided for exerting a tension upon the fillet and for varying said tension, and also means for automatically indicating the amount of tension exerted. The carriage driving mechanism is adjustably connected to the same mechanism as used for turning the cylinder, so that the travel of the carriage may be varied to correspond in the necessary way with the surface speed of the cylinder.

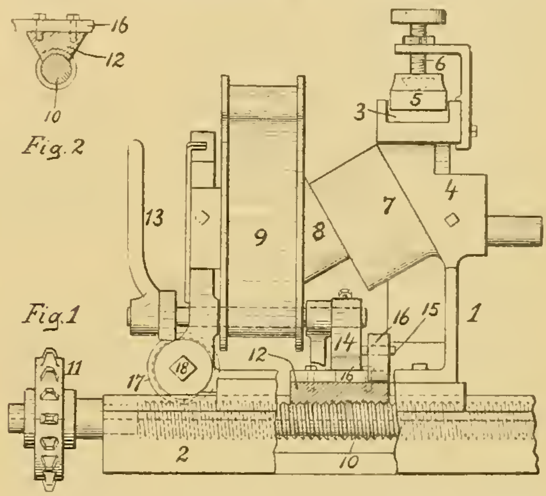
The details of the mechanism are best shown by means of the accompanying illustrations, of which Fig. 1 is a front view of the mechanism and Fig. 2 is a cross section of the screw and nut for operating the carriage.

Referring to the illustrations, 1 indicates the carriage which is mounted on the carriage stand 2 that extends across the width of the card cylinder, and the carriage is slowly moved across while the card clothing is being wound upon the cylinder, the movement of the carriage for every full revolution of the card cylinder being equal to the width of the fillet.

The guiding and tension devices consist of a recessed passage 3 in the upright piece 4, through which the fillet is passed, and on which the plate 5 presses to put tension on said fillet, the amount of tension being regulated by the screw 6. From the passage 3, the fillet passes over intermediate drums 7 and 8 and then around the lever 9 to the card cylinder.

The driving mechanism consists of a long driving screw 10 which is driven by a sprocket 11, said screw having a feeding nut 12 in threaded contact with it, the feeding nut being movably secured to the carriage, so that the latter may thus be actuated. The nut is in contact with about one-quarter of the circumference of the driving screw 10 as seen in Fig. 2.

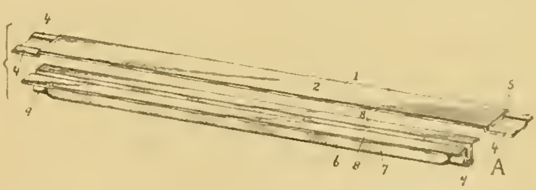
After the carriage 1 reaches the end of its travel, the nut 12 is raised out of contact with the screw 19 by means of a handle 13 which moves a rocking arm 14 carrying a pin 15 which passes through an opening in a lever 16. To this lever 16 the nut 12 is secured and is thus raised by the handle 13. The nut 12 is held down, when in contact with the screw 10, by having the lower end of the rocking arm 14 press against the lever 16 and be practically locked until released by the handle 13. The carriage is returned to the other end of its path by means of a worm gear 17 which is turned by a handle placed on the squared end of a shaft 18, on which said worm gear 17 is secured, the screw 10 in this instance being stationary, acting as a rack for the worm gear. When the device is in operation, *i. e.*, clothing the cylinder,



said worm gear 17 is free to move with the carriage, but in no way aiding the movement of the latter. (Saco & Pettee Machine Shops, Newton Upper Falls, Mass.)

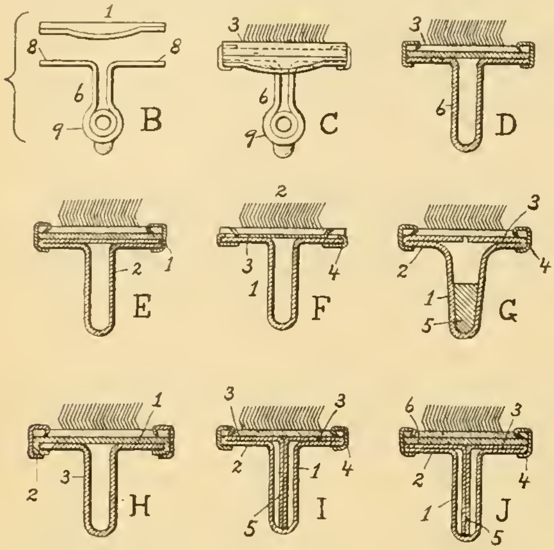
FLATS FOR REVOLVING CARDS.

Card flats, made of cast iron, are very liable to be sprung and thus lose their shape, a feature which tends to affect the shape of the card clothing attached



to it and consequently the operation of the carding engine. To overcome this disadvantage, flats of sheet metal are provided, which in turn are lighter than the cast iron flats, stiffer and consequently not as liable to spring out of shape, and remain so.

The flats are made in different ways, as will be shown, the principal requirement being to provide a



flat surface for receiving the clothing and one or more hollow ribs for stiffening it. At the same time it may be constructed so as to provide a means for stretching the card clothing attached to it. The flats also have guiding surfaces at their ends, which support them upon the flexible bends of the card and bear against the guides of the grinding mechanism.

The details of one style of flat as well as cross sectional views of other styles are shown in the accompanying illustrations, of which Fig. A is a perspective view of the parts of a two piece metal flat, before they are secured together, Fig. B being an end view of the same. Fig. C is an end view of the flat with the clothing attached.

Referring to these illustrations, 1 indicates a sheet metal piece for forming the face of the flat, having the flat surface 2 for receiving and supporting the card clothing 3 and having its ends made with guiding surfaces 4 and shoulders 5. The part 6 forms the back of the flat and acts to hold and stiffen the face 1. It is made of flat metal, which is shaped to form a hollow longitudinal central rib 7 and flat extensions 8, against the face of which the piece 1 fits and to which it is attached. The extreme ends 9 are shaped to be secured to the feeding chain for the flats on the card. The parts 1 and 6 are secured together by riveting, the card clothing being secured to the flat thus formed, as shown in Figs. C and D, the latter being another form of the two piece flat.

Fig. E shows a flat as made of one piece of flat metal, the part 1 being integral with the part 2 along one edge and being folded from that edge against the other part and so that the free edges shall be in line with each other.

Fig. F shows a flat as made of one piece 1, the clothing 2 having a stretching and backing plate 3, which serves to stretch and hold the clothing, and also by means of its extensions 4 to fasten it to the flat.

Fig. G shows a flat made of one piece of sheet metal and so constructed that it may also be used to stretch the card clothing and hold it stretched. It is shaped to form a hollow reinforcing rib 1, with lateral extensions 2, which fold back upon this to form the folded sections 3 upon the hollow rib. These reinforced portions serve to hold the clothing and are a part of the rib, being at the same time separable from each other, and by separating them slightly before attaching the edges of the clothing to the flat by the clips 4, the clothing may be stretched by slightly separating the sides of the rib. This may be done by inserting a separating plug 5 into the cavity of the rib between the sides and thus push them outwardly.

Fig. H shows a sheet metal flat in two parts, similar to the flat of Fig. A, with the exception that the part 1 is made wide enough to furnish the sections 2, which are bent around the edges of the wings of the part 3, in this manner not only fastening the part 1 to the part 3, but also forming an angular and stiffening reinforcement along each edge of the flat, which adds stiffness to said rib 3.

Fig. I shows a flat which is formed from one piece of sheet metal and which is similar to that shown in Fig. G, with the addition of inward extending stiffening sections 6 from the top forming parts 3. These inward extensions 6 rest against the inner surface of the rib, and serve to stiffen the structure of the rib, because of their width and also because of the angles which they form in conjunction with parts 3. The flat so made may directly receive the clothing, as shown in Fig. I, or it may have an additional plate 6 interposed for receiving it, as shown in Fig. J. (Saco & Pettee Machine Shops, Newton Upper Falls, Mass.)

HOWARD & BULLOUGH'S SETTING ARRANGEMENT FOR FLATS.

This arrangement has for its object the attainment of a simple and accurate method of setting Revolving Top Flats on Cards. The two accompanying illustrations clearly show the construction and working of the arrangement, Fig. 1 being a vertical sectional view, and Fig. 2 a plan view in section.

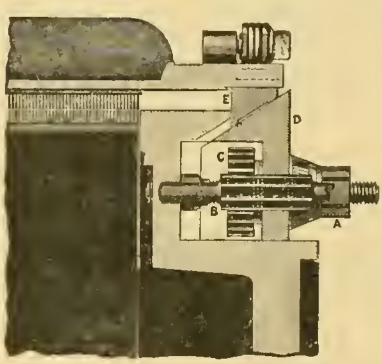


Fig. 1.

Letters of reference in the two illustrations indicate thus:—

A—is Index Nut which bears against outside of Rigid Bend D.

B—is Setting Key with fluted teeth, which gear into the teeth on Nut C.

C—is Toothed Nut which bears against the inside of Rigid Bend D.

D—is Rigid Conical Bend which is moved in or out.

E—is Flexible Conical Bend which rests on D and carries the Flats.

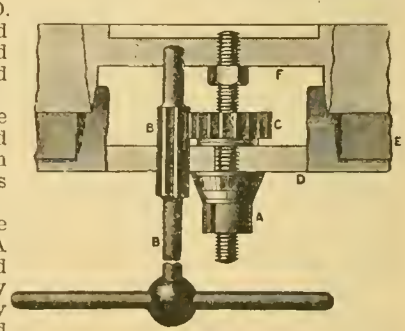


Fig. 2.

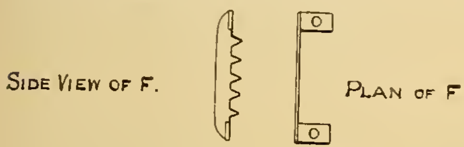
By turning the Index Nuts A and the Toothed Nuts C one way or the other, they move the Rigid Bend D in or out, and thereby raise or lower the corresponding Flexible Bend E which rests upon it.

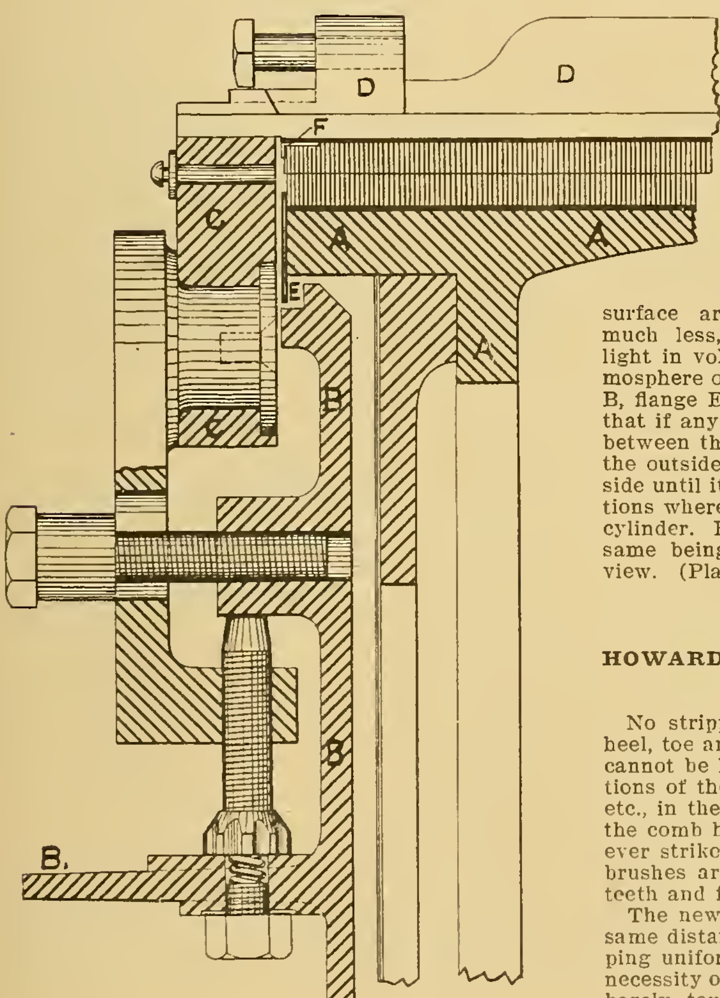
As the Flats rest upon the Flexible Bend E, they are raised or lowered with it. Each mark or division on Index Nuts A represents the 1000th part of an inch, and by turning the Nuts the distance of a division in one direction or the other, the Flats are correspondingly raised or lowered to this extent.

The setting cannot be tampered with after the Key B has been used to tighten the Toothed Nuts C. The Key B and a special wrench suitable for turning the Index Nuts A should only be in the hands of the overseer. (Howard & Bullough American Machine Co., Pawtucket, R. I.)

PLATT'S PERFORATED OR SLOTTED FLEXIBLE BENDS.

The principal feature in all revolving flat carding engines is the position of the fixed bends, which hitherto have been placed as close as practicable to the cylinder edges, the intervening space being filled up with linings or flanges made of wood or iron, or both. None of these methods however have had the desired effect of preventing the long standing evil known as "side waste," a feature however now successfully accomplished by an ingenious contrivance which permits the fixed bends to be placed under the ends or inside the cylinder, thus bringing the flexible bends or flat course to the position formerly occupied by the wood lining in former constructions. The advantages of the new construction will be readily understood by reference to the accompanying sectional view, a feature which at the same time will lead the observer to associate other and important changes, viz.: a shortened flat, the cylinder ends perfectly enclosed, resulting in improved selvages and the entire disappearance of side waste. The cause of side waste in former constructions undoubtedly lay in the large and exposed surface of the fixed bends to the action of the cylinder, the current of air created by each revolution became the disturbing influence by reason of being pent up between the bend and the cylinder, thus leading to a condition which cannot be better described than as a whirlwind. This action is constantly abstracting cotton from the ends of the flats, and especially in modern cards in which full width laps are used, and indeed in all carding engines that have been made, up to the present time. The evil has been largely increased since the introduction of heavy weights and large productions, for the higher the cylinder speed, the stronger is the current of air created and the larger the quantity of side accumulation made.





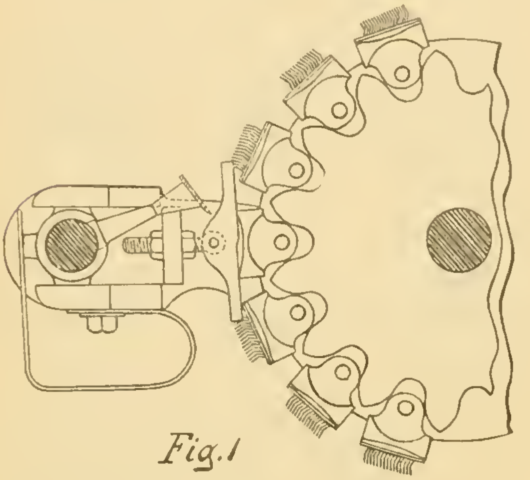
Again, a glance at the illustration shows at once the converse of the action just described. The fixed bend B is now placed inside the cylinder A, consequently the current of air made between it and the cylinder cannot escape so as to abstract any cotton from the flats D, this being prevented by the flange E. The flange E, 1⅛ in. broad, really takes the position of the fixed bent in the old card, and its surface area exposed to the cylinder being so much less, the currents of aid generated are so light in volume, that they are dispersed into the atmosphere of the room. From the position of the bend B, flange E, and flexible bend C, it will be observed that if any "side waste" is made at all, it must pass between the flange E, and flexible bend C and on to the outside of the bend B, and not gather on the inside until it is rolled into lumps, as in other constructions where the fixed bends are on the outside of the cylinder. F shows one of the end plates of a flat, the same being shown also in detail in side and plan view. (Platt Bros. & Co., Ltd., Oldham, Eng.)

HOWARD & BULLOUGH'S "FLAT" STRIPPING MOTION.

No stripping motion hitherto made will clear the heel, toe and middle of the flats equally, as the comb cannot be kept at the same distance from these portions of the flat, and hence leaves more or less dirt, etc., in the flat. A bristle brush to clear away what the comb has missed is necessary, which brush however strikes much of this dirt into the flats. If wire brushes are used it entails risk of cutting both the teeth and foundation of flats.

The new system enables the comb to work at the same distance throughout the whole flat, hence stripping uniformly, and practically doing away with the necessity of brushes, or using them as simple dusters, barely touching the wire, at the same time running them only at about one-tenth of their present speed.

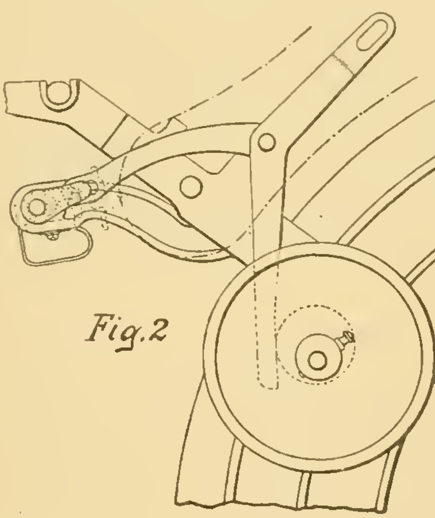
Ordinary wear naturally makes the lengths of chains driving the flats variable, and the flats "tilt," and there is no comb that will not catch the wire and damage it, if set close; however under the new system, no matter what the "tilting," the stripping is



done perfectly, and as well on an old card as on the newest.

Any high or low flats caused by bad setting or grinding are stripped as perfectly as the newest and most accurately set flats. Should dirt get underneath the flats and force them away no difference is caused in the perfect stripping, as the comb follows the flat.

The construction and operation of the new motion are best shown by means of the accompanying illustrations, of which Fig. 1 is a side view, showing the



comb and the flats in position for stripping; Fig. 2 showing the method of actuating the comb for the stripping purpose.

The comb for stripping the flats is mounted at each end in bearings, capable of sliding towards or away from the flats in suitable guides. These bearings are kept at a given distance from the flats by means of a shoe which presses against the working seating of flat, the shoe and seating being practically of the same width on face.

The comb is kept equidistant from the wire at any desired distance, by an adjusting screw on each end The shoe is so shaped that it allows for the "heel" of the flat, and thus insures the comb being always kept at the proper distance from the wire, and thus prevents the possibility of any damage to the latter.

To keep the shoes well against the working seatings of the flat, the sliding bearings for the comb-stock are securely pressed inward by springs.

The comb being centred at a point in front of the chain of flats, and striking in a circle below the line joining the centres of comb-stock and front chain block, gives a receding motion to the comb blade, causing it to effectually pull all impurities out of the wire.

This action, together with the fact that it is impossible for the wire on the flats to be forced into the comb by accumulation of dirt or "fly" on the blocks or flat seatings, constitutes this arrangement a most perfect flat stripping motion. (Howard & Bullough American Machine Co., Pawtucket, R. I.)

BATTEN AND HAYES' METHOD OF STRIPPING FLATS ON REVOLVING FLAT CARDS.

The object of this method of stripping the card flats is to facilitate the production of even and strong yarns by cleaning the stock more thoroughly, taking out a larger proportion of the short fibre, besides delivering the stock with its fibres straighter and in better parallelism than with an ordinary stripping arrangement on the card.

The new method consists in providing an additional stripping device which is located at an intermediate point between the licker in and the doffer, and by means of which the flats, after having performed a part of their travel in working relations with the main cylinder, are stripped, so that during the remaining portion of their travel upon the flexible bends they are enabled to act as thoroughly and efficiently in carding as they were after first returning to the cylinder, at the rear of the card. The details of the arrangement as applied to the card are shown in connection with the accompanying illustration, which is a side elevation of a portion of a card with the device applied.

With reference to the illustration, 1 indicates the main cylinder of a card, 2 is the licker in, 3 is the doffer and 4 the traveling chain of flats. 5 indicates the sheaves around which the traveling flats are passed, in order to guide the flats to the cylinder at the rear and to take them away at the front of the card. 6 is the intermediate sheave for supporting the upper length of the chain of traveling flats as it returns above the main cylinder from the doffer end of the card toward the licker in end. This sheave 6 is supported by a bracket 7, which is mounted on the main arch 8 of the card, said bracket 7 also supporting the flexible bend 9.

On the regular card the stripping of the flats is effected by means of a stripping comb 10, after the flats have left the flexible bends at the front of the card and are traveling back over the top.

The carding action between the main cylinder and the flats is most efficient when said flats first return to the flexible bends, in consequence of the flats being in a clean state, but as the flats move onward towards the doffer, the teeth of the card clothing on the flats fill up with dirt and short fibres and the efficiency consequently becomes less. As a result, the carding action during the latter half of the travel of the flats upon the flexible bends is much less than during the first half of such travel. It is to overcome this fault and to have the flats in good working condition during the entire time they are on the flexible bend, that an extra stripping device is provided near the centre of the travel of the flats. For this purpose, bridge shaped bends 11 are used so that as the ends of the flats slide along the flexible bends 9, they will pass onto said bridge bends 11, and thus be raised from the periphery of the main cylinder. Holding down brackets 12, adjustably mounted upon the flexible bends, act against the backs of the flats to hold said flats down firmly against the flexible bends at the points at which the flats leave and return to said flexible bends in traveling over the bridge bends 11.

The periphery of the main cylinder between the point at which the flats are uplifted from the same and the point at which they are again returned to working relations with the main cylinder, is enclosed by a cover plate 13, which is beveled at each side so that it may fit as close as possible to the points where the flats leave and return to the cylinder. This plate 13 is made adjustable by means of screws and may be set radially to the periphery of the cylinder. In the space between the uplifted portion of the chain of flats and the cover plate 13, a stripping comb 14 is provided for cleaning the uplifted flats as they travel past said comb. This comb is similar to comb 10 and is vibrated through levers from the same eccentric 15 as said comb 10.

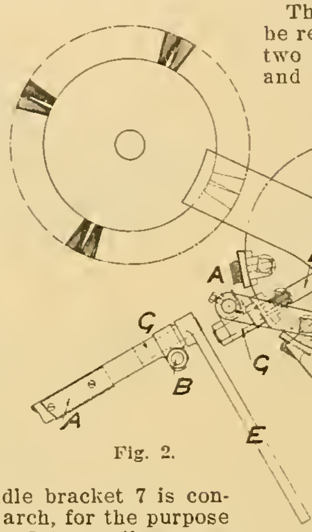
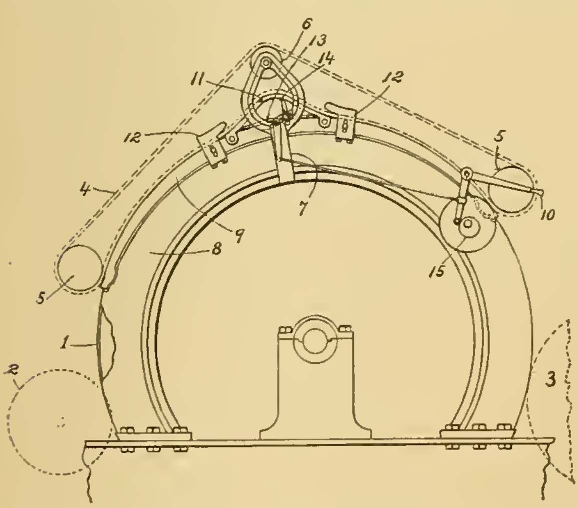


Fig. 2.

The outer portion of the middle bracket 7 is constructed in the form of an open arch, for the purpose of permitting inspection of the flats as they pass over the bridge bends 11, and also for the purpose of enabling easy access to be had to said flats and to



the stripping devices, for adjusting purposes and for removing strippings. The strippings at this point contain more dirt than strippings from regular cards where the flats travel the entire carding surface before they are cleaned, this feature showing that the length of time of working the flats before cleaning is excessive, so that without the additional middle stripper, as previously explained, the flats in their travel, fail to hold all of the dirt, etc., till time for stripping at the front, and consequently a certain amount of dirt will drop back on the cylinder and go forward into the delivered film.

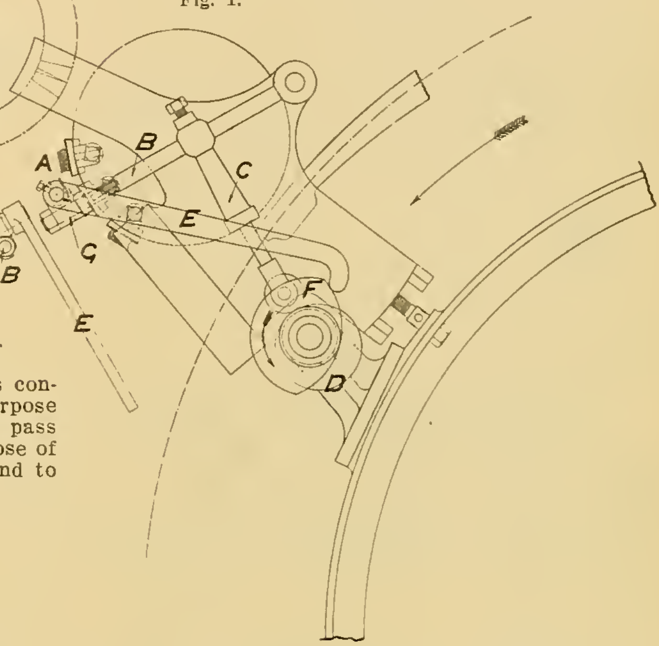
With the double stripper arrangement thus explained, the strippings at the front of the card are very clean and can be put back into the good cotton for spinning medium counts, a feature which certainly is an advantage. (Mason Machine Works, Taunton, Mass.)

PLATT'S RECEDING COMB,

For stripping the flats employed in self stripping revolving carding engines.

The construction and operation of this comb will be readily understood by means of the accompanying two illustrations, of which Fig. 1 shows the comb and the apparatus for operating it, in its side view,

Fig. 1.



showing also that portion of a revolving flat carding engine to which the comb is applied. Fig. 2 is a view in detail showing the comb in its front view.

The comb itself is indicated in both illustrations by A, the same being moved in the arc described by the stripping comb arm B by its connection C with the cam D as usual, but at the end of this downward or stripping stroke, the new mechanism consisting of the additional lever E, cam F, and cannon bracket G, comes into action, as shown in Fig. 1, producing a secondary or receding movement, entirely maintaining the comb at a safe distance from the card wire during the upward or return stroke, thus preventing the possibility of damage being done to the wire. The auxiliary cam F then passes out of action, leaving the ordinary cam D to complete the down stroke, and so on. The receding angle of the comb in relation to the card wire can be varied by the cam F if required.

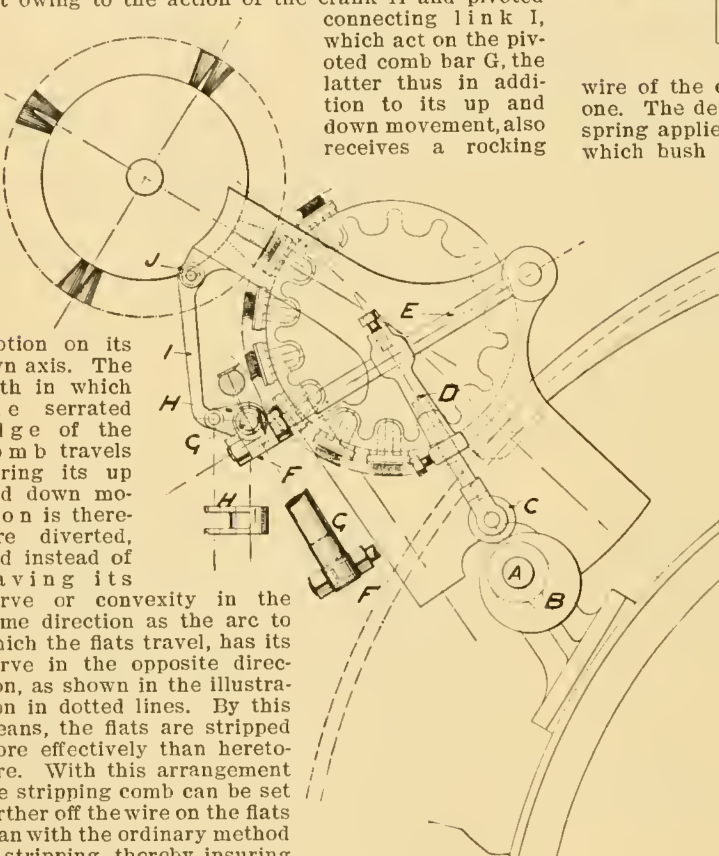
The advantages obtained by the adoption of this comb are:

(1) It permits of closer setting without damage to the card wire, for the reason that its secondary or receding motion draws or lifts the strips out of the flats before making the upward or return stroke. (2) The possibility of angular setting with relation to the card teeth. (3) By the withdrawing action at the termination of the downward stroke, the strips may be reduced to an extent utterly impossible with the old type of stripping comb. (4) The economy consequent on such lightened strips. (5) All danger of contact with the card wire in the return stroke is removed by the receding motion of the comb, and effectually disposes of any liability of disturbance of the angle of the wire well known hitherto as the cause of high wires on the flats. (Platt Bros. & Co., Ltd., Oldham, Eng.)

PLATT'S IMPROVED STRIPPING COMB.

This stripping comb combines an oscillating motion with the ordinary up and down motion, characteristic to these combs, and this at just the speed required for the combing movement essential to the perfect stripping of the flats.

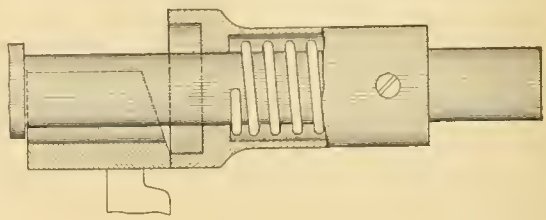
The action of the apparatus will be easily understood by reference to the accompanying illustration: The cam B, acting on the radial arms E, causes the comb bar G to rise and fall in the ordinary manner, but owing to the action of the crank H and pivoted connecting link I, which act on the pivoted comb bar G, the latter thus in addition to its up and down movement, also receives a rocking motion on its own axis. The path in which the serrated edge of the comb travels during its up and down motion is therefore diverted, and instead of having its curve or convexity in the same direction as the arc to which the flats travel, has its curve in the opposite direction, as shown in the illustration in dotted lines. By this means, the flats are stripped more effectively than heretofore. With this arrangement the stripping comb can be set further off the wire on the flats than with the ordinary method of stripping, thereby insuring greater safety to the wire.

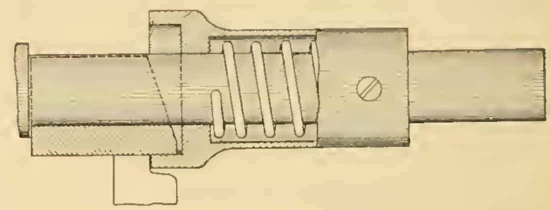


Letters of reference in the illustration indicate thus: A—Cam-shaft, B—Cam, C—Bowl, D—Fllbow, E—Radial Arm, F—Comb Bar Bearings, G—Comb Bar, H—Crank, I—Link, J—Link Bracket. (Platt Bros. & Co., Ltd., Oldham, Eng.)

HOWARD & BULLOUGH'S LOCKING DEVICE FOR STRIPPING BRUSH ON CARDS.

This simple device is a patented invention of a practical carder, its purpose being to prevent the stripping roll from jumping and being forced out of its bearing and thus jamming or knocking down the

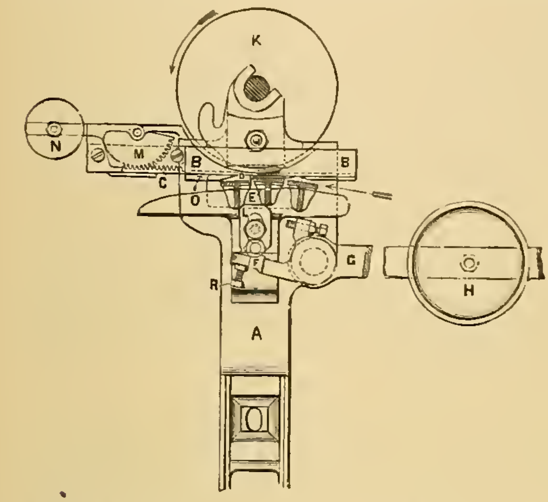




wire of the cylinder or doffer when stripping either one. The device consists of a special loose bush and spring applied to the shaft of the stripping roll, and which bush can be moved lengthwise on the shaft. The construction and application of the device is best shown by means of the accompanying illustrations, of which the top one shows the stripping roll shaft partly placed in one of the bearings provided for this purpose on the frame of the card. The lower illustration shows the stripping roll shaft in place and automatically locked, by the new device, to the bearing, by the flange of the bushing being pushed over the protruding end of the bearing by means of the expansion of the spring. After stripping, the roll can be instantly removed by sliding the bush slightly on the shaft, against the action of the spring. The advantages of the device are, that the automatic locking entirely prevents the jamming of the wire of the cylinder or doffer by the stripping roll jumping out of its bearings. It effects the saving of stripping rolls, as the same cannot be broken or damaged by jumping out of their bearings. It also saves time in stripping, as one man, with stripping rolls fitted wlth this device, can practically accomplish the work of two. On the ordinary stripping roll the ends of the filleting are the first to give out, as these are usually damaged by the stripping roll jumping out of its bearing, a feature prevented by the new device. With the application of this locking device, the wire at the ends of the rolls will last as long as any portion of the wire of the stripping roll. (Howard & Bullough American Machine Co., Pawtucket, R. I.)

PLATT'S GRINDING APPARATUS FOR REVOLVING FLATS.

The apparatus will be readily understood by reference to the accompanying illustration, in which A indicates the grinding fixing, to which is fixed the bridge bracket B, in which a rack and bar C slide; to this is attached a shoe D, the lower surface of which is formed to the required bevel at which it is desired that the card wire shall be ground. The working or carding surfaces of the flats E are supported and regulated by the shoe D when grinding by the action cf the lifter L, and the levers F and G,



the opposite end of the latter being loaded by a weight H. Each of the flats as they travel along seize the "lip" or projecting end of the shoe D, is carried along until the wires have passed under the grinding roller K, when the flat drops off the lifter L, and releases the shoe D, which immediately returns to its original position by means of the positive movement derived from the rack C, quadrant M, and weight N. In case the flat E should not leave the shoe D at the right moment, it will be carried against the fixed incline or stop O, which will at once cause the flat E to release the shoe D with certainty. Every flat in the set is dealt with in the same manner, thus insuring a uniformity in grinding that cannot be excelled. The attendant should try every flat as it is lifted in the shoe D, and set the lifter L with the setting screw R, so that every flat is pressed tightly in the shoe D.

The apparatus may be placed either at the back or the front of the carding engine, the former position being now mostly preferred, on account of its accessibility to the light, and also for the facilities which its more advantageous position offers to the attendant when setting the grinding roller. (Platt Bros. & Co., Ltd., Oldham, Eng.)

ROY'S TRAVERSE GRINDER FOR COTTON CARDS.

For grinding revolving flat cards, two traverse and one roller grinder are used at the same time, the traverse grinders for grinding the cylinder and doffer, and the roller grinder for grinding the flats. The traverse grinders are made, as a rule, with steel shells from 2¼" to 4" diameter, the Hardy pattern with 2¼" to 3" shells and the Roy pattern with 3½" to 4" shells. The grinding wheels are made with 3" to 4½" face, the wider face grinding faster.

These grinders are made in different styles for different makes of cards. Some have brass bushings for V and U shaped poppett heads and some are for poppetts with regular round bearings. They are made with a pulley at each end, one for driving and

one for traversing, or with only one pulley for driving, where a differential or self traversing motion is used. The illustration in its perspective view shows a Roy pattern traverse grinder with differential motion and adjustable grinding wheel (see special articles on "Traverse Grinding Motions" and "Adjustable Grinding Wheel," pages 87 and 88). The grinding wheel is usually covered with emery fillet, which, when worn can then be easily renewed. (B. S. Roy & Son, Worcester, Mass.)

ROY'S ROLLER GRINDER FOR COTTON CARDS.

This grinder as used for grinding the flats of cotton cards, and of which a perspective view is given in the accompanying illustration, is made of cast iron, sheet metal, or steel tubing, those made of steel tubing being the strongest and lightest. The heads at the ends of the roller are common heads, same as is put in any cylinder, or balancing heads for re-balancing the roller when thrown out of true by a new emery cover or from other reasons (see page 87). These rollers are also covered with emery fillet, held in place at each end by suitable clamps.

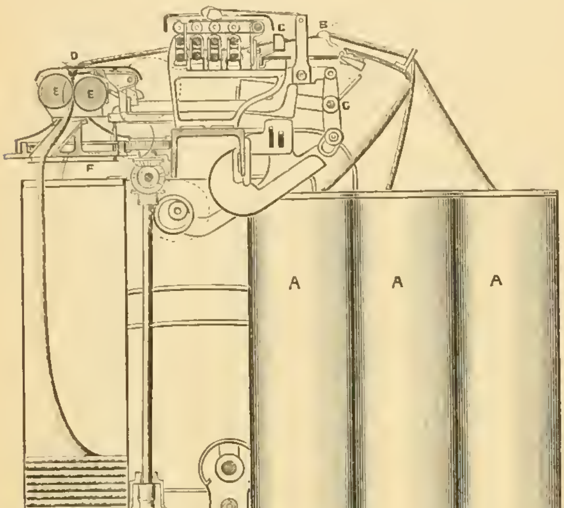
The roller is given a reciprocating motion by means of a worm and worm gear, enclosed in a casing, connected to the shaft of the roller and to the poppett head. This mechanism is called a reciprocator. (Roy's patents 276,884 and 540,926.) The

traverse of the roller is usually 1", consequently the roller is made 2" longer than the width of the card clothing on the flat, so that the roller will always remain on the card clothing of the flat while grinding. (B. S. Roy & Son, Worcester, Mass.)

PLATT'S DRAWING FRAME.

The object of this machine is to place the fibres of the sliver as coming from the carding engine, or the comber, more parallel and at the same time render the sliver as uniform as possible in its thickness. The accompanying illustration of this machine is given to assist in describing its construction and operation. It is fitted, as a rule, with four rows of top and bottom rollers (sometimes five or six), and to each coiler or delivery six or eight cans are placed at the back, according to circumstances.

The slivers as drawn from the cans A pass over the tumblers B back of the stop motion, through the guides C of the traverse bars behind the rollers, and through the draft rollers to the trumpet D of the front stop motion. The sliver then passes between the calender rollers E, through the tube of the coiler, and is deposited in the can. Underneath the coiler wheel of one of the cans of each head, a loose plate F is so arranged that when the can is full the plate is lifted by the coils of sliver, and being in connection with the rocking shaft G stops the machine. The whole of the cans in this head are then removed, replaced by empty ones, and the machine set to work again. There is one tumbler B to each sliver, and if the sliver breaks or the can becomes empty, the tumbler through which it passes overbalances, comes in contact with the oscillating bar on the rocking shaft G, and by simple mechanism stops the machine. The trumpet D of the front stop motion is connected with the same mechanism, its object being to stop the machine when the sliver is light or breaks from any cause, such as roller laps, etc. As the special function of the drawing frame is to lay the fibres of cotton parallel and of equal thickness by frequent doublings, etc., the rollers naturally play a very important part; the gearing is



arranged at one end of the rollers, which run at gradually increasing speeds from the back to the front lines, to attenuate the sliver or give what is called "draft." To maintain the flutes and the bearings of these rollers in good condition, the front, and sometimes the second, lines of rollers are case hardened. The draft from the front to the back rollers is usually arranged to suit the number of ends run into one, that is to say, when six ends are run into one, a draft of six, and for eight ends a draft of eight. It is customary to have three passages of drawing frames, or four passages for fine yarns, each head or passage having six, seven, or eight coilers, according to the weight of sliver to be produced. (Platt Bros. & Co., Ltd., Oldham, Eng.)

METALLIC DRAWING ROLLS.

The same constitute one of the two general types of top rolls used in connection with the drawing frame. In their general construction the metallic rolls are somewhat similar to a common bottom steel roll, only that the flutes on both metallic rolls are evenly spaced, whereas on the common steel bottom roll, it will be noticed, said flutes are unevenly spaced. Another point of difference in the two types of rolls is that the flutes are spaced farther apart in the metallic rolls, the pitch thus being coarser. The reason for spacing the flutes, in both metallic rolls, evenly apart is the fact that the two have to mesh together in a similar manner as a pair of spur gears. However the teeth or flutes of one do not sink as far into the grooves of the other as a regular gear, from the fact that the cotton sliver has to pass between them, and when, unless said sliver was fed in a very large bulk, the fibres would be very liable to be cut or strained from the pressure of contact of the rolls, which action would in turn weaken the sliver and render metallic rolls useless.

The rollers are prevented from meshing together too deeply by having each roll provided with circular collars, one at each end of each roll, so that when the rolls are placed in contact in the frame, the collars on the top roll rest on the respective collars of the bottom roll and thus allow the flutes to enter the grooves only a certain distance and revolve in that position. From this fact, it will be seen that the diameter of these collars is a very important point, and in fact is one of the most important parts of the rolls, for on the proper diameter of the collars depends the successful working of the rolls. If the collar is ground to a smaller diameter than is called for, the flutes will mesh too deeply and consequently cut or injure the fibres; again if the collars are not ground small enough, the flutes then will not mesh deeply enough, and owing to the fact that the revolutions of the top roll are dependent upon its meshing with the bottom roll, it is very apt to slip some of the flutes and thus break the sliver, if not at the same time injure the rolls.

Metallic bottom rolls as used in one frame have different diameters, and also contain a different number of flutes on a roll of the same diameter, or, as it is said, they have a different size fluting or pitch. The pitch of the flutes of the top roll should always correspond with the pitch of the flutes of its bottom roll. The back roll is made with the coarsest flutes, the flutes becoming finer in the succeeding rolls on the frame. Three different spacings of flutes, *i. e.* their pitches, are made, which are 16, 24 and 32 respectively. By these numbers, *i. e.* the pitches of the rolls, is meant the number of flutes and spaces on the roll per one inch of its diameter. This will then indicate that the 16 pitch rolls refer to the back rolls, 24 pitch to the middle rolls and 32 pitch to the front rolls. 16, 24 and 32 as quoted, do not indicate the total number of flutes on any of the rolls, but only the number of flutes and spaces on a roll per one inch of diameter and when consequently a 16 pitch roll, 1½ inch diameter will contain $16 + (16 \div 2 =) 8 = 24$ flutes and grooves on the roll. The same pitch roll but of a diameter of 1⅛ inch $= 16 + (16 \div 8 =) 2 = 18$ flutes and grooves on the roll. A 24 pitch roll, 1¼ inch diameter $= 24 + (24 \div 4 =) 6 = 30$ flutes and grooves on the roll. A 32 pitch roll, 1¼ inch diameter $= 32 + (32 \div 4 =) 8 = 40$ flutes and grooves on the roll.

When a roll contains 16 pitch flutes, the collars are ground down so that they are 0.07 of an inch smaller in diameter than the outside diameter of the flutes, which then allows the flutes of that roll to enter 0.035 of an inch into the grooves of the bottom roll and vice versa, when the diameters of the collars on the bottom are equal to the outside diameter of the flutes. When the collars of the bottom roll are also ground 0.07 of an inch smaller than the outside diameter of the flutes, the flutes of the rolls are allowed to enter 0.035 of an inch farther into the grooves, thus making the total depth of mesh of the flutes of both rolls 0.07 of an inch. The collars on each roll of 24 pitch rolls are ground down 0.06 of an inch smaller than the outside diameter of the flutes, thus making the total depth of mesh for both rolls 0.06 of an inch. The collars on the 32 pitch rolls are ground down 0.044 of an inch smaller than the outside diameter of the flutes, and when in this case the flutes have a total mesh of 0.044 of an inch. The pitch of the roll, independent of its diameter, indicates the amount to be ground off its collars, thus a 16 pitch roll, 1½ inch diameter, has its collars ground down 0.07 of an inch smaller than the outside diameter of the flutes, a 16 pitch roll 1¼ inch or any other diameter calling for the same amount of grinding off of its collars. The object of having different amounts ground off of the collars for the different pitch flutes, is for the purpose of making each different pitch of flutes on the rollers of the same diameter deliver

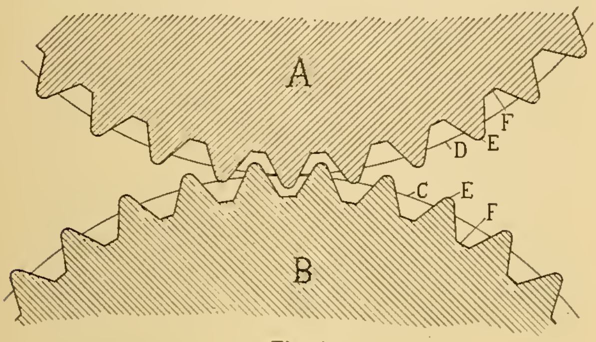


Fig. 1.

the same length of sliver when the rolls are given the same number of revolutions. The slivers on emerging from the front rolls are crimpy, owing to the meshing of the rolls.

In order to illustrate the manner in which the top and bottom rolls mesh into each other, two illustrations are given, of which Fig. 1 is a partial section of the top and bottom rolls, also showing the outlines of the two collars as placed on the rolls. Fig. 2 is a perspective view of the rolls, showing collars in pure rolling contact, but so adjusted as to separate the flutes while permitting them to interlock as shown in Fig. 1. Both illustrations will readily explain themselves by means of letters of reference, of which A indicates the bottom rolls, B the top roll, C the collar on the bottom roll, D the collar on the top roll, E the flutes and F the grooves on both rolls.

Among the advantages claimed for the use of metallic drawing rolls, several may be considered. The chief point in manufacturing at the present time

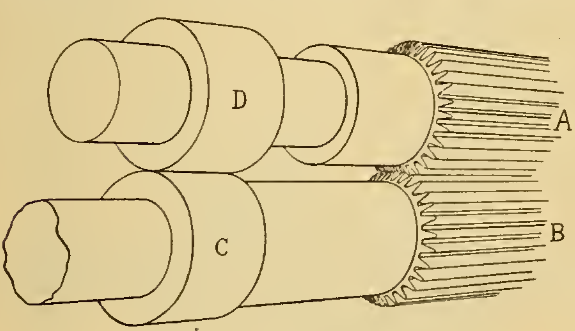


Fig. 2.

is to get off as large a production as possible and at the same time have it up to the standard in quality. Production may be increased by speeding up the machine and increasing the weight of material under operation, but a limit has been found where it is not advisable to overstep, as experience has shown that the life of the machine is shortened and the product obtained of an inferior nature. The production may also be increased by increasing the diameters of the rolls and keep the speed the same, but the limit has also been found for these diameters, owing to the distances between the pairs of rolls, and which must be maintained, thus setting a limit for them.

On a given diameter of metallic rolls, the flutes and grooves produce a periphery to this roll equal to that of a smooth roll having a larger diameter, thus if the diameter of the metallic roll is made as large as that of the largest smooth roll, it will deliver a larger amount of sliver than the smooth periphery roll, owing to its flutes and grooves, and hence an increased production is obtained. From this fact, it will be seen that to figure the delivery of the front roll, its equivalent of a larger diameter roll must be found and used in the calculation.

The bite of the rolls is positive, as is also the drive of the top roll, from the meshing of its flutes with those of its bottom roll, a feature which prevents the possibility of any slipping between the pair of rolls. This fact also enables the rolls to remain perfectly in contact with less weighting, thus reducing power required to rotate them.

Metallic rolls require little attention after once installed, the cost of maintaining them in working condition being practically nothing.

The draft of metallic rolls is different from that of the leather covered rolls, for which reason the number of teeth in some of the gears in the machine have to be changed in case of changing the latter from leather top rolls to metallic rolls. Equivalent diameters in place of actual diameters of the rolls must also be used in connection with calculations for metallic rolls as previously mentioned, the following equivalents being those to be used in order to figure the drafts and production correctly:

1 inch diameter roll, 32 pitch, to be figured as $\frac{8}{8}$ inch diameter roll.
1⅛ " " " 32 " " " " $\frac{9}{8}$ " " "
1¼ " " " 32 " " " " $\frac{10}{8}$ " " "
1⅜ " " " 32 " " " " $\frac{11}{8}$ " " "
1½ " " " 32 " " " " $\frac{12}{8}$ " " "

24 pitch is figured same as 32 pitch.

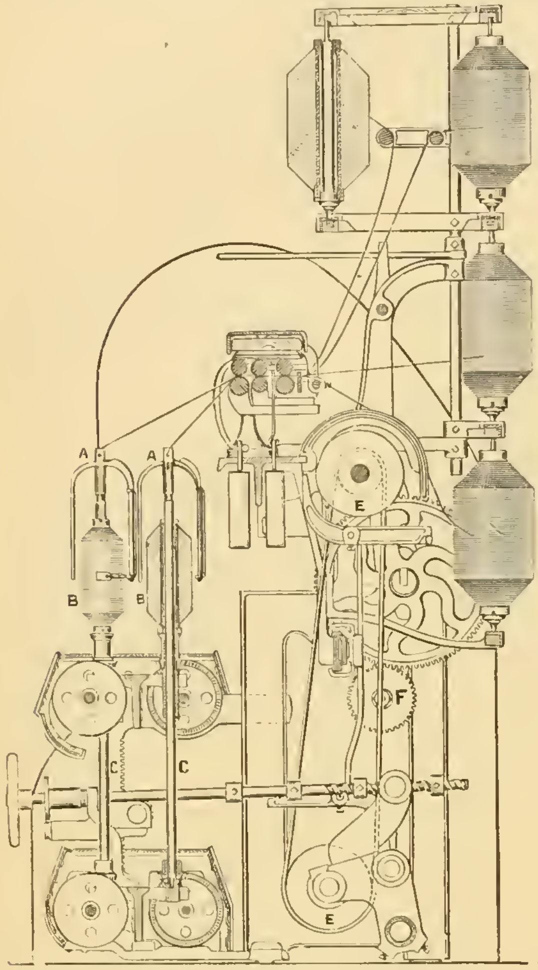
1⅛ inch diameter roll, 16 pitch, to be figured as $\frac{10}{8}$ inch diameter roll.
1¼ " " " 16 " " " " $\frac{11}{8}$ " " "
1⅜ " " " 16 " " " " $\frac{12}{8}$ " " "
1½ " " " 16 " " " " $\frac{13}{8}$ " " "

Besides allowing for metallic rolls the equivalents given for obtaining the main draft, we must also add an extra percentage of draft in order to obtain the actual draft, the percentage usually allowed for this extra draft, in connection with average counts of yarns, being about 10%. The same has for its cause the action of the flutes when pushing the sliver into their respective grooves on their mate roll, a feature which cannot help but impart an additional stretch to the sliver.

When using metallic rolls, care must be taken that the flutes are kept clean, for if they become clogged with lint or dirt they will more or less cut the fibres. Never allow the rolls to rust or become rough or nicked. (The Metallic Drawing Roll Co., Indian Orchard, Mass.)

PLATT'S FLYER FRAMES.

The object of these machines is to further elongate and stretch the fibres in the sliver as coming from the drawing frame, however in addition to the drawing process it is necessary at this stage to put in twist to give sufficient strength to the roving, so that it may put on and draw off the bobbin without any undue stretching. There are four systems of flyer frames, viz.: the slubbing, intermediate, roving and fine roving frame, and which are selected to follow according to the fineness of the roving required. For coarse counts of yarn there are usually two passages



of flyer frames, viz., slubbing and roving; for medium counts three passages, viz., slubbing, intermediate, and roving frames; and for very fine counts four passages, viz., slubbing, intermediate, roving and fine roving frames.

The slubbing frame receives one can per spindle, taken from the third or fourth passage of drawing frame, and draws or elongates the sliver by means of three rows of rollers, producing a roving, three, four, or five times or thereabouts finer than received from the drawing frame.

The bobbins from the slubbing spindles are next put in the creel of the intermediate frame, two bobbins to each spindle, and the drawing and twisting processes are repeated, the same being done in the roving and fine roving frames, where the latter are necessary, according to the counts of yarn to be produced.

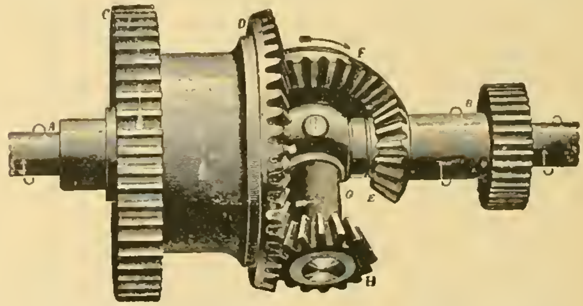
All these flyer frames are similar in general construction, but have graduated sizes of rollers and of bobbins, etc., to suit the counts of roving to be produced, therefore a description of one machine will serve for the whole series. On reference to illustration it will be seen that the cotton passes through the three lines of top and bottom rollers to the spindles. Each spindle has on its upper end a tubular flyer A, which surrounds the bobbin B, which fits on a bobbin wheel running on the collar or bolster of the spindle C. Both the spindles and the bobbins revolve in the same direction, but at different speeds, so as to cause the fibre to be wound on and twisted at the same rate as it is delivered from the rollers. By means of a shortening apparatus the length of traverse is reduced as each layer of roving is placed on the bobbin, and at the same time the strap on the cones E receives a definite movement, and the variable speed from the bottom cone is then transmitted through the winding motion on the driving shaft F to the bobbins B. Usually the front row of fluted rollers are case-hardened. (Platt Bros. & Co., Ltd., Oldham, Eng.)

HOWARD & BULLOUGH'S DIFFERENTIAL MOTION.

A satisfactory differential motion for speeders must combine simplicity, durability and lightness of running. These qualities are found in the differential motion shown in the accompanying illustration, which motion also reduces to a minimum the power to be transmitted through the cone belt. All of the gears on the jack shaft revolve in the same direction as the shaft and thus all "retarding friction" is eliminated, and more than this, the jack shaft which revolves faster than the differential, helps instead of hinders its motion, resulting in more accurate winding and consequently more even and better work.

As seen from the illustration, the jack shaft A is fitted with a short cross shaft G, at each end of which is a bevel gear. The smaller bevel gear H, works into the bell gear bevel D, which is loose on the jack shaft, and the larger bevel gear F, works into the differential bevel gear E. On the other end of the sleeve which carries this latter bevel gear is a spur gear B, which is driven through carriers from the bottom cone.

If the bottom cone is raised and consequently not working the spur gear B, just mentioned, is stationary and there is no winding, the spindles and bobbins being driven at the same speed. When the bottom cone is running, winding takes place as the excess speed of bobbins over spindles is given through the spur gear B. The cones and cone belt, in the machine, are used only to give the extra speed required of the bobbins to enable the roving to be wound on. The spindle driving gear has 40 T. and is fast on the jack shaft while the bobbins are driven through the bell spur gear C 50 T. Therefore, when no winding is taking place, the jack shaft revolves ⅕ faster than the differential, to give the same speed of spindles and bobbins. The teeth on the various



gears of the differential are so proportioned as to take into account this ⅕ difference in speed. (Howard & Bullough American Machine Co., Pawtucket, R. I.)

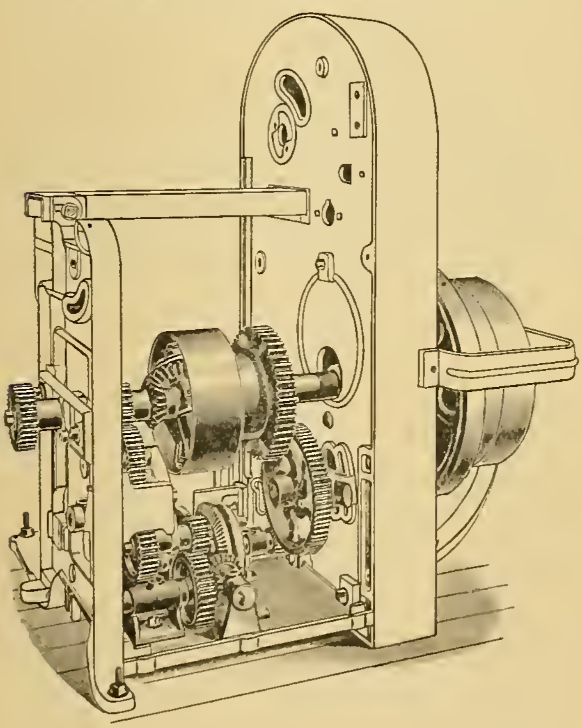
HOWARD & BULLOUGH'S LAY GEARING FOR SPEEDERS.

This arrangement of gearing was designed to afford every facility for effecting changes in the motion wheels controlling the lift. The parts connected therewith have been re-arranged, and two change places provided instead of one as in their former gearing.

Previously it was the practice to make the change by altering the wheel on the end of the reversing shaft, or the wheel on bottom of upright, gearing with the reversing wheels, but as this course was considered inconvenient and somewhat limited in range, two additional spur wheels, one of which is mounted upon a stud carried by an adjustable quadrant bracket, have been introduced. This latter is the additional change wheel, and can be readily replaced by one containing more or fewer teeth, as circumstances may require. To effect this object the short shaft carrying the bevel wheels is placed horizontally, instead of vertically, and the gearing is connected in the manner shown in the accompanying illustration.

In addition to providing two change places for the lift, this alteration also enables the back cross rail to be dispensed with, thus allowing free access to the main gearing. In fact, by removing this, any part of the gearing can be taken out and replaced with comparative ease. To further facilitate the removal of any of the gearing, the shafts upon which the wheels are mounted work in brackets, which are milled on the under surface, and slide in corresponding grooves in the framing and other supports. The parts are so arranged that it is impossible to fix any of them in the wrong place.

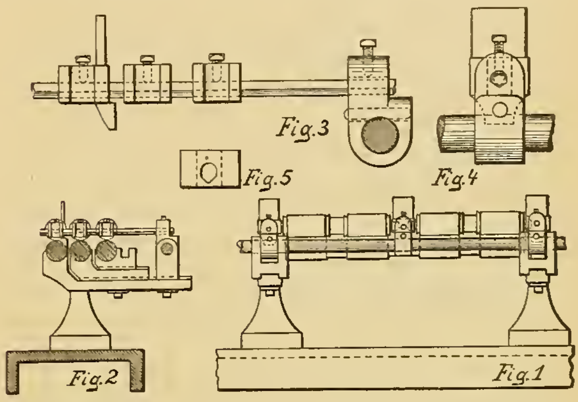
Another advantage of this arrangement is, that it dispenses with the necessity of altering the bevel wheel, gearing with the reversing wheels.



A horizontal bed plate is provided between the frame end and the first string piece, which, while serving as a rigid support for a portion of the gearing, also acts as a receptable for collecting any oil that may drip from the bearings. In connection with this new gearing an arrangement for locking the doors is provided so that the machine cannot be started with the doors open and the doors cannot be opened while the machine is running. This safety device does much to prevent accidents. (Howard & Bullough American Machine Co., Pawtucket, R. I.)

HOWARD & BULLOUGH'S ARRANGEMENT OF CAP BARS FOR SPEEDERS.

The figures below illustrate an improved construction of Cap Bars, which prevents the fingers or nebs



being twisted, and which at the same time reduces breakage to a minimum. Figure 1 shows view from back of frame of a cap bar applied to a machine with four spindles in a box. Figure 2 shows the end view of same, and Figures 3, 4 and 5 show enlarged details of cap bar.

As shown in these illustrations, the cap bar is fixed on the roller stand by an independent bracket, and the roller slides are free to move, allowing of the rollers being reset without moving the cap bar. The neb for the front top roller does not have to be disturbed as only the nebs for the other rollers have to be reset when moving the bottom rollers. (Howard & Bullough American Machine Co., Pawtucket, R. I.)

HOUGHTON'S STEEL THREAD BOARD,

comprising Houghton's hardened steel or porcelain thread guides, with steel or brass supports, adjusted either to a common (wooden) back rail or more properly to a Houghton metal back rail.

Thread guides and thread boards, as used in connection with cotton spinning frames and twisters, have until lately received little attention by inventors and mechanics, a feature proven by the fact that the thread boards and guides now in general use are about the same as those used 50 years ago. This assertion will certainly astonish cotton manufacturers more particularly, for the fact that they continually hear of improvements brought in the market in connection with cotton spinning machinery in general. Why the thread guide and its board was thus neglected, is certainly hard to understand, for they are just as necessary for spinning as a spindle, or ring, and any imperfections of the guide will cause trouble, just as quickly as imperfections in the ring or spindle. The breaking of ends during spinning or twisting is a matter that should receive the careful attention of the spinner, especially with the high speed of machinery that is now essential for economical production.

For causes for broken ends, we may quote badly worn or imperfectly adjusted rings or spindles, grooved or badly set thread guides. Since rings and spindles, as they are now made, are very near perfection, probably the commonly used thread guide is the cause for a large portion of these broken ends, since the same old thread board and guides, with all their imperfections, are still extensively used. Any cotton spinner will readily acknowledge that the nearer round spinning rings are, the less breaking of yarn and travelers, and that he would at once discard a ring that was badly out of round. He will also know, that in order to obtain the best results in his department, the mill must buy the best spindles and rings obtainable, and that in turn the thread guide should deliver the thread exactly over the centre of the spindle.

Central adjustment is required of all bodies revolving in conjunction with one another. The more perfect the adjustment, the less power required, and the results are correspondingly better. This physical law certainly also applies to cotton spinning. However, if this identical spinner will closely examine his thread boards, the proportion of guides that deliver the thread exactly over the centre of the spindle is very small, simply because it is practically impossible to adjust the common thread guides exactly, since one turn of the guide out or in, or in plain words, one-sixteenth of an inch, is the limit to their adjustment. Now again, one-sixteenth of an inch either way from the centre, however, makes one-eighth of an inch difference from the opposite sides of the ring, and a similar variation of the guide eye from the centre has the same action on the thread and traveler as a ring would that was so much out of round. A ring one-sixteenth of an inch oblong would be very quickly discarded by the spinner, while he will use without complaint a thread guide which he cannot place better than one-sixteenth of an inch either way from centre, and why will he use them? Simply because he knows they are adjusted as well as they can be. Many times, traveler, ring, spindle, or poor roving, are blamed for the threads breaking, whereas the fault rests with a badly adjusted thread guide.

Another important item for a thread guide, is its thread arrester, and which, unless it is held in right position, is the cause for many broken ends, for if this arrester is not in right position, it either fails to arrest the end when a thread does break, and lets the end whip around and break down the adjoining thread, or in other words, it catches and breaks a thread that is running all right. For this reason, many mills do not use this form of guide having a thread arrester, simply because it is so liable to become displaced, and injure the work rather than benefit it.

The grooving of guides is another cause for broken ends, and was undoubtedly the reason for the introduction of the so called "vibrating guide," and with reference to which there is a difference of opinion among spinners. It certainly cannot be disputed that vibrating the thread will prolong the wear of the guide, but as to what some persons claim, that this vibration permits the twist to run up to the bite of the roll better, we simply have to consider that while during spinning, the vibration one way is with the twist, the opposite vibration is naturally against the twist, and consequently the gain one way is offset by the opposite vibration. There will be also any number of spinners who will have found that the gain made by the longer wear of this guide, is lost by the greater breakage of travelers and the extra and uneven wear of the rings, caused by this vibration. The vibrating thread guide certainly cannot help but cause an uneven, jerky motion upon the thread and thus in turn upon the traveler, a feature certainly not in its favor.

We now might ask the question; what constitutes a perfect thread board? In answer we find: (1) Easy and accurate adjustment of the thread guides. (2) Permanence of adjustment of the thread guides. (3) The thread board to be of such a make to allow easy renewal of its thread guides when worn, and hold the new guides as solid as a new board would. (4) The thread board to be strongly made, so as to last as long as the frame, and this without any repairs. (5) The thread guides should be of some hard material to prevent grooving. (6) The thread boards should be made of some material that can be easily cleaned. (7) Permitting handy turning back of the thread guides for the purpose of doffing.

In wet twisting, the conditions are quite different from spinning, yet the requirements of a thread board for twisting are the same as for spinning, with the added complications caused by the action of water, which they have to meet. Nickeled brass seems to be the most suitable material for the thread board, as wood or steel are quickly injured by the action of water, and plain brass soon becomes sticky and hard to clean. While the thread guides may be, and are, made from brass wire, it wears out so quickly that it is not very desirable for this purpose. Steel besides being very expensive rusts so easily, and enamel wears off so quickly, that porcelain seems to be the most desirable material for a thread guide in wet twisting. One serious objection to the old style of porcelain guides now in use has been no adjustability, and this one thing, lack of adjustment, is probably the cause for 50 per cent. of the breakage in wet twisting.

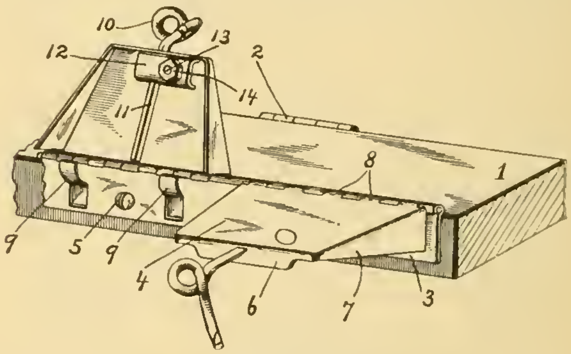


Fig. 1.

These requirements of a thread board, whether for spinning or dry or wet twisting, have been most excellently solved by the Houghton thread boards, as shown by means of the accompanying three illustrations, and of which Fig. 1 shows more particularly the adjustment of hardened steel thread guides to their supports and the adjustment of the latter to a wooden back rail. Fig. 2 shows two different kinds of thread guides, two steel thread guides, as previously explained, are shown down, the other thread guide, as shown turned back, referring to a porcelain thread guide, being shown in this position to illustrate the adjustment of the porcelain pot or eye to the support; all three thread guide supports being shown applied to a Houghton Metal Back Rail. Fig. 3 shows this Houghton thread board (thread guides, thread guide supports, and back rail) turned back for doffing.

The Houghton steel thread guide showing its adjustment to its support, and the adjustment of the latter to a common wooden back rail.

This steel thread guide is characterized by its easy and most accurate adjustment of its eye possible to the proper position over the centre of the spinning spindle, a simple constructed support for it, made of sheet metal, being also provided. A clear idea of this thread guide and the manner of its attachment to its support, will be gotten from the accompanying illustration Fig. 1, which is a perspective view of a portion of a common back rail of a spinning frame, showing two Houghton thread guide supports attached to it, each carrying their respective steel thread guide.

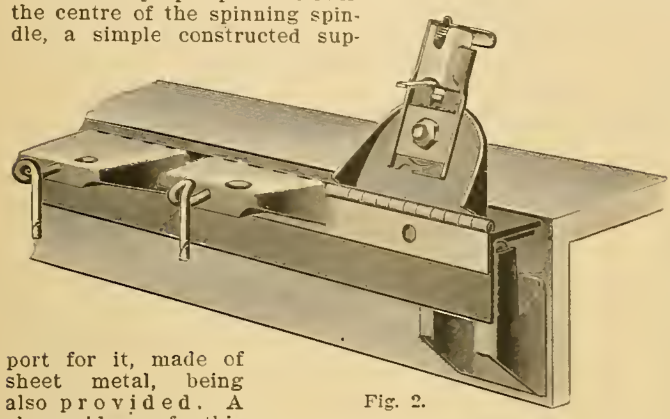


Fig. 2.

Referring to the illustration, 1 indicates a portion of a common wooden back rail of a thread board, which is hinged to the frame of a spinning or twisting machine by means of hinges 2. A sheet metal piece 3 is made as a portion of a hinge for the thread guide support 4, and is secured to the back rail 1 by means of screws 5. These pieces 3 also act to strengthen the board 1 and prevent it from warping, at the same time ensuring accurate spacing of spindles. The thread guide supports 4 are each stamped out of a single piece of sheet metal, forming a body portion and having a depending front flange 6 and side flanges 7. At its rear edge each support 4 is provided with sockets 8 for a hinge pin, and which are below the level of the upper surface of the support. This construction leaves the rear edge of each support entirely unobstructed, so that dirt or dust collecting on it can be readily wiped off.

The flat ends of the side flanges 7 of each support, form stops for holding said support in its normal horizontal position. Stops 9 made of part of the piece 3 and bent out into fingers, can be provided if so required, being however usually omitted. The thread guide 10 is made with an ordinary eye as with regular thread guides, but instead of having a round shank with screw threads at the end, this thread guide is made with a triangular shank 11, which prevents the guide from turning and displacing the snarl catcher and also allows the guide to be hardened without liability of breaking. These guide wires are made from a special drawn steel wire and will show no signs of wear after over two years continual use, without the threads vibrating, they simply have a highly polished appearance. Each thread guide is secured to its support by means of a clamping piece 12, which is U shape in cross section, the flanges or edges of which are notched to correspond to the triangular shape of the thread guide shank. Extending down through each clamping piece 12 from its support 4 is a blank headed screw 13, threaded onto the end of which is a nut 14. The head of the screw 13 fits into an integral socket in the support 4, and to hold the screw from turning, the head of the latter is provided with small wings or projections. By means of this construction, the smooth head of the screw is brought down flush with the surface of the support 4, so as to retain a smooth uninterrupted face over the entire upper surface of the latter. The thread guide is set in the position desired by simply loosening the nut 14, placing the eye so that it will be directly over the centre of the spindle and then tightening said nut 14, the triangular shape of the shank and its socket preventing any slippage by axial rotation. The guide wires thus adjusted are then held so firmly and solidly that when once adjusted they require no further care from the spinner.

As will be readily understood, these steel thread guides and their supports, as have thus been shown adjusted to a common wooden back rail, can, and more proper so, be also used with a metal back rail having counter balanced hinges, as is shown in connection with Fig. 2. In this instance the sheet metal piece 3 (see Fig. 1) is riveted to the metal back rail in place of screws 5.

The porcelain thread guide and its support. Fig. 2 shows one of these thread guides and its support turned back, in order to more clearly show its construction, *i. e.* the adjustment of the porcelain pot eye or guide, to its support. We see from it that these kind of thread guides have the same easy, perfect, adjustment to their supports as do the steel guides previously explained, and that each guide support is independent of the others, with a separate adjustment for each thread guide eye. The porcelain pot, i. e. porcelain portion of the guide eye, as will be seen from the illustration, is firmly held between the two upturned side flanges of the metal portion of the guide. Other features of this thread guide, as shown in connection with Fig. 2, are its metal threading finger, for guiding the thread to the eye as well as to hold the thread in the eye during spinning or twisting; a stamped out portion of the slot of the guide, bent up for the purpose of a snarl catcher, at the same time preventing any possible chance of the porcelain pot from sliding backwards; as well as the adjusting nut for regulating the proper position of the guide eye. All three thread guides and their supports are in this instance shown attached to one of Houghton's Metal Back Rails as compared to a common wooden back rail as was shown in connection with Fig. 1. The porcelain pot eyes, when grooved, can be removed, and this, as will be readily understood, at little expense (1½ cent per spindle).

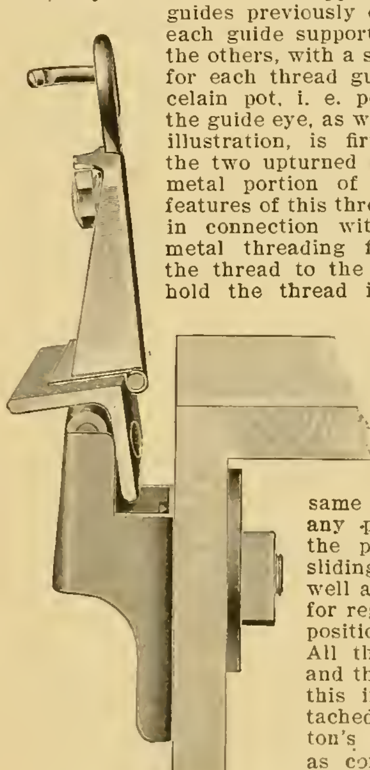


Fig. 3.

For wet twisting the metal portion of this thread guide and its support are made wholly of brass, in place of steel. These porcelain thread guides are a wonderful improvement over any kind of thread guide ever used for wet twisting, no other porcelain thread guide having any adjustment, neither do they have a snarl catcher. Actual use has proved this snarl catcher to be a great improvement.

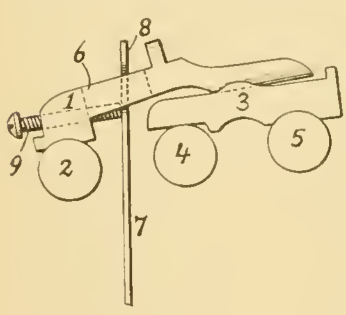
The Metal Back Rail for thread boards certainly is another most ingenious adjunct to any spinning or twisting frame. Its hinges, as carried in suitable brackets adjusted to the roller beam of the machine, are so constructed (counter-balanced) that the rail is held in position by its own weight, either while spinning or twisting (see position of back rail shown in Fig. 2) or when turned back for doffing, see Fig. 3, and requires no lifting device or brackets to hold it in the latter position.

In the old wood thread boards, some kind of lifting device and arrangements for holding up the rail while "doffing" has to be provided, and the operator must go to this device to lift and also to drop the back rail. This requires the operator to walk, twice the length of the frame at each doffing, a loss in time overcome by the new metal back rail, since the same can be lifted back or down from any point, and it being self balancing, by its own weight, naturally holds itself up when turned back for doffing, and also down in position for spinning. This saving in time for the operator as well as in the running of the machine, will soon pay annually the whole cost for thread board and metal back rails to any mill. This metal back rail will also prevent all warping or sagging which is characteristic of the wooden back rails used. This feature, considered with the necessity of humidifiers in a spinning room, will also be a strong point in favor of this metal back rail, since they are not affected by the moisture in the air.

DIXON'S TOP ROLL SADDLE FOR SPINNING FRAMES.

The object of the improvement is to provide an adjustable weighting arrangement for the top rolls, the arrangement consisting principally of a specially made top front saddle and a weight strap to be hung from said saddle.

The details of the arrangement are shown in the accompanying illustration, which is a side view, showing the front and rear top roll saddles, bearing on the journals of the top drawing rolls; and the front saddle provided with an adjusting screw, against which the weight strap bears. In the illustration, 1 indicates the top front roll saddle, having its front end resting on the front roll 2, and its back end on a pivot point on the rear saddle 3, the latter resting with its front end on the middle roll 4, and its back end on the back roll 5.



The front saddle 1, is provided with a vertical slot 6, in which the weight strap 7 hangs, the latter being provided at its top end with a widened part 8 which acts to hold the strap up. Projecting into the slot 6 from the front end of the saddle 1 is a screw 9 and against the end of which the weight strap 7 always rests, owing to the slanting position of the saddle 1, which causes said weight strap 7 to slide down until it comes in contact with the end of the screw 9.

By means of this screw, the resting position of the weight strap may be changed with a screw driver, thus changing the amount of weight bearing on the front roll to suit the requirements of the yarn being spun. The change may be made while the frame is running and the results immediately seen, thus making the proper regulation easier. (Dixon Lubricating Saddle Co., Bristol, R. I.)

ROLL CLEANING DEVICE FOR SPINNING FRAMES.

The object of this device is to provide a cleaning arrangement for the top rolls of spinning frames, which will automatically change its direction of travel over the rolls when it arrives at each end of the rolls, so that it will continuously travel from side to side between the stands on the machine, and thus require little if any attention from the attendant, who previously had to reverse similar devices by hand.

The new cleaner is shown in the accompanying illustration Fig. 1 in its cross section, Fig. 2 showing its application to the rolls. This adjunct to spinning frames is made of a double-conical form, with the larger portions of the cones forming the centre,

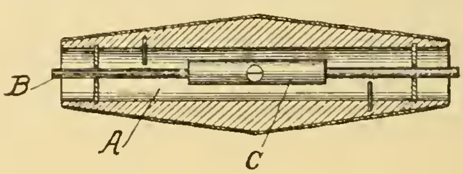


Fig. 1.

and is hollow, as at A, having extending through it a wire rod B, which is of greater length than the body of the cleaner. This rod is free to move through the cleaner and has secured to it at the centre of its length a weight C, which in turn rests in either end of the cleaner and holds it in one or the other tilted positions on the rollers, according to the end to which it is nearer. The weight C is prevented from sliding too far toward either end in the hole A, by means of suitable stop pins projecting from the top and bottom into the hole A, and thus in the path of the weight C.

It may be a question in some minds as to the reason why the cone shape of the cleaner should cause it to travel in the direction of the small end which is in contact with the rolls, for which reason a short explanation will be given.

We know that if a cylindrical roll was placed on the revolving rolls, it would receive rotation but would have no horizontal motion, because all lines, made on the surface of the cylinder by passing planes longitudinally through the centre of the cylinder, would be parallel to each other. But in the case of a cone, as used in this instance, the lines on the surface will not be parallel to each other, but since all of these lines must be parallel to the point of contact with the revolving rolls when they do come in contact, it will be easily seen that each successive line will come in contact with the rolls at a slight distance from the previous point, which distance may be measured by dropping vertical lines from the intersections of these lines on the surface with the base of the cone and measuring the horizontal distance between them.

For example, say we want to find the horizontal movement of the cone during one-half of its revolution, then considering the point of contact D as one point to measure from, we find the other point by dropping a vertical line from the point E to the roll and measuring between the point and the line. It will also be seen from this that a greater angle on the cone will produce a correspondingly larger movement of said cone for every revolution.

Referring again to the cleaning arrangement, when the cleaner is moving across the rolls, say for example, from left to right, it is held in its proper tilted position by the weight C with the rod B protruding from the right hand end of the cleaner. Situated on each side of the frame is a plate F for reversing the travel of the cleaner, said plates being provided with grooves G having small slots in which the bent pieces H rest, these being kept in place by spring attachments. Connected also to the bent pieces H are the circular plates I which are partly in the path of the travel of the cleaner. As the cleaner approaches one end, the wire rod B comes into that groove G and under the bent piece H which holds it down while the cleaner continues to approach, until it finally strikes against the plate I and pushes it back, which in turn moves the bent piece H outwardly, thus releasing the wire rod B, and as the weight C is now on the opposite of the centre of the cleaner, the latter will tip over and begin to travel in the opposite direction, until it comes to the

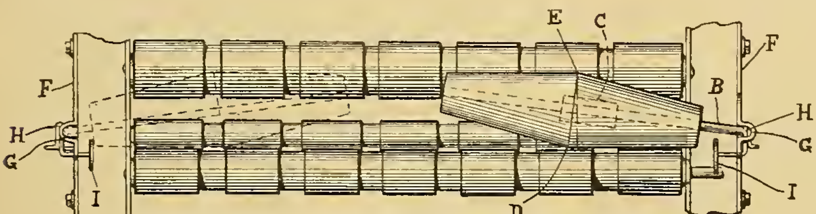


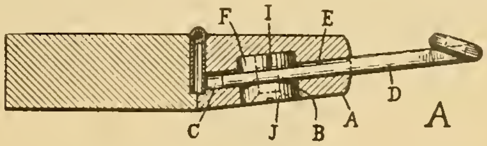
Fig. 2

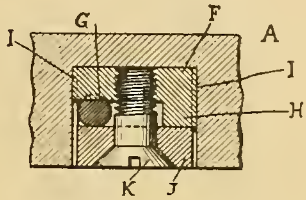
opposite end where the same reversing movement will be given to it. The object of the special arrangement for reversing is to make said reversing more positive, for in case only a plate was used for the rod to strike against, the weight is very liable to be pushed so slowly past the centre of the cleaner that it will often be balanced on the centre and stop the horizontal movement of the cleaner. (Victor Maheu, Willimantic, Conn.)

THE WHITIN GUIDE EYE FOR SPINNING FRAMES.

The improvement consists in a specially shaped guide eye and a clamping device on the finger boards of the machine, for receiving and clamping the stem of said guide eye, so that the same can be easily adjusted, *i. e.* bringing the eye in the proper working position, *i. e.*, directly over the centre of the spindle. The arrangement of the parts of the improvement is best shown by means of the two accompanying illustrations, of which Fig. A is a sectional view through the finger board of a spinning frame, with the guide eye and clamping mechanism shown in full lines; and Fig. B is an enlarged cross sectional view through the finger board, guide eye stem, and clamping mechanism. The letters of reference indicate the parts as follows:

A represents the hinged finger board of a spinning frame, having the circular recess B in its under side, and a small hole C located on the side of the recess B, to receive the stem of the guide eye D, which has the stem made with a flattened portion E on its upper surface. The clamping mechanism, which is





placed in the circular recess, consists of a circular clamping nut F, having the flat surface G, the projecting boss H, and the two fins I, which are pressed into the sides of the recess B and hold the clamping nut F in position.

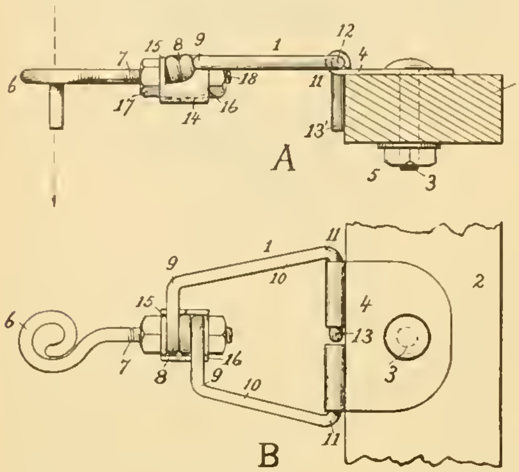
A circular clamping head J secures the flattened portion E of the guide eye D between the clamping nut F and the clamping head J, by having said clamping head J centrally countersunk to receive a screw K, which is threaded into the clamping nut F, and thus the left hand side of the clamping nut is pressed against the guide eye D with its right hand side acting as a fulcrum. To adjust the guide eye D, the screw K is loosened, the eye placed over the centre of the spindle and the screw tightened. (Whitin Machine Works, Whitinsville, Mass.)

GUIDE HOLDER FOR SPINNING OR TWISTING MACHINES.

This device consists in a wire guide holder arm composed of a single piece of wire, bent to form at its front a guide supporting coil, and at its rear a transversely disposed hinging axis, the latter being provided with a stop projection for sustaining the arm with the yarn guide at proper working position.

Fig. A is a side view and Fig. B a top plan view of this guide holder 1, shown attached to the thread board 2 of a spinning or twisting machine, by means of a bolt 3, extending through a hole in the attaching hinge plate 4 and thread board 2; said bolt being provided with a flat rounded head and a nut 5 on its lower end, thus permitting the hinge plate to be firmly clamped in position, while affording facility for lateral adjustment of the fore end of the guide holder by slightly swinging the plate to right or left on the bolt 3 as an axis. 6 is the guide eye, having a screw threaded shank 7, which in turn is secured in the guide holder 1, which is bent to form a coiled portion 8, that serves as a socket for receiving the shank 7 of the guide, and from which coil the wire members 9 on either side are disposed in outstanding relation and are thence extended rearward forming arm portions 10, their rear ends being bent inward at 11 or transversely offset in the same horizontal plane, to form the hinging axes or journal portions 12. At the end of one of these journals the wire is bent, as at 13, and terminates in the form of a downwardly projecting stop finger 13′.

Combined with the coil 8, a nut seating guard 14 is provided, the same consisting of a metal piece that bridges the coil and is provided with perforated end portions 15 and 16, that adjacently embrace the ends of the coil 8 and form parallel seats for the retaining



nuts 17 and 18, that are arranged upon the screw threaded shank 7 of the guide at front and rear of the socket. The sides of the guard 14 extend upward, and abut against the outstanding wire members 9 at either side of the coil, thus producing a firm structure and affording a stop against rotation of the guard when the nuts are turned against its ends. By the screw threaded shank 7 and nuts at the ends of the socket coil, facility is afforded for detachment and replacement of guide, as well as for the inward and outward adjustment of the guide to bring its eye in proper alignment with the spinning spindle when applied to use. (C. G. Tidemau, Worcester, Mass.)

STEEL SPINNING AND TWISTER RINGS.

Without question, the proper make of spinning and twister rings is of the greatest importance to cotton manufacturers, hence a description of a few of the most prominent makes, their points of advantage, will prove of the greatest of interest.

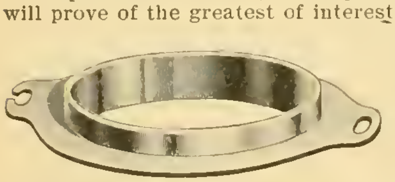


Fig. 1.

Fig. 1 shows what is known as the "*W. S. R. Co.'s Narrow Vertical Ring*," and which is a very popular style for twisters. These rings are reversible, a feature which naturally immensely prolongs their life.

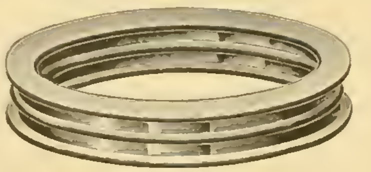


Fig. 2.

Fig. 2 shows what is known as the "*W. S. R. Co.'s Double Adjustable Ring*," and which can be used with either Cast Iron or Plate Holders, as preferred.

Fig. 3 illustrates what is known as the "*W. S. R. Co.'s No. 1 or Narrow Flange Ring*," which has a rapidly increasing demand, since by means of it a traveler can be used, made from a larger wire without increasing the weight of the traveler, a feature of immense value if we consider that if the traveler is made from heavier wire, its life is increased.

Fig. 3.

The Double Ribbed Burnished Spinning Ring. It is impossible, by any method of polishing, to produce a new spinning ring that will run as light as one that has been in use several months. Until new rings have become burnished by the action of the travelers, they have always caused a constant breakage of ends, an immense waste of travelers, a falling off in the quantity of yarn produced, and a loss in quality as well, to say nothing of the vexation among the operatives arising from the badly running work, the dissatisfaction among them caused by the increased labor they are called upon to perform, the consequent neglect of their regular work, and the serious effects of these evils upon all succeeding operations. These drawbacks have grown in seriousness as the speed of the spindles has been increased, and some remedy for these evils has been a long felt want.

Some years ago, the Whitinsville Spinning Ring Co., after many experiments, perfected a process by which this long felt want was supplied, the process being known as their patent metallic burnish.

Most remarkable results have been secured by the use of rings burnished by this process. Tests having shown that the use of the burnished ring greatly reduces the consumption of travelers, causes less waste, minimizes the breaking of ends when new rings are started, and materially improves the quality and increases the quantity of yarn spun. When we fully consider the amount of labor performed by the traveler, why should we hesitate to give it all the advantages we can? Often it is the most troublesome part of the supplies needed, because it is a continuous expense, and many are used. The burnished ring aids the traveler in its work, giving it every advantage in ease and lightness of running, since the less the friction between ring and traveler, the less the expenditure for travelers, the burnish reducing friction to a minimum.

Now that the varied advantages of the burnished ring have been set forth, just a word about its durability. When the burnished ring was first introduced, some spinners claimed that the burnishing would affect the life of the ring, and that rings subjected to that process would not prove as durable as rings burnished by the action of the traveler. Since these objections were raised, numerous tests have been made to ascertain the truth in regard to the comparative durability of the burnished and unburnished rings, and in every instance the burnished rings proved the more durable.

The greatest evil in cotton manufacturing is uneven yarn, the removal of which has been the aim and object of inventors and mechanics from almost the very inception of cotton spinning.

In connection with ring spinning, dirty travelers, *i. e.* travelers loaded with lint, are a prolific source of such uneven yarn. They render the yarn kinky and overstrained, seriously affecting the quality of the product in subsequent processes. Loose waste floating about the room gathers on the traveler, impeding the passage of the yarn, increasing the weight of the traveler, breaking ends, and adding materially to the work of the operative. Elastic yarns are the best, and the elasticity is largely controlled by the traveler. Unless the traveler is kept free from accumulations of waste or lint, we cannot secure the elasticity desirable, as the finer places in the yarn are so apt to break.

A remedy for that part which dirty travelers play in the making of uneven yarn is the *U. S. Standard Traveler Cleaner*, as shown in Fig. 4, and which keeps the travelers thoroughly cleaned, and does it automatically, requiring no attention on the part of the operator. This cleaner has many points of advantage, whose value will be readily recognized by practical spinners everywhere. It is neat, simple, cheap, durable, effective, easy to apply, always in place, and is self cleaning.

Fig. 4.

It is the simplest, because it consists of one piece of plain wire. No drilling or tapping of rails necessary to apply it. No screws needed to secure. No getting out of place when once in position.

It is the cheapest, because the cost of applying it is nothing.

It cannot get out of place, because it encircles the ring, is practically a part of the ring, and whatever position the ring may be in, the finger of the traveler cleaner is always at the proper distance from the flange.

It is self cleaning, because the angle given to the projecting finger prevents the accumulation of lint or dirt, and the circulation of air produced by the speed of the bobbin is sufficient to keep it clean.

Another device of the greatest importance to cotton spinners is a *Traveler Cup*, as shown in Fig. 5. This steel plate traveler cup meets a long felt want by providing a place in which travelers can be kept clean, and where they can be easily secured by the operator. The use of this cup saves travelers, and consequently enables the manufacturer to run his plant with greater economy. (Whitinsville Spinning Ring Co., Whitinsville, Mass.)

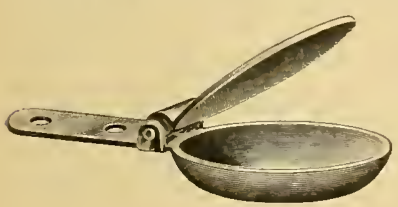
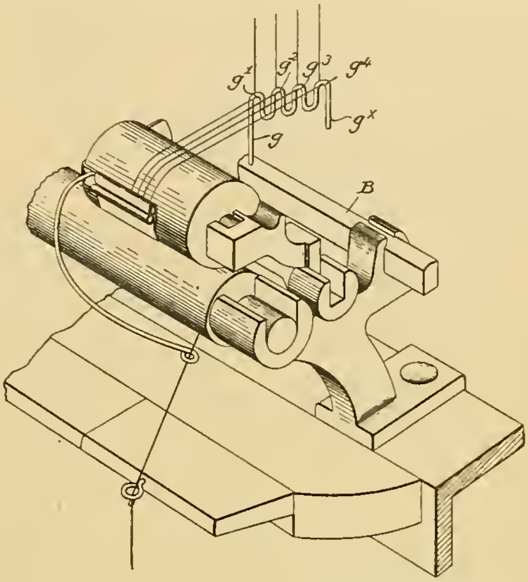


Fig. 5.

THREAD GUIDE FOR DRAPER TWISTERS.

The purpose of the new guide is to separate and in that shape guide the minor threads of a set of threads to be twisted in one compound thread, as they pass from the spools on the creel frame to the delivery rolls, so that the attendant can see at a glance whether or not all of the threads of the set are running properly, *i. e.* whether the minor threads of the set of threads as to be twisted in one compound final thread is complete, and thus if one thread breaks he can promptly piece it up. The guide also causes the threads to be delivered uniformly to the rolls, so that the twist is more uniform than where threads of the set are delivered collected.

The accompanying illustration is a perspective view of a sufficient portion of a twister, clearly showing the application of the new guide thereto. The new thread guide, as shown arranged in the illustration, to coöperate, for example, with a set of four minor threads, is made of stout wire, comprising an upright straight shank g, bent laterally at its upper end to form a head, the head being corrugated or crimped in the direction of its length to present a series of downturned open loops or eyes g^1 g^2 g^3 g^4, or as many loops as necessary, according to number of minor threads to be twisted in one compound thread, separated from each other by the intervening oppositely turned loops. The end of the wire at the



extremity of the head is extended downward, as at g^x, below the corrugations, to form a species of guard, to prevent by means of it any possible slack minor thread from leaving the guide, should said minor thread slacken sufficiently to swing down out of its proper eye. The shank g is secured in upright position in the transverse bar B behind the rolls, one of the guides being located back of each top roll for the set of threads passing thereto. (Draper Co., Hopedale, Mass.)

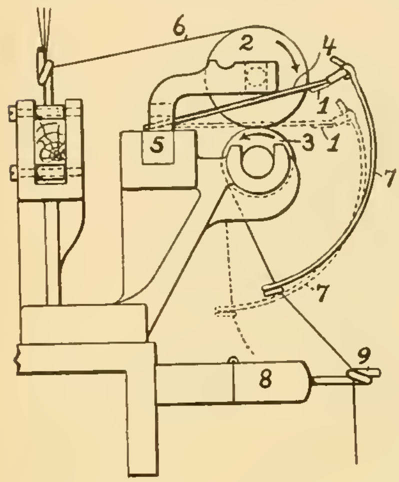
HOWARD & BULLOUGH'S TWISTER STOP MOTION.

The characteristics of this motion are its simplicity, light weight and quick action. The accompanying illustration represents a side elevation of a twister roll stand, showing this stop motion in full lines in its inoperative position; the position which it assumes after a thread breaks, being shown in dotted lines.

This motion is designed for twisting machines with single line top and bottom rolls, the yarn being delivered from the under side of the bottom roll. When the thread is running properly or unbroken, the motion is held so that the tongue 1 is away from the bite of the rolls 2 and 3 and the side wires 4 out of contact with the bottom roll 3. The free ends of the side wires are L shaped and limit the outward movement of the stop motion by striking the edges of the holes in the cap bar 5, through which the side wires project.

When a thread breaks, the stop motion falls into the dotted position shown in the illustration, and is then drawn back by friction of the side wires 4 on bottom roll 3 until the tongue 1 of the stop motion meets the bite of the rolls 2 and 3 and is drawn between them, this position not being shown in the illustration. This raises the top roll 2 and prevents it from revolving, thus stopping the delivery of yarn 6 by that roll.

The tongues 1 of this stop motion are made of German silver, so as to prevent wearing the rolls, and are shaped so as to lift the side wires from contact with the bottom roll, which prevents the side wires from grooving the bottom roll. The curved feeler wire 7, through which the thread passes, is pivotally connected at the top so that the thread board 8 with guide wire 9 can be lifted without damaging the motion.

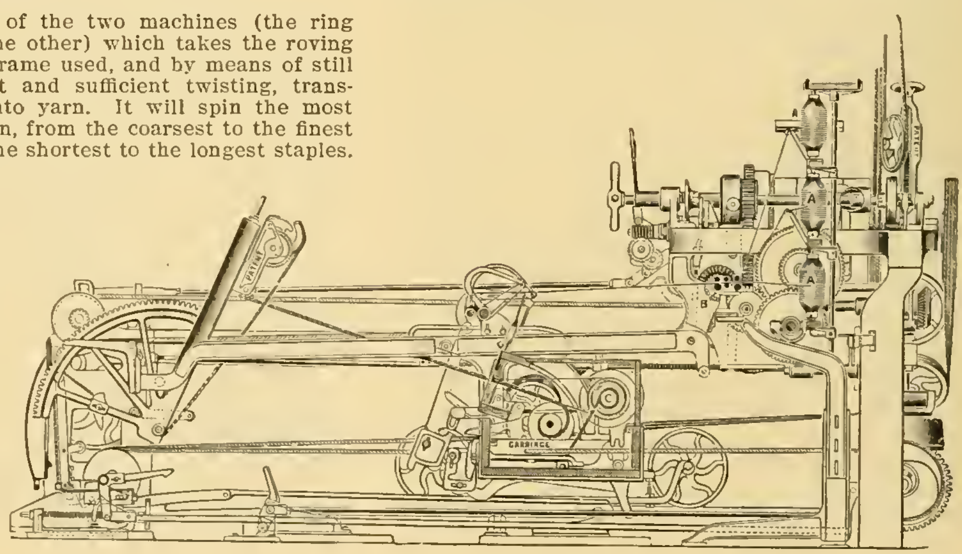


One of the advantages of this new stop attachment is that it is fastened to the cap bar instead of the top roll, and will not drop out when the top roll is removed. The pressure on the thread cannot be more than the weight of the motion as it is independent of the rotating parts.

The greatest advantages of this motion are the saving of waste and the prevention of singles. When twisting two ply yarns the device will operate if either thread breaks. As the top roll is stopped no yarn can be delivered until the end is properly pieced up, and the motion is designed in such a way as to keep the broken ends from catching the next ones and breaking them down. Machines equipped with these attachments can be started up after doffing without waiting to piece up. (Howard & Bullough American Machine Co., Pawtucket, R. I.)

PLATT'S SELF ACTING MULE.

The mule is one of the two machines (the ring spinning frame is the other) which takes the roving from the last flyer frame used, and by means of still further drawing out and sufficient twisting, transforms the roving into yarn. It will spin the most varied grades of yarn, from the coarsest to the finest qualities and from the shortest to the longest staples. The leading peculiarity of the mule is that, while the roller beams and rollers are fixed in one position, the carriage which supports the spindle has a backward and forward motion, to and from the roller beams. The illustration is a side elevation of this mule, showing the headstock containing the gearing for imparting motion to the whole machine, the creel containing the roving bobbins, the draft rollers, the square, viz., that part of the carriage which is underneath the framing of the headstock, and which contains some of the principal mechanism of the machine. The carriage contains the spindles on which the yarn is wound, the fallers, and the tin roller to drive the spindles; and the square contains the winding-on drum, etc. From the bobbins A, placed in the creel, the roving, either single or double as the case may be, passes through the draft rollers B to the spindles C, and by appropriate mechanism the carriage is made to travel outward from the roller beam, the tin roller being driven by ropes and the spindles by bands. The spindles are placed at an angle to the base line of the carriage, inclining towards the rollers, so that during the drawing out of the carriage, when the yarn is receiving the required twist from the rapid revolution of the spindles, the yarn may slip off the end of the spindle, and no winding takes place. Towards the completion of the outward run of the carriage certain changes in the gearing are made; the motion of the draft rollers B ceases, but the spindles C continue to revolve, and as the yarn is thus held by the motionless rollers a further stretch, called "after draft" or "jacking," may be given if necessary. This motion is, however, used only for certain classes of fine yarns. The spindles are then, by the mechanism of the headstock, made to revolve in the opposite direction to their first motion, thus unwinding the spiral coils of yarn on the spindles whilst the faller wire is being depressed to the proper position for guiding the thread on the spindle. In the final or third movement, the carriage begins its traverse towards the rollers, and as it runs in, the spindles revolve and wind on the spun and twisted length of yarn resulting from the previous cycle of movements. The length of the stretch averages about 64 inches, and according to circumstances up to five stretches per minute are made. As stated before, the mule will spin from the coarsest to the finest counts, and yarn has been spun to the astonishing degree of fineness of No. 400, that is, 400x840, or 336,000 yards, or about 190 miles in length, for 1 lb. of cotton. From 300 to 400 hanks to the pound are at times spun from Sea Island cotton. The mule illustrated shows rope taking-in motion, patent nosing motion and other improvements. (Platt Bros. & Co., Ltd., Oldham, Eng.)



PLATT'S SLOW SPEED AND JACKING MOTIONS FOR S. A. MULES.

The Slow Speed Motion employed in connection with this mule gives a slow speed to the spindles when the carriage is completing its inward run, and during the rise of the front or winding faller after the unlocking has taken place, its object being to control more effectively the winding of the yarn at the apex of the chase, and to coil a few turns on the spindle blade. By these means a firmer nose or chase of cop is made, and any tendency to produce snarled yarn is obviated; the motion is giving every satisfaction, particularly when spinning 80's counts and upwards.

A description of this motion is best given by consulting Figs. 1 and 2, which illustrations show that on the rimshaft there are two fast and two loose pulleys, with separate strap guiders and drums on countershaft, the broader fast pulley being for the purpose of driving the mule during drawing out, by a single broad strap in the usual manner, and the other for the slow motion in question.

The taking-in is driven as in the ordinary mule, by a band or rope from the countershaft, and during taking-in each strap is on its own loose pulley, and remains in that position until the carriage is nearing the termination of its inward run, when the slow speed is put into operation.

For the latter motion there is a bracket A, fixed to the spur of square with an adjusting screw, which carries a finger and bowl B, by which the period it is desired to put on slow speed, can be regulated. As the carriage is terminating its inward run, the bowl B comes in contact with an incline bracket C, fixed to a flat slide bar D, in front and on right hand side of headstock below the camshaft, and relieves a round slide bar E, attached to strap guider (on top of headstock over camshaft), which is holding the strap on loose pulley, thereby allowing the strap to go on the fast pulley belonging to the slow speed motion. On the winding or front faller shaft there is a finger F, which, at the completion of the unlocking of fallers, lifts up again the slide bar D, liberates a catch G, thereby allowing the slow speed strap to pass from fast to loose slow speed pulley. The ordinary broad strap on rimshaft is immediately allowed to pass from the loose to fast pulley by rod H, attached to strap guider, being liberated by the slide bar D, and then the mule commences its operation under ordinary conditions.

Platt's Jacking or Stretching Motion.

When this motion is used in connection with the S. A. cotton mule, the cam changes before the carriage completes its outward run; the jacking motion then draws out the carriage very slowly to the full extent of the draw or stretch. During this time the spindles are revolving at the full speed, and continue to do so until the twist motion forces the catch off to allow the strap to go on the loose pulley on the rimshaft.

The motion, as will be seen by consulting diagram Fig. 3, is arranged with the backshaft driving wheel connected to the arm of an epicyclic train of wheels, as shown in the accompanying illustration.

When the front roller catch box is in gear, the wheel G makes ⅔ of one revolution, whilst the front roller catch box makes one revolution, *i. e.* ⅔ revolution of arm *a*, and wheel G for one revolution of roller or wheel C. When the catch box is opened, and the front roller stops, then the arm *a* (or wheel G) runs at ⅙ speed of the catch box or wheel C, or in other words at ¼ the normal speed of carriage.

Other improvements in connection with this Mule which may be adopted, according to requirements, are: Automatic Nosing Motion, and quadrant box with 3 catches; Backing Off Chain Tightening Motion; Improved Construction of Square and Carriage Coupling; Guards over carriage wheels, rim band carrier pulley, middle drawing out from floor to scroll and

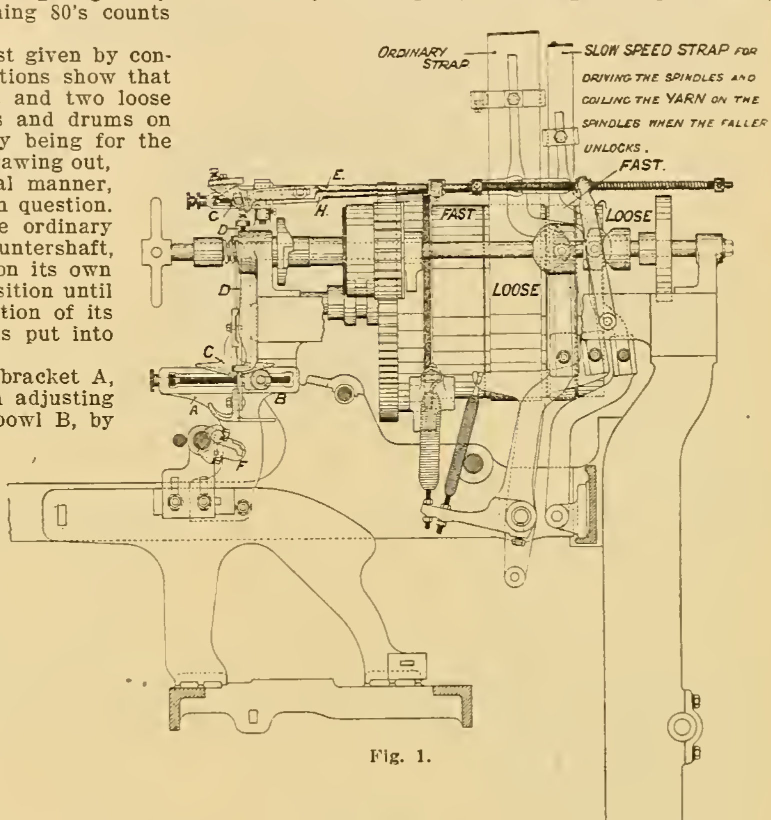


Fig. 1.

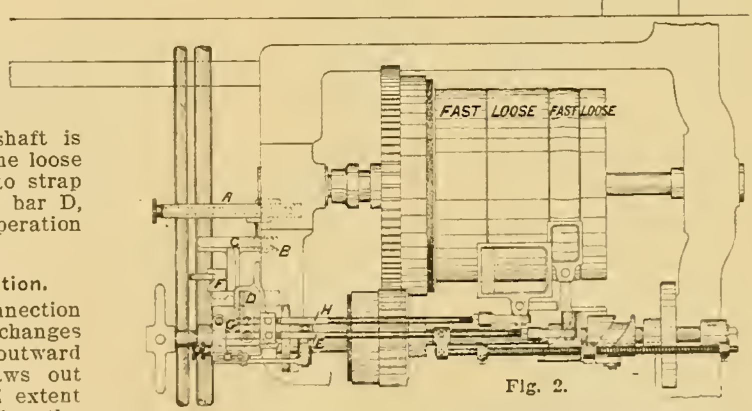


Fig. 2.

also over scroll, crown wheel, front roller pinion, change pinion and back roller wheel, backing off wheel on rimshaft, and a sheet iron guard behind the headstock; etc., etc. (Platt Bros. & Co., Ltd., Oldham, Eng.)

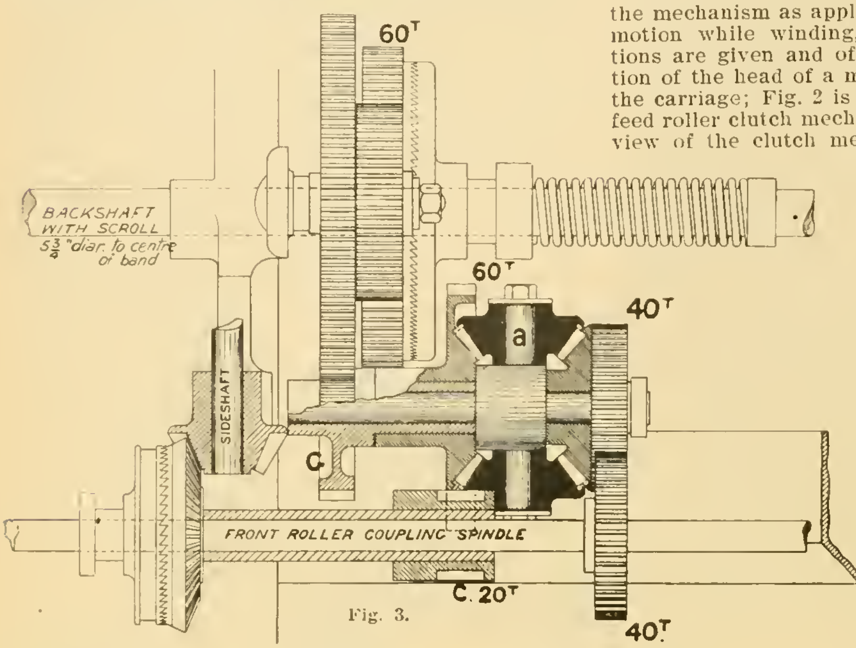


Fig. 3.

ANTI-SNARLING MOTION FOR SPINNING MULES.

This motion has for its object to prevent the forming of snarls or kinks in the yarn, by having it become slack for an instant, and when, owing to its twist, the same will have a tendency to kink. This slackness to the yarn occurs when the carriage has just run in and the fallers are getting into position ready for the next outward run of the carriage. When the fallers thus change positions, a certain amount of yarn (varying according to the varying size the cop has been built) is pulled off of the cop, producing in turn kinks, which to prevent is the object of this anti-snarling motion.

The principle by which snaring or kinking of the yarn under operation is prevented, is to start the feed rollers to deliver the roving a moment after the carriage has commenced its outward run, the cop in this manner taking up the slack as previously produced before any more roving is delivered by the feed rolls. In the same manner as thus providing this anti-snarling motion for the ordinary mule, the same can be used to start the feed rollers later on mules having a "roller motion while winding," that is, a short length of roving is delivered by the feed rolls during the run in of the carriage, and when a portion of the twist in the yarn runs down into the roving.

In order to explain the motion for starting the feed rolls after the carriage has started out, and the mechanism as applied to a mule using the "roller motion while winding," the accompanying illustrations are given and of which Fig. 1 is a side elevation of the head of a mule and the principal parts of the carriage; Fig. 2 is a vertical section through the feed roller clutch mechanism; Fig. 3 is a partial front view of the clutch mechanism, showing its connections and operation. The diagram A as shown in connection with Fig. 1 is a cross section of a clutch member on the feed roll, showing how it drives said feed roll.

Numerals of reference in the illustrations, refer to the different parts as follows: 1 indicates the feed roll which is driven through a train of gears to the clutch 2, the clutch member 3 being hollow and having two lugs 4, projecting inwardly from opposite sides of the member, to engage the fingers 5, secured on the feed roller shaft 1, and thus produce rotation of the latter. It will be seen that by having the lugs 4, of the clutch member 3, set in a position farther away from the fingers 5, when said clutch is rotated by having it thrown in clutch with the other member 6, the feed roll is not rotated for a correspondingly longer space of time, thus giving time for the slack in the yarn, as produced by the movements of the fallers, to be taken up. The clutch member 3, is positioned for each run out of the carriage by having a connection with the heavy sided (unbalanced) wheel 7, by means of a rope 7′ which fits into grooves on each. The wheel 7 is loose on the shaft 8 which is journaled in the part of the framing 9, said wheel having attached to its side a lug 10,

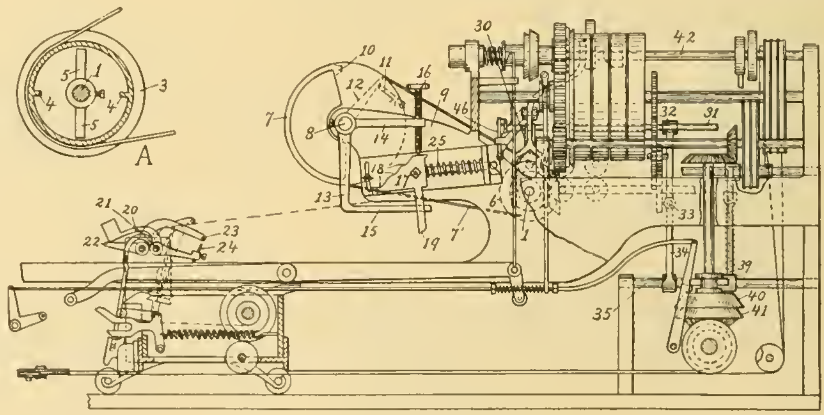


Fig. 1.

and a stop screw 11. Fastened to the shaft 8, is a stop finger 12, which projects between the lug 10 and the screw 11, and when the member 3 is out of clutch, the wheel 7 rotates in the opposite direction until the lug 10 comes against it. On the other end of the shaft 8 is secured a double angled lever 13, having both ends 14 and 15 extending horizontally toward the head of the mule. The setting screw 16 is fitted into the top lever 14, and has its end resting on the plate 17 when the run in of the carriage is made. The distance that the clutch member is turned back depends upon two items, that is, the distance between the lug 10, and the end of the screw 11, and the lowest position that the stop finger 12 can go. In order to have this distance made automatically variable to suit the different conditions of winding, the plate 17 is made use of.

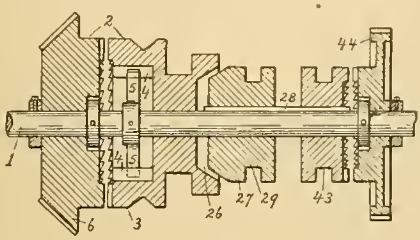


Fig. 2.

It has one side 18 so shaped that when it is moved backward, the screw 16 will fall lower and hence bring the stop finger 12 lower. On the under side of the plate is attached a projection 19, and on the carriage of the mule is placed a lever 20, centered at 21, having the back end, which is heavier, to rest on a projection 22 of the faller 23, and the other end of said lever 20 has a projection 24, which, when the faller rod rises too high, and takes off too much yarn, will strike against the projection 19 as the carriage moves in, and push the plate 17 in, against the spring 25, and when the point of the screw 16 will drop until it strikes the side 18 of said plate 17. By having the plate rest on a slant, it is only moved backward, as just explained, an amount to correspond with the amount of slack in the yarn.

When the carriage starts out and the clutch 2 is locked, the wheel 3 is rotated and in turn causes the wheel 7 to be rotated until the stop screw 11 comes against the stop finger 12, and raises it, causing the lever 15 to come against the framing 9, when said wheel stops and the rope 7′ slips in the groove until the clutch 2 is thrown again out and the member 3 freed. The heavy part of the wheel 7 causes it to rotate in the opposite direction until the screw 16 rests on the plate 17, thus the lugs 4 on the wheel 3 are positioned through the rope connection with the wheel 7, unless an extra amount of slack is made, when, as mentioned before, the fallers will raise, causing the projection 24 to come against projection 19 and push the plate 17 inward, allowing the screw to fall lower with a corresponding rotation of the lugs 4 from the fingers 5, thus delaying for a longer time the rotation of the feed roll when the carriage starts out. Immediately that the screw 16 is raised on the outward run, the spring 25 pushes the plate 17 out to its original position, to be moved again as the slackness of the yarn requires it. The screw 16 is adjustable, and can be moved by hand, which is done while the cop is building, as then the work is distributed between it and the plate 17.

When the "roller motion while winding" is used, an extra attachment is necessary, as the position of the lugs 4 in relation to the fingers 5 would be changed by the consequent rotation of said fingers on the feed roller shaft 1.

To prevent this relation from being changed after the lugs have been positioned, the clutch member 3 carrying the lugs 4, must rotate in unison with the feed roller shaft 1 during the extra rotation.

The right end of the clutch member 3 is provided with a conical shaped cavity 26, and a clutch sleeve 27 (sliding on key 28 on the feed roller shaft) fits into the cavity 26 and is also provided with a groove 29 in which a forked lever 30 slides. This lever 30 is secured to the horizontal shaft 31, which is fitted in proper bearings, and has connected to it near its other end a vertical lever 32, the other end of this lever being in turn connected to the horizontal rod 33. This rod 33 passes loosely through the top end of the vertical lever 34, which is rigidly secured to the rock shaft 35. A spring 36 is arranged on the rod 33 between a nut 37 and the lever 34, and another nut 38 is screwed on the rod 33 on the opposite side of the lever 34 from the spring 36. Attached also to the rock shaft 35 is a lever 39, one end of which controls the clutch 40 and 41, the other end being worked by the cam 42 through the levers shown in connection with Fig. 3. The clutch 40-41 controls the inward run of the carriage.

When the carriage completes its outward run, the clutch member 3 is thrown out and its lugs 4 are then positioned in relation to the fingers 5, as has been previously explained. The cam 42 in then throwing the clutch 40-41 in, rotates the rock shaft 35 and moves the vertical lever 34 in a left hand direction. This movement carries the horizontal rod 33 as well as the vertical rod 32 with it. The rod 32, being connected through the shaft 31 to the lever 30, throws the end of that lever so that the clutch 27 sliding in it will be forced into contact with the clutch member 3, and the clutch 27 being keyed sliding on the feed roller shaft 1, when it is in contact with the clutch 3, will cause it to rotate with the feed roller in unison. At the same time that the clutches 27 and 3 are thrown in contact, a clutch 43 is also

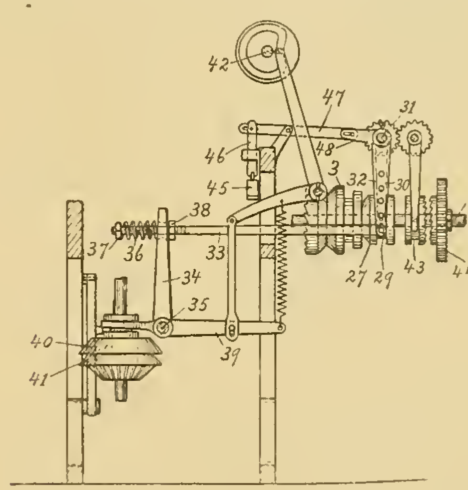


Fig. 3.

thrown into contact with a clutch member 44 carrying gear teeth, and which is continually rotated through a positive drive, by a connection not shown. This rotation is given the feed roll on the run in of the carriage and the position of the lugs 4 to the fingers 5 maintained. When the fallers are raised too high, and the plate 17 is pushed back, a wedge shaped head 45 forces bar 46 upward and through the levers 47 and 48 will rotate the shaft 31 and cause the clutches to move out of contact. (Timothy McAuliffe, Lawrence, Mass.)

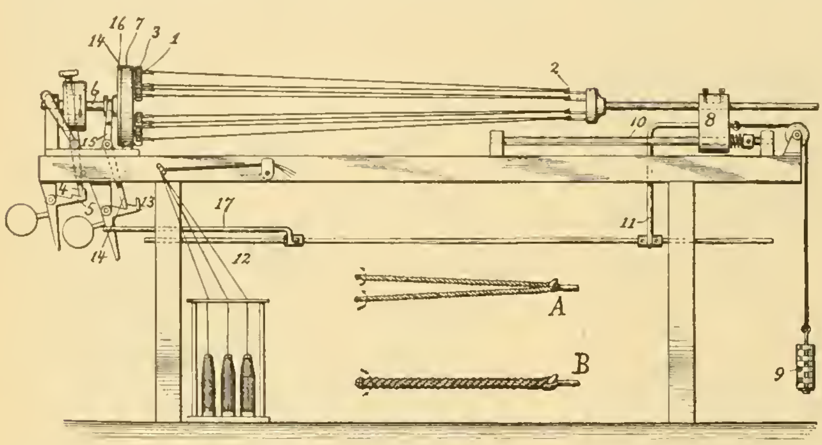
CULVER'S LOOP BANDING MACHINE.

The purpose of this machine is to produce in an economical manner the loop bands as used for driving the spindles of spinning and twisting machinery. Such bands are composed of cotton cord or yarn suitably twisted and doubled to form a loop at one end of the band by which the securing of the banding on the machine, where required to be used, is greatly facilitated.

The manufacture of these bands is done by means of loop banding machines, a specimen of which is shown in the accompanying illustration. It is organized to twist and double a number of the loop bands at one operation; it being claimed to be the first machine of its kind constructed in which two or more bands can be made simultaneously.

In the illustration of this banding machine (a side view of it), its length is somewhat reduced to show the relative proportions of the parts more clearly within a limited space. Detail illustrations A and B are given to show more clearly the formation of the loop band, viz.: A illustrates the operation of twisting the two strands of cord or yarn, and B the doubling of the banding.

The operation of the machine is thus: The machine having been adjusted to twist and double loop banding of the desired length, the operator secures the desired number of coarse threads to one of the twister hooks 1, then hooks the same threads over the corresponding loop hook 2, and secures the other ends of the threads to the other twister hook 1. Having thus formed one loop, the ends of which are fastened to the two twister hooks of the same frame 3,



the operator proceeds to secure in the same manner the other (five in this instance) strands of thread to the twister hooks of the other (five in this instance) twister frames. The operator now starts the machine by moving the belt from the loose to the tight pulley, at the same time moving the arm 4 one notch on the bell crank lever 5. Power is transmitted through shaft 6 to a gear (not shown), which engages with a series of gears, each of which is secured to a short shaft, journaled in standard 7, and thus communicated to the (six pairs in the present machine) twister hooks 1, through suitable gears and pinions in each of the twister frames, thereby twisting twelve strands in the machine simultaneously.

The twisting of these strands (see diagram A) acts to contract the same and draws the block 8 and the weight 9 toward the head stock. The block 8 is moved thereby on the rods 10, and this motion is transmitted through the rod 11 to the rod 12, until the end of the rod 12 engages with the bell crank lever 13, and knocks off the arm 14, when a spring (not shown) acts through the lever 15 to draw back the disk 16 and withdraw the pins as fast to the disk out of the way of the twister frames 3, thereby permitting the rotation of the twister frames 3 and the doubling of each of the pairs of strands into one band (see diagram B). The doubling of the bands continues to draw the block 8 forward until the end of the rod 17 engages with the bell crank lever 5, to knock off the shipper and stop the machine, when the operator removes the twisted and doubled loop banding from the machine and repeats the operation. (F. S. Culver, Taunton, Mass.)

HUMIDITY AND HUMIDIFIERS.

There is no doubt but that a warm and at the same time humid (moist) atmosphere is the one best adapted for the purposes of spinning cotton yarn, both conditions, heat and moisture, going hand in hand, and play a most important part in the production of smooth and strong yarn; for the fact that the cotton fibres are of a hygroscopic character, *i. e.* have the property of absorbing moisture, and in this way become, for the time being, less brittle, more pliable, and capable of being more thoroughly incorporated among themselves in the formation of a perfect thread. Electricity in the mill as produced by the friction of belts and other moving parts of machinery is a distributing agency among loose fibres and causes fuzziness in yarn, especially in dry weather, but when the presence of moisture in the air neutralizes this effect considerably. It is also for this purpose that a reasonable degree of humidity is desirable.

With reference to proper heat, this has long been easily enough attained by arrangements of steam pipes, made of wrought iron, through which high pressure steam is forced. The higher temperature of the steam enables a much larger radiation to take place than is possible with low pressures, and the pipes used are correspondingly smaller.

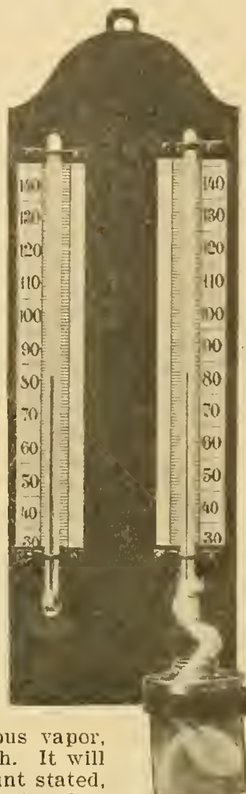
Although there are differences of opinion as to the proper temperature for cotton spinning, from 70° to 90° F. is the usual temperature, and while some spinners on coarse yarns are satisfied with 70° to 75° F., some spinners of fine counts may stop at nothing short of 95° to 100° F., but which may be considered quite unnecessary if proper attention is paid to humidificatiou.

The chief advantages of humidity and proper warmth in a spinning room are, that the cotton will work better, and having more elasticity will spin better, and in turn give better yarn, especially so on dry, hot days. In the card room, however, there is less need of humid atmosphere, besides there is danger of rusting the teeth of the card clothing or the needles of the comber, if such are used.

Regarding the proper amount of humidity to have present in a cotton spinning mill, about 60% of relative humidity is generally considered to be the most advantageous condition, that is considering fibre, machinery as well as the help.

However, as already previously referred to, humidity in a spinning room is not the only factor to be taken into consideration. For example, yarn may spin well say at 75° F., but if now the temperature should be raised, say 20° F., everything else remaining the same, there will at once occur a vast difference in the humidity of the room, although the actual amount of moisture in the room remains, showing that the relative humidity in the room changes with the increase in temperature.

The term, relative humidity, means the relation in percentage of the amount of moisture in the air at that time weighed in grains per cu. ft. as compared with the amount of moisture that the air would contain if it were perfectly saturated, and when any more moisture would be put in that space, it would be condensed or precipitated.



When entering any well heated room, you may notice that the air is very dry, having a parching effect, although as a matter of fact a cubic foot of air in such a room may contain just as much humidity as in a cubic foot of air outside, and yet we feel different, clearly showing that the actual amount of humidity in the air is not a deciding factor in our estimate of relative humidity. If a shallow dish containing water be placed in a warm room, said water will, by the natural process of evaporation, change into vapor, *i. e.* evaporate, the capacity of the atmosphere to absorb this water, or really hold it up in this invisible condition, varying according to the temperature in the room. The fundamental law for this evaporating of water is that at 32° F. a cubic foot of air will retain 2.13 grains of aqueous vapor, while at 100° F. it will retain 19.84 grains of aqueous vapor, *i. e.* about ten times as much. It will hold no more than the amount stated, the air being then saturated, *i. e.* has its maximum vapor tension or pressure. If the temperature of this saturated air is in turn lowered, if it is compressed into a smaller volume, or if an attempt should be made to add more moisture to this fully saturated air, then the moisture already in it will begin to be deposited in the form of dew, the temperature at which it does this being called the "dew point," which in turn varies according to the temperature of the moisture, *i. e.* the elastic pressure of the particles of vapor increases as their temperature increases, the air itself having nothing whatever to do with the humidity, it simply being a convenient vehicle for heating the vapor as rising from the surface of the water and in so doing increasing its elastic force and enabling still further evaporation to take place; the application of heat to the water itself causing vapor to be given off, and this rising in the atmosphere, will heat the air and so the same result naturally follows.

From the foregoing, it will be readily understood that the greater the heat of a room, the greater the amount of absolute humidity required in order to reach the same amount of relative humidity.

We will now consider the relative humidity. If air contains a certain amount of moisture, say about one-half of what would cause complete saturation, then the amount of humidity of the air is said to be 50%; so that when we say that air is "dry" we simply mean that the proportion of moisture in the air is little compared with if fully saturated, and for which reason cold air with little moisture in it may be very moist, while warm air with much moisture in it may be very dry; for which reason it will be seen that the expressions "dry air" and "moist air" are only relative terms, and simply express the proportion of aqueous vapor present at the given temperature compared with that which the same volume of air could hold.

It will thus be seen that the point of saturation, *i. e.* the "dew point" is the foundation of our estimate of "Humidity" or moisture in the air, and for which reason we must know this before the percentage of humidity in a room can be ascertained.

Absolute, Maximum and Relative Humidity.

Absolute humidity means the actual amount of vapor present in a given volume of air.

Maximum humidity means the amount of vapor that could be present in the same volume of air under precisely the same conditions of pressure and temperature.

Relative humidity means the ratio of the absolute humidity to the maximum humidity, and this is the humidity we are mostly concerned about with reference to cotton spinning.

The instrument for measuring the degree of relative humidity, *i. e.* drying power of the atmosphere, as we may say, is called the psychrometer or wet bulb hygrometer, or hygrometer for short, and consists of two delicate thermometers placed near each other, the bulb of one of which is kept wet, by being covered with a piece of muslin, the end of which (a kind of wick) dips into a small vessel filled with water. The accompanying illustration shows such a hygrometer, as manufactured by Queen & Co., Phila., Pa.

It is one of nature's laws that when anything evaporates, it absorbs heat, therefore, the water evaporating from the wick which surrounds one of the bulbs of the Hygrometer, absorbs or draws out the heat from the thermometer, thus lowering the temperature. The drier the air, the faster the water evaporates from the bulb and the greater the difference would be between the two thermometers. If the air would be perfectly saturated with moisture, there would be no evaporation taking place from the wick, and consequently the two thermometers would read exactly alike.

After ascertaining the difference between the two thermometers, by consulting table given on page 114 and which has been computed for this purpose by Queen & Co., the relative humidity may be read off direct. As for instance, if the temperature in the room was 100° F., according to the dry thermometer and the wet thermometer read 85° F., *i. e.* a difference of (100 — 85 =) 15°, then follow the air temperature column down to the 100 mark, and then follow that line out to the right until the 15th space = 54% humidity.

So fully have the benefits arising from a humid atmosphere been recognized by Cotton Manufacturers during recent years, that various methods of moistening the atmosphere, by specially constructed apparatuses, have come in the market. In some instances water is forced by means of special pumps at a strong pressure, generally of about 135 lbs. per square inch, and after having been filtered through a strainer inside a strainer box, through small apertures, and the water impinging against a fixed surface, which is about $\frac{1}{16}$ inch away, is broken up

Relative Humidity Table.

Air Temperatures.	Difference Between the Dry and Wet Thermometers.																													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
60	100	94	89	84	78	73	68	63	58	53	48	44	39	34	30	26	22	18	14	10	6	2									
65	100	95	90	85	80	75	70	65	61	56	52	48	44	39	35	31	28	24	20	17	13	10	6	3							
70	100	95	90	86	81	77	72	68	64	60	55	52	48	44	40	36	33	29	26	23	19	16	13	10	7	4	1				
75	100	95	91	87	82	78	74	70	66	62	58	55	51	47	44	40	37	34	31	27	24	21	19	16	13	10	7	5	2		
80	100	96	92	87	83	79	75	72	68	64	61	57	54	51	47	44	41	38	35	32	29	26	23	20	18	15	13	10	8	6	3
85	100	96	92	88	84	80	77	73	70	66	63	60	56	53	50	47	44	41	38	36	33	30	28	25	22	20	17	15	13	11	9
90	100	96	92	88	85	81	78	75	71	68	65	62	59	56	53	50	47	44	41	39	36	34	32	29	26	24	22	20	17	15	13
95	100	96	93	89	86	82	79	76	72	69	66	63	60	58	55	52	49	47	44	42	39	37	35	32	30	28	25	23	21	19	17
100	100	97	93	90	86	83	80	77	74	71	68	65	62	59	57	54	51	49	47	44	42	39	37	35	33	31	29	27	25	23	21

into an infinite number of fine particles, so as to humidify the surrounding atmosphere, whereas in other cases air is forced at high velocities over wet surfaces or through water, and the thus moistened air injected into the rooms.

Clarkson's Humidifier. The objects aimed at in the construction of this humidifier as manufactured by the Globe Moistening Co., of Fall River, Mass., is to provide besides humidifying the atmosphere of the room, also means to blow out the water and air nozzles, either or both, but principally the water nozzles, as well as means for automatically cleansing the exterior of the humidifier from dust, flyings, etc., as will always more or less collect on these apparatuses.

Of the accompanying illustrations, Fig. 1 is a vertical central section of this humidifier, and Fig. 2 a horizontal section of the cover turret at line x-x of Fig. 1 looking down. Fig 3 is a section of the water nozzle, and Fig. 4 is a sectional detail of the air escape in the lower cleaning ring.

A description of this humidifier is best given by quoting numerals of reference accompanying the illustrations, and of which 1 indicates the water basin, and 2 the water inlet to it. 3 is a strainer, constituting a lining for the bottom and side of basin 1. 4 is an integral upwardly extending flange extending around the water basin, and 5 is an upward extension of the side wall of the basin. 6 is a drip channel formed between the flange 4 and upward extension 5, and 7 the water escape passage from the channel 6 back into the basin 1. The basin cover 8 rests on upward extension 4, with its outer surface sloping downwardly into the drip channel 6 and its lower edge slightly above the bottom of the channel, so that drip water may fall off the cover into the channel and escape back into the basin 1. Cover 8 is formed with an air turret 9, having a plurality of air chambers, the cover 8 with its turret 9 being one casting. The cover 8 is formed within the turret wall 10 with vertical partitions 11, which form, with wall 10, the four quadrant shaped chambers 12 and the intersecting chambers 13, which separate the quadrant chambers one from another. The turret 9 has two independent chambers 14 and 15 in its upper part, chamber 14 communicating with the four quadrant chambers 12 and the chamber 15 communicating with the four intersecting chambers 13.

Cover 8 is provided with six vertical water nozzles 16, which are held in the cover and project outwardly thereof in line with corresponding horizontal air nozzles 17, which are each screw socketed (removable if any of the nozzles become bruised,

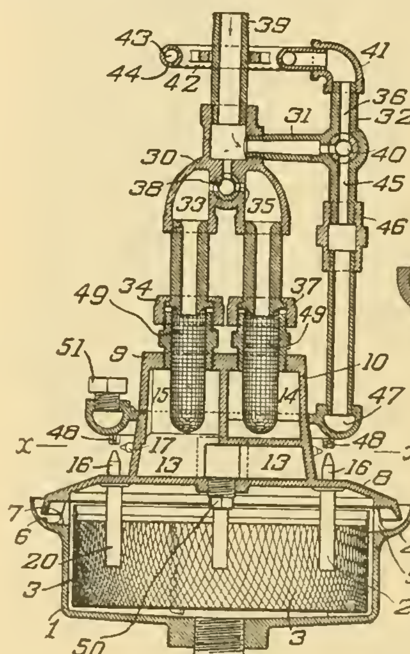


Fig. 1

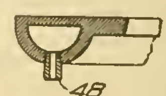


Fig. 4

Fig. 3

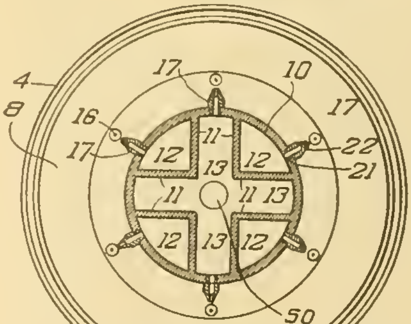


Fig. 2

jammed, or clogged) in the wall of the turret and lead into the described air chambers therein. The water nozzles 16 are formed with exterior screw threads 18, the exit orifices 19 being constricted relatively to the water tubes 20, which extend from the bottom of the nozzles down into the water basin 1.

The working of a humidifier may be here again referred to, and which consists in that when air is forced through the air nozzles 17 across the water nozzles 16, that water will be sucked up through tubes 20 and distributed as a spray into the room.

30 is a three way cock-body having a side outlet 31 to another three way cock-body 32. Cock-body 30 has its way 33 coupled with turret chamber 15 by a coupling 34 and its way 35 coupled with turret chamber 14 by coupling 37. 38 is a three way valve for cock-body 30, and 39 is the air inlet nozzle to cock-body 30. 40 is the three way valve for cock-body 32. 41 is a coupling connecting way 36 of cock-body 32 with the cleaning ring 42, which is chambered at 43 and provided with a plurality of perforations 44 on its under side, so that air may be blown through the perforations down on the humidifier to blow off dirt, lint and waste, as will always more or less collect on it in a cotton mill, and thus keep the apparatus clean. Cock-body 32 has its way 45 connected by a coupling 46 with the chambered jet cleaning ring 47 (extending circumferentially all around the humidifier), which is provided with air escape ducts 48, discharging against the exits of the air and water nozzles 17 and 16 respectively, and more particularly directly against the latter exits, blowing down into them. Consequently if the water nozzles become clogged a discharge of air under considerable pressure through the air escape ducts 48 will blow out lodgments in the water nozzles, and at the same time also blow off lodgments on the outer surface of cover 8. Screens 49 are employed to prevent any foreign matter from being drawn into the air chambers 12 and 13, the upper ends of these thimble shaped screens being secured in the couplings 34 and 37 respectively. The air turret 9 is formed with an orifice stoppered by a removable plug 50, and when consequently by taking off cover 8 and removing plug 51, the turret can be readily cleansed, if necessary. Similarly the jet cleaning ring 47 is provided with a removable plug 51.

When the two three way valves 38 and 40 are open, air under pressure will come in at 39 and be discharged not only through the air nozzles 17, but also through the orifices 44 of the cleaning ring 42 and the jets 48 of the cleaning ring 47. By properly turning valve 40, air may be wholly shut off from both cleaning rings 42 and 47 respectively, or admitted to one or the other ring, as desired. Again by properly turning valve 38, air may be shut off from either turret chamber 14 or 15, as desired.

SILK.

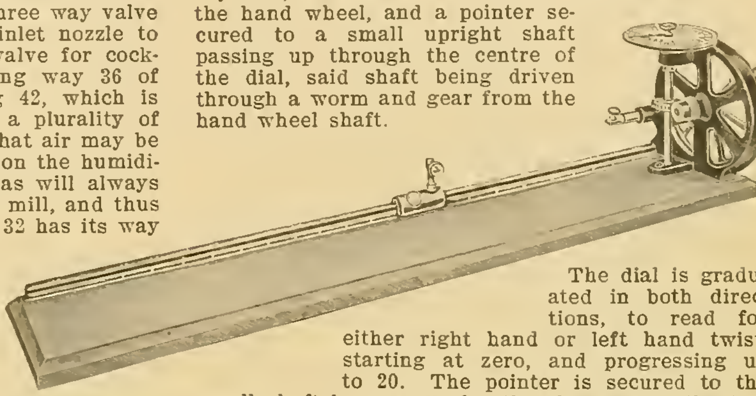
SIPP'S TWIST TESTER FOR YARNS.

This tester is characterized chiefly by the simplicity with which the number of turns per inch in the yarn tester can be ascertained, in fact it is so constructed that after turning the twist out of the length of thread under consideration, the number of turns per inch can be read directly from the dial, without requiring any calculation whatever. The construction and operation of the tester are best shown by means of the accompanying illustration, which is a perspective view, showing clearly the arrangement.

It consists principally in an arrangement for holding the thread to be tested, and an indicating arrangement for the turns per inch.

The yarn holder is made up of a revolving clamp for holding one end of the thread, and which is driven from the hand gear wheel shown, through a small pinion on the end of its shaft. A clamp for holding the other end of the thread is placed on a collar which is adjustable on a graduated rod, which is divided off into 20 inches, the clamp being held in any desired position by means of a set screw in the collar holding the upright clamp.

The indicating arrangement consists of a stationary dial, situated above and a little to the side of the hand wheel, and a pointer secured to a small upright shaft passing up through the centre of the dial, said shaft being driven through a worm and gear from the hand wheel shaft.



The dial is graduated in both directions, to read for either right hand or left hand twist, starting at zero, and progressing up to 20. The pointer is secured to the small shaft by means of a thumb screw at the top, and can be easily loosened so as to set said pointer back to zero, without having to turn the handle until it travels back. This, of course, saves a great deal of time, especially where a number of tests have to be made.

In making tests, it is advisable to use 20 inches of thread to be tested, then the turns per inch can be read directly off of the dial after untwisting the thread, because the gearing is so arranged that 20 turns of the revolving clamp will be made while the pointer progresses one whole number on the dial, thus the number indicated on the dial by the pointer, will be the number of turns in one of the threads. In case a less number of inches of yarn are only available for testing, simple calculation is all that is required, viz.:

Using 10 inches of thread—divide number indicated on dial by 2
" 5 " " " " " " " " 4
" 4 " " " " " " " " 5

For other lengths of thread to be tested the turns per inch would have to be figured from proportion, for example, suppose only 12 inches are to be tested, then we would have the proportion

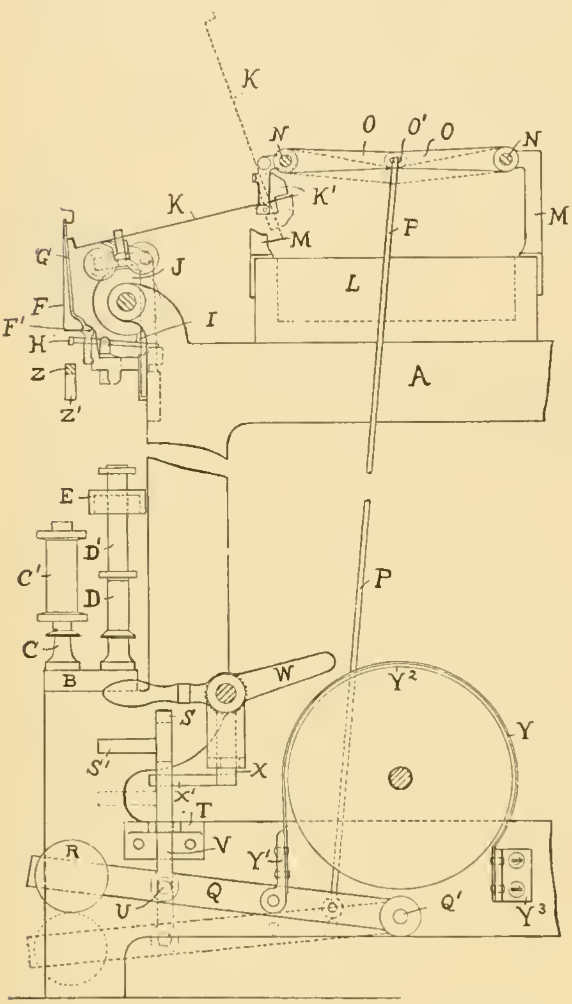
20 : 12 :: number indicated on dial : number turns per inch. (Sipp Electric & Machine Co., Paterson, N. J.)

TYNAN'S SILK SPINNER AND TWISTER.

This machine refers to that class of silk-spinning machinery in which the thread, after previous "cleaning," is wound from one bobbin onto another, at the same time putting "twist" into the thread. In connection with the spinning and twisting devices of the machine, there are combined two stop motions, one for operating the fallers when a supply thread breaks, the other acting to stop the supply bobbins (and this without operating the stop motion first referred to) at the moment when the shipper lever is shifted onto the loose pulley.

The accompanying illustration is an end view of the machine, clearly showing the several mechanisms referred to, one "bank" only being shown; if a double-bank machine, the spinning and twisting devices, with its "faller stop motion" and "kink preventers," are duplicated for the other side.

A is one of the side frames of the machine, and on which is mounted the spindle rail B. In this spindle rail B are mounted the two series of spindles C and D, one series carrying the supply bob-



bins C^1 and the other carrying the bobbins D^1 onto which the thread is wound. From the bobbins C^1 the thread passes up and around guide and feed rollers and thence down to the bobbin D^1, on which it is laid by a ring traveler mounted on the ring rail E, said traveler putting at the same time the required twist into the thread.

The fallers F of the "faller stop motion" normally remain in vertical position (as shown in the illustration), *i. e.* resting against the faller stand G, but if a thread breaks on its passage from one bobbin to the other, said faller drops down so that the portion F^1 engages with the end of lever H, rocking said lever and bringing its tooth 1 into engagement with the driving roller J, and thus (through intermediate connections) stop the machine. With this stop motion is combined another stop motion, acting either in connection with said faller stop motion or independent when the machine is stopped by the operator.

This second stop motion arrests at once the rotation of both series of bobbins and simultaneously throws the lever K (technically called a kink preventer) upward, carrying any paid-out supply thread up with it, thus keeping the threads from becoming slack and forming kinks which always are a disadvantage to perfect yarn.

On each end of the bobbin-supply box L, as mounted on top of the frame A, is secured a bracket M, in which are formed bearings for a shaft N, which extends the entire length of the machine, and has mounted on it the weighted levers or kink preventers K, said shaft having at the driving end of the machine secured to it an arm O provided with a hole O^1, into which is hooked one end of a rod P, having its other end secured to a lever Q, pivoted at Q^1 to the frame of the machine, and carrying at its outer end a weight R. At about its middle portion the lever Q is provided with a stud U, which enters a hole in a latch V; said latch slides in a slotted bracket T and has at its upper end a hook S and handle S^1. On the frame of the machine and above the latch V, is mounted the shipper lever W, formed with a part X and extension X^1, the latter being adapted to engage with the latch V.

A shoulder on the inner end of the bracket T holds the latch V and, in turn, the lever Q in raised position (see full lines in illustration), as is the case when the machine is running, but when the machine is stopped for any cause whatever, the extension X^1 of the shipper lever W engages the latch V and forces the same from its notch in bracket T, thus allowing the lever Q to drop into position shown in dotted lines.

To the lever Q is also secured a brake band Y, by means of a buckle Y^1, said brake band extending over a brake pulley Y^2 fast to the driving pulley of the machine (not shown), provided the same is driven by means of fast and loose pulleys, or to one of the friction members in case the machine is driven by friction device. At its other end, this brake band Y is fastened to bracket Y^3, thus when the lever Q drops, as previously mentioned, the brake band engages the brake pulley Y^2, and thus immediately stops all running parts of the machine. On the dropping of the lever Q the rod P is simultaneously pulled down, which in turn causes the shafts N to be rocked, causing the balanced lever (kink preventer) K to be tipped so that the weight K^1 is overbalanced and the lever K raises (to the dotted line position shown), carrying the thread with it, and thus prevents kinks in the yarn.

In order that the operator is able to stop the machine without the faller stop motion to operate, a bar Z is provided, extending all the way across in front of the machine, resting on support Z^1 and adapted to be brought in contact with the ends of levers H to thus control their operation.

To stop the machine, the operator first raises this bar Z and next knocks off the shipper lever W, which drops the lever Q, and in turn operates, as described, to throw the levers K upward simultaneously with the stopping of the machine. (Joseph E. Tynan, Paterson, N. J.)

TYNAN'S SILK DOUBLER AND TWISTER.

The purpose of the machine is the doubling and twisting together of several single silk threads (after the latter have been previously "cleaned" and twisted as the case may have required) into one thread. The amount of twist to be put into the yarn is regulated by the fabric the yarn is intended for, some fabrics requiring more, some less, again, some hardly any twist.

A uniform count (*i. e.*, size) of the yarn with an equal amount of twist (turns per inch) throughout said yarn, and this without any imperfections (technically known as "kinks," caused by loose-running supply ends) in the yarn, are items of the greatest importance to the manufacturer, since only then can he produce perfect fabrics. To accomplish these results, the new doubler and twister is provided with a stop motion, which stops the revolution of the bobbins from which the several supply threads as to be twisted are drawn, simultaneously with the stopping of the rotation of the spindle of the machine, caused either by the breaking or running out of one of the supply threads, doffing, etc. In other words, the motion of every part of the machine is arrested at the same moment.

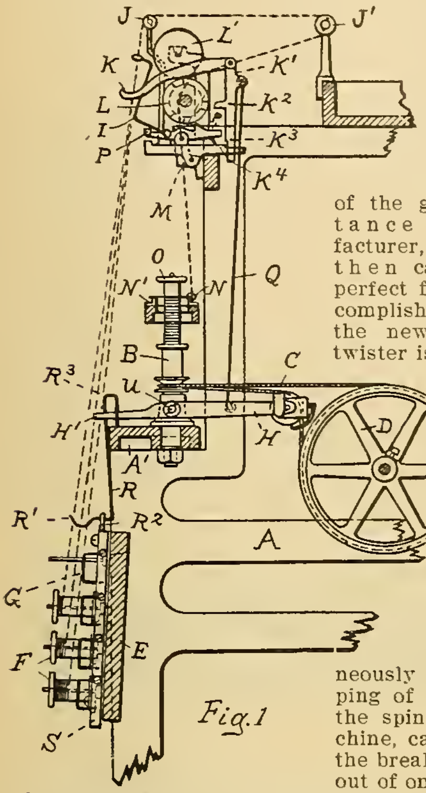


Fig. 1

To explain the operation of the different motions of the machine, the accompanying illustrations are given, and of which Fig. 1 is a vertical cross section of the machine, showing the threads being drawn from bobbins placed upon a creel, said threads, after passing over guides and feed rolls, being twisted and laid upon the bobbin on the twister spindle. Fig. 2 is a front elevation, enlarged compared to Fig. 1, of the creel with the supply bobbins, the brake bar and the bobbin brakes. Fig. 3 is a plan view, slightly enlarged compared to Fig. 2, showing the action of the brake mechanism upon a supply bobbin.

Examining illustration Fig. 1, we find on the frame A of the machine the spindle rail A^1, in which the spindles B are mounted, said spindles being driven by means of driving band C from driving pulley D. On the frame A is also mounted the creel board E, upon which are mounted, as required, one, two, three, or more banks of supply bobbins F, said bobbins being acted upon by brakes G.

Each thread, as to be in turn doubled with one or more similar threads, after leaving the bobbins F, passes up and through a faller I, from which they pass as single threads over and partly around guide rollers J, J^1 and feed rolls L, L^1, and thence through a guide eye M to the traveler N (as adjusted to ring rail N^1), and in turn onto the bobbin O as carried on spindle B. The rolls L L^1 revolve, and feed the threads to the traveler N, which puts the required amount of twist into the yarn. The roller L is provided with mortices adapted to be engaged by a claw formed on the rock lever P whenever said lever is rocked by the dropping of a faller I on account of its supply thread breaking.

Above this rock lever P is situated a lever K, having a latch K^1, which is supported by a shoulder K^3 resting on the back end K^4 of the faller stand, a lug K^2, limiting the drop of said latch K^1. To this latch K^1 is pivoted one end of a wire link Q, the other end of it being connected to the movable lever H, over which the driving band C passes.

When a faller I drops, the lever P is rocked, causing the claw as formed on the rock lever P to engage one of the mortices on roller L, thereby causing the lever P to be moved back so that it engages the latch K^1 and causes the shoulders K^3 to be pushed from its support. This causes said latch K^1 to drop and the lever H to be tilted, in turn slackening the driving band C and stopping the rotation of the spindles B.

For applying the brake to the bobbin simultaneously with the stopping of the spindle, the outer end of the lever H is provided with a fork H^1, which passes through a hook R^3 of a support R, connecting the end of lever H with the brake bar S (see Fig. 2). To this brake bar S are secured the brake wires G, which are bent at right angles at their end, as shown at T, in Fig. 3, for conveniently engaging the head of the bobbins.

The brake bar S is slidably mounted in slots S^1 on the creel E; thus it will be seen that when the lever H is tipped on account of the stopping of the machine, the front end H^1 of said lever H, as it raises (on account of the rear end of said lever dropping—see fulcrum U), will also raise the brake bar S (through support R), thus bringing the brake wires G into engagement with the heads of the bobbins, and at once stop the rotation of the same.

When the stop motion has thus operated, and the operator has to piece broken ends, he simply presses the support R inward, allowing the eye R^2 of the brake bar S to drop into the hook R^1 of

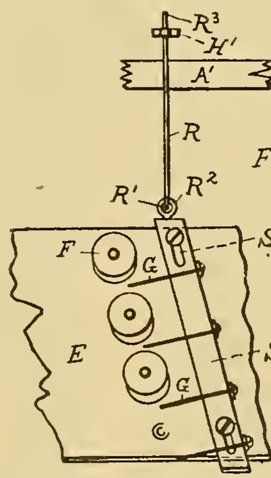


Fig. 2

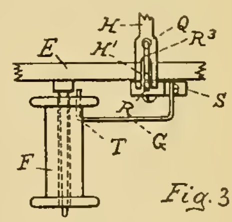


Fig. 3

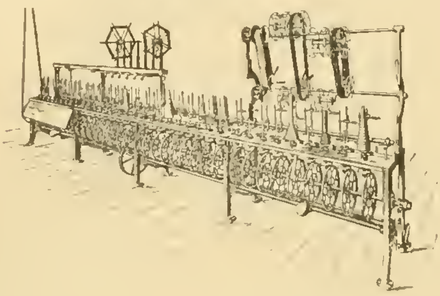
the support R, thus removing the brake wires G from engagement with the heads of the bobbins F, permitting the operator to piece any broken end.

When the machine has to be started, the operator presses down the lever K, thus raising the lever H, which in turn tightens the driving band C and starts the machine running, the hook R^1 at the same time springs automatically back into place and allows the brake bar S to assume its normal position. (Joseph E. Tynan, Paterson, N. J.)

WINDING, SPOOLING, WARPING AND BEAMING MACHINERY.

THE ALTEMUS HOSIERY WINDER.

A perspective view of this prominent winder for knit goods manufacturers, is given in the accom-



panying illustration. This winder is built with a variable motion for driving its spindles, and arranged to work either from pin swifts for hosiery skein yarns (as is shown at the left hand section of the machine in the illustration), or from wire swifts for woolen yarns (as is seen by consulting the right hand section of the machine in the illustration) as the case may require.

As will be readily seen from the illustration, the spindles of the machine are driven by friction, *i. e.* the disks of said spindles being driven by bearing on the periphery of their respective large friction wheels as situated in the lower portion of the machine.

A most important portion of this machine is its variable motion, which changes the position of the large friction wheels with reference to their acting on their respective disks of the spindles; said large friction wheels being made to move by means of a grooved cam as situated on the side of the machine, opposite to that carrying the fast and loose pulleys, bodily with their shaft laterally, and when consequently said friction wheels will change their position on the disk, *i. e.* work on a larger or smaller diameter of said disk, as the case may be. By this arrangement, it will be seen that the friction wheel will constantly change its position with relation to the respective friction disks, and thus produce the characteristic variable motion to the spindle as the cop is built. This variable motion is produced without gears, and consequently is simple in its construction and working, and easily adjusted.

The "guide" and the "former" of the bobbin in the machine, are combined with frictionless parts to the yarn, *i. e.* by porcelains, and as the yarn winds onto the bobbin, it raises the former wheel correspondingly. A yarn stripper, for cleaning the threads to be wound, is also provided to the machine. The power required for operating the machine is very little, and which consequently is another important item in favor of this machine. (Jacob K. Altemus, Philadelphia, Pa.)

THE NO. 50 UNIVERSAL WINDING MACHINE.

On pages 152 and 153 of Part 1 of this work a thorough description of the Universal Winding Method has been given, and which remains identical to their modern, otherwise designated as No. 50 Machine, in the construction of which the objects aimed at are: The highest practicable speed; The largest possible product; Occupying the smallest floor space; Requiring the least driving power; Running the least oil, wear and tear, and least care;

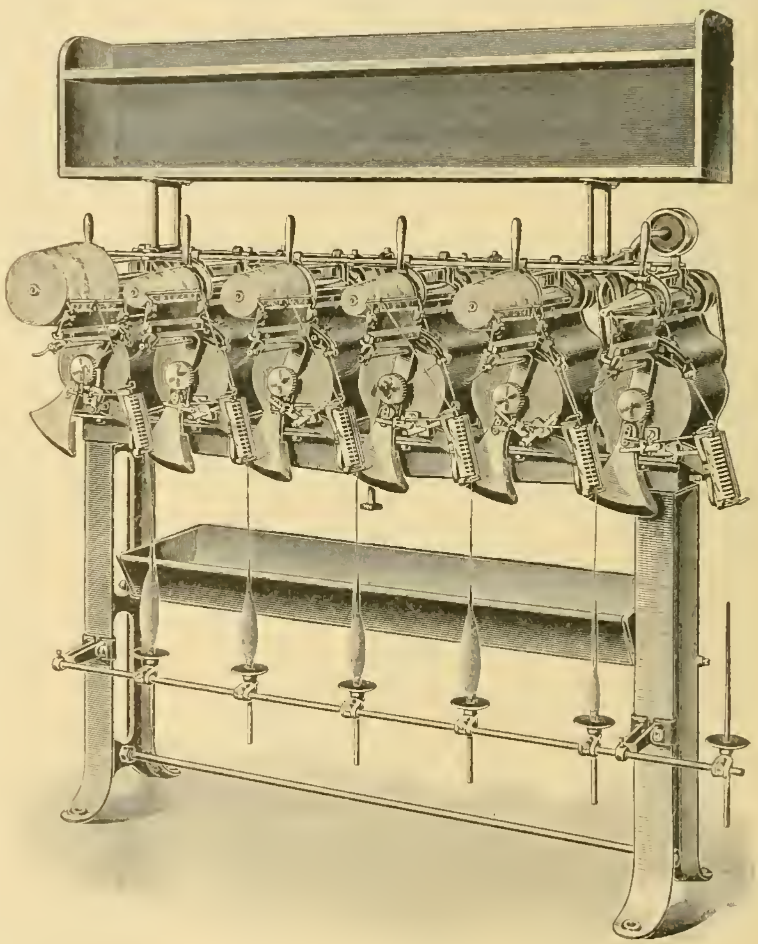


Fig. 1.

Making minimum waste, *i. e.* economical winding; winding the most compact and attractive package, and this in the best form for the market and for transfer purposes in mills.

This winder, as compared to other machines of this type, is essentially a high speed machine, and naturally requires a perfect oiling arrangement. Exhaustive study and experiment have resulted in the development of this element to the highest efficiency in this machine, the oiling being entirely automatic, *i. e.* self oiling, and requires no attention from the operator, except the filling of the reservoirs about once in two months. The spindle bearings are supplied through a new system of ring oilers, the gears run in an oil tight case, which also supplies the cam shaft bearings, and the idler pulleys carry their own reservoirs. Oil is constantly flowing from the reservoirs through the bearings and back again to the reservoirs, being used over and over again, thus reducing the cost of lubrication and care of machines. The machine is practically wear proof, and all bearings are absolutely protected from insinuation of lint or dust and also from leakage. This latter point will especially appeal to manufacturers, for in the handling of textiles it is vitally important to prevent damage to material by oil. Anyone having experience in yarn mills knows that the lint and fly deposited on machines act as a wick to spread the oil, and constant wiping will hardly prevent an accumulation of grease. In the Universal Winder No. 50, this problem has had effective treatment, and all exposed parts are kept perfectly free from oil. Besides the saving in wear and tear on the machine and in operators' time, by the effective lubricating system, there is also a considerable saving in driving power, the Universal Machine being guaranteed by its builders to be the lightest running winder of its class on the market.

Another item of importance that has been developed in the design of this new machine is the economizing of floor space. Considerable ingenuity is shown in the compacting of the structure, and the mechanism is lightened and simplified to the utmost extent, consistent with strength and durability. The new Universal Winder occupies considerable less floor space than usually allotted to similar types of machinery in winding rooms, and it lends itself to a grouping which secures the greatest economy of space with the highest operative efficiency.

The machine is built in two types, viz.: one for winding singles, the other for winding two or more ply. The first mentioned type of the machine, and of which a perspective view is given in Fig. 1, is more particularly adapted for winding soft spun yarn in conical form for delivery to knitting machines, whereas the other type of winder refers to doubling either 2 or 3 ends of fine yarn, in cylindrical form for delivery to twisters. In its general construction the latter resembles the first mentioned machine, the only difference being that the feeding attachments are in duplicate for each single end fed, the single ends as to be united, passing over a carrier pulley upon the top box of the machine, from which they descend to the spindle, previously passing through the traverse guide, which distributes the compound thread evenly over the cylindrical surface of the package. The regularity of the tension thus given to each single thread, produces such perfect alignment of the singles to be united, as to insure uniformity and full strength in the doubled yarn, and the finally twisted threads. Poor quality and waste from "cork-screw" twist as often caused by clearer waste or flyings being twisted in the yarn, making an inch or two of very coarse yarn, is entirely eliminated; an extra sensitive stopping device preventing the running in of loose ends. Spools are by this winder dispensed with, saving first cost and cost of renewal from loss and breakage incidental to their use; also a large percentage of labor in the operation of twisters is saved.

Tension. In winding soft spun yarn, retention of its elasticity and uniformity of twist is of primary importance, and special attention has been given to this requirement in the construction of the machines, by providing a sensitive, automatic tension device,

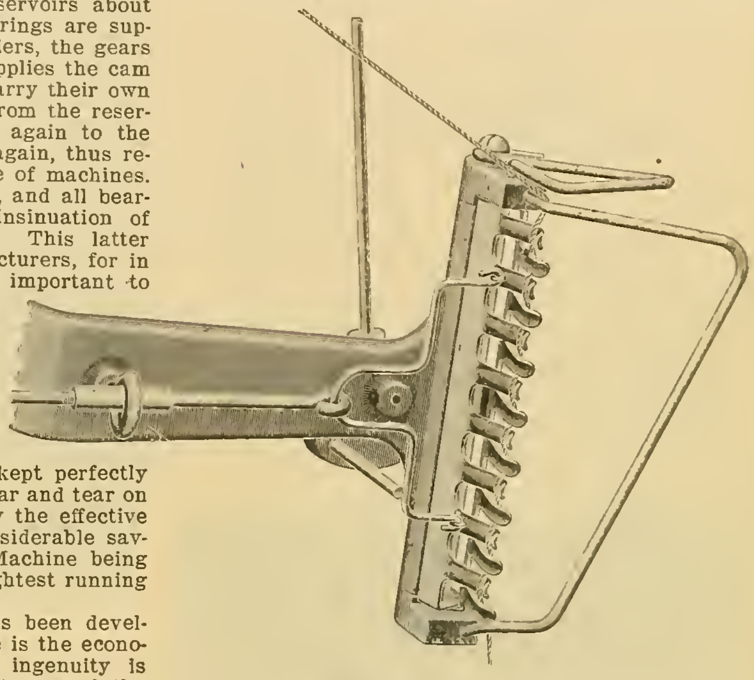


Fig. 2.

as shown more in detail in Fig. 2, the same consisting of highly polished steel blades with rounded surfaces bearing lightly against the yarn. These blades at the same time also act as yarn cleaners, by throwing off the loose specks and knubs from the surface of the yarn. As the package in process of winding increases in diameter, the tension on the thread wound is automatically reduced to compensate for the increased speed at which the yarn is drawn from the supply cop or bobbin. The tension can be adjusted with great delicacy for the finest yarns, thereby avoiding all strain and insuring delivery of thread to the winding spindle with perfect regularity. As the yarn is not injured by being drawn over rough felt pads or rigid supports, it retains all its original elasticity and strength.

Slub Detector and Stop Motion. The machines are also provided with a slub detector of improved design, which can be adjusted to clean all counts and grades of yarn, its object being to automatically stop the winding of the thread by the machine when a slub is present in the thread to be wound, the stopping in winding taking place without having to break the thread, the detecting mechanism acting as soon as the slub comes in contact with the detector rod of the device. A slub refers to any enlargement in the thread, caused by a large knot or bunch of fibres incorporated in a lump into the thread. This new device will enable the operator to readily cut the slub out of the thread and piece it together again in the cone winder; and without having to unwind, in connection with the winder for doubling purposes, a quantity of combined thread from the package on which it had been wound, in order to find where the "single" began, thus saving a great deal of time and waste material, besides producing a better wind than when the thread on the package had been disturbed.

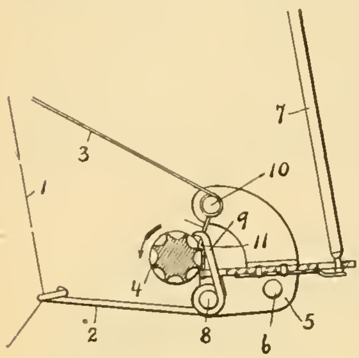


Fig. 3.

The new device is made to work in connection with the thread stop motion for automatically stopping the wind when a thread breaks, the details of both arrangements being best explained by means of the accompanying illustration Fig. 3, which is a side view of the new detecting mechanisms and the stop motion, showing the position of the slub detector when a slub in the thread has caused it to act to stop the winding on the respective cone.

Referring to this illustration, the thread 1 as coming from the cop (see Fig. 1 for it) is passed up through a regular tension arrangement (see Fig. 1 and 2 for it) to a drop wire 2 of the thread stop motion, and then through the eye of this wire to a


Fig. 4.

detector 3 of the slub detecting arrangement, which is provided at its outer end with a narrow longitudinal slit for the thread to pass through but small enough so as to prevent any slub from passing.


Fig 5.

From here the thread is passed to the winding arrangement (see Fig. 1 for it).

As mentioned before the two stop motions have a majority of their parts common to both motions, and consist principally of a rotating corrugated roll 4 and a movable plate 5 pivoted at 6, said plate 5 controlling the stop mechanism on the winding machine through the rod 7. The drop wire 2 is pivoted on the plate 5 at the point 8 and has its inner end 9 made hook shaped, so that when the thread 1 breaks and allows the drop wire 2 to fall, the hooked end 9 will come in contact with the rotating corrugated roll 4 and consequently be lifted by its continued movement, which in turn will cause the swing plate 5 to be lifted about its pivot 6, with the outer end connected to the rod 7 moving down at the same time, and through the proper mechanism stop the winding until the thread is pieced up again.

The detector 3 is also pivoted in the plate 5 at an upper point 10, and has its lower end 11 made with a shoulder about half way between the pivot 10 and its extreme end, which will engage with the revolving roll 4 when a slub in the thread comes under the detector 3 and raises it, since it cannot pass through the slit in said arm. The shoulder in the piece 11 prevents it from entering too far into the corrugations of roll 4, but enables the roll to raise it, which in turn through its connection to the plate 5 will raise it about the pivot 6 in the same manner as for the first stop mechanism, and thus prevent further winding until the slub is removed.

From the illustration which shows the detector 3, in the position for stopping the winding, it will be seen that a slub in the thread, instead of breaking the thread when it comes in contact with detector 3 will raise the latter and slide out of the slit, which will free the thread and at the same time stop the winding through the mechanism described, thus making the matter of cutting out the slub an easy and quick task for the operator.

The advantages claimed for the Universal Winder in comparison with Drum Winders, based upon an average of 15's single soft spun hosiery yarn may be summarized as follows: 40% saving in waste of material; 15% saving in labor cost of winding; 25% saving in cost of packing cases; 25% saving in freight on packing cases; 60% saving in mill floor space; 25% saving in warehouse space; 50% saving in power; 75% saving in oil; 75% saving in labor, (oiling and care of machines).

Universal Winding vs. Drum Winding. Since these two systems are frequently referred to in practical work in the mill, and as possible the average manufacturer is not thoroughly familiar with the difference in the principle of these two systems of winding, the accompanying two illustrations Figs. 4 and 5 are given. As previously mentioned, a thorough description of the Universal method of winding will be found in Part 1 of this work, showing on page 153 a completed package. Fig. 4 shows this Universal method of winding then explained, in connection with a portion of a package magnified, about five times its actual size; Fig. 5 showing (similarly magnified) a portion of a drum wound cone. (Universal Winding Co., Boston, Mass.)

TENSION DEVICE FOR LARGE UNIVERSAL WINDING MACHINES.

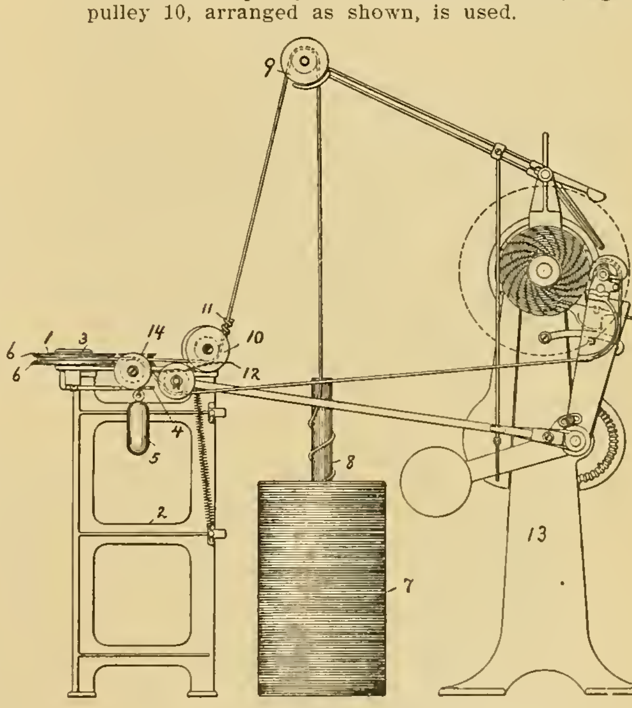
The new device refers to the very large styles of Universal Winding Machines, and is clearly shown in the accompanying illustration, which is a view illustrating the arrangement of the tension device in connection with their No. 7 winding machine, which in this instance is designed for winding heavy cord and twine in Universal packages of from 25 to 50 lbs. each. Hard twisted twine is very liable to kink and tangle in handling, and to avoid this and the knots resultant from breakages, the tension and cord controller is designed.

The tension wheel 1 is a grooved wheel which turns with or about a central shaft extending through an opening in a bearing constituting part of a frame 2, one side of the hub of the wheel lying upon said bearing, and at the opposite side of the wheel is a friction disk 3, which may be brought to bear with more or less pressure upon the side of the wheel, pressing the latter against its bearing, the wheel thus being clamped with more or less pressure between the bearings, so as to increase or vary the friction to any desired extent.

The disk 3 is connected with the shaft to which is pivoted a lever 4, bearing with its short arm upon some part of the frame and supporting an adjustable weight 5 upon its long arm, whereby the pressure upon the disk may be varied as required, while the disk is prevented from turning by the extension of the short arm of the lever into a slot in the frame. The cord or thread is laid in the groove of the wheel, and as the latter must turn with the travel of the thread, the friction applied to the wheel is brought upon the cord or thread, securing the desired tension.

In order to secure a positive adhesion of the cord or thread to the wheel, and at the same time permit it to enter and leave freely the grooves thereof, and also to cheapen and facilitate the construction of the wheel, the same is made of two sections, or parts, each having a hub section and a rim 6, and between the rim and the hub section extends vertically a series of arms, and when the sections are brought together the arms of one section alternate with the arms of the other section. The rims 6 are so disposed that when the sections are brought together the rims will be separated, while the arms extend from the rims toward the hub in such a manner that the arms of one section will intersect those of the other. The arms are bent or projected, each series to one side, so as to enter the spaces between the arms of the other opposite section, forming a substantially V-shaped groove at the rim of the wheel. Such groove, however, instead of having continuous opposing faces, consists of alternate ribs and spaces, so that the thread or cord which is laid in the groove of the wheel, instead of lying in one plane, is waved, being bent over each arm in the opposite recess, whereby even if the thread or cord lies loosely in the groove of the wheel, it will so bite or hold upon the arms thereof that there can be no possible slippage, and the wheel, of necessity, turns positively with the travel of the cord or thread.

In order to carry the thread freely from the supply 7, a post 8 is arranged axially on a line with and within the supply and around which the thread is coiled loosely, as shown, which tends to prevent it from twisting or tangling in passing from the supply. To maintain it in proper position in passing from the supply, a pulley 9 is arranged above or in line with the supply, and in order to direct the thread or cord from the said pulley to the tension wheel 1, a guide pulley 10, arranged as shown, is used.



The Guide Pulley is a grooved pulley, and to direct the thread properly thereto a guide in the form of a coiled wire 11 is used, and which guide is supported by the frame of the machine in proper position; and to prevent the thread from falling out of the groove of the wheel 10 a yielding finger 12 is used, being a spring finger fastened to the frame and extending into the groove of the wheel below the same or near the bottom and yielding for the passage of knots, etc. From the tension wheel 1 the thread or cord extends to the winding machine 13.

In order to secure an extended arc of contact of cord and tension wheel, the pulley 14, which conducts the cord to the wheel, is arranged as near as possible to the point where the cord leaves the wheel.

The lever bearing the roll 9 is pivoted and maintained at its highest elevation by a spring attached to the frame of the machine. A rod is also attached to this lever connecting with the stopping mechanism of the spindle, so that any depression of the arm will operate to stop the machine quickly. Where the twine in delivery from the package 8 kinks or tangles between that point and the roller 9, the arm is pulled down by the operation of the machine to such a point that the knock-off lever operates before the twine breaks. The operative can then remove the kink, and the arm being restored to its original position, the machine can be once more put in operation, thus preventing breakages and knots in the twine, and producing a better product. (Universal Winding Co., Boston, Mass.)

HORROCK'S STOP MOTION FOR HALL'S DRUM SPOOLER.

In the process of winding 2, 3, 4 or more ends together upon one spool for the purpose of afterwards twisting the compound strand into one thread, the requirement is that this winding is done with the minor threads kept at equal tension, with as few breakages as possible, and with the threads continuous in their length, that is, that no minor thread must be absent. Thus, a stop motion is required for these winders, which, if one of the minor threads breaks or runs out for one reason or the other, shall automatically stop the spool as well as the further winding of the unbroken threads, and this must be done before the end of the broken thread is wound upon the spool, since otherwise waste to the wound material would result by being compelled to unwind some of the wound compound thread until getting to the starting of the "single." To prevent this trouble is the purpose of the Horrock's stop motion, which is shown in perspective view in the two accompanying illustrations, showing the motion in its two extreme positions, viz: Fig. 1 shows Spool being driven by drum and winding, and stop-motion wires lifted clear of revolving triangular shaft. Fig. 2 shows spool lifted clear off drum, by raising brake lever—winding stopped—stop motion wires dropped and having been acted upon by revolving triangular shaft.

The threads 1 as coming from their respective cops or bobbins as arranged in the creel or cop or bobbin stand of the machine, are in turn conducted through clearer plates, over a drag board 2, which is adjustable, whence they pass through the eyelets of detector or drop wires 3, as are slidably mounted in a tilting box 4, over the carrier pulleys upon the top box (not shown) of the machine, from which they descend as a compound thread 5 to the spool 6, on their way passing through traverse guides (not shown), which distribute the yarn evenly over the spool. In operation, should one of the minor threads 1 break, the wire suspended upon it drops and comes in contact with the triangular shaft 7, which is revolving in the direction of the arrow. The wires 3, as mentioned before, are mounted in a tilting box 4, from the top of which there is a horizontal projection 8, holding in position a small prop 9, which is adjustably fastened to a lug 10. A movable break lever 11 is provided, pivoted at 12, having at its one end a shoe 13 to stop the revolution of the spool when said shoe goes into action, and at the other end a vertical piece 14, having at its upper end a pin 15, which has the spool carrier 16 as well as the lug 10, pivoted upon it. 17 indicates the drum which, by means of friction, rotates the spool.

When one of the threads 1 runs out or breaks, its detector wire 3, being thus liberated by the thread being absent or slack, will drop into the path of the revolving triangular shaft 7, causing in turn to tip the box 4, which in turn will release the prop 9, which then allows the brake lever 11 to rise, while at the same time the spool 6 and its carrier 16 descends to meet the rising brake shoe 13. Through this double movement, the brake is brought into action to stop the spool in half the time that would be taken if the spool did not descend. It is this remarkably quick action which has rendered this machine so popular with the trade. A severe test

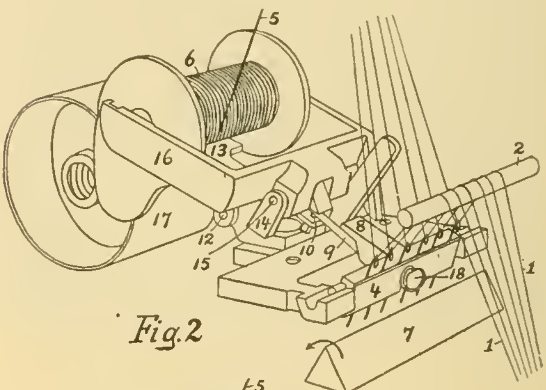


Fig. 2

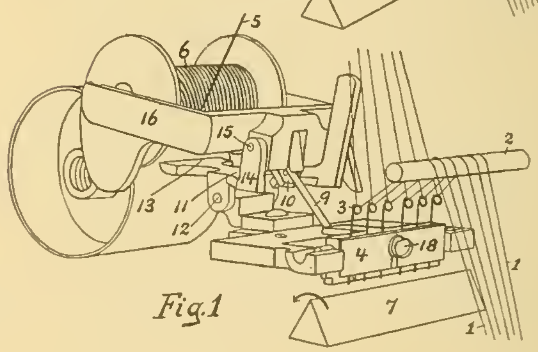


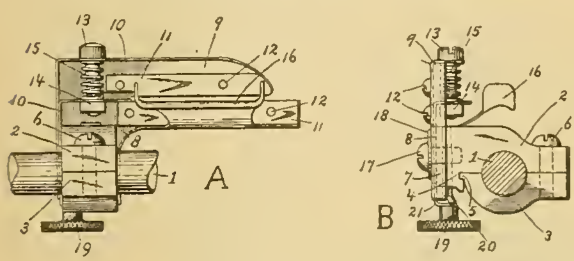
Fig. 1

was tried with this machine; that of breaking a thread at each cop or bobbin, the method of breaking being to hold the cop or bobbin, and in each case the end was left at some distance from the spool, thus enabling a new connection to be made without loss of time, omitting the making of waste by breaking the other minor threads as going on the same spool. There is thus no necessity or temptation to the employee to break down all the threads and tie them up together in a bunch knot, the presence of which in doubled yarns so greatly deteriorates them. Another common defect in doubling yarns for twisting, is the laying of the foundation for "corkscrewing," in the latter process, owing to one of the minor threads of the compound strand being wound at a different tension than the others. This trouble is overcome in the Hall winder, a perfectly uniform drag being given to each minor thread throughout the entire operation of doubling-winding. The machine will wind the most tender yarns, the drag being so easily adjusted that it does not affect the stop-motion, which is quite as quick in its action when winding tender yarns with little drag as it is with coarse yarns where more drag is desired, consequently permitting a change in winding fine counts and tender yarns to coarse counts and strong yarns, and vice versa, to be made immediately.

When less than six minor threads are to be doubled, loosen thumb screw 18 and remove the respective detector wires for threads omitted from box 4, after which tighten screw 18 again. (F. A. & P. Hall, Lawrence, Mass.)

HOUGHTON'S THREAD GUIDE FOR SPOOLERS.

The object of the improvement is to provide means, on a thread guide for spooling machines, for setting the guide to suit different counts of yarns, as well as for setting the guide to different elevations for different lengths of spools, at the same time providing means for introducing the thread parallel with the face of the thread guide jaws. The improvement consists essentially of a hub which is clamped upon the lifter rail, and jaw carrying pieces stamped from sheet metal, which have a sliding connection with the hub, in turn permitting said jaw carrying pieces to be



moved up or down so as to vary the elevation of the guiding jaws. This sliding connection of the jaw carrying pieces also permits a variation in the width of the slot between the guide jaws to be made to suit different counts of yarn. The accompanying illustrations will give a clear idea of the various parts of the new device.

Fig. A is a front view of the new thread guide, and Fig. B an end view of it showing the positions of the parts in their proper relations to each other. Numerals of reference indicate thus:

1 represents the traverse or lifter rail, which is moved up and down in the operation of a spooling machine and which carries the required number of thread guides. The thread guide consists of two castings 2 and 3, the top casting 2 being provided with a transverse groove 4 for receiving a tongue or projection 5 from the bottom piece 3, said parts being drawn together and fastened onto the lifter rail 1 by screw 6.

Projecting rearwardly from the top clamp piece 2, is a lug 7, forming a vertical way upon which the L-shaped jaw carrying pieces 8 and 9 are either individually or simultaneously adjusted. The jaw carrying pieces 8 and 9 are stamped from sheet metal and are provided with flanges 10 which serve to stiffen said jaw carrying pieces and also permit them to be fitted accurately together.

Mounted in each of the jaw carrying pieces 8 and 9 is a steel jaw piece 11, adjustably secured in place by screws 12.

To regulate the space between the steel jaws 11 in order to set the guide to different numbers of thread, a screw 13 is provided, which is threaded into a nut 14 and has a coiled spring 15 mounted on it, normally tending to separate the thread guide jaws 11, so that by tightening the screw 13, the slot between the jaws can be narrowed, while by loosening said screw, the slot can be widened.

In order to prevent the thread from binding while passing between the thread guide jaws 11, it should pass between the jaws on a line parallel with their faces, and to accomplish this, the lower L-shaped jaws carrying supports 8 are provided with an extension 16, having a rounding upper surface for guiding the thread in the desired direction and turned up ends acting as stops for preventing the thread from passing out from between the thread guide jaws 11.

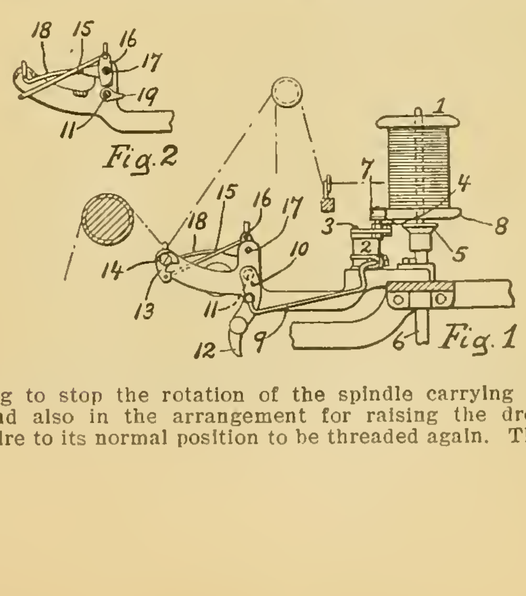
To secure either an individual or simultaneous adjustment of the jaw carrying pieces in the thread guide, the clamp screw 17 is turned to loosen the washer 18, which holds the jaw carrying pieces 8 and 9 in place, and when this has been done the jaw carrying pieces can be adjusted with respect to each other by turning the adjusting screw 13, or the jaws may be simultaneously raised or lowered to the desired position to compensate for variations in the lengths of spools. This last adjustment can, if desired, be done by hand, but an adjusting screw 19 is provided for the purpose, having a circumferential groove 20, which is engaged by a finger 21 extending therein from the jaw carrying piece 8.

When the thread guide is provided with an adjusting screw 19, the jaw carrying pieces 8 and 9 need not be clamped in place by the screw 17, but said screw and its washer 18 may be employed simply to hold the jaw carrying pieces in place, so that the adjusting screw 19 may be manipulated at any time without first loosening the screw 17. (L. T. Houghton, Worcester, Mass.)

PAYNE'S STOP MOTION FOR SPOOLERS.

The object of this motion is to stop the rotation of the respective spool when a thread breaks. The motion is so arranged that upon the breakage of a thread, the fallen drop wire will be automatically returned to its raised position, in which position the eye of the drop wire can be readily threaded for the continued operation of that spool.

This stop motion consists principally in an arrangement for raising the spool slightly when a thread breaks, in order that it may be stopped without hav-



ing to stop the rotation of the spindle carrying it, and also in the arrangement for raising the drop wire to its normal position to be threaded again. The details of the motion, as well as its method of operation, are best shown by means of the accompanying illustrations, of which Fig. 1 is a side view of the stop motion, showing the parts in the position after a thread is broken, and Fig. 2 is a side view, partly in cross section, of a portion of the arrangement for raising the drop wire into position after a thread breaks.

Referring to the illustrations, 1 indicates the spool upon which the thread is being wound. Situated in front of the spool is a loose sleeve 2, pivoted at 3, and having at its lower end a spring arrangement which tends to move said loose sleeve 2 to the position shown in Fig. 1, in its normal position, being entirely out of contact with the spool.

Situated on top of the loose sleeve 2 is a loose pin 4, which, when a thread breaks, comes under the spool 1 and raises it off of the supporting disk 5 of the spindle 6, and by means of a loose rubber wheel 7 coming in contact with the lower rounded head 8 of the spool, thus stops its rotation. Connected to the lower portion of the loose sleeve 2 is a rod 9, the other end of which is loosely connected to a gravitating catch lever 10, said lever being attached to a shaft 11. In its normal position this lever 10 is held practically horizontal by having its end 12 held by a catch 13 as pivoted at 14. It is through this catch 13 that the loose sleeve 2 is permitted to be acted upon by the spring arrangement, previously mentioned, and thus have the pin 4 to raise the spool.

Connected to the catch 13 is a rod 15, its other end being secured in a lever 16 as pivoted at 17, the drop wire 18 being also pivoted at 17 and movable with the lever 16. The drop wire is held in the position shown in Fig. 2 by a thread passing through its eye, and when said thread breaks, the end of the drop wire will fall and by its connection with the lever 16, will cause the same to move slightly to the left and through the rod 15, push the catch 13 out of contact with the catch lever 10, thus allowing the latter to act as previously explained.

On the same shaft 11, which the catch lever 10 is attached to, is a wiper arm 19 as seen in Fig. 2, and consequently when the catch lever 10 is released and swings down, it partially rotates the shaft 11 and thus causes the wiper arm 19 to press against the lower end of lever 16 and bring it back to its former position, and at the same time, the drop wire 18, through its connection with said lever, will be brought back to its normal position ready to be threaded again. When the thread which was broken has been properly pieced up, the catch lever 10 is snapped back into the catch 13, which action causes the spool to drop into its regular working position and begin to wind the yarn again. (George W. Payne & Co., Pawtucket, R. I.)

THE BARBER KNOTTER.

This device is designed to tie a spooler's knot more quickly and better than is possible with the use of fingers only, and in its working, comprises three principal operations in order to make the completed knot, viz.: making the loop for the knot, cutting the ends of the two threads to be united, and then making and drawing the knot tight.

A perspective view of the knotter is given in Fig. 1, showing said knotter as adjusted to the hand for operating, the mechanism being in the act of tightening the knot and stripping it from the tying bill. Fig. 2 is a top view, partially in cross section, showing the two threads being operated upon. Fig. 3 is a horizontal cross sectional view through the barrel of the knotter.

In order to tie a knot, two threads are laid by the operator on the side arm 1 and over a thread guide 2, said threads passing intermediately, over the tying bill 3 of the knotter. When the threads are placed in this position, the thumb lever 4 of the implement is depressed by the thumb of the hand upon which said implement is mounted, and this movement is communicated by suitable mechanism to the tying bill 3 to rotate the latter. This tying bill is rotated through about one and one-third revolutions, thus, owing to its shape, winding the threads about said bill, cutting off and clamping them, so that the threads may be tied together with very short ends. The clamping action of the thread clamp 34 upon the threads is delayed until sufficient slack (to form the knot) has been taken up by the rotation of the tying bill, but as soon as the loop for the knot has been formed and the waste ends of the threads cut off in the tying bill, the threads are then clamped, the knot drawn tight and stripped from said tying bill.

In the operation of the knotter, the left hand of the operator is slipped within the handle strap 5, the loop having been adjusted to the size of the oper-

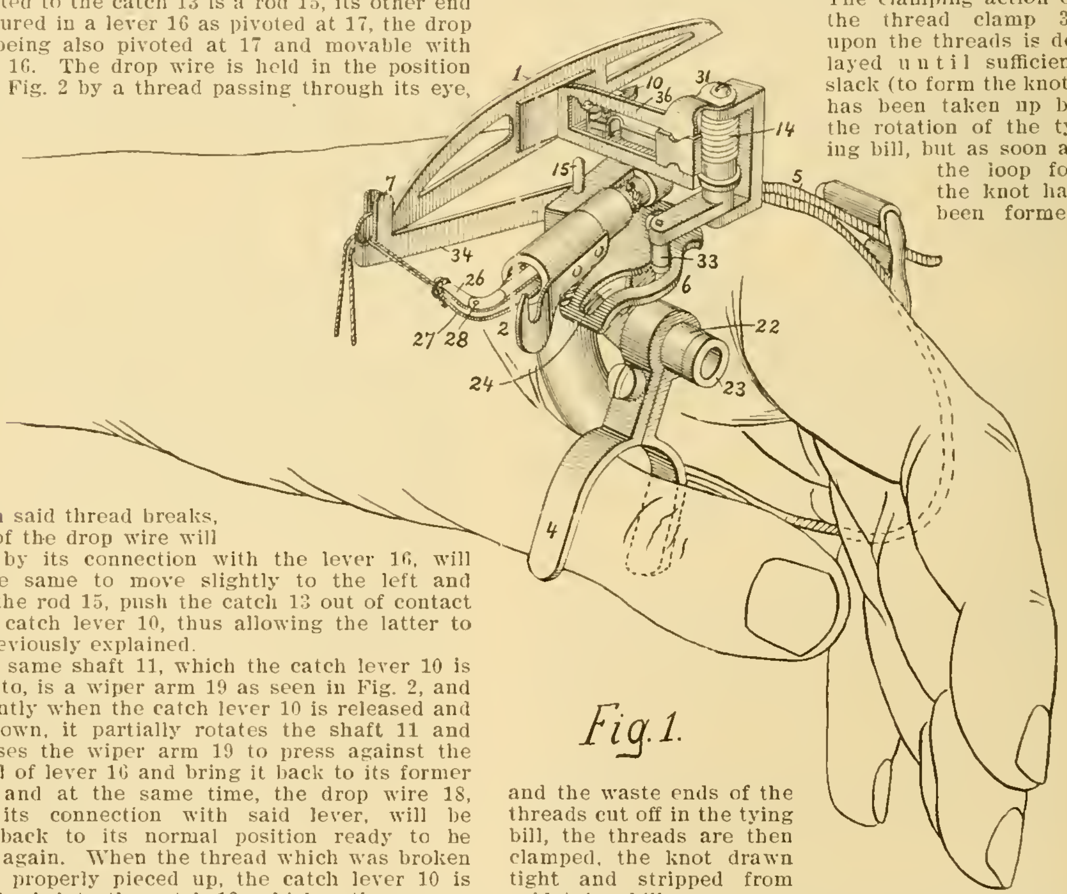


Fig. 1.

ator's hand. The thumb is placed within the thumb fork 4 and the latter thrown to its highest position by an upward movement of the thumb, whereby the parts are placed in the first or initial position for tying the knot. The ends of the threads to be united, grasped side by side, are then placed by an outward movement of the right hand of the operator over the side arm 1 and the thread guide 2, as mentioned. These pieces being inclined downward, the two threads naturally seek the forward ends of the side arm 1 and the thread guide 2, passing across the tying bill 3. A downward pressure upon the thumb piece 4, moves a sector cam gear 6 and thus rotates the tying bill 3. A movement of the thumb piece, sufficient to cause the parts to assume the second position, *i. e.*, to rotate the tying bill through three-quarters of a revolution, causes the clamping fingers 7 to move forward on the side arm 1 and clamp said threads within the hooked forward end of said side arm 1. This clamping of the threads, however, is not done until the tying bill has taken up sufficient slack to form the knot. In this second position, as shown in Fig. 2, the shearing and clamping jaw 8 of

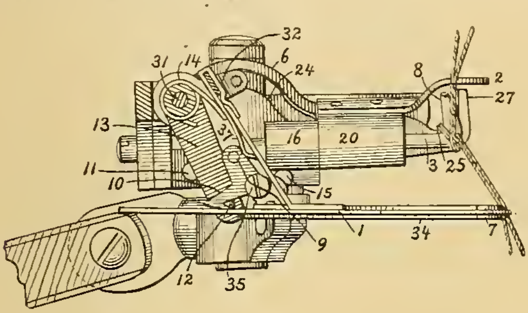


Fig. 2

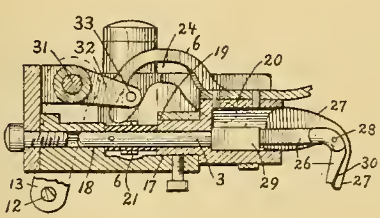


Fig. 3

the tying bill stands open to receive the ends of the threads, as passing over said tying bill to the thread guide 2, which, as the bill passes from the second to the third position, said jaw 8 shears on side nearest the thread guide 2 and clamps on the side toward the side arm 1. A further rotation of about one-quarter or one-third of a revolution of the tying bill places the parts in the fourth and last position assumed by the mechanism, as shown in Fig. 3. During this last movement, the side arm 1, with the threads clamped within the hook at the forward end of said arm by the clamping fingers 7, is swung outward upon its pivotal support, thus taking up the slack in the threads that is made just as the tying bill turns toward the side arm 1, and as the knot is drawn from said bill, the short ends of the threads are pulled from the clamping jaws of the bill. Just after this time, a trigger pin 9 of a catch 10 is brought into contact with a trip pin 11, said catch being rocked upon its pivot against the action of a spring, and thus the engagement between the end of the catch 10 and projection 12 on the bell crank arm 13 is broken. The spring 14 as tending to separate the side arm 1 from the bell crank arm 13 then throws said side arm forward and back to its normal position against the stop pin 15. In order to get all of the parts back into the first position, the thumb of the operator is moved upwardly.

In order to explain the different operations more clearly, a detailed description of the construction of this Knotter will now be given. 16 is a standard, having eccentric openings 17 and 18 passing through it, which together with an eccentrically placed sleeve 19 of the cam barrel 20, fitting into the opening 17, hold the tying bill 3. The tying bill 3 has a spiral pinion 21 secured to it near its rear end, which is rotated by means of the sector cam gear 6, which has teeth similar to those of the spiral pinion. This sector cam gear 6 has a hub 22 to which is secured the thumb piece 4, thus the tying bill 3 is rotated by the movement of the thumb of the operator, the hub 22 being movably placed on a stud having a flanged head 23. The sector cam 6 is also provided with a cam groove 24, which groove is of an outline resembling that of the letter U, with its arms widespread and curved outwardly at their upper ends.

The cam barrel 20, as its name indicates, has its inner surface made somewhat irregular, it being substantially of heart shape in transverse section.

The tying bill 3 is flattened for about one-half of its length by being cut away, and the forward end of this cut away portion is turned back a little more than at right angles to the length of the shaft, at the point 25, to form the clamping jaw 8. Two similarly shaped pieces at the ends 26 and 27 are pivoted on the pin 28 which is secured to the tying bill 3. The bill spring 26 is made of thin spring material, and its rear end is held in place beside the tying bill by means of a sleeve 29, which practically surrounds said tying bill 3. This bill spring 26 is provided with a shear edge 30, the shank of the bill spring being bowed outward slightly near its middle and twisted spirally a very little, in order that the cutting edge of said bill spring shall bear against the cutting edge of the shearing and clamping jaw 27, which lies between the tying bill jaw 8 and the bill spring 26, with a uniform pressure from heel to point. As was mentioned, the jaw 27 is pivoted on the pin 28, one side of said jaw being provided with a shear edge to coincide with the shear edge 30 at the inner edge of the bill spring 26. The rear end of the shearing and clamping jaw 27 is made quite wide, so as to engage opposite sides of the cam barrel 20, and thus be operated by it in either direction with a positive motion.

The shearing and clamping of the threads are accomplished by the action of the cam, during the rotation of the tying bill 3.

The movement of the mechanism for tightening the knot is accomplished by means of the cam groove 24. Pivoted at 31 is a bell crank lever having the arms 32 and 13. A roller 33, secured on arm 32, lies in the cam groove 24, and thus as the cam is moved, the arm 32 is given a lateral movement. The other arm 13 carries the thread clamp 34, having at its forward end the two upwardly extending spring fingers 7. The thread clamp 34 is connected with the outer end of the arm 13 by means of a knife edge pin 12, which in turn allows the connection to be broken at the proper time. The spring latch 10 is pivotally mounted at 35 on the bracket 36 which is loosely mounted on the pivot 31, and carries the side arm 1, and as the outer end of catch 10 is engaged with the pin 12, when the lever 13 is moved backward, the side arm 1 is thrown outwardly, this movement continuing until the catch pin 9 on the catch 10 comes in contact with the trip pin 11, thus stopping said catch pin, and as the arm 13 continues its movement, the catch is moved on its pivot 35 and thus releases its outer end from the knife edge pin 12.

A spring 14, coiled about the pivot 31 is attached at one end to the arm 13 and at the other end to the bracket 36, and by its elasticity tends to hold said arm 13 and bracket 36 apart; thus when the bracket 36 is released, it immediately swings back to its original position, against the stop pin 15. After the catch pin 9 of the catch 10 is out of contact with the stop pin 11, which occurs with the backward swing of the side arm 1, a spring 37 which presses against the catch 10, puts it again in position so that the outer end of said catch may engage the knife edge pin 12 of the arm 13 when it is returned by the action of the cam groove 24. (Barber & Colman, Rockford, Ill.)

SIPP'S IMPROVED SILK QUILLER.

The object of this machine is to wind silk yarns into the form of cops for use during weaving. The cops are produced on spindles in the machine which receive constant revolution, said cops being built up by means of a traverse and yarn guiding motion. The size of the cop itself controls the building of the cop by having a wheel in contact with the upper portion of the cop, the friction between the two causing the cop to rotate the wheel, and this latter being on a rod, threaded through a projection of the traverse motion, causes said rod to work itself outwardly and the wheel just out of contact with the cop. The yarn guide is connected to the threaded rod, and by moving outwardly with it, guides the yarn on to successive portions of the spindle, thus producing the desired build of cop. Each cop is controlled individually by its contact wheel, so as to insure of each cop being firm and evenly built up.

The details of the construction and operation of the machine are shown by means of the accompanying illustrations, of which Fig. 1 is an end view of the machine, showing more especially the traverse arrangement, and Fig. 2 is a top plan view of an end portion of the machine, corresponding to the end shown in Fig. 1.

Referring to the illustrations, 1 indicates the driving shaft of the machine, on which are secured friction disks 2, and these in turn drive the spindles 3, separately, through the respective friction cones 4 on the ends of the said spindles 3. The spindles 3 are held by special bearings 5 and 6 respectively, the latter being secured in a pivoted holder which is actuated when a cop is full and swings that end of the spindle so that the other end carrying the friction

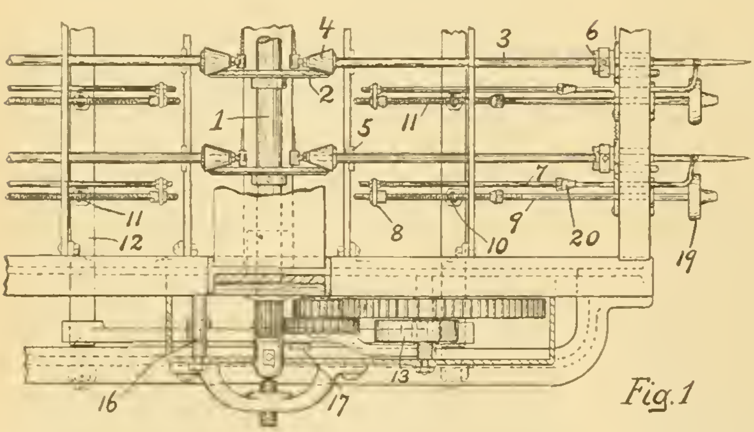


Fig. 1

cone 4 will be thrown out of contact with the friction disk 2, the bearing 5 being used as a pivot for the spindle, and in this manner stopping the rotation of said spindle. The yarn traverse motion consists of

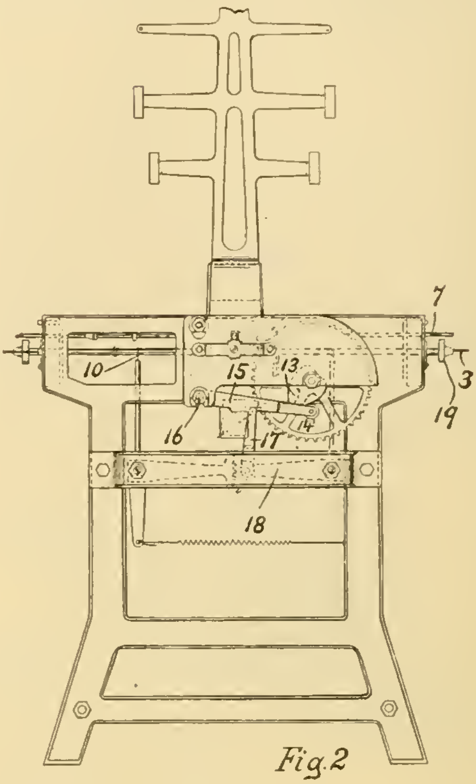


Fig. 2

yarn guides 7, the eyes of which are directly over their respective spindles, and the back ends are connected by forks 8 to threaded rods 9. The threads on these rods work in threaded bearings 10 on the top of their respective rods 11, which are secured to a shaft 12. It is through the partial backward and forward rotation of this shaft 12 which gives the traversing motion to the thread guides, so that they may properly build the cop. The partial rotations of the shaft 12 are obtained from a cam 13 which is positively driven, through the gears shown, from the main shaft 1. The cam 13 presses on a roller 14, carried by a lever 15 as pivoted at 16, and this lever in turn presses against a lever 17 connected to one of the two arms 18 which are formed with teeth at their point of contact and are connected at their other ends to the shafts 12 respectively, thus imparting motion to them. The length of the stroke or traverse may be varied by placing the end of the lever 17 in different notches on the lever 15.

The method of building the cop is to gradually change the position of the yarn guide eye as the cop becomes larger, and is done by the use of a contact wheel 19 on the end of each rod 9. This wheel is so placed that as yarn is wound on the spindle, the wheel will come in contact with the yarn, and owing to the rotation of the spindle will also be rotated. This rotation will cause the threads on the rod 9 to work themselves through the threaded bearing 10 and thus cause the rod to move outwardly. When the rod 9 is moved, through the connection at 8, the yarn guide rod 7 is also moved outwardly and thus guides the yarn on to successive portions of the spindle. The motion of the rods outwardly is very gradual, and the cops are thus made firm and smooth. A dog 20 is provided on each traverse guide rod 7 to regulate the length of the cop built, by coming in contact with the bearing arrangement at 6 when the cop is of the proper length, and releasing a catch which frees the holder of the bearing, causing the latter to swing around so that the friction cone 4 will go out of contact with friction disk 2 and thus stop the winding on of the yarn. The spindle is easily set again by simply snapping it back into place when the dog 20 is out of the way. The yarn guide rod 7 and the rod 9 are re-set by simply lifting the threaded part of the latter rod out of contact with its threaded bearing and pushing them backwardly, then allowing the threaded rod to enter again into the threaded bearing. (Sipp Electric and Machine Co., Paterson, N. J.)

GOODWIN'S IMPROVED WOOL AND WORSTED SPOOLER.

These spoolers are used to wind wool or worsted yarns from the bobbins on to a spool, said spools of yarn being afterwards used in the creel of a dresser or warper in making the warp for the loom.

Several improvements have been added to this spooler, among which are, to use a plain surfaced compression roller which is sustained in end journals and may be easily moved out of and into con-

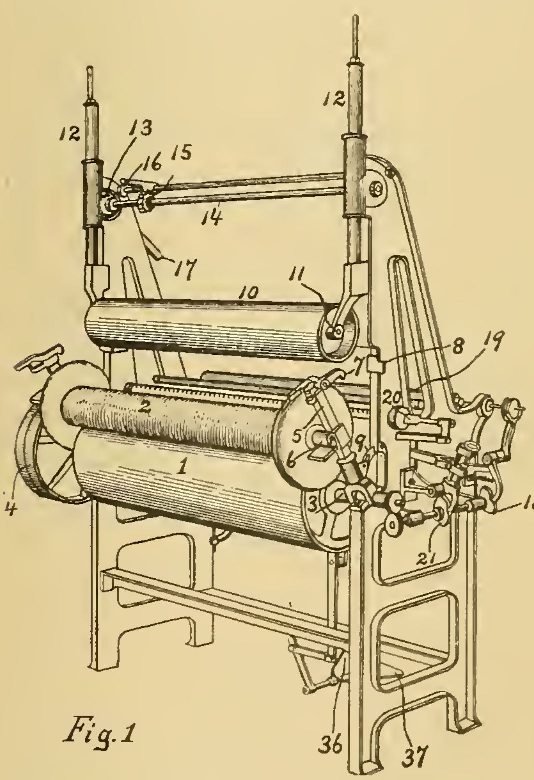


Fig. 1

tact with the spool on which the yarn is wound, besides this, said roller is retained in a stationary position while changing spools. The bearings for the journals of the spools are made movable and serve to sustain the spool not only during the winding

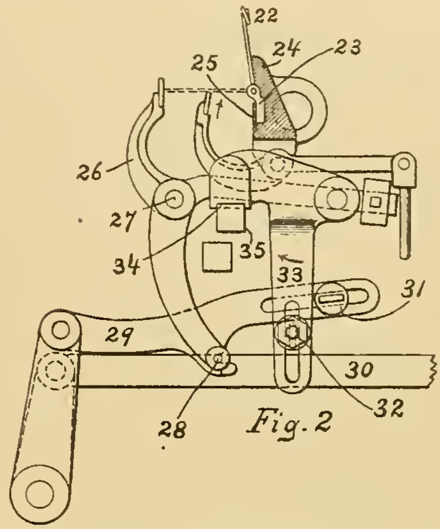


Fig. 2

operation, but also while the operator severs the thread from the full spool, preparatory to removing it from the machine and thus saves the operator the trouble of sustaining the full spool with his knee while he severs the threads. An arrangement for varying the stroke of the traverse guide is also provided to suit different conditions of winding, and besides this, the relative direction of reciprocation of the front guide and the yarn guides that lead the threads into the machine can be changed.

The construction of the machine is best explained by means of the accompanying illustrations, of which Fig. 1 is a perspective view of the machine, showing the parts in the position they occupy when a full spool is being taken out. Fig. 2 is a detail view of the principal parts of the stop motion. Referring to the illustrations, 1 indicates the driving drum of the machine which rotates the spool 2 by means of frictional contact, said drum being covered with cloth or leather to aid in rotating the spool by increasing the friction. The shaft 3 of the drum is supported in bearings in the frame of the machine and has the driving pulley 4 secured to it at the left hand end. Loosely mounted near each end of this shaft 3 are upright arms 5 carrying the bearings 6 for the journals of the spool 2. The top of each arm 5 has a latch 7 which catches on projections 8 on the frame of the machine and hold the bearings in a vertical line while winding, and which are loosened when desired to put the spool in the position for doffing (as shown in illustration), said bearings being prevented from swinging too far, by means of a piece 9. The bearings 6, of course, are movable on the arms 5 and are gradually raised as the spool becomes full. From the special shape of the bearings, and having the arms on which they slide made movable, it will readily be seen that doffing full spools is made very much easier for the operative who formerly had to support the full spool partly by one knee while the threads were severed.

The compression roller 10 is held in bearings 11 which are placed within the end rims of the roller, thus allowing said compression roller to go between the ends of the spool without hindrance. These hearings are secured to the lower ends of upright racks 12 which carry the required weights (not shown) for the roll on top of said racks. These racks are in mesh with gears 13, secured on shaft 14, which also carries another gear 15, having a pawl 16 in contact with it to keep the compression roller 10 in a raised position while doffing a full spool, said roller being raised by moving the lever 17, as attached to the shaft 14, downwardly.

The traverse and guiding arrangement for the threads to the spool consists of a thread guide which is given a reciprocating movement from a cam 18 through the levers shown, said guide being mounted in bearings on each side of the machine. From the thread guide, the threads pass over a roll 19, then separately through wires connected to the stop motion, and from there to another reciprocating guide rod 20, which receives its motion from a cam 21 through the levers shown. The levers are arranged to vary the traverse of the guide rod both as to distance as well as position in relation to the spool, as may be required by said spool. From this guide rod, the threads are wound on to the spool.

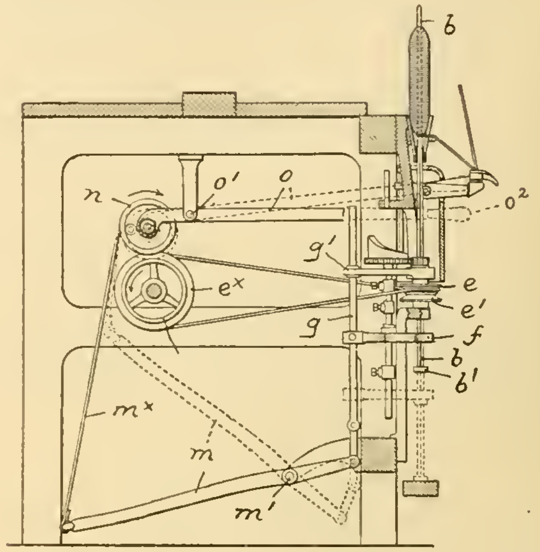
The stop motion controlling the passage of the threads is shown in Fig. 2, where each drop wire 22 is pivoted on a foot 23, said feet being inserted in a guideway of a bar 24, the feet being retained in said guideway by a plate 25, secured to said bar. The feet 23 are inserted loosely in the guideway of the bar, so that they may move laterally, as necessity requires, to adapt themselves to the line of the threads. When a thread breaks, the wire 22 drops to the position shown in dotted lines, that is, it comes in the path of a vibrating lever 26, as pivoted at 27 and having its lower end carrying a pin 28 which fits into an open slot in a lever 29, the latter being vibrated from an eccentric on the machine through lever 30 and the connections shown. When the vibration of lever 26 is stopped, the pin 28 slides out of its slot in the lever 29, causing the latter to fall so that as it moves to the left, a stud 31 comes against a stud 32 on a lever 33 and moves it in the direction of the arrow. This movement raises the end 34 out of contact with the belt shifter piece 35 and allows a spring to move it, thus shifting the belt to the loose pulley and stopping the machine. Through lever connections, the machine may be stopped by a lever 36 of the treadle arrangement, and re-started by the lever 37 independent of the stop motion after being once set. (Davis & Furber Machine Co., North Andover, Mass.)

STINSON'S COP WINDER.

The same is of the vertical cop winder type, having means provided for automatically withdrawing the spindle from the cop when the same is filled.

The accompanying illustration is a sectional side elevation of this cop winder, clearly showing the mechanism for removing the spindle from the cop. On the frame of the machine is fulcrumed at o^1 a lever *o*, provided at one end near the front of the machine with a handle o^2 and at its other end with a wheel *n* arranged over the driving pulley e^x. On this wheel *n* is fast a strap m^x connected to one end of a lever *m* as pivoted at m^1. The other end of this lever *m* is connected to a rod *g*, sliding in bracket g^1 as secured to the frame of the machine. Said rod also carries a forked arm *f* surrounding the spindle *b*, which in turn carries a collar b^1 on its lower portion and also the fast and loose pulleys *e* and e^1.

When the cop is full and ready to be taken off, the operator moves the handle o^2 into its raised position, causing the wheel *n* to come into contact with the driving pulley e^x, thus winding the strap m^x onto wheel *n*, in turn moving the lever *m* into its dotted line position, bringing the forked arm *f* on rod *g* into engagement with the collar b^1, thus forcing the spindle out of the cop.



After the operator has removed the cop, the handle o^2 is pushed down, thus returning the parts to their normal working position. (Lindsay, Hyde & Co., Philadelphia, Pa.)

ELECTRIC STOP MOTION FOR DENN WARPERS.

The object of this motion, as its name indicates, is to stop the machine by electrical connections when a thread breaks in its passage from its spool in the creel, at the back of the machine, to the beam, in front of the machine, on which the threads are being wound. The construction of the stop motion is based on the completion of an electric circuit by a detector wire dropping, when its warp thread breaks. The circuit wires, carrying a current of electricity and having an electromagnet on it, energizes the latter and causes it to attract a lever to itself which will in turn allow a spring to shift the belt shipper and put the belt on to the loose pulley.

The detector wires through which the threads pass separately are loosely pivoted on an upright piece which forms one terminal of the circuit, the detector wires being arranged on the upright piece so as not to interfere with any movement of each other. Situated just behind this upright piece is a contact strip which forms the other terminal for the electric circuit, so that when a detector wire swings down on its pivot, it forms a contact with the strip and thus completes the circuit with the consequent shifting of the belt from the fast to the loose pulley.

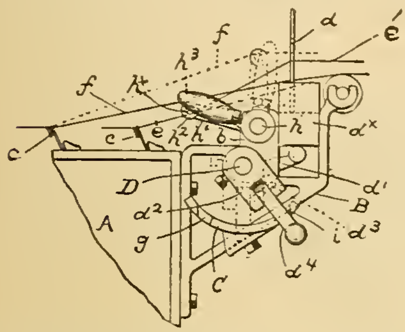
The thread, after passing through the eye of the detector wire, is passed through a hook on the same upright piece which holds the detector wires, and thus offers more support for the latter and at the same time, provided the thread becomes slack, prevents the stop motion to operate.

Owing to the special shape of the detector wires and the space between their pivots and the contact strip, when a detector wire falls on the breakage of a thread, the wire does not make a solid impact with the contact strip, but instead it has a slight rebound which causes it to strike two or three times before becoming stationary, which action tends to prevent the surface of the contact strip from becoming oxidized and making an unsatisfactory electric contact. (Globe Machine Works, Frankford, Pa.)

LEASE FORMING MECHANISM FOR DRAPER WARPERS.

The illustration is a side elevation of such a portion of a warping machine required to be shown, with the mechanism applied thereto.

A rock shaft *h* is mounted in bearings *b* of brackets B, secured to the frame A of the warping machine and having secured thereto the hubs of rocker arms h^1, the free ends of which have positively connected therewith a warp-separating rod h^x, the ends of the rod being tightly inserted in eyes h^2 of the arms h^1. The warp threads are divided into two series, one series *e*, after passing through the drop wires *c*, extend under the warp-separating rod h^x and then through the notches of the dents *d*, while the threads *f* of the other series pass above the rod h^x and between the dents.



In the illustration the dents *d* are shown raised, elevating the threads *e* well above the threads *f* into full line position e^1, forming a shed for the passage of the lease thread between the warp threads *e* and *f*, while the threads *e* are uppermost. After the lease thread is inserted the dents are lowered, the threads *e* being thereby lowered to dotted line position, and the handle h^3 is turned into dotted line position, raising the rod h^x, and thereby elevating the threads *f* into dotted position f^1, making a second shed, with the threads *f* uppermost, and the lease thread is passed therethrough. The handle h^3 is swung past dead centre when the rod h^x is elevated, so that the latter will be maintained elevated until the lease has been effected.

To elevate the dents when it is desired to elevate the treads *e*, a rock shaft D is provided, having rounded rocker arms d^1, which extend at their free ends beneath the dent box d^x. The projecting end of the rock shaft D has fast thereon an arm d^2, to which is pivoted at d^3 a handle d^4 adapted to enter one of the notches *g*, *i*, in a locking plate C, secured to the adjacent bracket B. When said handle is swung to the right, the dents *d* will be raised, the handle being placed in the locking notch *i* to maintain said dents elevated.

After the lease has been formed, with the threads *e* uppermost, the handle is unlocked, swung to the left, rocking the shaft D to lower the dents, and said handle is placed in the locking notch *g* and there held until the dents are to be again operated. (Draper Co., Hopedale, Mass.)

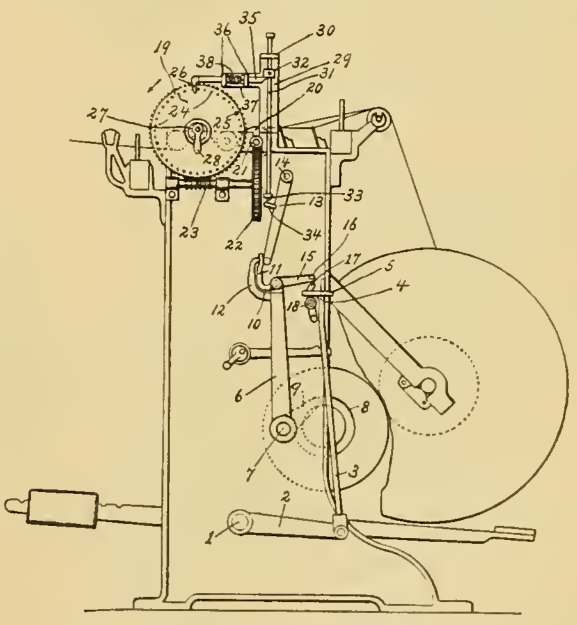
MEASURING MECHANISM FOR DRAPER WARPERS.

The object of the mechanism is to provide a simple and efficient measuring motion, which may be set to measure a certain number of yards of warp, and which will automatically stop the warper when the required amount has been wound on to the warp beam. The mechanism acts in connection with the regular thread stop motion, and its connection on the machine is shown in the accompanying illustration, which is an end view of a warper with its parts shown in their relation to each other.

In the illustration, 1 indicates the shaft which operates the belt shifter (not shown). On this shaft 1 is connected a lever arm 2, the other end of which is jointed to a vertical rod 3. Near the top end, this vertical rod 3 is provided with a shoulder 4, which when the warper is running, remains pressed against the under side of the plate 5. A vibrating arm 6, centered at 7, and which gets its motion from the cam 8 through the lever 9, carries a bell crank lever 10, one lever of which 11, extends upward between the bent piece 12 of the vibrating arm 6, and the end of the vibrating lever 13 centered at 14. The other end, 15, of the ball crank lever 10 extends out horizontally and carries a pin 16, which when the arm 11 is held firmly, just goes over the lever 17, centered at 18, the other end of which presses against the vertical rod 3. If the lever 13 is prevented from vibrating, the arm 11 is freed and the other arm 15 falls, because of its weight, and the pin 16 comes behind the lever 17 and pulls it forward, thus causing the other end to press the vertical rod 3 back, which frees it, and through connection mentioned, stops the machine.

The principal parts of the measuring motion consist of a disk 19 which is driven from the measuring roll 20 through the worm 21, the gear 22 and the worm 23 through connections shown. It is provided with holes 24 to receive a peg 25, which in turn will come against a projection 26 during the revolution of disk 19, and pull it forward.

The disk 19 is centered on an eccentric 27 which has a handle 28, and can thus be raised out of contact with the worm 23 and set in any desired position by hand. A bracket 29 on the frame has a guide 30 for an upright headed slide-rod 31 provided with a collar 32, and having its lower end guided by a fixed collar 33 on the main frame, the lower end of the slide-rod 31 being normally held out of the path of a lug 34 on the vibrating arm 13 by



an arm 35, which is slidably mounted in guides 36 on the arm 37 of the bracket 29 and a spring 38 inserted between the guides 36 on the arm 35 to keep one end under the collar 32. The opposite end of arm 35 is bent downward at 26 and, as mentioned before, is in the path of movement of the pin 25, so that when the rotation of the disk 19 brings the pin 25 into engagement with the part 26 the arm 35 will be drawn out from beneath the collar 32, thus causing the slide rod 31 to descend into the path of the lug 34 and stop the vibration of the arm 13, which in turn, through the mechanism before described, stops the machine.

By having the proper numbers of teeth in the gears 22 and 19 and the worms 23 and 21 correct, one revolution of the disk gear 19 will represent a certain number of yards wound on the warp beam, the space between the holes 24 in turn each representing a certain number of yards. Thus by selecting a zero point on the disk and setting the peg 25 in the correct hole, when the correct number of yards have been wound on the beam, the peg will come against the projection 26, and as explained before, the machine be stopped. (Draper Co., Hopedale, Mass.).

EASTWOOD'S WARPER.

In this warper means are provided whereby the constantly increasing tension on the yarn, as the diameter of the warp on the beam increases is compensated for, in turn effecting a uniform tension to the warp threads throughout the entire operation.

Fig. 1 is a top plan view of this warping machine. Fig. 2 is a side view of part of the tension mechanism, and Fig. 3 is a sectional view of the indicating mechanism.

The frame of the warper is surmounted by two bed plates a^1, a^2, the one, a^1 being larger than the other and provided at one corner with a projection. b is the main drive shaft, journaled beneath the bed plate a^1, and being slightly movable longitudinally in its bearings. The shaft b carries at one end a friction disk b^1 and at its other end a pulley c. A bracket c^1 projects outwardly from the frame and carries a set screw c^2, around which is coiled a spring which tends to force the shaft in toward the frame.

Connecting the two side frames of the machine are two rods d, provided with brackets d^1, one of

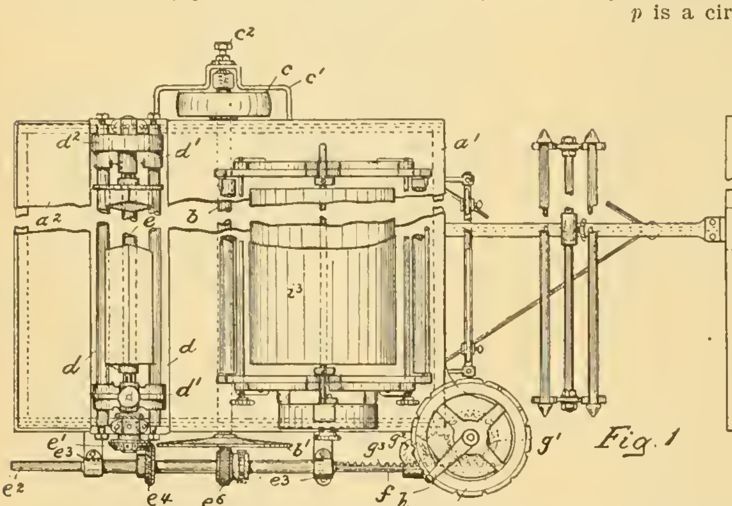


Fig. 1

which is formed with a gear casing d^2 in which is journaled a train of gears. On the end of shaft e is mounted a bevel gear e^1 meshing with a bevel gear c^4 mounted on shaft c^2 as journaled in brackets c^3 on the frame of the warper. The brackets c^3 also form supports for a movable rack bar f, the teeth g^3 of which mesh with a pinion g^2, which meshes with a train of gearing g^1 as mounted on the projection of the bed plate a^1. The shaft c^2 carries a friction wheel e^6 which bears on the large friction disk b^1; thus by rotating the crank h on

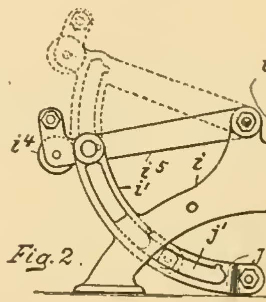


Fig. 2.

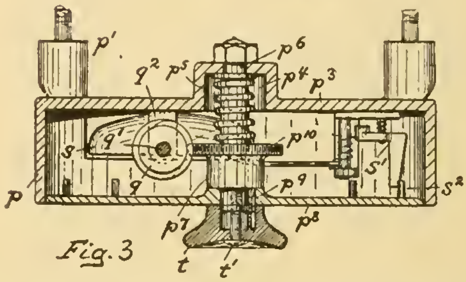


Fig. 3

the disk g as connected to the train of gears g^1, the rack bar f will be moved longitudinally, and the position of the friction wheel e^6, relative to the centre of the friction disk b^1, will be altered, in turn regulating the speed at which said friction disk b^1 and consequently the warp beam travels.

Upon the bed plate a^1 are mounted two standards i each having a pair of integral arms i^1, each having a recess i^2, which affords for a seat for the warp roller i^3. In these standards are fulcrumed two pairs of levers i^5, extending downward from each of which is an integral arc-shaped guide j, provided with slots j^1. In each pair of levers i^5 is journaled a roller i^4, thus by moving the rollers i^4 up or down in the slots j^1 the tension on the warp yarn is increased or diminished.

p is a circular case having its front wall removed and provided on its rear face with projections p^1, for securing the casing in position to the standard of the warper. In the rear wall p^3 of this case is formed a recess p^4, in which is disposed a spiral spring p^5, that is coiled about a shaft p^6. Near its outer end and within the casing, this shaft carries a collar p^7, and also a disk p^8, which takes the place of the front wall of the casing and is kept from rotating relatively to said collar by means of a pin p^9, that projects from the collar and penetrates said disk. The collar has an integral worm wheel p^{10} formed with it, whose teeth engage the threads of a worm q, that is mounted upon a shaft q^1, journaled in arms q^2, projecting from the rear wall of the case, said shaft q^1 also carrying another worm wheel that engages a worm mounted upon the end of the adjoining trunnion of the beam i^3.

t is a knob that is loosely secured to the shaft p^6, outside of the disk p^8, by means of a screw t^1, penetrating it and extending into the shaft, being prevented from rotating relatively to the disk by the pin p^9, which projects into it. The outer face of the disk p^8 is marked off in graduations, which constitute a scale which is read by means of a pointer.

When the beam i^3 rotates, its trunnion imparts through the worms on shaft q^1, as previously mentioned, and the worm wheel p^{10}, a rotary movement to the disk p^8. As often as one of the pins s^2 is brought into engagement with the pawl s^1, the hammer will be actuated and the gong s sounded. The amount of material that has been passed over the beam i^3 is determined at any time by reference to that mark upon the disk to which the pointer refers.

If at any time it is desirable or necessary to manually operate the indicator, so as to set it back, for instance, it is only necessary to press the knob against the action of the spring p^5 until engagement between the worm wheel p^{10} and worm q^1 is broken, whereupon the disk may be turned without reference to the means which automatically rotates it.

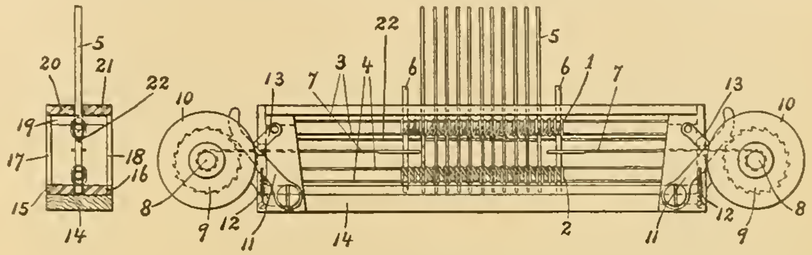
Referring to the mechanism whereby power is transmitted to the warp beam from the main drive shaft, it will follow that by virtue of the arrangement and construction of parts described, with refence especially to the friction disk b^1, the beam can be thrown into operation very gradually, and so the undue and sudden strain that would otherwise be exerted on the threads obviated. (Benjamin Eastwood Co., Paterson, N. J.)

EXPANSION COMB FOR BEAMERS.

The object is to provide an expansible comb for above mentioned machinery, which may be easily cleaned out, thus preventing the comb from becoming clogged by the accumulation of dirt, a feature which heretofore has required, that the frame containing the comb had to be taken out of the machine in order to unclog the comb. Another object is to make the setting of the comb to the desired width more positive than in previous makes.

The accompanying illustrations will give a clear idea of the construction of the comb and also the method of expanding or contracting it to the width desired; Fig. 1 being a front elevation of the comb arrangement, and Fig. 2 a cross section through the comb and its frame.

Referring to the illustrations, the comb is made up of two pairs of springs 1 and 2, the coils of each spring engaging the coils of the other spring of the same pair, the pair of springs 1 being held near the top of and parallel to the frame by means of a pair of guide wires 3 placed within the spring on opposite sides of its axis, while the pair of springs 2 is similarly held near the bottom of the framing by means of wires 4. These springs are used to hold the wires 5, which compose the comb, in an upright position and equally spaced apart from each other, and also to make the comb expansible, by having attached to rods 6 at each end of the comb, straps 7 which are in turn attached to their respective spindles 8. Secured to each spindle is a ratchet 9 and hand wheel 10, which are used to set the comb to different widths. The comb is held at any desired width by having pawls 11



engage with the teeth of the ratchets 9 and held in contact with them by means of springs 12 and latches 13, which press them against their respective ratchets.

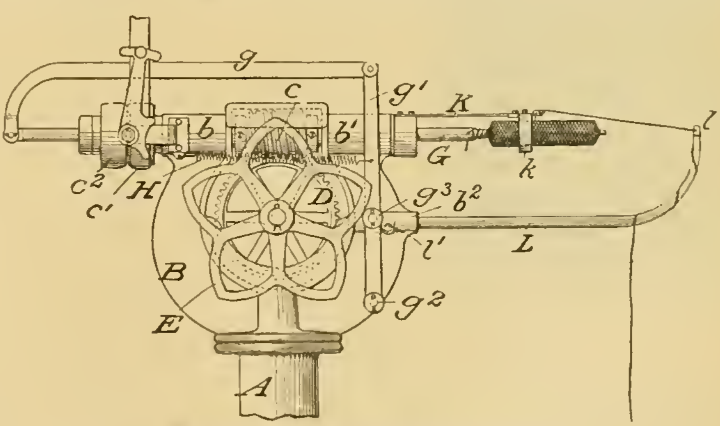
The frame of the comb is made so that it may he easily cleaned out when necessary, and consists of a wooden bottom piece 14, having bottom strips 15 and 16 on top of it, said strips being placed to act as a bottom support for the wires 5 of the comb. Side pieces 17 and 18 are used at each end to form the frame, and short pieces 19 are placed between them at the top of each end, to act as supports for the top metallic strips 20 and 21 which enclose the top and act as top supports for the wires 5. These strips are screwed down to the piece 19 and hence are easily removed when it is desired to clean out the framing.

A stop rod 22 is placed in the frame under and in contact with the upper pair of springs 1, and passing through holes in the wires 5. This prevents the sagging of the pair of springs 1 and keeps them about as far from the pulling points of the straps 7 as the lower pair of springs 2 is, the latter pair being supported upon the bottom strips 15 and 16; this arrangement having a tendency to keep the wires 5 parallel with each other. (T. C. Entwistle Co., Lowell, Mass.)

ROYLE'S COP WINDER

For Winding the Cops as used for Card-lacing Machines.

By means of this cop winder a spiral wind of the cord is produced, the coils being a considerable distance apart and alternately reversed as they extend



back and forth from end to end of the cop, resulting in a cop which freely unwinds during card lacing.

The illustration is a view of the machine in side elevation, the base of the support being omitted.

A indicates the support for the machine, made in the form of a hollow pillar, on which is fixed a hollow casting B, developed at its top into bearings b, b^1, for the spindle operating sleeve, which is provided with a loose and fast pulley c^1, c^2, for driving the spindle. The spindle support is provided with a worm c, which meshes with a wheel D, to which is secured a five-pointed cam E, which engages with roller g^3 on a lever g^1, as pivoted at g^2 to the casting B. The other end of this lever g^1 is attached to an arm g, which is connected to the spindle G, this arrangement sliding the spindle in its bearings five times for every revolution of the cam E, spring H giving the retracting movement to the spindle.

An arm K is attached to the spindle support, being provided with a ring k, which serves to stop the machine by frictional contact when the cop has reached its desired size.

An arm L is mounted in a socket b^2, and is provided with a guide eye l, the arm being held in its socket by a dowel pin l^1 extending into a groove in said arm, thus permitting it to rock in its bearings. (John Royle & Sons, Paterson, N. J.)

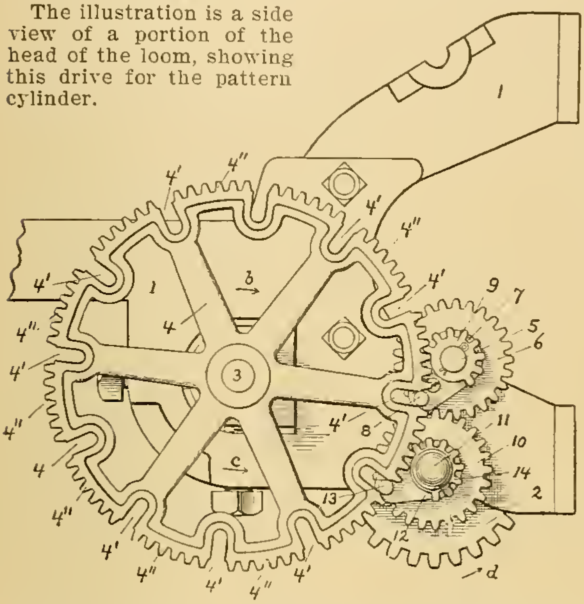
WEAVING MACHINERY AND SUPPLIES.

SHEDDING MOTIONS.

OPERATING THE PATTERN CYLINDER IN KNOWLES LOOMS.

The object is to simplify the system of gears used for rotating the pattern cylinder in either direction, in connection with the fast and slow motion of the latter.

The illustration is a side view of a portion of the head of the loom, showing this drive for the pattern cylinder.



On the frame 1 is mounted the lower cylinder gear 2, which is the main drive for the pattern cylinder as mounted on the shaft 3. The pattern cylinder gear 4 has in its periphery a series of open end slots 4′, between each of which are formed teeth 4″. On a stud 5, fast to the frame 1, is loosely mounted a gear 6, and rigidly secured to said stud 5 is a plate 7 provided with a stud 8 and a mutilated pinion 9, the teeth of said pinion meshing with the teeth 4″ of gear 4 and in turn impart a slow movement to the pattern cylinder. The stud 8 enters the recess 4′ and imparts a fast movement to the pattern cylinder for the remainder of the rotation of the gear 6. Meshing with this gear 6 is a corresponding gear 10, which is loosely mounted on the extended journal of the lower cylinder gear 2 and connected therewith to rotate with said lower cylinder gear by the sliding key 11. Also loosely mounted on the extended journal of the lower cylinder gear 2 is a plate 12 having a driving pin 13 thereon and a mutilated pinion 14 secured thereto or made integral therewith, the teeth of which mesh with the teeth 4″ on the gear 4 to communicate a slow motion to said gear while the driving pin 13 on the plate 12 enters the recesses 4′ on the gear 4 to communicate a fast motion to said gear 4.

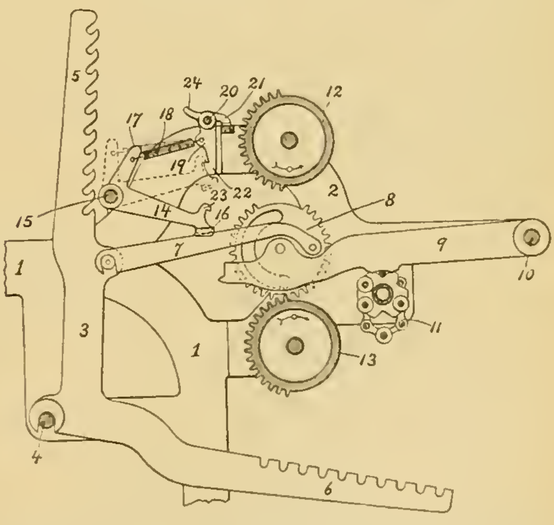
The operation of the mechanism is as follows: In the operation of the loom until now, the revolution of the cylinder gear 2 in the direction of arrow *d* will, through the sliding key 11, cause the plate 12, carrying the driving pin 13 and the mutilated pinion 14, to rotate with said gear 2 and through pin 13 and pinion 14 communicate a continuous fast-and-slow motion to the pattern-cylinder gear 4 in a forward direction, or in the direction of arrow *b*. The engagement of the teeth 4″ on the gear 4 with the teeth on the mutilated pinion 9 will rotate said pinion and also the gear 6, loosely mounted on the stud 5, and the gear 10, loose on the journal of the cylinder gear 2.

In case it is desired to reverse the movement of the pattern cylinder gear 4, or move it in the opposite direction, as indicated by arrow *c*, the sliding key 11 is pushed in to disconnect the plate 12 and the mutilated pinion 14 from the journal of the cylinder gear 2, and leave them loose on said journal and connect the gear 10 with said journal to cause it to rotate with the cylinder gear 2. The revolution of the gear 10 will rotate the upper gear 6, with which it meshes, and with it the plate 7 and pinion 9, and cause the pattern-cylinder gear 4 to rotate in the reverse direction, or in the direction of arrow *c*. (Crompton & Knowles Loom Works, Worcester, Mass.)

MAKING THE ACTION OF THE KNOWLES' HEAD MOTION POSITIVE.

The accompanying illustration is a side view, partly in cross section, of a portion of this shedding mechanism, having the improvements combined therewith.

Referring to the illustration, 1 indicates a portion of the arch of a loom to which is attached the head stand 2. 3 indicates one of the harness jacks, as



pivoted on a rod 4, said rod extending across the width of the shedding mechanism, and being also used as a pivot for the other harness jacks which are placed side by side in the mechanism. The two sets of straps which connect to the harnesses in the loom are attached to the harness jacks 3, at 5 and 6 respectively, and thus produe a shed during weaving. Each harness jack 3 has a connector 7 pivotally attached to it, the other end of said connector being connected to a vibrator gear 8. Each gear 8 is carried by a vibrator lever 9 as pivoted at 10, said levers 9 resting on the pattern chain 11, which is made up of rolls and tubes according to how it is desired to operate the harnesses. The vibrator gear 8 is actuated by coming into the path of either of the two cylinder gears 12 and 13, which revolve constantly in the direction of the arrows. The gear 8 is revolved in one direction for one-half of a revolution by the upper cylinder gear, when a roll on the pattern chain 11 comes under the lever 9 and raises it, and in the opposite direction for half a revolution by the lower cylinder gear when the roll passes from under the lever 9. These movements of vibrator gear 8 are converted from circular into linear motion by means of the connector 7, and the harness jack 3 is thus moved back and forth on its pivot 4 to raise and lower the harness.

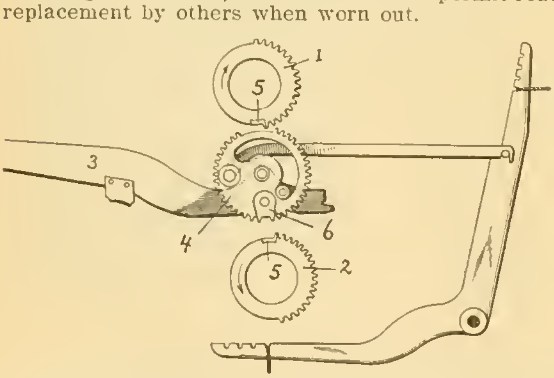
In order to make the action of the vibrator gear 8 as positive as possible, so as to get perfect shedding, a bell crank lever 14 as pivoted at 15 is provided, having one end made grooved at 16 so as to fit on the top side of connector 7. The upper portion 17 of the bell crank lever has one end of a spring 18 connected to it, the other end of said spring being attached to a catch 19 as pivoted at 20.

This catch is provided with a projection 21 which limits the movement of the catch. The action of the spring 18 keeps the lever 14 pressed firmly against the connector 7 and thus makes its movement positive. The lower end of the catch is shaped in the form of a projection 22, which will hold the lever 14 up when its projection 23 is in catch with it.

When it is not desired to use the full number of the harnesses, the levers 14 are raised off of the connector 7 of the unused harness and held out of contact with them by means of the catches 22 and 23, until they are to be used again, when they are released by simply pressing on a thumb piece 24. (Crompton & Knowles Loom Works, Worcester, Mass.)

REPAIRABLE GEARING FOR THE KNOWLES HEAD MOTION.

The novelty consists in providing removable initial teeth to the driving and pitman gears of the shedding mechanism, which initial teeth permit ready replacement by others when worn out.



The illustration is a side view of parts of the shedding mechanism gearing, showing the construction of the new teeth.

Between the driving drums 1 and 2 are the free ends of the harness actuating levers 3, the drums 1 and 2 acting to move said lever 3 by engagement with the pitman gear 4; *i. e.*, one toothed section co-operates with a drum turning in one direction and the other toothed section co-operates with the drum turning in the other direction.

The teeth which have to stand the most strain during the running of the loom are the initial teeth, *i. e.*, the teeth which go first into mesh, and for which reason the drums 1 and 2 are each provided with a removable tooth 5, and the pitman gear 4 with a removable toothed plate 6, thus providing in turn easy repairing when the initial teeth of either gear become worn.

SHEDDING MOTION FOR C. & K. DOBBIES.

In former constructions of this shedding mechanism the connections, *i. e.*, the hooked jacks for raising and lowering the harness levers, were pivoted upon said levers; whereas, in the new construction, a series of harness lever actuating cams are provided, the same being moved by the hooked jacks, thus making the connections entirely separate from the harness levers.

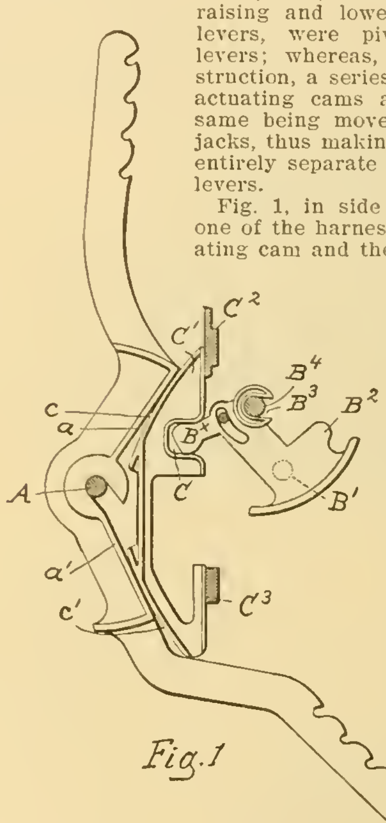


Fig. 1

Fig. 1, in side elevation, shows one of the harness levers, its operating cam and the actuator for the latter. Fig. 2 shows the connection for moving this operating cam, *i. e.*, the lifting and depressing jacks.

Examining this latter illustration, we find that these connections B (one for each harness frame), instead of being pivotally mounted on the harness levers or an extension therefrom, as in former constructions, are mounted on studs B^1 of actuators B^2, said actuators having their hubs slotted at B^3 to fit over and be sustained by a rod B^4. Each of said actuators has an arm or projection B^x, adapted to engage a harness-lever-moving cam C^1, said arm entering a notch C in said cam, the cam being depressed whenever a harness lever is to be acted upon to effect the lifting of its attached harness frame, and the cam being lifted whenever a harness lever is to be moved to depress its co-operating harness frame. The cam C^1 is sustained and guided by guides C^2, C^3, which insure a positive movement of the cams in straight lines. Each cam C^1 has two acting faces or inclines c, c^1, which co-operate with the inclines a, a^1, of the harness levers, the incline a being located at one side of the supporting rod A for the harness levers, while the inclines a^1 are located at the opposite side thereof. These cams C^1

while they act to turn the harness levers about the fulcrum A, also act when in their extreme positions to lock the harness levers in their extreme positions to thereby maintain the warp threads in the proper plane of the shed; said cams also acting while turning the harness levers about their fulcrum to prevent said levers from moving at a faster speed than that determined by the movement of the shed-forming knives.

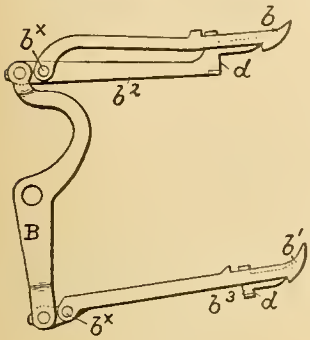


Fig. 2.

Each connection B (see Fig. 2) has operatively joined to it at its upper end a hooked lifting jack *b*, and at its lower end a like hooked lifting jack b^1. Each connection B has at its upper end a depressing jack b^2, and at its lower end a like depresing jack b^3. These depressing jacks are pivoted directly upon the ends of the lever B, and have pivots b^x sustaining the hooked lifting jacks *b*, b^1, previously referred to.

The movement of the harness levers in one direction is effected by the engagement of the hooked jack *b* with the usual knife. When the harness has been raised, the means for effecting the return movement of the same consist in providing the depressing jacks b^2 b^3 with a shoulder *d*, which engages the respective shed-forming knife on its return movement, and thus puts the harness frame connected with said depressing jack into the opposite shed.

Another method of operating the harness levers is shown in Fig. 3, in which the harness levers are provided with two cam horns *e* and *f*, which in turn are engaged by toes *g* and *h* on a cam slide or actuator *i* when the same is moved, thus raising or lowering the harnesses connected with the levers as required by indications *j* on the pattern chain *k*. (Crompton & Knowles Loom Works, Worcester, Mass.)

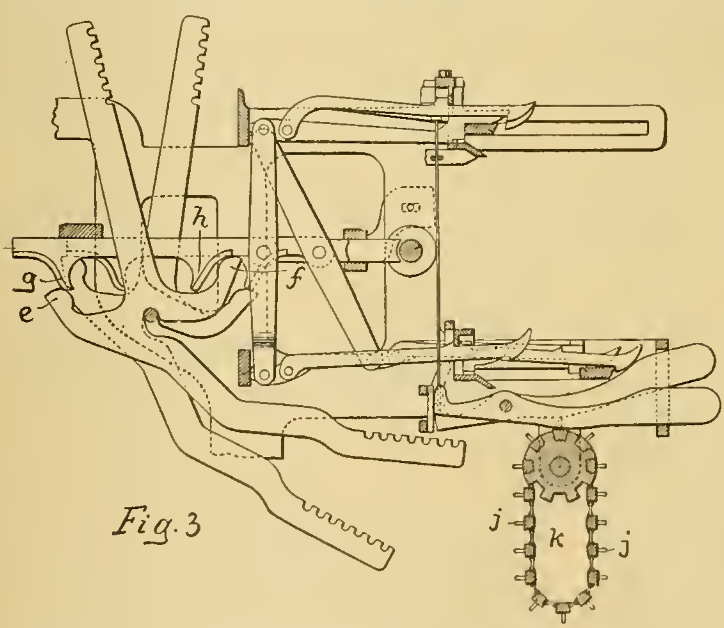


Fig. 3

CLUTCH MECHANISM FOR C. & K. DOUBLE ACTING DOBBIES.

The object is to provide to double acting dobbies, as provided with a double index pattern chain, a mechanism for automatically unclutching one portion of the clutch mechanism from the other, and then clutching them again at predetermined intervals, and whereby the rotation of the chain can be stopped while the weaving continues with a double index.

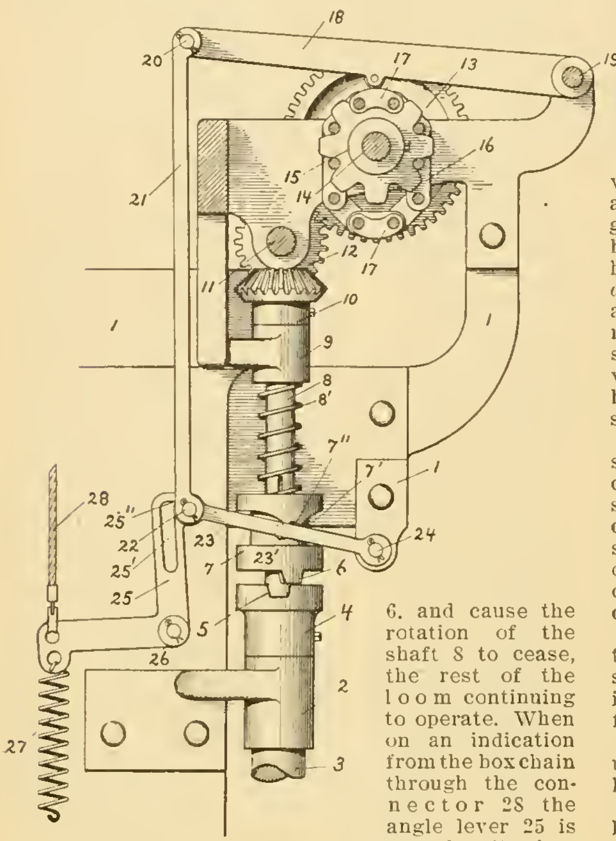
The accompanying illustration is an elevation of a driver shaft and connections to a pattern-chain cylinder for operating the same, with the clutch mechanism applied thereto.

Examining this illustration, we find numeral 1 to indicate a portion of the loom frame, having a bearing 2 for a vertical shaft 3, which has a bevel gear (not shown) fast on its lower end, meshing with and being driven by a bevel gear on the driving shaft of the loom. On the upper end of said vertical shaft is fast the lower member 4 of the clutch, having in this instance a recess 5 to receive the projection 6 on the upper member 7 of the clutch, which is splined on a vertical shaft 8, having a bearing 9 on the framework 1. A spiral spring 8′ encircles the shaft 8 and acts to force down the clutch member 7. On the upper end of the shaft 8 is fast a bevel gear 10 which meshes with and drives a bevel gear (not shown) fast on one end of the horizontal shaft 11, the opposite end of said shaft having fast a pinion 12, which meshes with and drives a gear 13 fast on the shaft 14, carrying the pattern cylinder 15, which has thereon a pattern chain 16, carrying a series of indications 17.

Extending over the pattern cylinder 15 is an indicator lever 18, pivotally mounted at one end on a rod 19 and pivotally attached at its other end by a pin 20 to the upper end of a connector 21. The lower end of this connector is pivotally attached by a pin 22 to one end of a lever 23, the opposite end being pivotally mounted on a pin 24, secured to the framework 1. The lever 23 is provided with a pin 23′ (shown by broken lines), adapted to extend into an annular groove 7′ in the upper clutch member 7 and to engage and travel on the cam surface 7″ on the upper clutch member 7. The pin 22, which connects the link 21 to the lever 23, extends in a vertical slot 25′ in an angle lever 25, pivoted on a pin 26, secured to the framework 1. A side slot 25″ leads out from the vertical slot 25′. The opposite end of the angle lever 25 has attached thereto the upper end of a spring 27, the lower end of which is attached to a stationary part on the loom frame. The lower end of a connector 28 is also attached to the end of the angle lever 25, said connector 28 being operated by the box chain.

In the operation of the mechanism, when one of the indicators 17 in the rotation of the pattern cylinder comes under the roll 18′ on the lever 18, said lever is raised, and through link 21 the lever 23 is raised, so that the pin 23′ will extend into the upper part of the annular recess 7′ in the clutch member 7, and the projecting end of the pin 22 at the end of the lever 23 will extend in the upper part of the vertical slot 25′ and allow the spring 27 to act to move the angle lever 25 and cause the side slot 25″ to receive the pin 22, and thus lock the lever

23 in its raised position. The continued revolution of the clutch member 7, through its engagement with the clutch member 6, will cause the cam portion 7″ to ride up on the pin 23′, and thus disconnect the member 7 of the clutch from the member



6. and cause the rotation of the shaft 8 to cease, the rest of the loom continuing to operate. When on an indication from the box chain through the connector 28 the angle lever 25 is moved on its pivot point 26 to move the pin 22 out of the side slot 25″ and into the upright slot 25′, and the pattern indicator on the pattern cylinder, having passed from under the roll 18′ on the lever 18, the spring 8′, encircling the shaft 8, will act to force down the upper clutch member 7, so that in the continued revolution of the lower clutch member 4 the parts will be clutched and the shaft 8 and the parts driven thereby again put into operation. (Crompton & Knowles Loom Works, Worcester, Mass.)

REVERSING MOTION FOR C. & K. DOBBIES.

In this mechanism means are provided whereby the pattern surfaces of the shedding and the box motions as well as the multiplying mechanism may be turned backward or forward, in unison, at one operation; operating said mechanisms through one shaft having two worms.

Fig. 1 is an end elevation of the mechanism, Fig. 2 a detail in plan, showing the worm of the box motion and the worm toothed gears, actuated thereby, and the sliding collars which form parts of the clutches.

The frame work A is provided with a bearing A^1, through which extends a shaft A^2 having a beveled toothed gear A^3 which meshes with another bevel-tooth gear A^4 on the end of shaft A^5 which constitutes a part of the driving mechanism. The upper end of the shaft A^5 has fast on it the hub of a disk B^4, provided with a notch to receive a tongue a (see dotted lines) extended downwardly from a latch B^3, pivoted on shaft B^2, said shaft being surrounded by a stiff spring B^1 which normally acts to keep the tongue a in engagement with its notch in the disk B^4. This arrangement moves the two shafts A^5 and B^2, although in two parts, in unison.

The part B^2 is provided with two worms a^1, a^2, the one a^1 engaging with the gear a^3 on the shaft B as carries the pattern chain of the shedding motion and which it rotates continually. The other worm a^2 (see Fig. 2) rotates the gear a^4 and its sleeve a^{10} intermittingly about the stud a^5.

The sleeve a^{10} has fixed to its end opposite the worm-toothed gear, a plate a^6, having a notch a^7, and also has mounted upon it a collar a^8, having an annular groove a^{11} and a finger a^{12}, said collar being free to be slid on said sleeve and cause said finger to move back and forth in the notch of said plate. The worm a^2 also engages a second like worm-toothed gear a^{13}, as fast on sleeve a^9, having at its front end a connected disk a^{14}, having a notch a^{15}, and the said sleeve a^9 has mounted upon it loosely, between said worm-toothed gear a^{13} and said disk, a collar a^{17}, having a finger a^{18} which enters the notch a^{15} in said disk, said collar having an annular groove a^{19}.

Both collars a^8 and a^{17} are free to be slid on the sleeves a^{10}, a^9, collars and sleeves forming part of a clutch. The stud a^{20} of gear a^{13} receives upon it a sleeve a^{16}, having connected with it a chain carrying cylinder a^{10}, on which is hung the box chain b. The sleeve a^{16} also has connected with its inner end a disk having a series of spaces, which may be entered, one or the other, by the finger a^{18} at the end of the collar a^{17}.

The stud a^5 receives upon it a sleeve d, having detachably secured to one end thereof a hand wheel d^2, said sleeve having at its opposite end a disk d^3, having a series of spaces in which may be entered the finger a^{12} of the collar a^8 at desired times.

The sleeve d also has as part of it a cylinder d^1, upon which is hung the multiplying pattern chain, having at suitable intervals high links or indicators.

The disks or plates b^3 and d^3 constitute each one-half of a clutch, the other halves being the collars a^8 and a^{17}, said collars having the fingers a^{12} and a^{18}, and either one of the said sleeves d or a^{16} may be rotated at any desired time by simply putting the clutches into operation, and they may be left at rest for any desired time by putting the clutches out of operation.

In a bracket c^3 of the framework is mounted a stud c^2, which receives a lever, bent, to present a depending extremity c^1, which enters the annular groove a^{19} in the collar a^{17}. This lever has an upwardly extended ear and at the side of said ear the said stud c^2 receives on it loosely an adjustable continuation c^8 of said lever, said continuation having an upwardly extended short arm c^7, provided with a slot c^6, through which is extended a screw c^5, by which the particular angles occupied by the end c^1 of the lever, and the end of the continuation c^8, may be varied to insure just the proper movement for the collar a^{17}. The continuation c^8 of the lever c has a stud c^{10}, on which is pivoted a shoe c^{12}, said shoe resting immediately above the chain of the multiplying mechanism in position to be struck by an indicator when it is desired to effect the clutching of the finger a^{18} of the collar a^{17} with the plate or disk b^3 to start the sleeve a^{16} and chain b in motion.

The stud c^2 also has mounted loosely upon it, but at its opposite end, a second lever having a depending end which enters the groove a^{11} of the collar a^8, and the end of the stud c^2, has an adjustable continuation f, the same as the one c^8. The continuation f of this second lever has a pivot or stud f^1, upon which is mounted a shoe f^2, which stands above and in position to be acted upon by the indicator b^1 of the box chain b, and when a special indicator b^1 acts on the shoe f^2 this second lever is turned to cause the finger

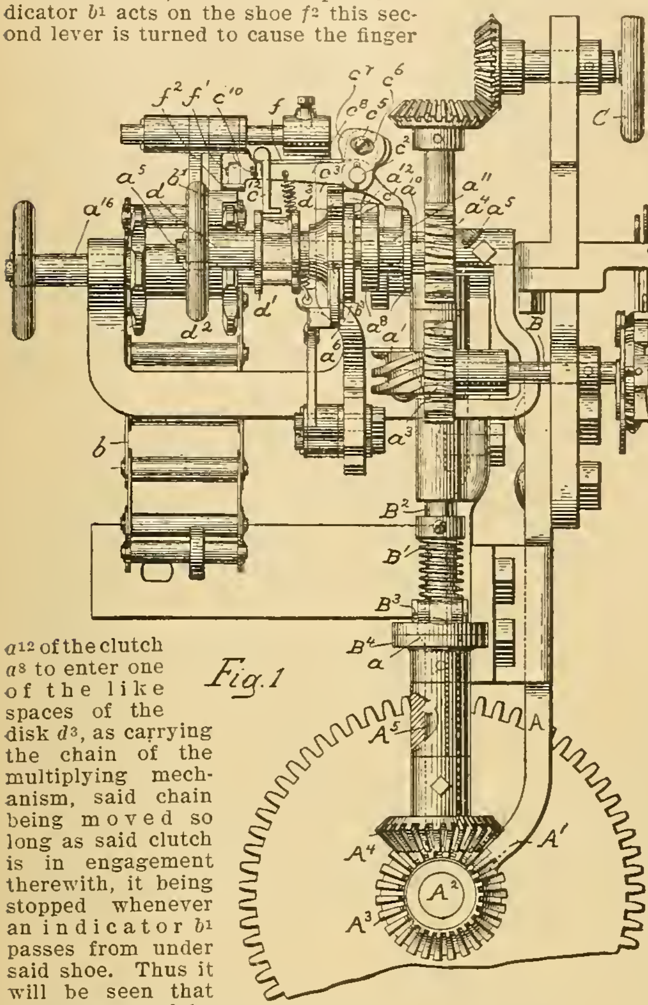


Fig. 1

a^{12} of the clutch a^8 to enter one of the like spaces of the disk d^3, as carrying the chain of the multiplying mechanism, said chain being moved so long as said clutch is in engagement therewith, it being stopped whenever an indicator b^1 passes from under said shoe. Thus it will be seen that the operation of the multiplying mechanism is governed by the indications on the multiplier chain, the same moving the collars a^{17} or a^8 to determine which shall operate.

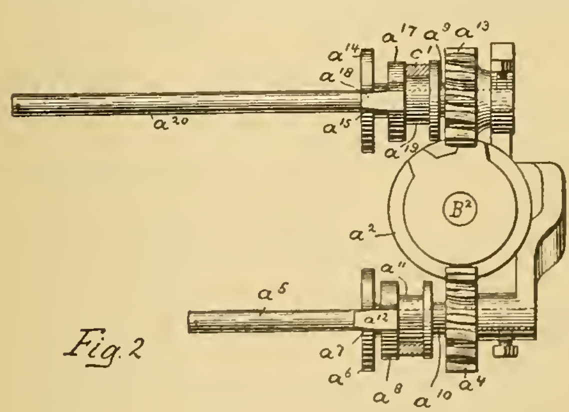


Fig. 2

When the loom stops on account of the filling having run out, the hand wheel C is turned backward one revolution, causing the multiplying and pattern-chain mechanisms to be turned back one pick, the tongue a slipping out of its notch in disk B^4, thus permitting only the upper part of shaft B^2 to turn.

Thus when the loom is again started the pattern chain having been turned back, it will not make a miss-pick but start on the same pick it left off with. The mechanism thus described can also be turned back for more than one pick, as required, with the same result. (Crompton & Knowles Loom Works, Worcester, Mass.)

HARNESS EVENER FOR C. & K. DOBBIES.

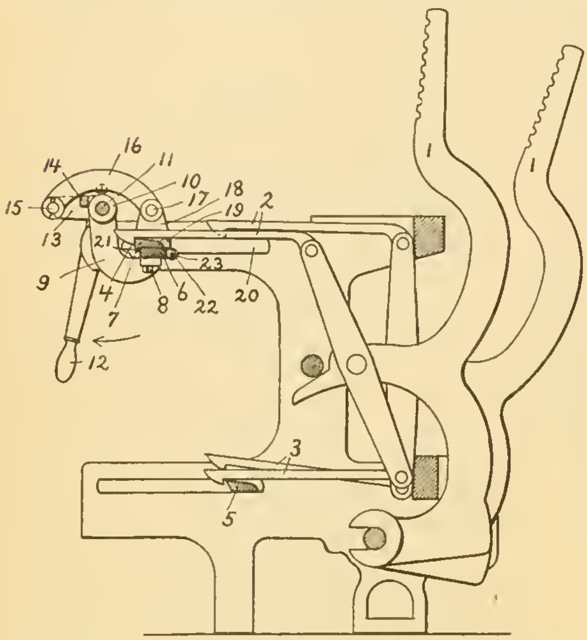
The construction and operation of this mechanism is best explained by reference to the illustration, which is a sectional side elevation of a portion of a dobby, showing one harness jack in its raised and the other in its lowered position.

The harness jacks 1 are moved as always through their hooked fingers 2 and 3, engaging with the lifter bars 4 and 5, respectively. The upper lifter bar 4 is made in two parts 6 and 7, the lower part 6 having rigidly secured thereto at each end upon its under side by a bolt 8, the lower end of a stand 9, the upper end of which has a bearing 10 for a transverse rocking shaft 11. On the outer end of the shaft 11 is fast an operating handle 12 and a crank arm 13 having a side projection 14, which acts as a stop to engage the front edge of the stand 9 on the forward movement of the crank 13.

To the outer end of the crank 13 is pivoted on a stud 15 one end of a link 16. The other end of this link 16 is pivoted on a stud 17 in the upper end of a lug 18 on the end of the upper bar 7. At the lower front part of this lug 18 is a pin 19, which extends into and travels in the slot 20.

The upper bar 7 has a downwardly extending projection 21 on its rear edge, which extends over the rear upper edge of the lower bar 6 and holds the two bars together, causing them to move back and forth as a single lifter bar in the normal operation of the loom. The front edge of the lower bar 6 has in a lug extending out therefrom a rod 22 on which are mounted small rolls 23, which the downwardly extending lip 21 on the upper bar 7 will engage and travel on when the bar 7 is moved forward to extend over the bar 6.

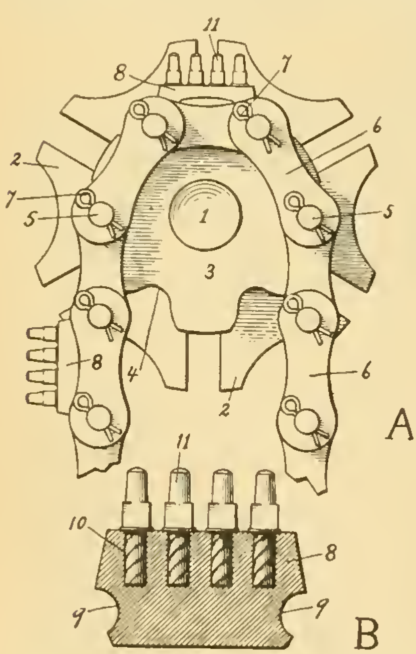
When it is desired to even the harnesses or to lower those that are in their raised position, the handle 12 is moved in the direction of the arrow, which rotates the shaft 11 and through crank 13, link 16, lug 18 and pin 19, extending in the slot 20, raises the rear edge of the upper bar 7, the pin 19 acting as a pivot to disengage the lip 21 thereon from the lower bar 6 and move the bar 7 to its extreme inward position, allowing the upper hooked jack 2 to move with it, the jack and harness connected therewith being moved into its lowered position. When the loom is started, the moving outwardly of the lower lifter bar 5 will move inwardly the lower section 6 of the upper lifter bar 4, and cause it to pass under the upper section 7, the rolls 23 engaging the lip or projection 21 on the section 7. The movement of the handle 12 in the opposite direction will return the bar 7 to its position on the bar 6, in case the loom is not started up, and raise the harness jacks 1.



(Crompton & Knowles Loom Works, Worcester, Mass.)

CONNECTION FOR BARS IN THE PATTERN CHAIN OF C. & K. DOBBIES.

This connection of the bars is somewhat similar to that employed on their ball and chain dobbies, the manner in which it is adapted to the wooden bars being best explained by referring to the accompanying illustration, of which diagram A is an end view of the pattern chain barrel as carrying the pattern chain, the bars of which are shown with the improved connection, and diagram B a vertical section through a bar with pattern pegs (in side elevation) shown inserted into said bar.



1 indicates the pattern chain barrel or cylinder, which is loosely mounted on the shaft (not shown), and is rigidly connected to and rotated with the star wheel 2, said star wheel receiving its motion from a revolving pin (not shown).

The pattern chain barrel 1 has at each end a head 3, having grooves 4, to receive the ends of the iron rods 5, of the pattern chain. Two of these rods 5, are connected on either side of the chain by means of a metal link 6, having a hole near each end to receive the ends of the rods 5, said link being kept in place by having split pins 7, placed in holes placed near the ends in the rods 5. Every pair of rods 5, carries one of the wooden bars 8, of the pattern chain, the shape of said bar being shown in its section in Fig. B. The length of the bars is a little less than the length of the iron rods 5, and of a width a little greater than the distance between two of these iron bars 5.

On each side of the wooden bar 8, near its lower surface, is provided a concave recess or groove 9, sufficiently large to readily receive the iron rod 5, previously referred to. By means of the rods 5, extending in the grooves 9, of the bars 8, said bars are supported and maintained in position on the pattern chain.

To prevent any endwise movement of the bars 8 on the iron rods 5, tubes are placed on the iron rods 5 at each end, to extend between the ends of the bars 8 and the metal links 6. The wooden bars 8, are provided with a series of holes 10, to receive the pattern pegs 11, which are made with a reduced shank to extend into the holes 10, in the bars 8, having an enlarged upper portion to engage the upper surface of the bars 8. The holes 10 in the wooden bars 8 extend about half way through the bar, which is a sufficient depth to receive and properly hold the reduced ends of the pegs 11. In assembling the parts of the chain, the bars 8 are connected with the iron rods 5 by removing a connecting link 6, which connects two ends of the rods 5 from one side of the chain, and inserting the wooden bars 8 between a pair of iron rods 5, by fitting the rods into the grooves 9, prepared for them, and then replacing the metal link 6, and the split pins 7. The wooden bars 8 may be provided with one or more series of holes (four being shown in the illustration) therein (according to scope of dobby) to receive the pattern pins 11. (Crompton & Knowles Loom Works, Worcester, Mass.)

FOUR WEAVE C. & K. DOBBY.

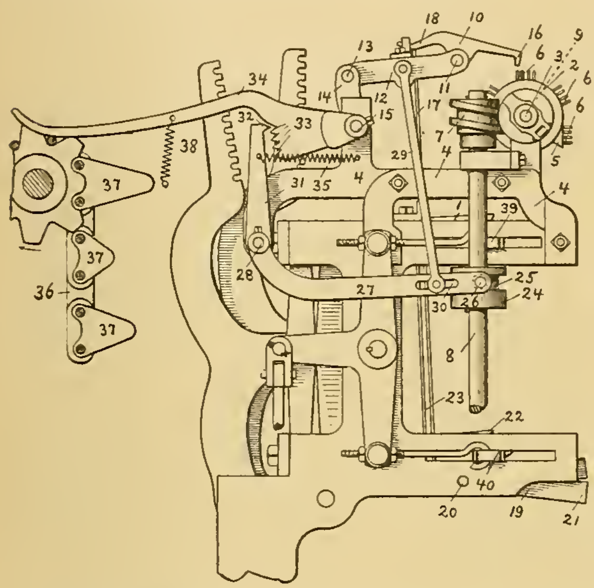
The object is to combine with an ordinary dobby mechanism a supplemental mechanism to produce four different weaves in the fabric.

The accompanying illustration is a side elevation of a portion of a dobby head, having this mechanism applied thereto.

Examining the illustration we find arranged above the upper hook jacks 1, the pattern cylinder 2, fast on a shaft 3, mounted in bearings on the frame 4. On the pattern cylinder 2 is supported the pattern chain 5, having four sets of pegs 6 arranged on each bar, for the four different weaves to be produced in the fabric. Rotary motion is communicated to the pattern cylinder 2 by means of a worm 7, fast on the upper end of an upright driven shaft 8, meshing with a worm gear 9, fast on the end of the shaft 3.

Extending over the pattern cylinder 2 are a series of pattern indicator levers 10 (one indicator for each harness), and which are centrally pivoted on a transverse rod 11, supported on the outer end of the hinged frame 12, which is pivotally mounted on a traverse rod 13, in the upper ends of the arms 14, which are secured at their lower ends on a rock shaft 15. Each pattern indicator lever 10 has a downwardly extending projection 16 on its end, which is adapted to engage the pegs 6 of the pattern chain, there being a slight recess or depression in the end of said projection 16, into which extends the projecting end of a peg 6 when engaged by the said projection during the revolution of the pattern chain. A vertical wire 17 extends under and engages the end 18 of each indicator lever 10, and at its lower end extends into a recess in the lever 19, pivoted at 20. The opposite end 21 of said lever is weighted and causes the hook projection on its other end to engage the lower edge of the lower hook jack 22 to raise said jack. A vertical wire 23 is supported at its lower end in the recess in the lever 19, and engages at its upper end the upper hook jack 1.

Fast on the upright driven shaft 8 is a cam 24, which has a cam groove 25 therein, into which extends and travels a roll on a pin 26, on a lever 27, fast on a rock shaft 28. A link 29 is secured at its lower end in a slot 30 in the lever 27, and is pivotally attached at its upper end to the hinged frame 12, carrying the pattern indicator levers 10.



Fast on the rock shaft 28 is the lower end of an arm 31, which has a projection 32 at its upper end, adapted to engage recesses 33 in the lever 34, fast on the rock shaft 15. A spring 35, attached to the lever 31 and to the frame, holds said lever 31 in engagement with the recesses in the lever 34. As the lever 27 is raised and lowered by the cam 24, the arm 31 moves with it, and away from and into engagement with the recesses 33 in the lever 34, to leave said lever free to be moved by an auxiliary pattern chain 36, having pattern surfaces 37 thereon of different elevations, to move the lever 34 into four different positions, the projecting end of said lever being held in engagement with the pattern surfaces by a spring 38.

The operation is as follows: The revolution of the upright shaft 8 will, through the cam groove 25 in the cam 24, and the roll on the pin 26 on the lever 27, move said lever 27 and through link 29 raise and lower the hinged frame 12, carrying the pattern indicator levers 10 at regular intervals and at the same time move the arm 31 out of and into engagement with the lever 34. In case there is no peg 6 extending under the end 16 of one of the pattern indicator levers 10, the downward movement of the hinged frame 12, carrying the pattern indicator levers 10 through the link 29 and lever 27, operated by the cam 24, will move down the pattern indicator levers 10 and carry the end 16 down, and allow the weighted lever 19 to rock on its pivot support 20 and raise the lower jack 22, and through the wire 23, the jack 1 out of the path of the lifter bars 39 and 40. When a peg 6 comes under the end 16 of the pattern indicator lever 10, it will hold up said end, and the downward movement of the hinged frame 12 carrying the pattern indicator lever 10, will, through wire 17, rock the lever 19 and allow the jacks 1 and 22 to move down into position to be engaged by the lifter bars 39 and 40.

When the pattern surfaces 37 on the pattern chain 36 operate the lever 34, they cause said lever to rotate the rock shaft 15, and move it in one direction or the other to change the upright position of the arms 14, carrying the rod 13, on which the frame 12 is hinged, so as to move the frame 12 forward or back to cause the indicator levers at their engaging ends to be in a position to engage any one of the four rows of pegs 19 to produce any one of the four weaves, while the arm 31 acts to hold the lever 34 in its adjusted position. (Crompton & Knowles Loom Works, Worcester, Mass.)

MULTIPLIER MECHANISM FOR PATTERN CHAINS FOR C. & K. LOOMS.

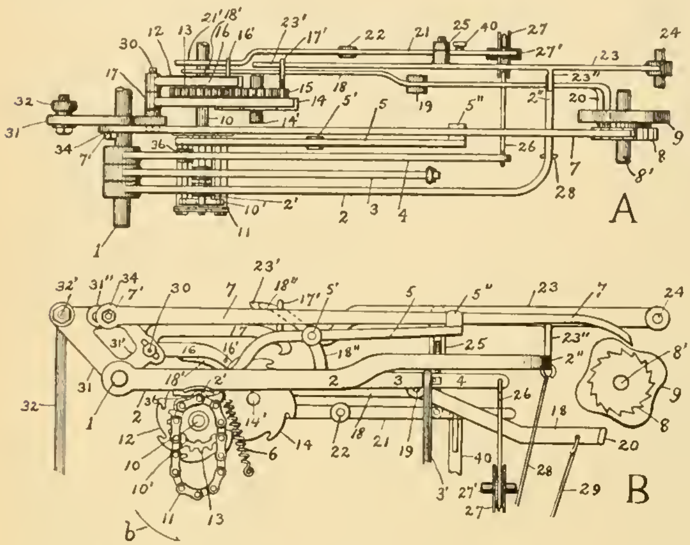
This multiplier mechanism is intended for looms for weaving blankets and other fabrics containing borders, and has for its objects the reduction in the length of the pattern chain, by means of a reversing motion for said chain, so that after the chain has made nearly a complete revolution in one direction, it is made to automatically reverse its direction of motion, and thus provide means for repeating a certain portion of said pattern chain and multiplying a certain pick.

In order to give a detailed description of the mechanism, the accompanying illustrations are given, of which Diagram A is a plan view of the pattern chain mechanism, shown in the correct position required for weaving the body of the blanket, etc.; Diagram B is a side view of the parts shown in Diagram A; and Diagram C is a diagrammatic view, showing parts of a loom which are used to call the pattern chain into action, the parts being shown in position for operating the auxiliary chain as required for the multiplication of picks.

Numerals of reference indicate the parts as follows: A shaft 1 has loosely mounted on it one end of the levers 2, 3, and 4 which extend over the bars of the pattern main chain 11 and rest on the tubes or rolls on said bars. The lever 3, through the connector 3′ operates the movable shuttle boxes in the usual way. The lever 5, centrally pivoted at 5′, has one end extending over and resting on the tubes or rolls of the pattern chain and is held in contact with the tubes or rolls by a spring 6. The opposite end of the lever 5 has a slotted side extension 5″, which extends under and holds the free end of the pawl 7 out of engagement with the ratchet wheel 8, as attached to the multiplier cam 9 on a stud 8′ until it is desired to operate said multiplier cam. The chain shaft 10 carries the pattern barrel 10′ which supports the pattern chain 11, made up of bars which carry rolls and tubes in the usual manner.

Fast on the chain shaft 10 is the ratchet 12, having integral with it the gear 13. An auxiliary ratchet 14, mounted on a stud 14′, has the gear 15 integral with it, which meshes with the gear 13. The pull pawl 16 is made to engage with its free end, the ratchet 12 to turn said ratchet and the gear 13. The pull pawl 17 is made to engage, with its free end, the auxiliary ratchet 14 in order to turn said ratchet and the gear 15.

A lever 18 is centrally pivoted at 19 and has the upwardly curved extensions 18′ and 18″. The extension 18′ extends under a pin 16′ on the pawl 16, and the extension 18″ extends under the bent end of the pin 17′ on the pawl 17. The opposite end of the lever 18 has a side extension 20 to engage with the multiplier cam 9 when required.



The lever 21, centrally pivoted at 22, has one end 21′ bent to extend under the pin 16′ on the pawl 16. The lever 23, pivoted at one end on a stud 24, has at its other end a curved extension 23′, which extends under the bent end of the pin 17′ on the pawl 17. The levers 21 and 23 are connected by an adjustable connector 25. To one end of the lever 21 is connected the end of a flexible connector 26, which passes under a roll 27 on a stud 27′. The other end of the chain 26 is attached to the free end of the lever 4.

The downward extension 23″ on the lever 23 rests on the bent free end 2″ of the lever 2. The free end 2″ of the lever 2 is connected by a connector 28 to the free end of the lever 50, pivoted at 51 and having a pin 50′ on said lever. The end of the lever 18 is connected by a connector 29 to a flexible connector 52, which passes under the pulley 53, pivoted at 54. The opposite end of the flexible connector 52 is secured to the lower end of a latch 48, pivotally mounted on a screw 49, extending through an elongated slot 48′ in the latch 48. The latch 48 has a notch 48″ to engage the pin 50′ on the lever 50, and at its upper end an inclined surface 48‴, which is engaged by the end 46′ of the rod 46. A spring 55, secured to the latch 48, acts to hold the latch in engagement with the pin 50′.

A bell crank lever 43 is pivoted on a stud 44 in a stand 45, and one end of the bell crank lever 43 is connected at 43′ to the rod 46, the opposite end 46′ of which engages the inclined edges 48‴ on the latch 48, as stated before. The opposite arm of the angle lever 43 extends over the auxiliary pattern chain 41. A spiral spring 47, loosely coiled around the rod 46, and bearing at one end against an arm 47′ on the stand 47″, and at its other end against a collar 46″, adjustable on the rod 46, acts to keep the arm of the angle lever 43 in engagement with the auxiliary pattern chain 41.

Referring again to pawls 16, 17, and 7, the pawl 16 is pivoted on a pin 30 on an arm 31′ of the crank 31 mounted on the shaft 1, and the pawl 17 is also pivoted at 30 on arm 31′ of the crank 31. The pawl 7 is pivoted at 7′ on a stud 34, fast in the extension 31″ on the crank 31. A regular oscillating movement is communicated to the crank 31 and to the three pawls 16, 17, and 7 through the rod 32, pivoted at 32′ to the crank 31 and connected at its lower end to a driven part of the loom.

When the parts are in the position shown in Diagrams A and B, the body of the blanket is being woven, and to put the parts in these positions with the pawls 16, 17, and 7 out of engagement with their respective ratchets, a roll 2′ on the pattern chain 11, is brought under the lever 2 to raise said lever, and through extension 23″ on the lever 23, resting on said lever 2, to raise the lever 23, which, engaging the bent end of the pin 17′ on the pawl 17, lifts said pawl out of engagement with the ratchet 14. The raising of the lever 2 causes a downward pull on the lever 18 through connector 28, lever 50, pin 50′, latch 48, flexible connector 52, and connector 29, attached to said lever 18. The downward pull on the lever 18 through the extensions 18′ and 18″, which extend under and engage the pins 16′ and 17′ on the pawls 16 and 17, raises said pawls and holds them out of engagement with their respective ratchets 12 and 14. The pawl 17 is held up by both levers 23 and 18, while the pawl 16 is held up by the lever 18 alone. At this time there is no roll on the chain under the lever 5, and therefore the spring 6 acts to raise the other end 5″ of said lever 5, and hold the pawl 7 out of engagement with the ratchet wheel 8, so that both chain driving pawls 16 and 17 and the multiplier pawl 7 are out of engagement with their respective ratchets.

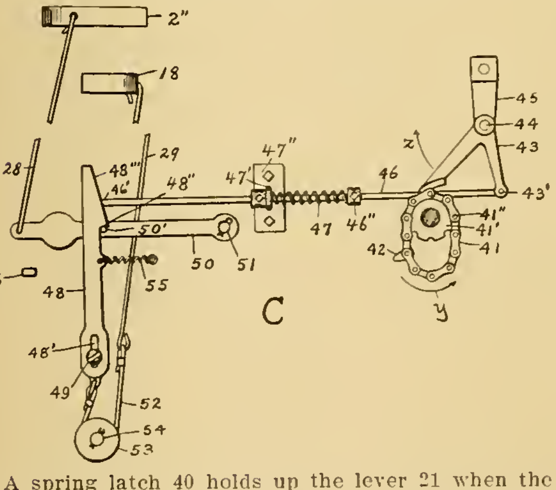
The operation of the mechanism for giving a forward movement to the pattern chain when, for example, the body of the blanket is completed and the pattern chain is called for, will now be described. The parts shown in Diagram C are in the position they occupy when the pattern chain is inoperative. The auxiliary pattern chain cylinder 41 is revolving all the time in the direction of the arrow *y*, and in the revolution of said pattern chain cylinder, the pattern ball 42 on the pattern chain is brought under one arm of the bell crank lever 43, which is then moved in the direction of the arrow *z*, and through rod 46, connected to the other arm of said bell crank lever 43, the latch 48 is moved on its pivotal support 49 until it is disengaged from the pin 50′ on the lever 50. Said latch will drop until the upper end of the slot 48′ strikes the screw 49. The dropping of the latch 48 causes a slack in the flexible connector 52, which slack is taken up by the turning movement of the lever 18 on its pivotal support 19, which is induced by gravity. The movement of the lever 18 allows the pawl 16 to drop into engagement and operate its ratchet 12 and start the chain 11 in the direction of arrow *b*, Diagram B, because the raising of the lever 23, through connector 25, moves lever 21 on its axis 22 and drops the end 21′ out of contact with the pin 16′ on the pawl 16. The revolution of the ratchet 12 through pawl 16, movement being communicated to said pawl through crank 31 and the rod 32, will revolve the chain 11 in a forward direction and remove the roll 2′, from under the lever 2, allowing said lever to drop, and through connector 28 allowing the lever 50 to drop with the pin 50′, (stop 56 limits the downward movement of said lever,) and said pin 50′ will again be engaged by the latch 48, the pattern ball 42 having passed out from under the arm of the angle lever 43 to allow the spring 47 to move the rod 46.

and the spring 55 to move the latch 48 into position to be engaged by said pin 50′. The pattern chain 11 will now advance a bar at a time for each movement of the ratchet 12 caused by the pawl 16.

To multiply a given pick, for this purpose a roll on the pattern chain is brought under the lever 5 to raise its end and at the same time lower the other end 5″ and allow the pawl 7 to turn the ratchet 8 and the multiplier cam 9 attached to it. The rotation of the cam 9 brings one of its projections into contact with the extension 20 on the lever 18 and causes said lever to move on its pivotal support 19 to raise the pawl 16 and the pawl 17 out of engagement with their respective ratchet wheels. A depression in the periphery of the cam 9 allows the lever 18 to move and take its opposite position and allow the pawls 16 and 17 to engage with their respective ratchet wheels and again operate the pattern chain and stop the multiplication of picks.

In the operation of the forward movement of the chain 11, the chain having completed one revolution, except one bar, it may be desired to reverse the movement of the chain. It will be noticed that there is a roll 36 on the chain 11 (see Diagram A), one bar in advance of the roll 2′. The roll 36 is under the lever 4, and when the chain 11 has completed one revolution in a forward direction the roll 36 comes under the lever 4 and raises said lever, and through flexible connector 26, passing around the pulley 27, draws down the lever 21, pivoted at 22, and raises the opposite end 21′ of said lever 21, which extends under the pin 16′ on the pawl 16 and raises the pawl 16 out of engagement with the ratchet 12. At the same time, through the connector 25 the lever 23 is drawn down with the lever 21, allowing the pawl 17, held up by the end 23′ of the lever 23, to engage with the ratchet wheel 14, and through pinion 15, fast to said ratchet wheel and meshing with pinion 13, fast to the ratchet wheel 12, turn the pattern barrel 10′ and the pattern chain 11 in the opposite or reverse direction.

It will be seen that the pattern chain 11 in reversing will perform all of the operations described in connection with the forward movement of the pattern chain, including the multiplication of certain picks, if desired, but exactly in the reverse direction. The pattern chain 11 will continue to move in the reverse direction until the roll 2′ is again brought under the lever 2 and the chain is stopped.

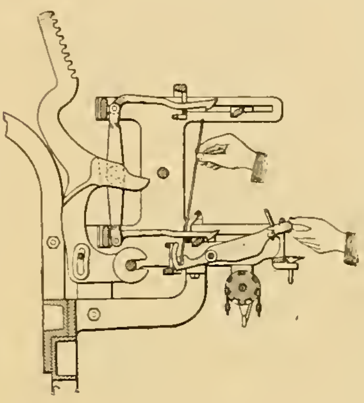


A spring latch 40 holds up the lever 21 when the support of the lever 23, having the extension 23″ resting on lever 2, is withdrawn by the roll 2′ passing from under the lever 2. (Crompton & Knowles Loom Works, Worcester, Mass.)

METHOD OF TAKING OUT THE CONNECTING WIRES IN CROMPTON-THAYER DOBBIES.

The accompanying illustration is a side elevation, in section, of the new Crompton-Thayer Dobby, showing the method of taking out the wires connecting the hooked jacks in said dobby.

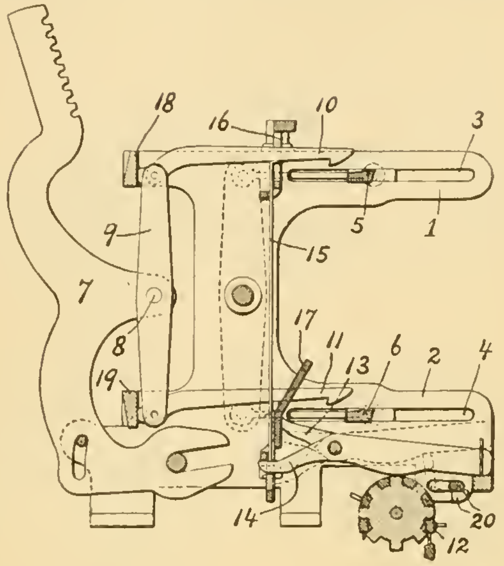
The piece in a dobby that generally goes across the top of the grate in which the indicating fingers lie, is in the new dobby made so that the same can be easily removed by simply taking out a cotter pin, which then allows the indicating fingers to be raised abnormally high (see left hand in illustration), thereby depressing its end, which then allows the top of its mate upright wire to go abnormally low, and from which position the latter then can be easily removed by bringing it a little forward, and then lifting it out of the dobby. This certainly is a distinctive advantage over those dobbies where said upright wire has to be bent, in order to take it out. (Crompton-Thayer Loom Co., Worcester, Mass.)



DOBBY FOR WHITIN LOOMS.

This dobby is characterized by its compactness of construction and the economical use of parts, especially those for operating and controlling the movement of the hooked jacks and levers. The accompanying illustration is a cross sectional view of this dobby, and in which 1 and 2 indicate its end frames, being provided with slots 3 and 4 in which the lifter bars 5 and 6 slide for operating the hooked jacks. Each harness jack 7 as pivoted at 8, has attached to its centre projection, a connector 9; each end of said connector having attached to it the rear ends of the top and bottom hooked jacks 10 and 11 respectively. These jacks 10 and 11 are moved back and forth by means of the lifter bars 5 and 6 respectively when the hooked ends of the former drop into their paths. The dropping of the jacks is controlled by the pattern chain 12, through the lever 13 for the lower jack 11, and through the lever 14 and vertical rod 15 for the top jack 10. Each top hooked jack 10 is placed in a separate slot of an upper grate 16, which thus act as a guide for the former. The lower end of the grate is curved to an angle of 90°, and has slots in that portion which are used as guides for the top ends of the vertical rods 15, thus not requiring the use of other guides or collars, and consequently reducing the cost of construction of the dobby. The lower jacks 11 are similarly guided in the slots of a lower grate 17, said grate also being provided with slots for guiding the levers 14. The lower ends of the rods 15 are also held in their proper position by holes in the grate 17, these latter coming in between the part of the grate with one set of slots and the other part with the other set of slots.

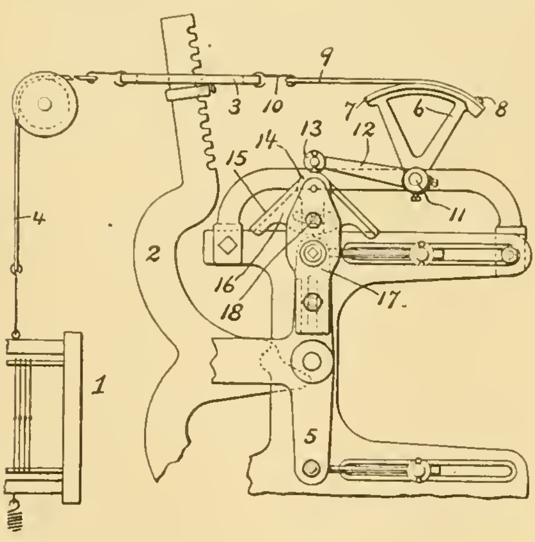
The working of the dobby is similar to the regular style, the stops 18 and 19, of course, being used alternately as pivots for the connectors 9 when the jacks are actuated. The harnesses may be leveled by means of a pivoted piece 20 being pushed under the ends of the series of levers 13 and 14 by means



of a handle at the side of the dobby. (Whitin Machine Works, Whitinsville, Mass.)

LENO MOTION FOR WHITIN DOBBIES.

In leno or gauze weaving it is necessary to cross the whip threads against the standard threads, a feature which puts an extra strain on the whip threads, and, in order to reduce this strain as much as possible, when a thread has to be in the upper part of the shed for two or more picks, the leno *i. e.* the half and return motion is used, which in turn obviates the necessity of the whip threads moving from the upper part of the shed to the closed shed, and then back again to its original position when the next shed is opened.



The half and return motion thus means, that the harness only moves to an intermediate position (halfway), and then back again to its original position, *i. e.* without descending to the closed shed.

The construction and operation of the Whitin leno motion is best given by means of the accompanying illustration, which is a side view of the principal parts of this dobby and in which 1 indicates a loom harness operated by a harness lever 2, through a slotted link 3, which fits over said harness lever and cord 4, said harness lever 2 in turn being operated through harness jacks (not shown) from the actuating rocker 5 of the dobby.

The leno or half and return motion consists of the segmental arm 6, with a curved rim 7, to which is connected at 8 one end of a strap 9, the other end being connected to the link 3 through a wire 10. The segmental arm 6 is secured to a shaft 11, which shaft also has an arm 12 secured to it. This arm carries at its end, a roller 13, which is kept pressed on the cam 14 by means of a spring coiled around the shaft 11. The cam 14 consists principally of two side faces 15 and a slotted plate 16 by which said cam may be secured in any desired position to the cam support 17 by means of a clamping bolt 18. The cam support 17 is secured to the top end of the actuating rocker 5, and consequently the cam 14 is moved back and forth with said rocker, making a movement in each direction for every pick. Owing to the cam 14 having two slanting faces, the roller 13 in pressing against said faces gives a backward and forward swing to the segmental arm 6, while the rocker 5 makes a movement in one direction or makes what is termed a back and return movement. The effect of this movement on the harness is that as the harness starts downwardly it is held in an intermediate position for a small space of time by having the cam roller 13 resting on the highest part of cam 14, and if said harness is to remain up for the next pick, the raising harness lever 2, actuated by the dobby, at this time will catch the harness, just as the segmental arm is about to begin a return movement.

If the harness is to remain down for the next pick, the segmental arm will make its return movement in time to allow said harness to be in the lower shed at the next pick.

The cam, in being made adjustable, can vary the movements of the segmental arm as desired. (Whitin Machine Works, Whitinsville, Mass.)

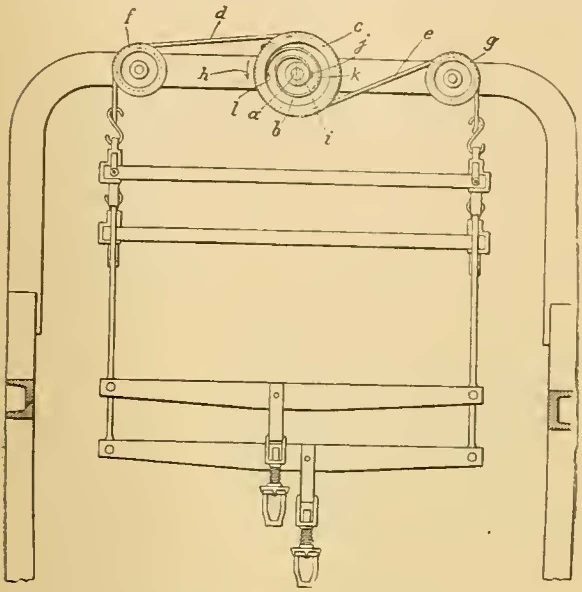
HARNESS RETRACTOR FOR DRAPER LOOMS.

This device refers to that class of looms wherein the harness frames are moved positively in the lower portion of the shed by means of cams, and raised in the upper portion of the shed by means of spring actuated drum winding. Two or more harness frames can be used, as the movement of each is effected independently of the others.

The accompanying illustration shows the gist of the new device—the spring actuated drum winding mechanism, *i. e.*, harness retractor device — in its front elevation, so much of portions of loom being shown in connection with it as are required to get a clear understanding of the working of the new mechanism.

In this class of looms, the harness frames are depressed (pulled down) by means of harness cams (not shown in illustration).

The arch of the loom sustains a horizontal stud, *a*, and projecting forwardly therefrom, and on said stud is mounted a plurality of spring operated rotatable actuators, one for each harness frame. Each actuator is made as a circular disk *b*, having an overhanging annular flange *c*, externally grooved, the disk having a hub to be supported rotatably on the stud *a*, the actuator being substantially an externally grooved drum. These drums are mounted upon the stud, one in front of the other, above their



respective harness frames, and flexible straps *d*, *e*, are wound from opposite directions above the grooved periphery of each drum and secured thereto, their other ends being led over guide rollers *f*, *g*, and in turn attached to the harness frames.

When the drum is rotated in the direction of arrow *h*, the connection *d*, *e*, will be unwound, and the harness frame attached thereto lowered, opposite rotation of the drum winding up the connections and lifting the harness frame. A collar *i*, is secured to the stud *a*, within each drum in front of the disk *b*, thereof, and by a suitable set screw *j*, one end of a coiled spring *k*, is fixed to the collar, the spring, of the flat or clock spring type, being coiled about the collar and having its other end secured at *l* to the inner circumference of the flange *c*.

When each harness frame is depressed positively by its cam (not shown), the drum of said frame will be rotated in the direction of arrow *h*, and its spring thus wound, storing up its power. As the cam rotates, and in turn releases the down pull on the harness frame, the spring *k*, of its drum expands, turning the drum oppositely to the arrow *h*, and thereby winding upon its periphery the connections *d*, *e*, that is, lifting the harness frame. Any stretch of the flexible connections *d*, *e*, is taken up by the springs, and the opposite winding of each pair of connections effects an even and uniform movement to the harness frame. (Draper Co., Hopedale, Mass.)

STAFFORD'S DOBBY.

The construction of this dobby is seen by referring to the accompanying illustrations, of which Fig. 1 is a side elevation of this dobby, and Fig. 2 is a vertical section through the dobby, showing more in detail its different parts for operating the harnesses.

Referring to the numerals of reference in the illustrations, 1 indicates a rock shaft, which carries a lever having upper and lower arms 2 and 3 respectively, and which arms vibrate back and forth with the rock shaft 1 as a centre, the motion which said arms receive being obtained from the loom through the lever rod 4, which is connected by a joint to the arm 5, said arm being centred on the rock shaft 1 and having a rigid connection with the levers 2, 3, thus imparting the vibrating motion to them. It will be noticed that there are two levers centred on the rock shaft, i. e., the one on the front side of the dobby being indicated by 2, 3, and the one on the back side of the dobby being indicated by 6, 7, each arm of the latter lever being a little longer than the corresponding arms 2, 3, of the front lever.

Connected to the ends of the arms 2, 3, are the rods 8 and 9 respectively, the other ends of which are connected to the front end of the top and bottom lifters 10 and 11 respectively. On the ends of the back arms 6 and 7 are connected rods 12 and 13 respectively, which are longer than the rods 8 and 9. The other end of the rod 12 is connected to the top lifter 10, while the rod 13 is connected to the bottom lifter 11, hence the back ends of the lifters will receive a greater movement than their front ends.

The harness levers 14 are pivoted on the rod 15 at their lower ends, and are connected at their middle projections to the connectors 16 by means of a joint 17, each end of the connectors 16 being jointed respectively to a hooked jack 18. These jacks are operated from the harness chain 19 through the levers 20, one of them resting under a lower hook, while the adjacent lever has a wire resting on it, which has its top end resting under the top hook of the same connector 16 as the bottom hook. From the leverage shown, it will be seen that when a peg or ball of the chain 19 comes under the lever 20, its other end is lowered, and the hook jack 18 falls into the path of the vibrating lifter 10 or 11 according to which hook is operated, and is carried

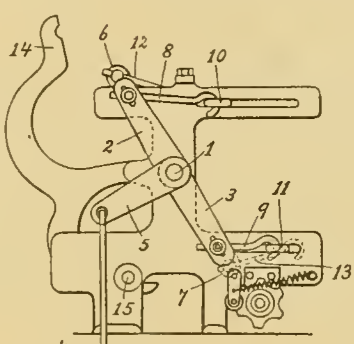


Fig. 1.

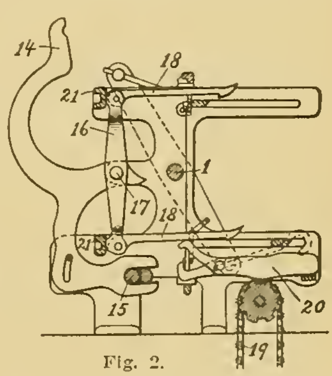


Fig. 2.

outward by it. Through the connection previously referred to, the respective harness lever 14 is thus given a movement, and by its connection with the harness (not shown), said harness is raised. As was stated, the object of the motion is to have all the threads of each section of the shed in one plane, and this object is accomplished for the top shed by having the levers for operating the lifters 10 and 11 of different lengths as described, for the reason that the back end of the lifters, by being connected to the longer levers, will move through a greater distance than the front ends of said lifters, and hence the hooked jacks 18, which are situated toward the back of the dobby, will get a longer pull, and through their connection with the harness levers 14, will give a correspondingly increased movement to them.

It will be readily understood that each successive harness lever, as it approaches the front of the dobby, will receive a slightly less upward movement than the harness lever just back of it. In this manner all of the threads in the top section of the shed are brought into one plane, thus obtaining half of the object of the improvement. The other half, that is getting all of the threads of the bottom section of the shed in one plane, is accomplished by setting the lower pivot 15, at a horizontal angle, thus having the back end of said pivot farther away from the harnesses than the front end. The positions of the stop bars 21, being parallel to the loom side, when the hooked jacks are free, the connectors 16 are vertical, and the pivots 17 are in a straight line. Owing to the horizontal inclination of the pivot 15, the lower end of the last harness lever 14 is farther away from the harnesses than the lower end of the first harness lever, and consequently its top end to which the harness straps are connected is closer to the harnesses and thus the harness itself is lower than the harness which is connected to the first harness lever. The top of each successive harness lever is a little higher than the one just back of it, and in this manner all the warp threads in the bottom section of the shed are brought into one plane. (Geo. W. Stafford, Warwick, R. I.)

SHEDDING MECHANISM FOR WEAVING HOSE.

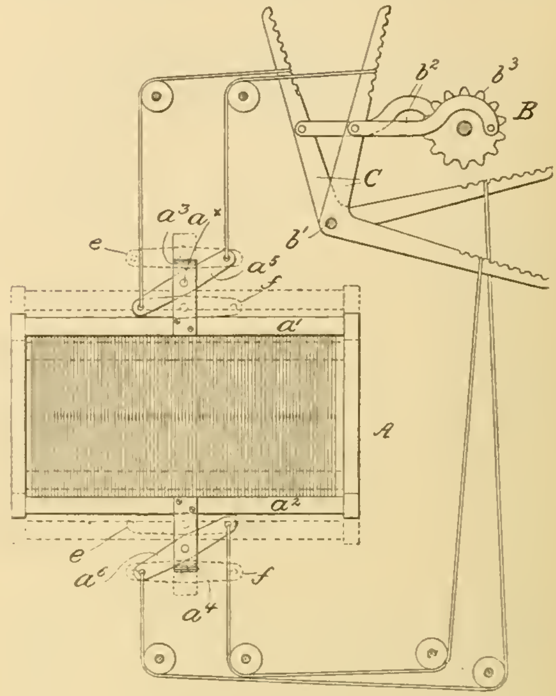
This shedding mechanism provides for dividing the movement of the harness frame, or making the same intermittent by the alternate action of the jacks, or effecting full movement without a subdivision by simultaneous action of the jacks.

A represents a harness frame, and B pattern controlled jack operating mechanism. Jack levers C are pivotally mounted upon a bar b^1, and connected by links b^2, with pinions b^3, which are operated by devices controlled by the pattern chain (not shown).

To the top cross bar a^1 of the harness frame A is secured a bracket a^3, to which is pivoted at a^x a lever a^5, and to the lower cross bar a^2 of the harness frame A is secured a similar bracket a^4 and lever a^6. Levers a^5 and a^6 are connected by cords to the harness frame.

Two levers C are utilized to operate the harness frame A, one being connected with the corresponding ends of both of the levers a^5 and a^6 by means of a cord e, while the other lever C is connected with the opposite ends of said levers a^5 and a^6 by means of the cord d. The dotted outlines of the levers a^5 and a^6 shown at e indicate the position occupied by said levers when the harness frame A is in its elevated position, and the dotted outlines shown at f indicate the position occupied by said levers when the harness frame A is in its lowermost position, while the full line position shown in the illustration indicates its intermediate position. By causing the levers C to be alternately operated, the harness frame may be raised or lowered from one extreme position to the other extreme, step by step, or when the levers C are simultaneously operated in the same direction, the frame A will be moved directly from one extreme position to the other extreme.

The levers C work on fulcra afforded in their connections with the jacks, and when the latter are working alternately, one end of each lever is held through its connections with the inactive jack so as to work on a fulcrum at that end when the other jack operates, and so the

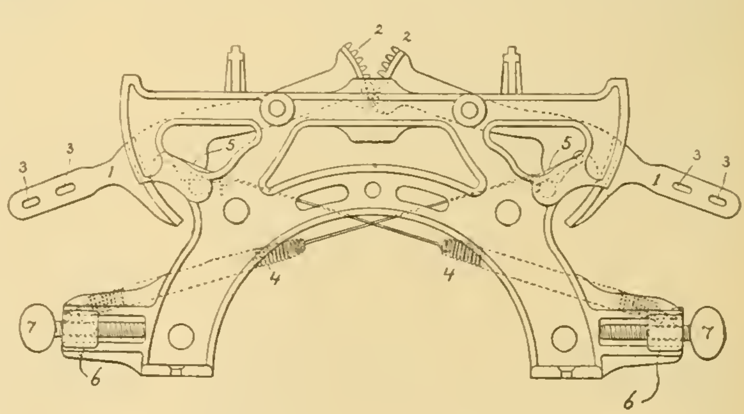


lever works first on a fulcrum at one end and then on a fulcrum at the opposite end to accomplish the before mentioned "step-by-step" movement of the harness frame. (Preston Hose and Tire Co., Marlboro, Mass.)

UNDER MOTION FOR C. & K. DOBBIES.

This device, as used for effecting the return movement of the harness, has for its object the production of means whereby the power of the springs can be conveniently varied, progressively from front to rear, in the series of harness frames employed in the loom.

The illustration is a front elevation of this under motion as fastened to the floor beneath the harnesses,



and consists of a series of rocking levers 1 arranged in pairs (one pair for each harness), being operatively connected by segment teeth 2 to each other so that said pair of levers move in unison. The outer ends of these levers 1 are provided with holes 3 for the reception of the harness cords, each one of said levers having connected therewith a spring 4 by means of its loop 5. Two cross bars 6 (adjustable by means of set screws 7) are located at opposite ends of the frame, and the springs of each set of levers 1 are connected to their respective bar, on the opposite side of the frame, thus preventing any crowding of springs, as well as the same time providing for a convenient adjustment of the power of the springs.

It will be also noticed that by the arrangement shown the springs exert the greatest power when the harness is down, which power is gradually lessened as the harness is raised. (Crompton & Knowles Loom Works, Worcester, Mass.)

BOX MOTIONS.

BOX CHAIN MULTIPLIER FOR C. & K. LOOMS.

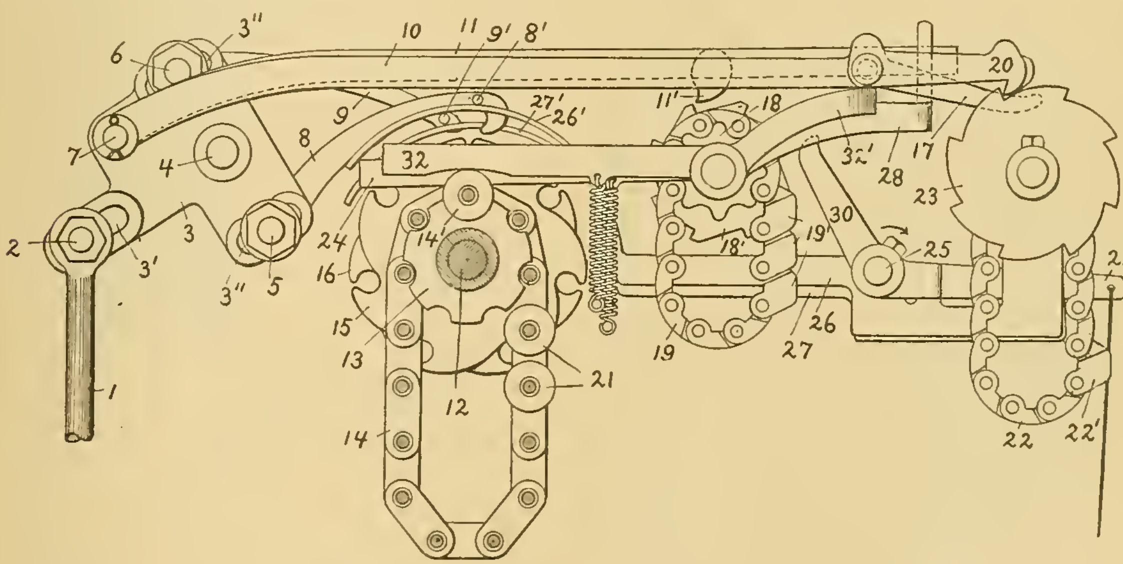
The object is to reduce the length of the drop box pattern chain by providing means for automatically reversing said chain, and means for repeating a certain portion of said chain as well as means for multiplying a given pick. The illustration herewith given is a side view of the mechanism, showing the means for effecting these movements.

To the upright rod 1 is given a regular up and down motion from a driven part of the loom, the upper end of said rod 1 being adjustably connected by a bolt 2 with a slotted portion 3′ of the plate 3, which is mounted to rock on a stud 4. In slots 3″ in the plate 3 are adjustably secured studs 5 and 6, a stud 7 being also secured in said plate 3. On the stud 5 is pivotally mounted the pull pawl 8, and on the stud 6 the push pawl 9, and on the stud 7 pull pawls 10 and 11 as working the multiplier. Fast on shaft 12 is the drop box pattern chain cylinder 13. Two ratchet wheels 15 and 16 are fast on the shaft 12, with their teeth extending in opposite directions, and adapted to be engaged by the pawls 8 and 9 to turn the pattern chain cylinder 13 forward or back, as desired.

In the normal operation of the mechanism the upward stroke of the rod 1 will rock the plate 3, causing the pawl 8 to rotate the ratchet wheel 15 one tooth, the multiplying mechanism being out of operation, since the arm 32 will be resting on the bars of the pattern chain, and thus through its end 32′ raise the end 17 of pawl 10 out of engagement with the ratchet wheel 23 of the multiplier chain 22, so that the same cannot operate.

Multiplying for a given number of picks. When a roller 14′ on the chain 14 raises the arm 32, and thus operates the ratchet wheel 23, and in turn the multiplier chain 22, composed of high and low links, any portion of the chain 14 can thus be repeated until continued revolution of the multiplier pattern chain 22 will bring a high link 22′ on the chain 22 under the end 17 of a forked pawl to raise said end 17, and at the same time raise the pawl end 20 out of engagement with the ratchet wheel 23, leaving said ratchet wheel at rest. The main pattern chain 14 will then continue in the same direction as before, that is, if the pawl 8 is down and operating the pattern-chain cylinder 13 in one direction, it will continue down, and if the pawl 9 is down and operating the pattern chain cylinder 13 in the opposite direction, it will continue down, and therefore a given section of the pattern chain 14 will be repeated instead of the chain being reversed.

When to multiply a given pick, a roller 21 is brought under the end of lever 24 and it will raise said lever and lower the end 28, extending under the pawl 11, to allow the extension 11′ on the pawl 11 to engage with the ratchet wheel 18′, connected with the auxiliary pattern chain cylinder 18, and turn said ratchet wheel and cylinder and move the chain 19 thereon until a high link 19′ is brought under the multiplying arm 30, which raises said arm and rotates the shaft 25 in the direction of the arrow to move the lever 29, and in turn controlling levers 26 and 27 to raise the ends 26′ and 27′ of said levers and cause them to engage the pins 8′ and 9′ on the pawls 8 and 9, and raise said pawls out of engagement with their respective ratchet wheels 15 and 16. The multiplication of any one bar will thus continue as long as there is an unbroken suc-

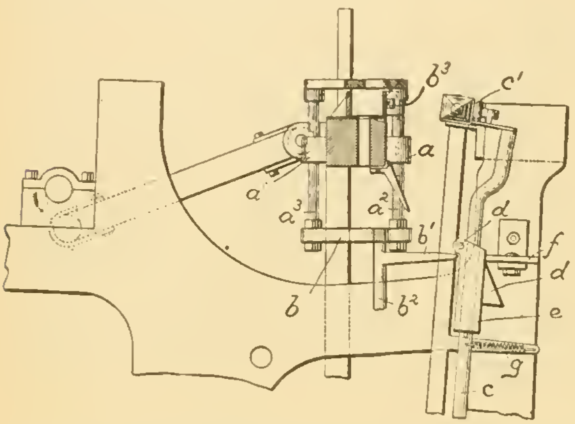


cession of the high links 19′ on the chain 19, but as soon as a low link comes under the arm 30, the shaft 25 will be rotated in an opposite direction, and the levers 26 and 27 will be released and allowed to move to allow one of the pawls 8 or 9 to engage with its ratchet wheel, and move the pattern chain proper. (Crompton & Knowles Loom Works, Worcester, Mass.)

IMPROVEMENT TO THE C. & K. SHUTTLE CHANGER.*

The object is to do away with the running shuttle box as used in this class of looms, the front plate of the stationary box being raised, when required, to receive a spare shuttle from the shuttle feeder, the latter forming at that time a temporary box for the shuttle.

The accompanying illustration is a side elevation of part of a loom showing the lay on its forward stroke, the shuttle feeder being ready to operate, to place a fresh shuttle on the lay.



In the new construction, the end of the lay is extended to form the bottom of the shuttle box, said lay being provided with two ears *a*, a^1, for receiving slide rods a^2, a^3, united by a cross bar *b*. This cross bar is formed with a rod b^2, provided with a lifter b^1. By means of this rod b^2 the cross bar *b* is lifted, in turn raising the slide rods a^2, a^3, and the binder b^3 to thus permit the placing of the spare shuttle on the lay.

The shuttle feeder lever *c*, is provided with a stud on which is pivoted the spare shuttle binder c^1. The lever *c* has co-operating with it an actuator *e*, having a cam *d* and a stud d^1 adapted to engage with the lifter b^1.

When required to change the shuttle, the usual actuator lever which operates to move the lifter rod b^2 is moved, in turn lifting the binder b^3 with the cross bar *b*. At the same time the lifter b^1 engages the stud d^1 on the actuator *e*, causing the same to engage a projection *f*, which, through spring *g*, moves the shuttle and its feeder into the space previously occupied by the running shuttle, the same having been discharged at the other end of the lay, and when the binder c^1 acts in place of the regular binder b^3, until the latter, with cross bar *b*, returns to normal (lowered) position after the spare shuttle has been picked from the shuttle feeder, and when the latter is withdrawn from the shuttle box ready for replacing with another shuttle by the weaver. (Crompton & Knowles Loom Works, Worcester, Mass.)

*For a complete description of this mechanism see pages 24, 25, 26 and 27 of Part 2 of this work.

SHUTTLE BOX MOTION FOR MASON LOOMS.

This motion has for its object the production of means whereby a positive locking of the shifting tooth (so that when in mesh it is practically a solid part of the gear) is obtained, in turn producing a strong, durable and self shifting mechanism.

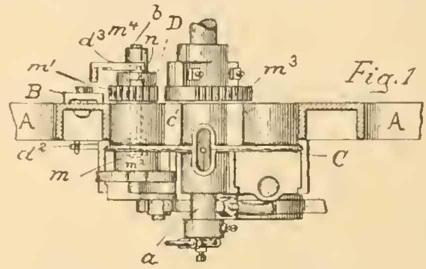
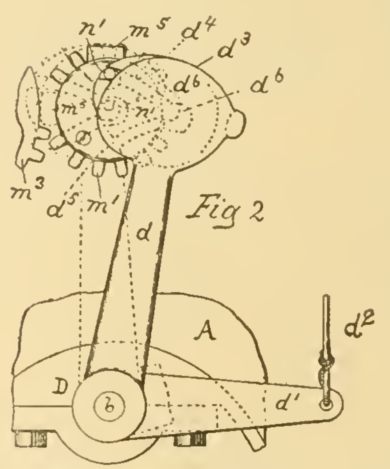


Fig. 1 is a top plan view of the mechanism, and Fig. 2 is an enlarged inner side elevation of the gear with the shifting tooth and the controlling means for the shifting mechanism, the parts being shown in position to prevent shifting at the first dwell, but ready to start.

Examining the illustrations we find a bracket C secured to the loom side A having a bearing for the shaft *a*, and a bearing *c* for the hub *m* of the toothed gear m^1, to which hub is secured the face plate m^2. A mutilated gear m^3 is secured to the crank shaft *a* adjacent to the gear m^1, the number of teeth being such as to give only one-half a revolution to the gear m^1 when in engagement therewith.

On a bracket B, secured to the loom frame, and in a bearing D is fulcrumed a shaft *b*, to which the controller (shown as practically a bell crank *d*, d^1) is secured, the arm d^1 being connected by a wire d^2 with the inner end of the box-motion lever, controlled by the pattern chain. At its upper end the arm *d* is enlarged to form a head d^3, which swings in a path closely adjacent and in front of the cap m^4, the inner face of the head having two cam grooves d^4, d^5 extending from a nearly circular recess d^6 to the edge of the head, the grooves being adapted to receive the stud n^1 secured to the shifter.

In Fig. 2, the bell-crank controller is shown in normal position, maintained therein by its own weight, the inner end of the pattern lever resting on the plain portion of the pattern chain, and at such time the stud n^1 of the shifter is in its highest position, and it is so maintained because the stud is in the outer end of the cam slot d^4 of the controller, and the tooth m^5 nearest the mutilated gear m^3 is retracted, so that said gear will not rotate the gear m^1. Now, if it is desired to operate the box motion, a ball on the pattern chain raises the pattern lever and through wire d^2 swings the controller to the left and into dotted line position, the weight of the shifter *n* causing it to drop, the cam groove d^4 permitting it to descend, the shifter acting to shift the slide bar or carrier to the left to bring the tooth m^5 into operative position, and the driven



gear m^1 will be rotated one-half revolution, causing the stud n^1 to travel in a circular path in the recess d^6 from above the axial centre of the gear m^1 to directly below it, and out of the inner end of the groove d^4, the gears m^1 and m^3 being out of mesh. If the box motion is to be again operated, the controller is released and will move into normal position, but the stud n^1 will travel from the inner end of the cam groove d^5 to its outer end, the weight of the shifter n causing it to drop.

The shifting of the tooth carrier is not effected by the direct operation of the pattern mechanism, but by the weight of the shifter, and the only strain brought upon said mechanism is that necessary to effect the slight movement of the controller from full to dotted line position, Fig. 2, thus relieving the pattern mechanism of all strain necessary to shift the tooth of the shifting-tooth gear, and by the mode of supporting the tooth carrier in said gear the shifting tooth is practically a solid part of the gear when in operation. (Mason Machine Works, Taunton, Mass.)

LET OFF MECHANISMS.

LET OFF MOTIONS FOR DRAPER LOOMS.

This mechanism is used in connection with the well-known "Bartlett" let off motion, and has for its object to provide means whereby the actuating pawl will be gradually set to take up an increasing number of teeth on the ratchets (as the diameter of the warp on the beam decreases) with the same movement of the whip roll.

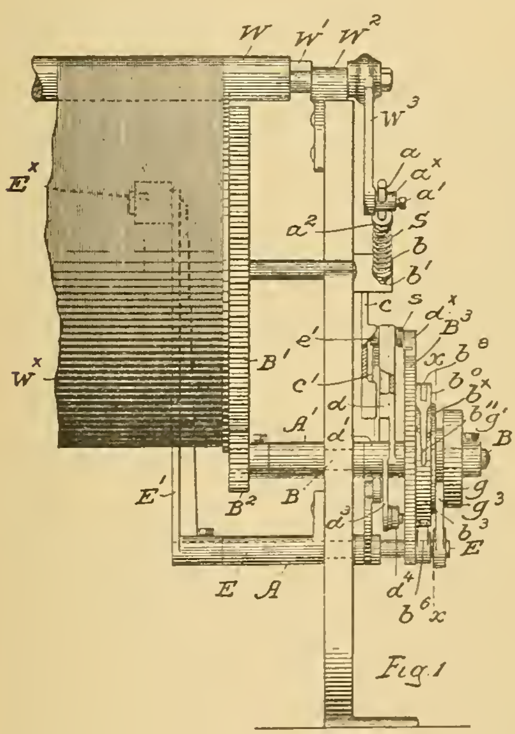


Fig. 1

Fig. 1 is a rear elevation of a portion of a loom with this mechanism applied, and Fig. 2 is an enlarged section of part of the mechanism on line x, x, Fig. 1.

W indicates the whip roll as mounted in arms W^1, secured to the rocker shaft W^2. Secured to said rocker shaft is the rocker arm W^3. A rocking stud a^x on the free end of the arm W^3 has extended through it a rod a, secured by a set screw a^1, said rod having fast upon it a collar a^2, against which bears one end of the tension spring S, as coiled around the rod, and at its other end bearing against an ear b on a bracket, secured to the loom side, the rod passing loosely through a slot b^1 in the ear. The end of the rod a extended through the ear is pivotally connected with one member c of a compound pawl carrier, said member having a longitudinal guide-way c' in its outer face.

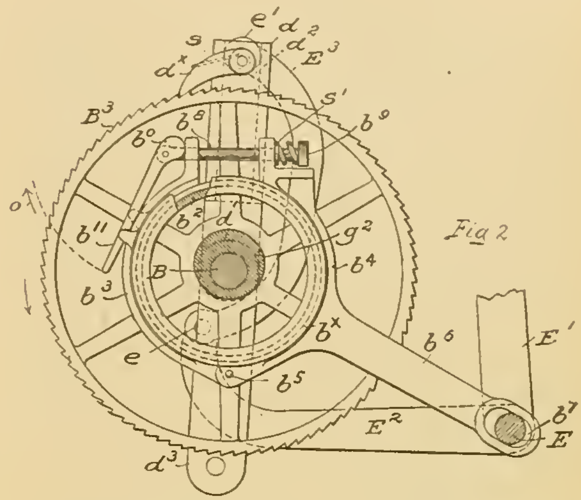


Fig. 2

A hub A^1 on the frame forms a bearing for a pinion shaft B, having fast thereon at its inner end a pinion B^2, in mesh with the beam gear B^1. The shaft is extended through and beyond the loom side, and has loosely mounted upon it the let off ratchet B^3, and between the latter and the loom side the hub d^1 of the other member d of the pawl carrier is loosely mounted on the shaft, said member d being upturned alongside of the member c, and having in its face adjacent thereto a longitudinal guide-way d^2. A let off pawl d^x is mounted on the member d and pressed upon the teeth of the ratchet by a spring s. A short arm d^3 depends from the hub d^1, and has pivotally connected with it a slide bar d^4, supported in a bearing on the loom side, said slide bar having adjustably mounted upon it a collar. A link connected to the lay sword is rearwardly extended and upturned to form an eye embracing the slide bar d^4 back of a collar, the forward beat of the lay bringing said eye against said collar and moving the slide bar toward the front of the loom. Such movement of the bar swings the member d of the compound pawl carrier c, d to the left (backwards with reference to Fig. 1), and imparts the feed stroke to the pawl d^x, the termination of such stroke of the pawl being always at the same point.

A sleeve bearing A on the inner side of the loom frame supports a rock shaft E, extended beyond the loom side and having fast upon it at its inner end an upturned arm E^1, provided at its upper end with a roll E^x (shown in dotted lines), which rests upon the periphery of the yarn mass W^x on the beam. Beyond the loom side said rock shaft has fast upon it a second arm E^2, rearwardly extended and upturned at its inner end and pivotally connected at *e* with the lower end of an upturned radius bar E^3, bent to clear the pinion shaft B. The upper end of the radius bar extends between the members *c* and *d* of the pawl carrier, and is provided with a transverse stud e^1, the opposite ends of which enter the guide-ways c^1, d^2 of said members, respectively. The arms E^1, E^2 form a bell-crank lever, and when the beam is full, the arm E^2 will be raised and the stud e^1, which is the connection between the members *c* and *d*, will be at its highest point and the stroke of the pawl d^x will be governed by the throw of the member *c*. As the yarn is wound off, however, the diameter of the mass W^x constantly decreases, and the roll E^x will move toward the axis of the beam and the rear end of the arm E^2 will descend, so that the connection e^1 will move away from the fulcrum of the member *c* and toward the fulcrum of the member *d*, viz., the pinion shaft B. This results in increasing the throw of the member *d*, and consequently increases the stroke of the pawl, by setting its starting point farther back along the ratchet, so that a greater number of teeth will be delivered, although the throw or swing of the member *c* remains substantially constant. Thus while the movement of the whip roll remains substantially the same, the pawl will be set back a gradually increasing distance as the yarn winds off to compensate for the constantly decreasing diameter of the yarn mass. The shaft B has fast upon it the hub g^1 of an annular internal gear *g*, having eleven teeth and meshing with a gear of ten teeth loosely mounted on an eccentric hub g^2 fast on the ratchet B^3, an arm g^3 having a longitudinal slot in its free end to embrace the rock shaft E, permits slight rocking and longitudinal movement of said arm.

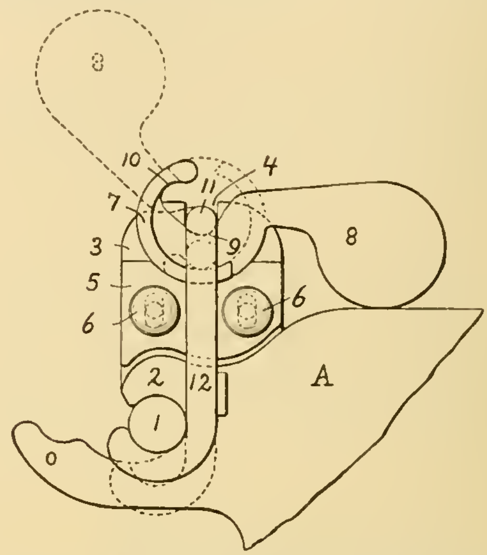
A friction clamp coöperates with the ratchet B^3, the latter having fast upon its outer face a peripherally-flanged hub b^x, having a band b^2 of felt around it, to be embraced by a two-part clamp b^3, b^4 pivotally connected at b^5, and held from rotation by an arm b^6 on one of the parts slotted at b^7 to embrace the rock shaft E. The separated ends of the clamp members are connected by a draw bar b^8 headed at b^0 and with a spring s^1 between it and the adjacent part of the member b^4, the other end of the clamp bar passing loosely through the upturned part of the member b^3, and having a locking cam b^0 mounted upon it to lock the clamp in operative position. By lifting the handle b^{11} of the cam in the direction of arrow *o* the clamp will be released, so that the ratchet can be readily rotated by hand when necessary. (Draper Co., Hopedale, Mass.)

BEAM LOCK FOR WHITIN LOOMS.

The object is to securely lock the journals of the warp beam against its fixed bearings and thus prevent all rocking motion or vibration of the warp beam as is caused by the strain on the warp during weaving.

The accompanying illustration is a side view of part of the end frame of a loom, showing the beam journal held against its fixed bearing on the end frame by a hooked clamp in solid lines, indicating at the same time in broken lines the position of the clamp when the journal is released.

A indicates one of the end frames of a loom, and O the rearward projecting horn, forming the temporary support of the journal 1 of the warp beam when the beam is placed in the loom. The journal 1 bears obliquely on the fixed bearing 2 in the direction in which the strain on the journal is exerted. From the end frame A extends upward the lug 3, provided with the central slot 4. A bolster plate 5 is secured to the lug 3 by the bolts 6, extending through elongated holes in the lug 3, said bolster having a concave bearing on its upper end, on which bears the segmental cam 7 of the lever 8. In the centre of the cam 7, and near one side of the cam, are two concave seats connected by a plane surface. A round bar 11, which connects the hooked arms 12, is supported in the concaved seat 9 when the journal is in the raised position, as shown in solid lines. As the seat



9 is in the centre of the cam, the hooked arms 12 are supported on what may be termed a "dead bearing," because no strain exerted by journal 1 on the hooked bars can change the position of the bearing.

When the warp beam is to be removed, the lever 8 is swung into the position indicated in broken lines, the hooked arms 12 being then supported by the bar 11, bearing on the concaved seat 10. By loosening the bolt 6 the bolster 5 may be adjusted and the pressure exerted by the hooked arms on the journals 1 of the warp beam regulated. (Whitin Machine Works, Whitinsville, Mass.).

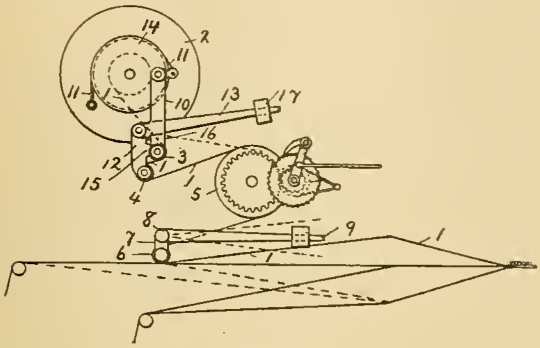
LET OFF FOR PILE FABRIC LOOMS.

One of the most important features for weaving tapestry carpets is the exact let off of the pile warp in order to produce as sharp a cut off of the change of colors in the fabric as possible, thus producing a more exact reproduction of the design in the fabric.

The illustration is a side elevation of the operative portions of this let off mechanism.

Examining this illustration, we find the pile warp 1 conducted from the rear side of the warp beam 2 in front of and over the roll 3 to the rear of and over the roll 4, over the sand roll 5, and around the roll 6, journaled in the short arms 7 of bell-crank levers 8.

Whenever a wire is inserted in the fabric, a greater length of the printed warp 1 is required in order to cover the wire and form the pile, and this extra length of warp is provided for and a uniform tension maintained by means of the roll 6, as journaled in the rocking-bell crank levers 8, the insertion of the wire causing the roll 6 to swing forward and lift the weighted arms 9, which fall and carry the roll 6 back to take up any slack in the warp.



An indicator for the let off of the pile warp: For this purpose a graduated scale is applied to the sand roll 5 by drawing a series of lines on a strip of paper or thin cardboard and wrapping the same around the end of the sand roll beneath one or more spring clips, which serve to retain said cardboard in position and allow it to be exchanged for different graduated scales when desired and as directed by height of pile wires, or wires per inch used.

The bell crank levers 10, to which friction straps 11 are attached, are so arranged that the weight of the bell crank levers 12, with their weighted arms 13, will serve to draw the friction straps 11 closely against the friction wheels 14 and cause them to act as a brake upon the warp beam 2. As the warp is drawn forward by the intermittent rotation of the sand roll 5, a pulling strain is exerted upon the roll 4, holding the short projections 15 against the arms 16 of the bell crank levers 10, as shown in the illustration. The forward movement of the roll 4, when the projections 15 are in contact with the arms 16 of the bell crank levers 10, serves to rock the bell crank levers 10 and release the friction straps 11, thereby allowing the warp beam 2 to turn. As the rocking of the bell crank lever 12 must raise the weighted arms 13, the tension upon the yarn between the sand roll and warp beam can be adjusted by moving the weights 17 upon the arms 13, enabling that tension to be secured, which will cause the change of color to register accurately with the lines on the scale as marked on the thin strip of cardboard wrapped around the sand roll 5

It will thus readily be seen that the weaver can regulate any variation in the let off as required by simply moving weight 17. (Crompton & Knowles Loom Works, Worcester, Mass.).

LET OFF FOR "DOUBLE SHED" LOOMS.

The mechanism relates to looms in which two banks of shuttles are used, the object being to provide for taking up the slack in the warp threads which extend during weaving in the plane of the fabric. The accompanying illustrations are side views of two forms of these tension devices.

Referring to Fig. 1, we find that there is a separate rocking arm for each whip roll 1 and 2, said support consisting of an angle lever 3, 4, each being pivoted to its respective pivot 5, 6. The arm 4 has on its outer end a stud or pin 7, adjustable in an elongated slot 8, and extending out from the side into a like slot 9 in the arm 3.

By this connection of arms 3 and 4, it will be seen that the tension on the set of warp threads *g*, by the raising or lowering of the harness, will draw the arm 4, respectively carrying the roll 2, in the direction of arrow *a*. At the same time, by the pin and slot connection of the two arms, the arm 3 carrying the roll 1 will be moved in the direction of arrow *b* and put tension on the warp threads *h*. This motion of the two arms is simply reversed when the shed changes.

Referring to Fig. 2, which shows another arrangement of the whip roll supporting arms, we find used a separate arm or support for each end of the whip rolls 1 and 2, over which warp threads *i* and *j* respectively pass from the warp beam 10. Two arms 11 and 12 are pivotally connected at 13, with their free ends provided with open end slots 14 and 15 to receive the journals or ends 16 and 17 of the whip rolls 1 and 2. The opposite ends of the arms 11 and 12 are pivotally connected with the arms 18 and 19, and at the other ends of the arms 18 and 19 are pivotally attached to roll 20, which travels on a flange 21 on a stand 22. Spring 23, attached to a hook 24 on roll 20 and to a stationary point (not shown), acts to draw down the roll 20 and move whip rolls 1 and 2 toward each other.

Thus the tension on the set of warp threads *i* by the raising or lowering of the harness above or

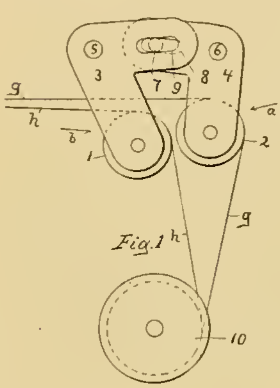


Fig. 1

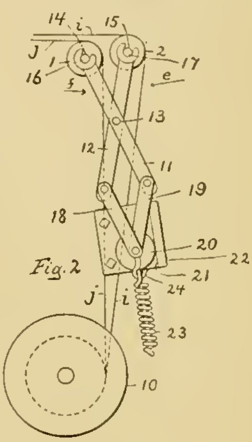


Fig. 2

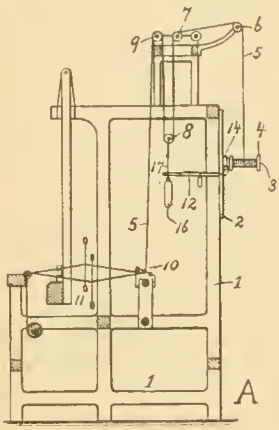
below the plane of the fabric will draw the whip roll 2 in the direction of the arrow *e*, and at the same time, through the shear joint connections, move the whip roll 1 in the direction of arrow *f* to put a tension on the warp threads *j*, extending in the plane of the fabric being woven, and *vice versa*, if the tension is on the set of warp threads *j*, the whip roll 1 will move away from the whip roll 2 and the tension put on the set of warp threads *i*. (Crompton & Knowles Loom Works, Worcester, Mass.)

LET OFF FOR NARROW WARE LOOMS.

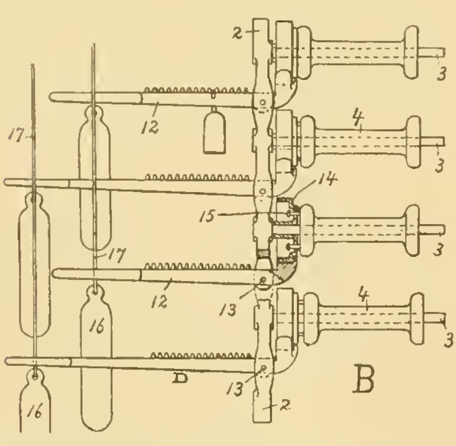
This motion is used in connection with ribbon or other narrow ware looms, and belongs to that class of looms in which the delivery, *i. e.* let off of the warp thread from the spool is controlled by friction and operated by the take up of the thread.

The object of the mechanism is to provide a let off motion, simple in construction, and uniform and positive in its action, besides allowing exhausted spools to be easily substituted by full ones.

The working of the motion in connection with the loom and also the details of the arrangement are best explained by means of the accompanying illustrations, of which Fig. A is a vertical cross section, showing a portion of a ribbon loom with a single warp thread spool, supplied with the new let off. Fig. B is a side elevation, partly in section, and on a larger scale than in Fig. A, showing a series of spools and their let off mechanisms more in detail.



Referring to the illustrations, 1 indicates the frame of the loom, which is equipped with means for operating the lay, harness, and take up mechanisms in the usual manner. 2 is one of a group of bars supported on the frame 1 and carrying a series of fixed rods 3, extending outwardly to receive a corresponding series of warp spools 4. The warp threads 5 as coming from the spools 4 are passed up over the pulleys 6 and 7, then down under the suspended pulley 8, and back again over the pulley 9 from which point they are passed under whip rolls 10 to the harnesses 11. Friction is put on the spools 4 by means of levers 12, centred at 13, pressing with its short end against friction pulleys 14, to which the spools are secured by means of screws 15, the other ends of said levers 12 being weighted in order to produce the required friction. The suspended pulley 8 is held down by a weight 16, which is connected to it by means of a wire 17 passing through the forked end of the lever 12. The friction on the spool 4 is sufficient to cause the pulley 8 and its weight 16 to rise when the take up motion of the loom is pulling the warp threads forward. As the weight 16 continues to rise, it finally comes in contact with the lever 12 and raises it slightly, which action causes a decrease in the friction on the spool 4 and consequently more warp is unwound. With this unwinding of the warp from the spool, the weight 16 falls out of contact with the lever 12 and thus the unwinding is stopped. The weight again starts upward and when it comes again in contact with the lever 12, the same unwinding will result, and in this manner



a uniform and even let off of the warp is automatically obtained. The spools are not placed directly over each other in the frame, in order to avoid any interference with the freedom of the weights, also the levers 12 are made alternately long and short for the same purpose. (William W. Uhlinger, Paterson, N. J.)

TAKE UP MECHANISMS.

TAKE UP MOTION FOR WHITIN LOOMS.

Thin places are frequently caused in the cloth, during weaving, due to the fact that the take up motion of the loom continues in operation for a brief space of time after the filling fork has detected the absence of filling in the shed. The object of the new mechanism is to arrest automatically the cloth take up as soon as the absence of filling in the shed is detected by the filling fork.

In order to better explain the mechanism, the accompanying two diagrams are given, showing the principal working parts of this take up in relation to each other, and their positions with reference to the framing of the loom.

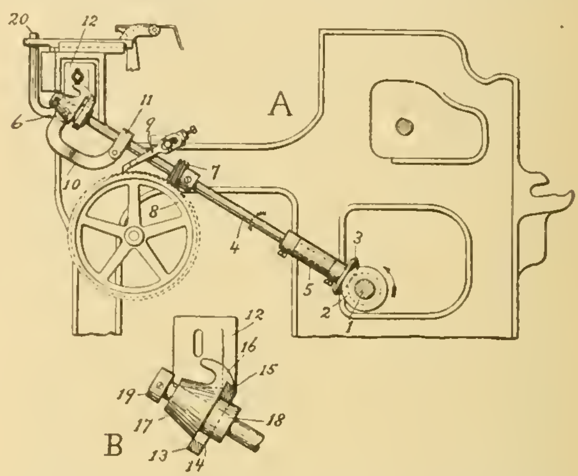


Diagram A is an end view of the loom showing the parts of the mechanism in their correct positions while the loom is running. Diagram B is a side view, partly in section, of the latch head by which the take up mechanism is held up out of contact with the ratchet wheel of the take up motion.

The motion consists essentially in an oblique shaft driven at one end from the cam shaft. Near the centre of its length a worm is fastened to it, which works into the ratchet wheel, and this in turn drives the sand roll. The other end of the shaft is supported by a bracket which is attached to the rock shaft, so that when the filling breaks and the rock shaft is partly rotated, the oblique shaft is raised, causing the worm to disengage the ratchet wheel, and so arrest the take up of the cloth.

Referring to diagram A, 1 is the cam shaft, to the end of which is secured the bevel gear 2. Meshing into 2 is the gear 3 fixed on the end of the oblique shaft 4. This end of the oblique shaft is held in position by the sleeve 5, the bracket which holds it being journaled on the cam shaft. The oblique shaft 4 extends from the cam shaft 1 toward the rock shaft 6 and has secured to it the worm 7, placed so as to engage with the ratchet gear 8, with which the pawl 9 engages to hold the ratchet gear in the advanced position. To the end of the rock shaft 6 is secured the bracket 10, the opposite end of which is jointed to the collar 11, around the shaft 4, but loose on the same. On the end framing at the breast beam is secured the bracket 12, the arm 13 of which is provided with the elongated opening 14 (see diagram B). The edge 15 is beveled so as to engage with the hook 16 of the latch head 17, the stud 18 which is attached to it being provided with flattened sides and extends through the elongated opening 14 in the arm 13. The shaft 4 extends through the latch head 17 with a loose sliding fit. The collar 19 is secured to the end of the shaft 4.

When the parts are in the normally operative positions (shown in diagram A) and the loom is running, the worm 7 is in engagement with the ratchet gear 8, which controls the rotation of the sand roll and consequently the take up of the cloth. The worm securely locks the ratchet gear, so that it cannot be moved by hand, as is the case when the ratchet gear 8 is operated by a reciprocating pawl mechanism in which the take up mechanism may be and at times is operated by hand to secure a surreptitious gain of cloth. When now a shuttle fails to lay the required pick, the filling fork is carried backward by the snake head and by means of the regular levers, shifts the belt from the fast to the loose pulley. At the same time that the fork goes backward it pushes the arm 20 out, and this arm being attached to the rock shaft 6, causes it to partly rotate. The bracket 10, rocking with the rock shaft, raises the shaft 4 and disengages the worm 7 from the ratchet gear 8, which is, however, held in the advanced position by the pawl 9. The hook 16 on the latch head 17, having been brought higher than the edge 15, slides down over it, thus securing the shaft in the raised position, with the worm 7 out of contact with the ratchet gear 8.

By this arrangement the take up mechanism is disconnected at the same time with the release of the spring shipper, and the take up of the cloth or the warp instantly arrested. The weaving of thin places in the cloth is thus avoided and the laborious back winding of the warp and cloth by the weaver unnecessary. On releasing the latch head 17, the worm 7 engages with the ratchet gear 8 and continues to take up the cloth as it is woven. (Whitin Machine Works, Whitinsville, Mass.)

TAKE UP MECHANISM FOR DRAPER LOOMS.

In this mechanism two filling forks are employed (one on each side of the loom), the one acting to effect the stoppage of the loom on failure of filling, the other co-operating only with the take up pawl to prevent its operation and thereby obviate thin places in the cloth.

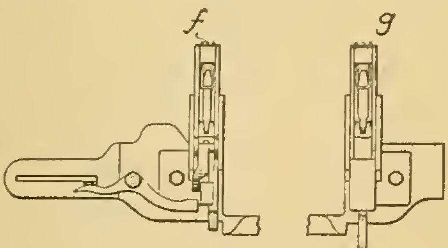


Fig. 1

Fig. 1 is a top view of the two filling forks, one at each end of the loom, and Fig. 2 is a detail of a portion of the take up mechanism.

In co-operation with the take up mechanism two pawls *d* and *e* are shown to operate successively, the pawl *e* being fulcrumed on a stud e^1 and longitudinally slotted to straddle the shorter pawl *d*, which is also slotted as at d^1, to slide on the stud e^1 when the pawl *e* is disengaged.

The pawl carrier *a* is bent and extended forward as at a^1 and at its outer end an upright short arm a^4 is adjustably secured to it by a bolt a^5.

The pawl *e* has at its fulcrumed end a depending ear e^2, on which is pivoted a dog e^3, having a cam surface e^4 on its lower edge adapted to rest on and be actuated by a pin d^2 on an arm d^3. This arm d^3 is provided with a cam rib d^4, and the dog e^3 has on its inner face a lateral shoulder e^5.

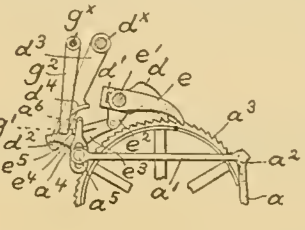


Fig. 2

If the filling fails while the shuttle is going to the right, the same is detected by the fork *g* and the shaft g^x is rocked, swinging the arm g^4 inward, the offset g^1 engaging the shoulder of the dog and pushing the latter inward to thereby swing the pawl *e* up out of engagement with the ratchet wheel a^3, and at the same time the arm g^2 engages the pin a^6 and through the arm a^4 disengages the actuating pawl a^2. Thus the action of the take up is interrupted, and at the same time the disengagement of the pawl *e* permits the take up to let back as far as allowed by the slotted pawl *d*, preventing a thin place in the cloth, while the fork *f* detects on the return shot of the shuttle and thus stops the common loom, or effects a change of filling carriers in connection with Northrop looms.

When the fork *f* operates, it moves the rock shaft d^x, and the arm d^3 thereon is swung inward, the pin d^2 acting on the cam edge e^4 of the dog, lifts the pin until the shoulder e^5 is above an offset g^1 on arm g^2, and as the arm d^3 swings inward, the cam rib d^4 engages the projection a^6 of the arm a^4 and disengages the actuating pawl a^2, so that the take up action is stopped at once, thus preventing a thin place in the cloth. (Draper Co., Hopedale, Mass.)

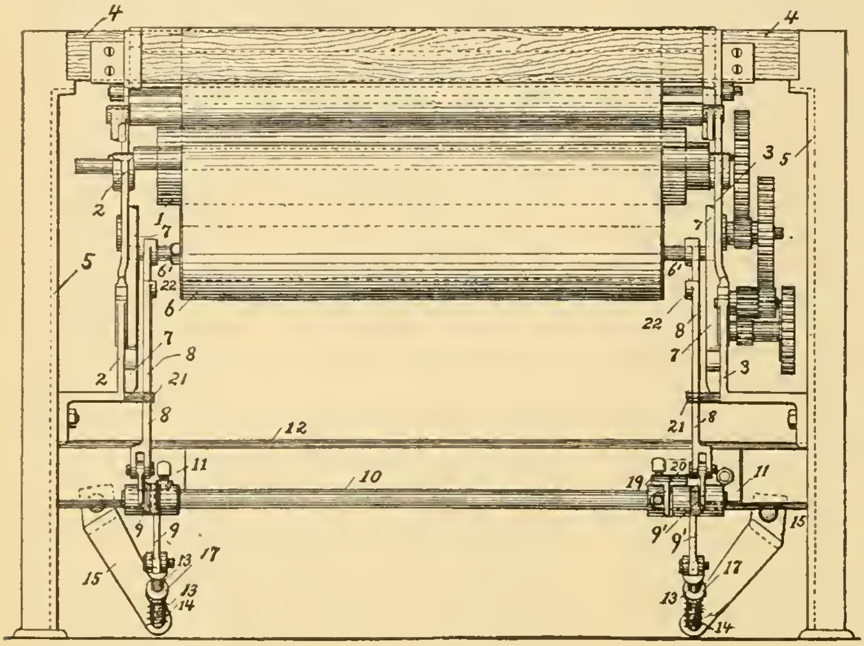
TAKE UP MECHANISM FOR C. & K. LOOMS.

The object is to provide means for releasing the winding up roll from contact with the take up roll, when removing said winding up roll from the loom; or to release one end only of the winding up roll to adjust the edge of the cloth at that end.

The accompanying illustration is a front view of the take up mechanism, having this device applied.

The take up roll 1 is supported at its ends in bearings on stands 2 and 3, attached to the breast beam 4 and loom side 5. The winding up roll 6 extends below the take up roll 1 and has a journal 6′ at each end thereof, which extends into the fixed vertical guideways 7 on the stands 2 and 3, said guideways 7 being open at their lower front edge to allow the removal of the journals 6′ and the taking out of the winding up roll 6, as supported by the vertically moving supports 8, one at each end of the winding up roll, the upper end of each support being recessed or grooved to receive the journals 6′ on the ends of the winding up roll 6.

The lower end of each support 8 is pivotally connected to one arm of angle levers 9 and 9′. The angle lever 9 is fast on the shaft 10, and the angle lever 9′ loose thereon, said shaft 10 being loosely mounted at each end in stands 11, secured to the cross girth 12 of the loom. The other arm of each angle lever 9 and 9′ is connected to a rod 13, provided with an adjustable spring 14, and loosely mounted at its inner end in a stand 15, attached to the back girth 16 of the loom to have a sliding motion therein. The springs 14 bear at one end against the stand 15 and at the other end against an adjusting collar 17, secured on the rod 13 by a set screw, and act to yieldingly hold the winding up roll 6 in its upper position



and pressed against the take up roll 1 through the angle levers 9 and 9′, and vertically moving support 8. The shaft 10 has fast upon it at the right hand end a foot treadle 19, projecting toward the front of the loom. Beside the treadle 19 and integral with the angle lever 9′, which is loosely mounted on shaft 10, is a second foot treadle 20.

When the treadle 19 is pressed down by the foot of the attendant, it will rock the shaft 10 and move down the front end of the angle lever 9 at the left hand end of the loom, and with it the support 8 of the winding up roll 6 at that end of the loom. When the treadle lever 20, integral with the angle lever 9′, loose on the shaft 10, is moved down, the angle lever 9′ will also be moved down with it and the support 8 at the right hand end of the winding up roll 6, to release said end from the take up roll 1. If the two treadles 19 and 20 are moved down together, angle levers 9 and 9′ will be operated and both ends of the winding up roll 6 will be lowered simultaneously.

The stands 2 and 3 are each provided with a projection 21, against which the support 8 will rest when in its lowest position and with the journals 6′ of the winding up roll 6 at the opening in the guideways 7, preparatory to the removing of the winding up roll 6 from the loom.

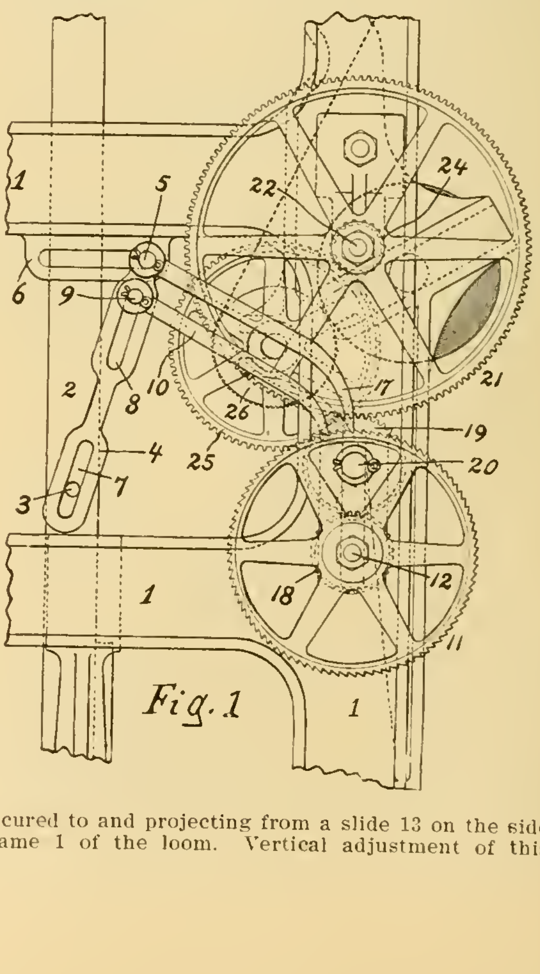
When the supports 8 are in their lowest position, they are retained there against the pressure of the springs 14 by the lugs 22 thereon engaging with the projections 21. When the foot of the attendant depresses the levers 19 and 20, and moves back the winding up roll 6, so that its journals 6′ will enter the vertical portion of the guideway 7, the lugs 22 will be disengaged from the projections 21 and the springs 14 through intermediate connections will act to raise the winding up roll 6 into yielding contact with the take up roll 1 and hold it there. (Crompton & Knowles Loom Works, Worcester, Mass.)

ANDERSON'S TAKE UP MECHANISM.

The object aimed at in this take up is its simplicity of construction and operation, the fixer being able to change the action of this take up, *i. e.* change the number of picks introduced per inch in the cloth, by simply changing one of the gears, the number of teeth in this change gear representing the desired number of picks to the inch put in the cloth.

Of the accompanying illustrations, Fig. 1 is a side view of sufficient portions of a loom to illustrate this take up, and Fig. 2 is a view of the same, partly in end elevation and partly in section.

A description of the construction and operation of this take up is best given by quoting numerals of reference accompanying the illustrations, and of which 1 represents part of the loom frame, 2 part of the lay, which carries a pin 3, engaging with a slotted lever 4, hung to a pin 5, which is adjustable longitudinally in a slotted lug 6 fast to frame 1. Lever 4 has a slot 7, which engages the pin 3, and a slot 8 for the reception of an adjustable pin 9, which carries a pawl 10, which in turn engages with the teeth of a ratchet wheel 11, the latter being mounted so as to be free to turn upon a stud 12,



secured to and projecting from a slide 13 on the side frame 1 of the loom. Vertical adjustment of this slide 13 on the loom frame is effected by providing said frame with a vertical slot 14 for the reception

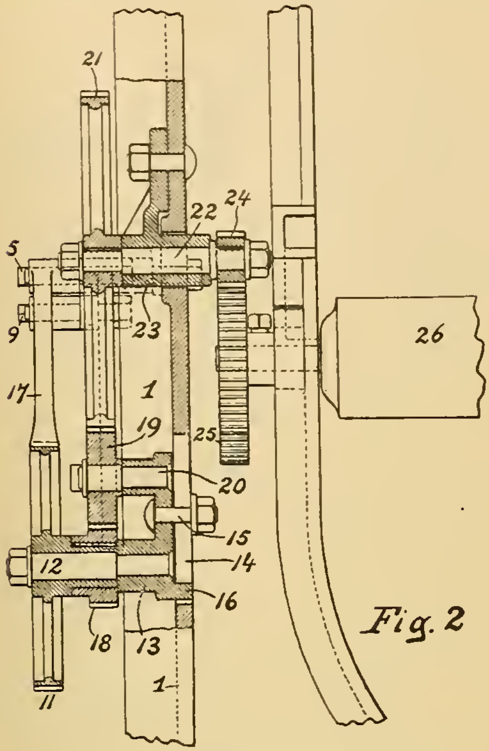


Fig. 2

of the bolt 15, whereby the slide is secured to the frame, a lug 16 on the slide also entering said slot, as shown in Fig. 2, so as to insure the proper guidance of the slide in its vertical movement. Hung to the fulcrum pin 5 of the lever 4 is a detent 17, which engages with the teeth of the ratchet 11 and prevents back movement of the same. Secured to the hub of the ratchet wheel 11 is a pinion 18, and meshing with the latter is another pinion 19, which is free to turn upon a stud 20, secured to, and projecting from, the slide 13, said pinion 19 meshing with a spur wheel 21, which is secured to a shaft 22 free to turn in a hanger 23, secured to the frame 1, as shown in Fig. 2, said shaft 22 also having a splur pinion 24, which meshes with a spur wheel 25 on the shaft of the take up roll 26. The spur wheel 21 constitutes the change wheel of the gearing and has as many teeth as the desired number of picks per inch in the fabric to be woven, see heavy dotted line 26 indicating direction of the run of the woven cloth from breast beam, to take up roll 26 to cloth beam 27. The ratio of the spur wheel 25 and the pinion 24, being fixed and the number of teeth in the ratchet wheel being also known, all that remains to be determined, in order to permit the use of a change gear as described, is the respective relation of the circumference of the take up roll 26 to the number of teeth in the pinion 18, the pinion 19 being a negligible quantity.

Assuming that C represents the circumference of the take up roll, P the number of teeth in the pinion 18, R W the number of teeth in the ratchet wheel, and R the ratio between the wheels 24 and 25, the equation is as follows: $\frac{C.\ P}{R\ W} = R.$ (The D. A. Tompkins Co., Charlotte, N. C.)

AUTOMATIC FILLING CHANGING MECHANISMS.

A FILLING CHANGING DEVICE FOR NORTHROP LOOMS.

This device has for its object to provide means in the regular filling changing mechanism of the Northrop loom, whereby the filling will not be changed suddenly upon the action of the filling feeler, thus producing a more uniform action, at the same time relieving the parts from sudden strain.

Fig. 1 is a sectional side elevation of the filling fork and the parts for controlling the operation of the filling supplying mechanism, showing said parts in normal position before the feeler has felt the filling in the shuttle. Fig. 2 is a perspective view of the sliding latch support and the guide therefor.

The device is operated upon by the regular filling feeler of the loom. A stop b^x is secured to the stand B, as fastened to the breast beam of the loom, by a bolt extended through the slot b^6 in a lateral extension b^4. The stand B is also provided with upright walls b^1, b^2, to form a guideway for the filling fork slide m, the bottom of the guideway being longitudinally slotted as at b^3 to permit the vibration of the filling hammer W. The extension b^4 is separated by a guideway b^5, in which is longitudinally movable a sliding bar c, having an upturned ear c^1, and being cut away as at c^2. The slide bar c has fulcrumed on its ear c^1, as at c^4, a latch carrier c^5, provided with a depending foot c^6, which rests on the arm of the filling feeler (not shown) when the latter is in normal position. To the inner end of the latch carrier c^5, is pivoted at g a depending latch c^x, which rests against the enlarged end c^3 of the slide bar c, the lower end of the latch c^x, when in normal position, extending into the path of the dog w of the filling hammer W, so that when said hammer moves forward it will engage the latch and move it and the slide bar c to the right, in Fig. 1, the outer end of said bar engaging an upturned arm d^3, fast on rock shaft d^1, and thereby effect the filling change.

In order to prevent any lifting tendency of the slide bar c, it is provided with a lateral lug c^9, having a beveled upper face to extend under an upturned and overhanging projection b^9 on the wall b^1, and the extension b^4 has an overlapping detent b^{10}, secured to it and extended over the outer end of the slide

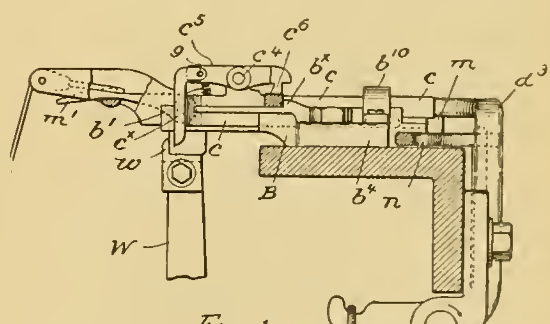


Fig 1

bar c, so that the latter when moved outwardly by engagement of the filling hammer and the latch will move properly in its guideway b^5. The return of the slide bar to normal position is effected by the action of the spring S through the shaft d^1 and arm d^3, inward movement of the slide being limited by the engagement of the lug c^9 and stop b^9.

When the filling in the shuttle is sufficient in volume to swing the feeler upon its fulcrum, the extremity of the feeler arm will be swung inward or toward the lay, and thereby drawn from beneath the foot c^6 of the latch carrier, whereupon the spring S will lift the inner end of the carrier, raising the latch from the path of engagement of the dog w of the filling hammer before the critical point in the stroke of the latter is reached, and no movement of the slide c will be effected. When the latch is lifted, the foot c^6 descends between the stop b^x and the arm of the filling feeler, and so prevents return of said arm against the stop, and consequently the return of the feeler to normal position is prevented until the foot c^6 is lifted or withdrawn from in front of the arm of the filling feeler.

Should the filling break, or be accidentally exhausted, the outward movement of the filling hammer will operate through the hook m^1 and the tail of the fork to move the slide m out and into engagement with the end of the knock off lever, moving the same against a spring, thus releasing the shipper handle from its holding notch and stop the loom. The end of the knock off lever n is notched, to embrace an upturned arm d^4, loosely mounted on the rock shaft d^1 and having a downturned end d^5 to effect disengagement of the take up pawl and ratchet when the loom is stopped. (Draper Co., Hopedale, Mass.)

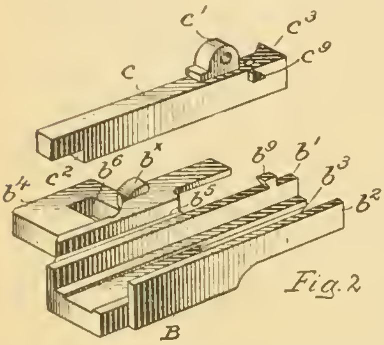


Fig. 2

RETARDING DEVICE FOR THE FILLING FEEDER IN NORTHROP LOOMS.

The object of this device is to provide means for retarding the movement of the feeder before the filling carrier reaches its fixed stop, thus obviating any shock to the filling carrier.

Fig. 1 is a transverse section of a portion of a loom aud its filling supplying mechanism. Fig. 2 is an enlarged perspective (compared to Fig. 1) of the retarding device and Fig. 3 is another form of the same.

The guard c, as extending around the filling feeder plate a, is cut away at its lower end, between which and the "stop" for the filling carrier to be next operated upon, is interposed the new retarding device, consisting of a flat plate h having a hub h^1 at one end, and reduced in diameter at the other end, forming a stud h^2, which is extended through the stand a^1. A spring (not shown) coiled around the stud h^2 tends to lift the plate h into the path of the filling carriers.

When the transferrer descends to change the filling carrier the plate h yields, hence serves as a support and guide for the filling carrier.

As soon as the transferrer is retracted the plate h is moved up by its spring, previously referred to, into engagement with the next filling carrier, and as the feeder moves forward the plate is depressed gradually into the position shown in Fig. 1, the resistance thus made by the plate acting as a retarding device, allowing the filling carrier to come gradually against the stop (seen at the left of the filling car-

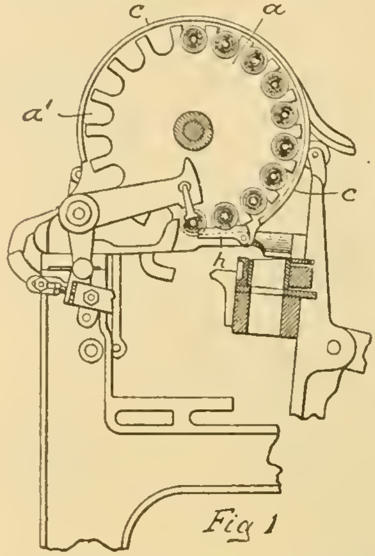


Fig 1

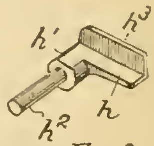


Fig. 2

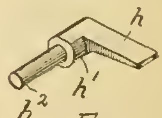


Fig. 3

rier to be operated upon next, and against which the latter rests), instead of with a quick sudden jar.

When cops are used the plate h is provided with a flange h^3 as shown in Fig. 2, to fit in between the yarn and the head of the skewer; but when bobbins are used the plate is made merely flat as shown in Fig. 3. (Draper Co., Hopedale, Mass.)

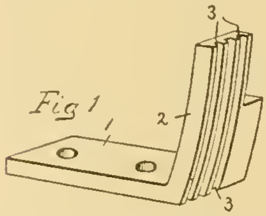
AN IMPROVED "STOP" FOR FILLING CARRIERS FOR NORTHROP LOOMS.

In the ordinary construction of the filling supplying mechanism a smooth stop is employed for guiding the filling carrier, when to be transferred, the new device having for its object the production of means for engaging and positively guiding the filling carrier into its proper position relatively to the shuttle when transferred from the feeder.

Fig. 1 is an enlarged perspective view of the guide detached, showing the means for guiding and positively engaging the filling carrier, and Fig. 2 is a part plan view of the head of a filling carrier in engagement with the guide shown in section.

This guide is L-shaped, its foot 1 being held in place by bolts. The front end of the foot is upturned at 2 to form the stop proper, which projects in the path of and engages the head of the filling carrier next to be transferred, the face of the stop being convexed from top to bottom to conform to the movement of the filling carrier during transfer. A series

Fig 1



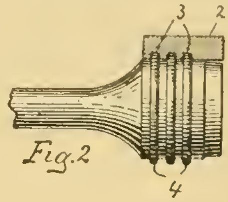


Fig. 2

of longitudinal grooves 3 are formed in the convex face to receive the projections 4 on the head of the filling carrier, so that during transfer the stop positively engages and guides the filling carrier until it enters the shuttle, effectually preventing any longitudinal displacement of the filling carrier or any twisting from its proper position as it enters the shuttle. (Draper Co., Hopedale, Mass.)

SHUTTLE SUPPLYING MECHANISM FOR C. & K. AUTOMATIC LOOMS.

This mechanism has for its object to provide means by which a number of shuttles, one after the other, may be supplied automatically to the shuttle feeder, doing away with the placing of a fresh shuttle on the feeder any time a change of shuttles had occurred.

Fig. 1 is a front view of a part of a loom, showing the parts of the shuttle changing mechanism. Fig. 2 is an end view of the reel showing the manner of holding the shuttles.

Extending out from the breast beam is a stud 15, on which is loosely mounted the hub 16′ of the reel 16, said reel being provided with outwardly-extended fingers 16″, forming recesses to receive the shuttles 17. The shuttles 17 are held in the recesses by means of spring actuated fingers 18 pivoted on the studs 19, springs 20 keeping said fingers against the shuttles.

Fast on the outer end of the stud 15 is a stationary circular guide 22, and a corresponding guide 23 is secured to the end of the breast beam. These guides are grooved on their inner surfaces to receive the points of the shuttles and hold the same in proper position as the reel 16 revolves to supply a new shuttle to the feeder plate.

A lever 29 is centrally pivoted on a shaft 30 mounted in a stand 11 as secured to the loom side.

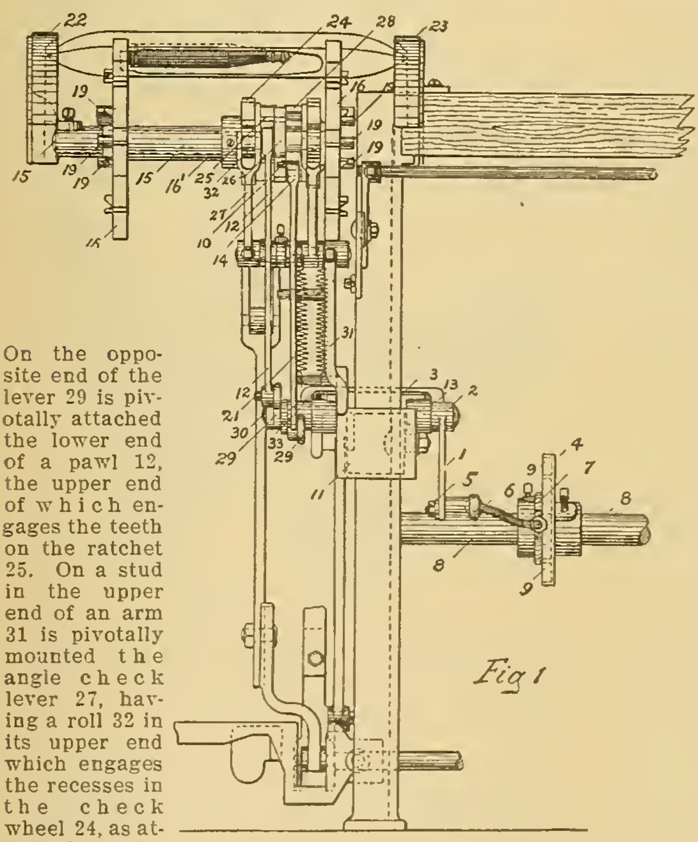


Fig 1

On the opposite end of the lever 29 is pivotally attached the lower end of a pawl 12, the upper end of which engages the teeth on the ratchet 25. On a stud in the upper end of an arm 31 is pivotally mounted the angle check lever 27, having a roll 32 in its upper end which engages the recesses in the check wheel 24, as attached to the ratchet 25, to hold said ratchet in position after each partial revolution.

A lever 33 is loosely mounted on the shaft 30, and to its outer end is pivoted the lower end of the pawl

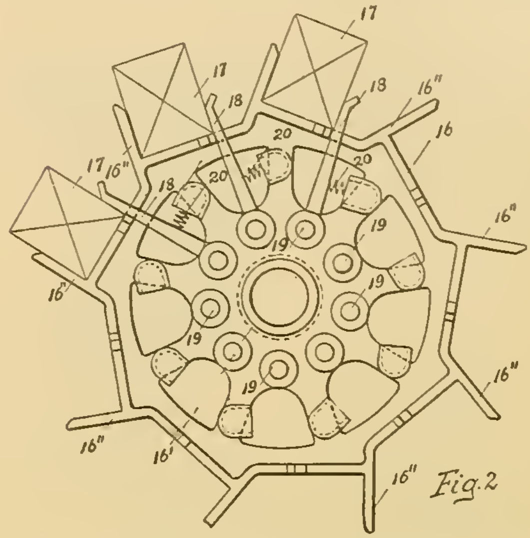


Fig. 2

21, the upper end 14 of which is adapted to engage the ratchet teeth of the ratchet 28 and turn the reel.

The inner end 13 of the lever 33 is connected by a bar 3 with the hub 2 of the lever 1, said hub 2 being loosely mounted on the shaft 30. The free end of the lever 1 is slotted and pivotally attached by a bolt 5 to the outer end of the rod 6, the inner end of which is provided with a forked end 7, carrying a pin which travels in a cam groove 9 in the cam 4, fast on the bottom shaft 8. The revolution of the cam 4 through the pin previously referred to, rod 6, lever 1, bar 3 and lever 33, communicates a regular up and down motion to the pawl 21; but said pawl, by reason of a pin 10 thereon riding on the pawl shield 26, forming a part of the ratchet 24, cannot engage and turn its ratchet 25 and the reel 16 until the pawl shield 26 is moved out of the way of the lug or pin 10.

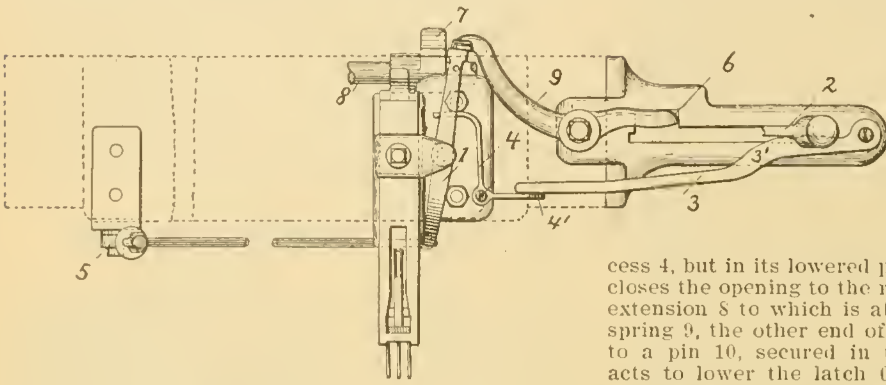
Whenever the change shuttle mechanism operates by reason of the failure of the filling, the pawl 12 is operated through lever 29 to give one turn to the ratchet wheel 24. The movement of the ratchet wheel 24 also moves the pawl shield 26 and allows the pawl 21 to engage and move its ratchet wheel 25, fast on the hub 16′ of the reel 16, and communicate a partial rotation to the reel 16 and deposit a shuttle on the shuttle feeder plate immediately after the shuttle feeder has returned to its normal position from carrying a shuttle into position to be thrown through the shed. (Crompton & Knowles Loom Works, Worcester, Mass.)

SUPPLEMENTAL MECHANISM TO THE C. & K. AUTOMATIC LOOMS.

The object is to provide means by which the movement of the shipper handle, to stop the loom, will automatically throw the filling changing mechanism out of operation, the same remaining out of operation upon the return movement of the shipper handle to start the loom, until the weaver puts said filling changing mechanism again into operation, thus permitting the running of the loom with or without its filling supplying mechanism.

The illustration is a top plan view of the filling fork slide and its co-operating parts of the filling supplying mechanism, the shipper lever being in inoperative position.

On the filling fork slide is pivoted the usual actuating lever 1 of the filling supplying mechanism, and between this lever 1 and the shipper handle 2 is a lever 3, which forms the connection whereby the filling supplying mechanism is thrown out of operation. This lever 3 is provided with a cam surface 3′, adapted to be engaged by the shipper handle. The free end of the lever 3 engages the arm 4′ of an angle lever 4, the other arm of said angle lever being bent upward to engage the actuating lever 1 of the filling supplying mechanism.



When the shipper lever 2 is moved by the weaver out of the notch 6, it engages the cam surface 3′ of the lever 3 and moves outwardly the free end of said lever, which in turn moves the angle lever 4 and causes the actuating lever 1 to move out of engagement with the arm 7 on the shaft 8, which operates the filling changing mechanism. When the shipper lever 2 is returned by the weaver to its position in the notch 6 to start the loom, the actuating lever 1 will still remain out of engagement with arm 7, so the filling changing mechanism cannot operate, but said lever 1 will remain in engagement with the knock off arm 9 and stop the loom in case of filling failure in the running shuttle.

When it is again desired to throw the filling supplying mechanism into operative position, the weaver by operating the lever 5 brings the actuating lever 1 into position to engage with the arm 7 of the filling supplying mechanism. (Crompton & Knowles Loom Works, Worcester, Mass.)

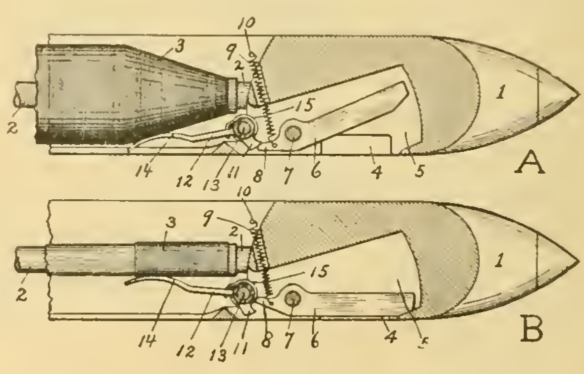
FILLING DETECTING MECHANISM FOR C. & K. AUTOMATIC LOOMS.

The object of the mechanism is to provide a feeler device for the bobbin in the shuttle, so that a new shuttle containing a full bobbin may replace the one in the loom just before all of the filling runs entirely off the bobbin, in order to prevent any possibility of missed picks in the cloth.

The mechanism consists essentially of a specially constructed shuttle and a projecting bar on the loom, for detecting the near absence of filling on the bobbin at the proper time so that the replenishing mechanism may be operated to replace the about exhausted bobbin in time with a full one. The details of the construction of the shuttle, showing the mechanism in the two principal positions, are given in the accompanying illustrations, of which Fig. A is a vertical cross section of the part concerned in the shuttle, showing the mechanism in the position when a full bobbin is in the shuttle, and Fig. B is the same cross section of the shuttle, showing the mechanism in the position which it occupies when the bobbin is nearly empty and ready to be replaced.

Referring to the illustrations, 1 indicates the body of one end of a shuttle, 2 a spindle for holding the bobbin or cop, pivotally mounted at one end in the shuttle, and 3 is the bottom portion of a cop as placed on the spindle 2. A recess 4 is made in the outside of the shuttle near its rear end, and at the bottom of the shuttle. This recess 4 extends in the shuttle body upwardly in the form of a narrow slot 5, within which is free to move a latch 6, pivoted on a pin 7. The latch 6 in its raised position, as shown in Fig. A, leaves a free opening in the recess 4, but in its lowered position, as shown in Fig. B, closes the opening to the recess 4. The latch 6 has an extension 8 to which is attached one end of a coiled spring 9, the other end of said spring being attached to a pin 10, secured in the shuttle. The spring 9 acts to lower the latch 6 when it is released from engagement with the extension 11 on the filling feeler 12, which is pivoted on the pin 13. The curved flattened end 14 of the feeler 12 bears on the bobbin or cop 3 and is held in engagement with it by a spring 15 which is attached at one end to the feeler 12 and coiled around and fastened at its other end to the pivot pin 13 of the feeler 12.

When the bobbin or cop 3 is full, as shown in Fig. A, the feeler 12 is held outwardly, and the extension 11 is caused to engage the extension 8 on the latch 6 and hold the latch in its raised position against the action of the spring 9. As the filling on the cop 3 is gradually exhausted, the feeler 12, which is operated by the spring 15, moves on its pivotal support 13 until the filling is nearly exhausted, when then the extension 11 passes by the extension 8 on the latch 6 and allows the spring 9 to instantly lower the latch, as shown in Fig. B.



A projection from the loom, which enters the recess 4 in the shuttle when the lay comes up to the fell of the cloth, is suitably connected to the filling fork mechanism which operates the replenishing mechanism in the usual manner, and when the latch 6 is held up by a sufficiently large cop, as explained, the projection will enter the recess 4 properly, and no transfer of bobbin, cop or shuttle, as the case may be, will take place, but as soon as the cop or bobbin becomes small enough through weaving, to allow the latch to fall over the recess 4, the projection is prevented from entering said recess 4, and consequently acts upon the filling fork, which, through proper mechanism, replaces the cop, bobbin or shuttle, as the case may be.

The time of the disengagement of the extension 11 on the feeler 12 from the extension 8 on the latch 6, to allow the latch 6 to be lowered, is regulated by the amount of filling to be left on the cop or bobbin 3 before it is replaced by a full one. (Crompton & Knowles Loom Works, Worcester, Mass.)

STOP MOTIONS.

ELECTRIC WARP STOP MOTION,

With Signal for Locating Broken End or Ends at a Glance.

This stop motion, built by Textile Appliances, Ltd., Providence, R. I., is most simple in its construction, operation and application to any make of loom, as will be readily understood from the accompanying illustrations, and is especially interesting on account of the distinct novelty of the method by which such simplicity is secured. In Fig. 1 the actuating mechanism is shown in side elevation, with parts in section, in the position occupied when the loom is running, with no thread broken; while Fig. 2 shows the same mechanism, in perspective view, with parts in section, in the position when the loom is stopped, on account of a broken thread.

The operation of the stop motion is as follows: A lease *a* is taken in the warp, and between every two threads a straight spring, steel wire *b* is engaged, as shown at Fig. 1, in such a way that it cannot pass to the larger lease rod *c*, which is provided with a metal slip pointing towards the other lease rod, so long as the two warp threads *d* and *e* are unbroken. If, however, either of these threads breaks, the wire *b* springs back against the metal slip in the lease rod *c*, Fig. 2, and thus closes an electric circuit, carrying a weak and sparkless current like that used for the telephone, operates a simple mechanism connected with the belt shipper, and stops the loom. In fact, the action is virtually a mechanical one, the electrical arrangements being of insufficient power even to indicate the nature of the action.

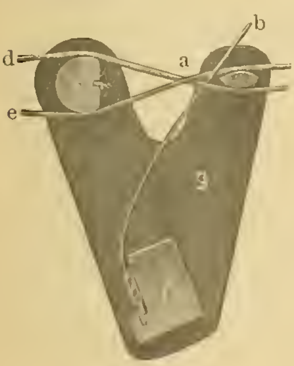


Fig. 1.

The spring wires *b* are set in combs, usually about an inch long, which are carried in the comb clamp *f* below. These inch segments accommodate sets up to any number within the requirements of weaving practice. For fine goods, and where frequent change of sley is required, a shorter segment is used so as to provide for variation in the latter respect within the wider limits necessary. The tension of the wires *b*, on the lease *a*, is under complete control, and can be regulated to entirely avoid abrasion of the yarn; it is governed by the angle at which the comb clamp *f* is held relatively to the contact rod *c*. This comb clamp *f* can be readily adjusted by changing its position in the end plates *g* relatively to the contact rod, suitable holes being provided in the latter for this purpose. Two end plates *g* are used, one on each side of the warp; only one can be shown in the illustrations, the other being a duplicate of it.

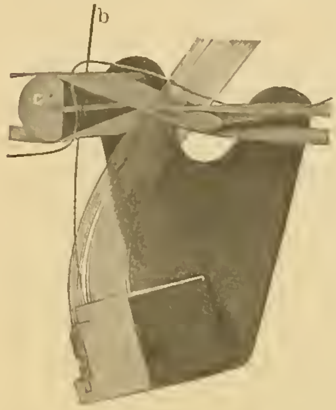


Fig. 2.

This stop motion occupies no more space than an ordinary lease, because the stopping device is contained between the two lease rods. The warp can be drawn into the combs, either by hand or by a drawing in machine, before it comes to the loom, or the combs can be placed in position after the warp is hung in the loom. All that is necessary to hold the two lease rods and the bar *f* in position in the loom, is the ordinary pair of leather straps, connecting them to the whip roll. The lease rods are thus not fixed to the loom side, but are free to take their proper positions, and allow the natural movement of the warp, so that the cover of the cloth is unaffected. A pair of flexible wires, passed under screws at the ends of the contact rod *c* and comb clamp *f*, suffice to convey the small current.

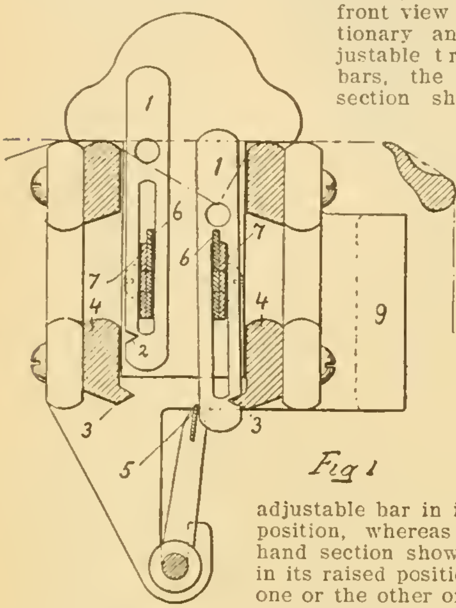
It remains to describe the small electromechanical motion which knocks off the handle of the loom when the circuit is closed upon the breakage of a thread. It consists of a novel arrangement by which an exceedingly small current is made available to bring about the required action. The principle is such that the actual force required to knock the handle off, which is sometimes considerable, is supplied entirely by a moving part of the loom itself, and not by the electrical mechanism, which only acts to cause a locking effect, which brings this outside force into play. The novelty of the arrangement lies in the method of producing this locking effect so as to cause the force supplied by the loom to be transmitted through the device to the starting handle with the exercise of a very small magnetic force. The parts, with the exception of a lever, through which the motion is derived from any moving part of the loom, and a projecting moving part, which acts upon the setting-on handle, are all enclosed in a dust-tight casting, made with a circular slotted flange, by which it can be very readily clamped by two bolts upon the loom side. Simple arrangements are provided to convey to it motion from any moving part of the loom, which is generally found conveniently on the reciprocating sword. The mechanical and electrical details of this device have been so thoroughly worked out, that while it can be actuated by so small a current, it is practically proof against wear. Sufficient current to operate the mechanism of one loom is easily derived from a single dry cell, sealed in a box screwed below the loom, whereas in a complete installation the current is derived from a small dynamo.

The spring wire *b*, released by means of a broken warp thread, besides stopping the loom, as before described, at the same time provides for a clear signal to the weaver (see Fig. 2) where the broken warp thread is located, thus making mending quick work, resulting in turn in an increased production per loom, an item of the greatest importance to manufacturers. (Textile Appliances, Ltd., Providence, R. I.)

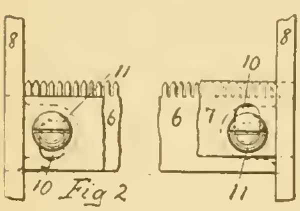
WARP STOP MOTION FOR C. & K. LOOMS.

This construction is an improvement to the one described on pages 63 and 64 of Part 2 of this work, and has for its object to modify the construction of the detectors, and to combine therewith a transverse guide bar having its upper edge toothed; an additional transverse guide bar with a plain upper edge being arranged vertically adjustable in connection with the former.

Fig. 1 is a sectional view of this stop motion mechanism, and Fig. 2 a front view of the stationary and the adjustable transverse bars, the left hand section showing the adjustable bar in its lowered position, whereas the right hand section shows said bar in its raised position. Either one or the other of said positions may be used as required.



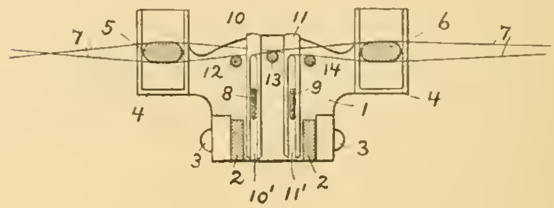
Each detector 1, has on its outer edge at its lower end an angular notch 2, which is adapted to engage and receive the angular projection 3 on the lower transverse bar 4 when engaged by the feeler 5 to stop the loom in the usual way. The detectors have an elongated opening for the reception of the two transverse guide bars 6 and 7 previously referred to.



The stationary guide bar 6 is secured at its ends to plates 8 on the stands 9 and has a serrated upper edge, into which the detectors drop when a warp thread fails and are thus held to prevent them from twisting. The adjustable guide bar 7 has at each end an elongated slot 10, by means of which it is adjusted, by screw 11, to the stationary guide bar 6. Thus when guide bar 7 is lowered it will leave the teeth of guide bar 6 exposed, and which are covered when guide bar 7 is raised on a level with said teeth. (Crompton & Knowles Loom Works, Worcester, Mass.)

ANOTHER WARP STOP MOTION FOR C. & K. LOOMS.

The improvement relates to that class of warp stop motions in which the detectors are hung between the lease rods, the object being, in case of a slack warp thread, to prevent its detector from lowering to such an extent as to stop the loom. Guides are also provided for the lease rods to keep them continually at the same distance from the detectors.



The illustration is a cross section of this warp stop motion.

The end plates 1 of the supporting frame are provided with detector rests 2, secured to the frame by means of bolts 3; said frame extending into vertically slotted brackets 4, in which are mounted the ends of the lease rods 5 and 6.

Extending transversely between the end plates 1 are the two guide bars 8 and 9 for the two sets of detectors 10 and 11, which are made with long, open end slots 10′ and 11′, through which the guide bars 8 and 9 extend. The detectors 10 and 11 are suspended upon the lower planes of the warp threads 7, one set upon one half of the warp threads and the other set upon the other half of the warp threads and each set between the intersection of the warp threads and a lease rod.

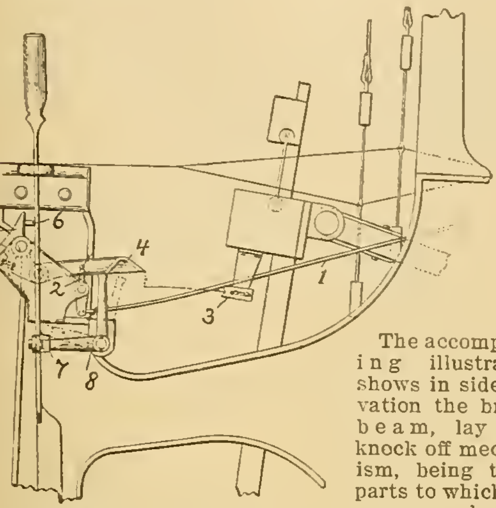
Extending transversely between the end plates 1, and secured thereto, are three parallel rods or rests 12, 13, and 14, one of which (13) extends directly under all of the warp threads 7 at their point of intersection and between the two sets of detectors, and all the warp threads are supported on said rest. Each of the other two rests 12 and 14 extends under the lower planes of the warp threads 7 just outside of the detectors 10 and 11 and inside of the lease rods 5 and 6, and support the lower planes of the warp threads.

It will be seen that all the warp threads are supported on each side of the detectors and close thereto and independent of the two lease rods, so that said detectors are maintained in their normal positions even if there is a sag in any of the warp threads outside of either lease rod, they only dropping into their abnormal position, provided their respective warp thread breaks, and when they drop sufficient below their rests 2 in order to come in contact with the feeler of the stop motion, and thus by means of the regular connections arrest the running of the loom.

The vertical movement of the lease rods in the slots of the brackets 4 allows for any extra tension on either set of warp threads in the operation of the loom. (Crompton & Knowles Loom Works, Worcester, Mass.)

KNOCK OFF ATTACHMENT TO C. & K. WARP STOP MOTIONS.

This attachment is operated from the regular warp stop motion (detectors and feeler) as situated in rear of loom, the object being to insure a positive knock off for the loom. To accomplish this, means are provided whereby when the shipper handle is in its operative position the same will act to lift and retain a dagger lifter in its normal position, leaving the dagger itself sustained by a support; but when a warp thread breaks the feeler and its connections operate to tip said support, in turn allowing the dagger to drop (into operative position) and be struck by the bunter (as fastened to the lay) in turn stopping the loom.



The accompanying illustration shows in side elevation the breast beam, lay and knock off mechanism, being those parts to which the new mechanism only refers to; the warp stop motion as situated in the rear of loom (not shown) being of usual construction.

Rod 1 forms the connection from the warp stop motion thus referred to, to the new knock off mechanism. When a warp thread breaks the respective detector drops and is engaged by the feeler of the warp stop motion, in turn moving the rod 1 forward, which causes the dagger support 2 to be tipped, allowing the dagger to drop in the path of bunter 3, as adjusted to the lay.

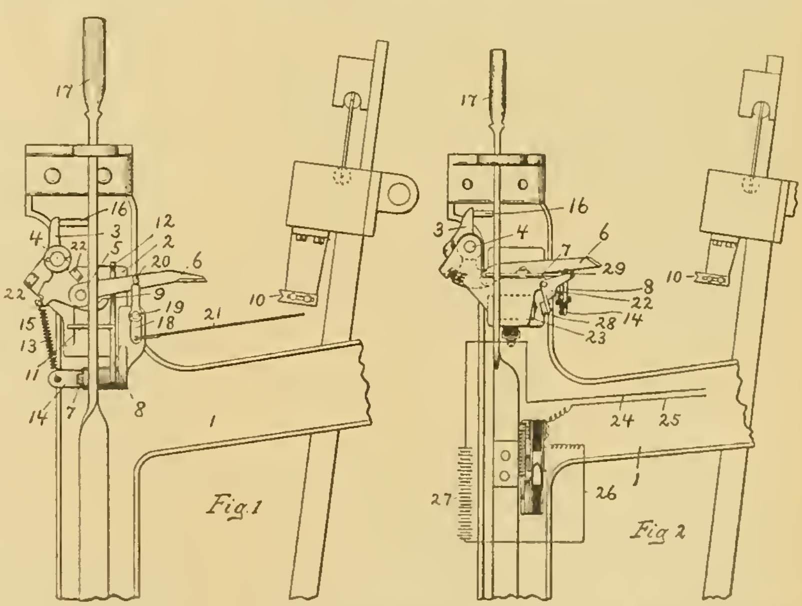
The dagger 4 when thus struck by the bunter 3 operates (through connections shown in dotted lines) the dagger carrier 5 which in turn, through stud 6, knocks the shipper rod from its holding notch and thus stops the loom.

After mending the broken warp thread or threads, the weaver brings the shipper rod into its normal position, which brings a lug 7 to act against the rear end of the dagger lifter 8, turning the same and thus placing said dagger in its normal position, in which it is sustained by its support 2. (Crompton & Knowles Loom Works, Worcester, Mass.)

ANOTHER KNOCK OFF ATTACHMENT TO C. & K. WARP STOP MOTIONS.

The object is to stop the loom through the dagger, from both sources, *i. e.*, in case the warp stop motion operates, or the shuttle improperly boxed.

Fig. 1 is a right hand side elevation of the front portion of a loom showing the construction of the stop mechanism, the lay being shown in its backward position.



To the side frame 1 of the loom is secured a stand 2, a dagger carrier 3 being mounted to turn on stud 4 in said stand. The dagger carrier 3 has jointed to it at 5 the dagger 6, the lower portion of said carrier being provided with a stud 7, on which is mounted the main dagger lifter 8, having a cam surface 9 thereon to engage the under side of the dagger and hold the same out of engagement with a bunter 10, as fast on the lay.

The dagger lifter 8 has at its side an extension 11 extending in the path of the shipper lever 17, and at its upper end an extension 12, which extends over the dagger and prevents the same from being thrown back. A spring 13 is connected at one end to an extension 14 on the hub of the dagger lifter 8, and at its other end to a hook 15 on the dagger carrier 13. This dagger carrier at its upper end engages and operates a stop lever 16, pivoted at the under side of the breast beam (said stop lever 16 being commonly actuated to unlock the shipper handle whenever a shuttle fails to be properly boxed in the ordinary way), moving said lever 16 and moving the shipper handle 17 out of its retaining notch, so that it will spring into inoperative position when the dagger 6 is engaged by the bunter 10.

In connection with the main dagger lifter 8, the second dagger support 18 is provided, centrally pivoted on a stud 19 in the stand 2, with its upper end adapted to extend under and engage a projection 20 on the dagger 6. The lower end of the second dagger support 18 has attached to it a connection 21, leading to the warp stop mechanism (not shown), and through which the operation of the dagger support 18 is controlled to move from under the projection 20 on the dagger 6, and allow the dagger 6 to drop into position to be engaged by the bunter 10 on the forward movement of the lay.

When through the breaking of a warp thread, or a warp thread becoming too loose, the second dagger support 18, through connection 21, is moved from beneath the dagger 6, said dagger will drop into position to be engaged by the bunter 10 on the forward stroke of the lay, the dagger lifter 8 being held in its backward position out of engagement with the dagger 6 by the engagement of the shipper lever 17 with the side extension 11 on said dagger lifter 8. The engagement of the bunter 10 with the dagger 6 will move the dagger carrier 3 on its pivot 4 to cause it to actuate the stop lever 16 to move the shipper lever 17 out of its retaining notch, and allow it to spring back and operate to stop the loom in the usual way.

Upon the movement of the shipper lever 17, as described, the spring 13 immediately acts to rotate the dagger lifter 8 on its supporting stud 7, and move the cam surface 9 under the dagger 6 to raise said dagger and move it out of the path of the bunter 10, as seen in Fig. 1. At the same time the spring 13 acts to move the dagger carrier 3 on its pivot stud 4 away from the stop lever 16, a stop 22 on the stand 2 limiting the movement of the dagger carrier 3. The dagger 6 is thus put into a position where it cannot be struck a second time by the bunter 10, and also into a position where the second dagger support 18 can be moved under the dagger 6 to support it. The movement of the shipper lever 17 by the hand of the operator to put the loom into operation will cause it to engage the extension 11 on the dagger lifter 8 and move the dagger lifter 8 out of engagement with the dagger 6, while the second dagger support 18 immediately returns to its normal upright position, thus leaving the parts in an operative position.

This same mechanism may also be used in connection with an electric warp stop motion, for which reason the illustration Fig. 2 is given, being a side view, clearly showing the operation of the stop mechanism when operated by the electric stop motion previously referred to. In this instance an electromagnet 23 is, by means of the wires 24, 25, and 26, in electric circuit with the binding posts on that part of the warp stop motion at the rear of the loom.

When a warp thread breaks or becomes too slack, the electromagnet 23 is put into electric connection to complete the circuit and establish a current derived from the battery 27 and thus the electromagnet 23 is energized. Under said conditions the armature 28 as attached to the angle lever 22 of the dagger lifter 3 will be drawn toward the electromagnet 23, and said angle lever 22 moved in opposition to its spring to allow the dagger 6 to fall into the path of the bunter 10. The downward movement of the dagger lifter 22 will allow the spring 14 to move the latch 8 and cause an extension thereon to engage and extend over the upper edge of the lifter 22. The dagger 6 is now in the position to be struck by the approaching bunter 10 to turn the dagger carrier 3 on its pivot 4, and through the knock off lever 16 to disengage the shipper lever 17 from its holding notch, and thus stop the loom. The movement of the shipper lever 17 releases the centrally pivoted lever 7, and allows the spring 29 to act to move said lever, and through said lever to move the latch 8 out of engagement with the lifter 22 against the action of the spring 14, and allow the spring of the dagger lifter to act to move the dagger lifter 22 and withdraw the armature 28 from the magnet 23, thus interrupting the circuit as the loom is stopped. (Crompton & Knowles Loom Works, Worcester, Mass.)

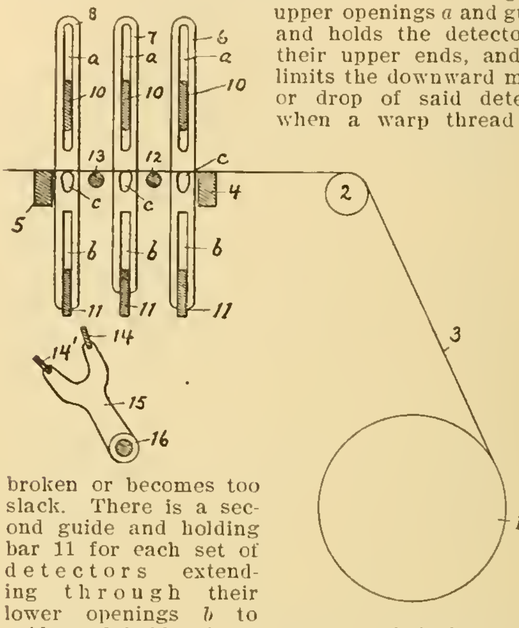
WARP STOP MOTION FOR C. & K. SILK LOOMS.

In weaving silk goods or cotton fabrics having a high warp texture, it is impossible to use a common warp stop motion, since there is not room for all the detectors thus required to work properly.

To overcome this difficulty is the object of the stop motion shown in the accompanying illustration in its cross section, *i. e.* a stop motion using three series of detectors.

In this illustration numerals of reference indicate thus: 1 the warp beam, 2 the whip roll over which the warp threads 3 pass. 4 and 5 are warp supporting bars extending transversely across the loom and are supported at their ends in a frame (not shown). Between the warp supporting bars 4 and 5 are three sets of detectors 6, 7, and 8, arranged in three parallel rows. Each detector has an elongated opening *a* in its upper part and an elongated opening *b* in its lower part, which has one end open, as shown, and there is an opening or warp eye *c* in the central part between the openings *a* and *b* for a warp thread to pass through, and by means of which the detector is supported in its normal position when the warp thread is not broken or too slack.

There is a guide bar 10 for each set of detectors, which extends through the upper openings *a* and guides, and holds the detectors at their upper ends, and also limits the downward motion or drop of said detectors when a warp thread 3 is broken or becomes too slack. There is a second guide and holding bar 11 for each set of detectors extending through their lower openings *b* to guide and hold said detectors at their lower ends.



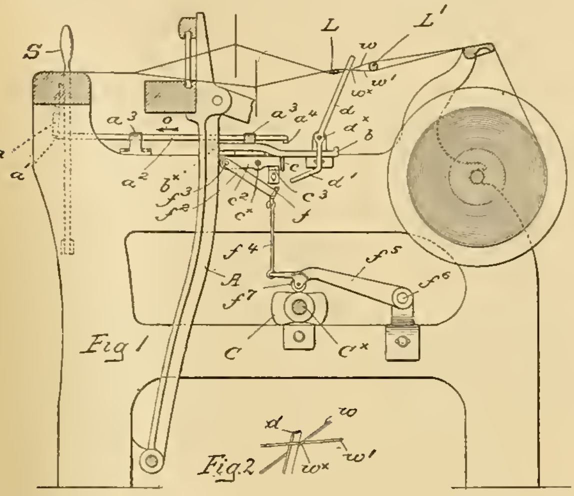
Between the three series of detectors extend two transverse rods 12 and 13, supported at their ends, and which act to support the warp thread between the detectors.

In connection with the detectors, and forming a part of the warp stop motion, are employed two feeler blades 14 and 14', secured at their ends upon the forked end of a rocking arm 15, fast on a rock shaft 16, to which a regular rocking motion is communicated. It will be seen that the feeler blades 14 and 14' on the rocking arm 15 move in the arc of a circle, and consequently if the lower ends of the three sets of detectors 6, 7, and 8 are in the same horizontal plane, the lower ends of the middle set of detectors 7 will be nearer the arc of movement of the feeler blades 14 and 14' than the outside detectors 6 and 8, for which reason the middle set of detectors 7 are shortened at their lower ends, so that in case of any slight slackness of the warp they will not be lowered sufficiently to come in the path of or be engaged by the feeler blades 14 and 14'. (Crompton & Knowles Loom Works, Worcester, Mass.)

WARP STOP MOTION FOR DRAPER LOOMS.

Fig. 1 is a sectional view of a loom having this stop motion applied thereto, and Fig. 2 shows the manner in which the detector engages the crossed warp threads, and by means of which crossing said detector is held in normal condition.

a indicates the knock off lever, pivoted to the loom frame and being pivotally connected at a^1 with a knock off rod a^2 mounted to slide in bearings a^3 on



the loom frame, the rear end of this rod having an offset a^4.

A bunter b is pivoted to one of the lay swords A at b^x, said bunter being guided by a flat bar support c, set upright, and having its lower edge toothed and attached at its ends to arms c^2, fulcrumed at c^x on the loom frame, a stop c^3 limiting the downward movement of this support c. f indicates a feeler, having a notched edge, said feeler being attached to rocker arms f^2 (one on each side of the loom) fulcrumed at f^3 on the outer ends of the arms c^2.

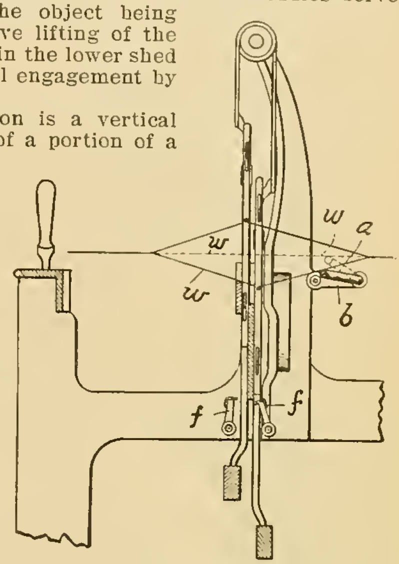
The link f^4 connects the rocker arm f^2 with a lifter arm f^5, fulcrumed at f^6, being provided with a roller f^7, which travels on the cam C mounted on the cam shaft C^x, and by which means the feeler f is vibrated. A series of detectors d are pivotally mounted on a transverse rod d^x, as extends across the loom, the lower ends of the detectors being bent at d' toward the path of the feeler f.

The upper end of each detector is extended between the lease rods L. L' to engage a pair of cross threads w, w', at the crossing w^x thereof, as shown most clearly in Fig. 2, it being shown therein that the detector crosses either warp at the side opposite to which said warp engages the other one of the pair. The detectors will be maintained in the position shown in both illustrations, and thus are kept inoperative so long as the crossed warps of each bar remain intact, but should either warp fail, then the detector will be free to slide along the other warp toward the back of the loom, the portion of each detector above its fulcrum being the heavier, such movement of the detector into operative position interposing its finger between the feeler and bunter support c. After such interposition, the feeler will at its next upward stroke, engage the finger and press it against the toothed edge of the support c, so that at that time the feeler and the support will rock in unison on the fulcrum c^x to thereby raise the bunter b, so that at the next forward movement of the lay the bunter will engage the bent end a^4 of the knock off rod and move the latter in the direction of the arrow o, Fig. 1, to release the shipper handle S, and thereby stop the loom. Under normal conditions the feeler is vibrated about the fulcra f^3, and relatively to the bunter support c, but the interposition of the detector finger d' will cause both the support and feeler to move in unison on the fulcrum c^x.

The notching or serrating of the opposed jaws of the bunter support c and of the feeler f, respectively, prevents twisting of the finger portion of the detector when interposed therebetween. (Draper Co., Hopedale, Mass.)

YIELDING WARP REST FOR DRAPER LOOMS.

This warp rest is used in connection with a warp stop motion mechanism in which the heddles serve as detectors, the object being to secure positive lifting of the detectors when in the lower shed out of accidental engagement by the feeler.



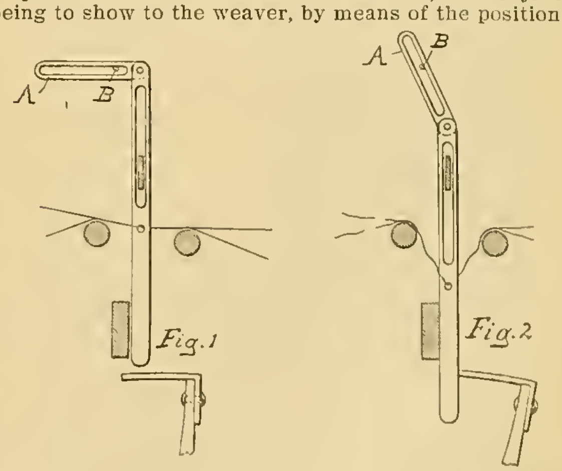
The illustration is a vertical sectional view of a portion of a loom, showing this warp rest applied thereto.

The same consists of a bar a extended across the loom in rear of harness and below the warps, being formed with journals adapted to rock in bearings of brackets b, secured to the loom frame. A spring (not shown) surrounds one of the journals of the warp rest, tending to lift the same upwards.

When the warps w are moved into the lower shed, as shown in the illustration, they press on the warp rest, and consequently depress it from the dotted line position against the action of its lifting spring; the tension thus imparted to the warps acting to lift the detector heddles positively out of accidental engagement by the feeler f. (Draper Co., Hopedale, Mass.)

SIGNAL ATTACHMENT TO WARP STOP MOTIONS FOR DRAPER LOOMS.

This attachment is applied to the detectors of warp stop motions of the usual construction, the object being to show to the weaver, by means of the position

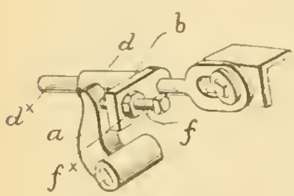


of said attachment, at a glance where a certain warp thread is situated, which, by means of breaking, had caused the stopping of the loom. Fig. 1 shows the attachment (and also its detector) in its normal position; Fig. 2 showing said attachment in the position the same occupies when its respective warp thread has been broken (the detector dropped).

The attachment consists of a slotted lever A, movably pivoted to the top of the detector. The prominent change of position of the attachment (signal to the weaver) is caused by means of a rod B passed through the slot of the attachment. This rod B is fastened on each end to the two side frames of the loom, and acts as a fulcrum for guiding the attachment from its normal to raised position caused by the drop of the detector, and vice versa, from its raised to its normal position, caused by the weaver lifting the respective detector to mend the broken warp thread. (Draper Co., Hopedale, Mass.)

BRAKE MECHANISM FOR NORTHROP LOOMS.

On pages 79 and 80 of Textile Machinery, Part 2, the principle of this mechanism has been described, the present improvement having for its object the production of means whereby the mechanism is capable of finer adjustment, to be efficient in all circumstances, thus preventing cracks in the cloth, as was more or less the case with the former construction previously mentioned.



The illustration is a perspective detail of the means for effecting the fine adjustment of this brake mechanism before referred to.

In the construction explained in Part 2 of this work, a toe *a* acts directly upon the collar *d* to move the brake rod d^x longitudinally to the right to apply the brake when the loom is stopped; but in the new construction an adjustable abutment *f* is mounted on the collar, to be engaged by the toe *a* of the actuator when the latter operates. A lateral extension *b* on the collar *d* is provided with a threaded hole to receive the screw *f*, which constitutes the adjustable abutment, a check nut f^x locking the latter in adjusted position, the rear end of said abutment being located in the path of the toe *a*. By turning the screw *f* in one or the other direction, the engagement therewith by the toe *a* of the actuator will be delayed or accelerated correspondingly, so that the application of the brake is adjusted or varied relative to the operation of the stopping means. (Draper Co., Hopedale, Mass.)

FILLING STOP MOTION FOR C. & K. LOOMS.

The object is to provide a positive mechanism for controlling the downward movement of the filling feeler fingers which rest upon the filling after every passage of the shuttle through the shed, and on the absence of the filling are moved downwardly into a recess on the top of the lay and through intermediate connections raise the knock off dagger to a position where it will engage mechanism on the breast beam on the forward beat of the lay to in turn stop the loom.

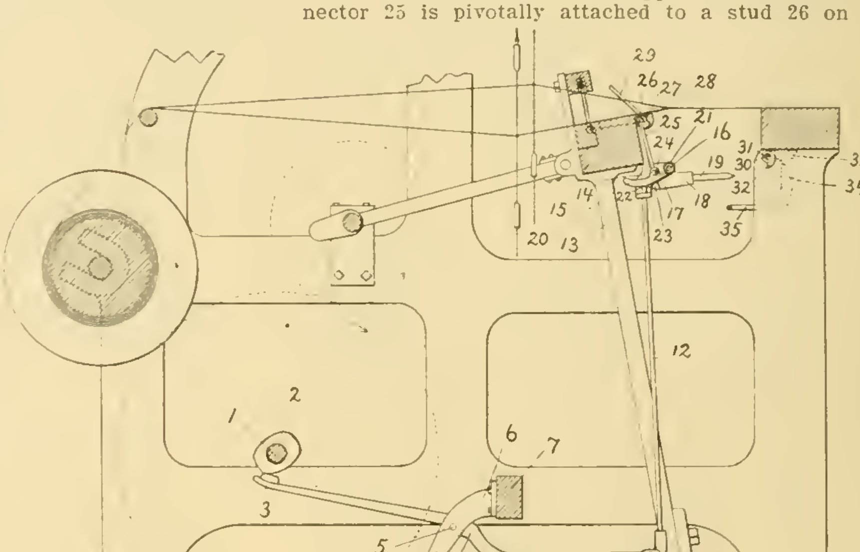
The illustration is a sectional side elevation of parts of a loom with the new device applied thereto, showing the filling feeler fingers or wires in their raised position.

Examining the illustration, we find that on the bottom shaft 1 of the loom is fast a cam 2, the periphery of which engages one end 3 of a lever 4, centrally pivoted on a stud 5 on a bracket 6, bolted to the girth 7. A spring 8, attached at one end to the lever 4 and at its other end to an extension 9 on the bracket 6, acts to hold the end 3 of the lever 4 in engagement with the cam 2 on the bottom shaft 1.

On the opposite end of the lever 4 from the end 3 is a slot 10, which receives a stud 11, fast to the lower end of the vertically moving rod 12, which has a bearing at its upper end in an extension 13 on the stand 14, secured to the front side of the lay 15.

On a stud 16, secured to the stand 14, is pivotally mounted a rocking lever 17, having secured thereto at its front end 18 the knock off dagger 19. The rear end of the rocking lever 17 has a cam surface 20 thereon, which extends directly over and is engaged by the upper end of the vertically moving rod 12. On the stud 16 is secured a coiled spring 21, the free end 22 of which engages a lug 23 on the rocking lever 17, and thus acts to hold the end 20 of said lever in engagement with the upper end of the rod 12.

To the rocking lever 17, at the rear of its pivot stud 16, is pivotally attached at 24 the lower end of a connector or link 25. The upper end of said connector 25 is pivotally attached to a stud 26 on a



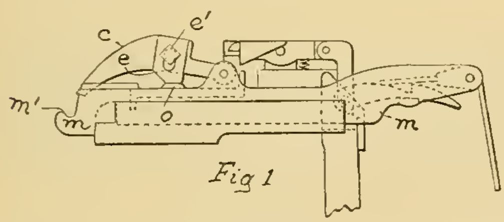
crank 27, as is fast on a rock shaft (not shown) journaled in bearings 28 at the upper end of the stand 14. The filling feeler fingers 29, as fast on this rock shaft (not shown), are operated by the crank 27 and move with said shaft.

Extending under the breast beam is a rock shaft 30, having fast thereon a collar 31, with an extension 32. On the end of the shaft 30 is a latch 33 (shown by broken lines), which engages the upper end of a centrally pivoted lever 34, the lower end of which is secured to a connector or rod 35, which operates to stop the loom.

The operation of the mechanism is as follows: As the lay beats up, the cam 2 on the bottom shaft 1 is partially revolved, and the lever 4 is moved on its pivotal support, causing the rod 12 to be lowered and allowing the spring 21 to act to move the lever 17, and through the connector 25 and crank 27 move down the filling feeler fingers 29 upon the filling thread, which if not broken, prevents said fingers from completing their full downward movement into the recess in the lay, and the dagger 19 on the lever 17 is held in a position in which it will not engage the projection 32 on the collar 31. In case of the absence of the filling thread on the forward beat of the lay, the spring 21 (the end 3 of the lever 4 being on the low part of the cam 2) will move the lever 17 and cause the filling feeler fingers 29 to be moved to their lowest position into the recess in the lay, and consequently the dagger 19 to be raised to a position where on the forward beat of the lay it will engage the projection 32 on the collar 31, and in turn stop the loom. (Crompton & Knowles Loom Works, Worcester, Mass.)

FILLING STOP MOTION FOR NORTHROP LOOMS.

The object is to permit the weaving of either fine or coarse goods on the same loom. When weaving fine goods, and the filling breaks, the filling changing mechanism will then not operate, and the loom stops, in turn permitting the weaver to remove the part of a pick caused by said breakage, and insert a full pick, thus preventing imperfections in the fine cloth (which in coarse cloth would not be objectionable), and



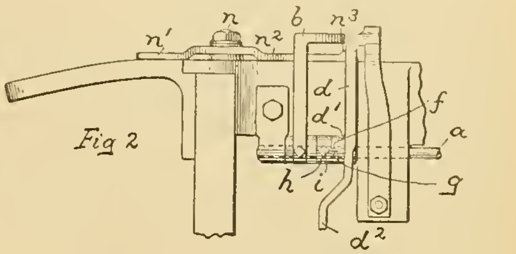
when then the filling changiug mechanism is brought in action any time upon breakage of a thread.

Fig. 1 is a side elevation of the filling fork and its coöperating parts. Fig. 2 shows in elevation the lock coupling which determines whether the filling supplying mechanism shall operate or not.

In the construction of this stop motion, the outer end of the filling fork slide *m* is provided with an upturned hook m^1, into which enters the downturned end of an arm *d*, having its hub d^1 loosely mounted on the rock shaft *a* and being further extended into an arm d^2, which operates to effect the disengagement of the take up pawl when the filling fails.

The knock off lever n^1 is fulcrumed at *n*, the end n^2 passing under the bend of an arm *b* and being upturned at n^3 in the path of a dog *c*, which is provided with an adjustable cam *e* normally resting on a projection *o*. When the filling fork slide moves, the dog *c* drops down on the top of the end n^3 of the knock off lever, thus releasing the shipper handle and stopping the loom. The hub d^1 is shouldered at *f* to engage the opposite shoulder *g* on a collar *h*, also mounted on the rock shaft *a* and adapted to be secured thereto by a set screw *i*. The collar *h* serves as a lock coupling, to at times connect the arm *d* with the rock shaft, for if the collar is made fast on the rock shaft by the set screw *i*, when the arm *d* is swung outward by the slide, the shoulder *f*, acting on shoulder *g*, will operate to turn the rock shaft *a* and effect the actuation of the filling supplying mechanism.

On the other hand, if the collar *h* is loose on the shaft, the rocking of the arm *d* will have no effect upon the rock shaft *a*, nor consequently upon the filling supplying mechanism. If, therefore, coarse or common cloth is to be woven, the lock coupling will be made operative by securing the collar *h* to the rock shaft, so that if the filling breaks the filling



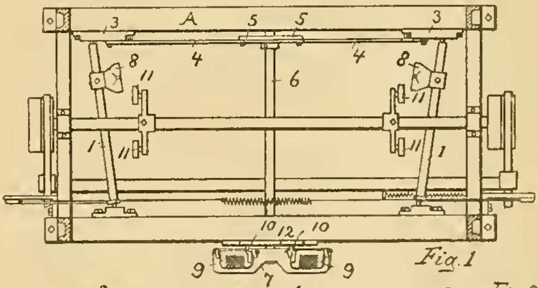
supplying mechanism will be actuated, and at such time the cam *e* will be set on the dog *c*, to operate, as previously described.

Should the loom be weaving fine goods, however, in which part of a pick must be removed, the lock coupling *h* is simply released, so that the shaft *a* will not be rocked upon failure of the filling, and at the same time the set screw e^1 will be loosened and the cam *e* will be raised on the dog *c*. This permits the free end of the latter to drop behind the end n^3 of the knock off lever, and at the first outward movement of the slide *m* due to filling failure, the dog will operate the knock off lever to release the shipper handle, and thereby stop the loom, to permit the weaver to remove the part of a pick and insert a full one. (Draper Co., Hopedale, Mass.)

PICKING MECHANISM.

ROY'S PICKING MECHANISM.

The novelty in this construction of a picking mechanism consists in means, whereby said picking mechanism may be readily connected or disconnected by the weaver without affecting the running parts of the loom.



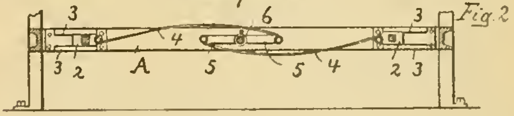


Fig. 1 is a horizontal sectional view of the lower portion of a loom, showing, in plan, the picking mechanism in inoperative position. Fig. 2 is a vertical sectional view, showing a portion of the mechanism by which the picker shafts are shifted.

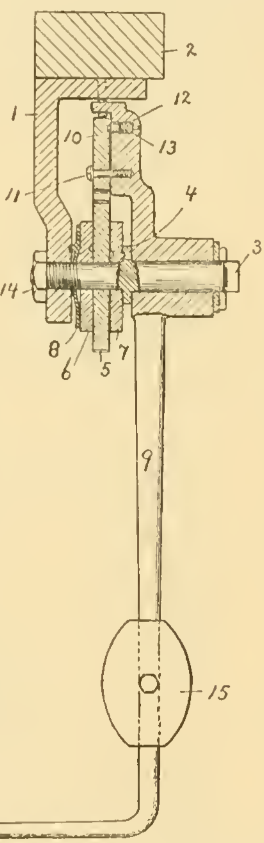
Each picker shaft 1 is pivoted at one end in sliding boxes 2, sliding in brackets 3 secured on the rear girth A of the loom. Each sliding box 2 is connected by links 4 with the ends of radial arms 5 carried on a rock shaft 6. The forward end of this shaft 6 is provided with a two armed foot treadle 7, provided with the two foot plates 9. Each of the foot plates 9 is provided with fingers 10 adapted to enter holes in a plate 12 to secure the treadle in either of its two positions.

When the weaver places his foot on one of the plates 9, he thus rocks the treadle into operative position, the arm 5 operating to slide the boxes 2 so as to bring the picker shoes 8 into engagement with the picking rolls 11. When for one reason or the other, it is desired to throw the picking mechanism out of operation, the weaver, by placing his foot on the opposite foot plate 9, thus rocks the treadle 7 into its inoperative position, the arm 5 operating to slide the boxes 2, and in turn moving the picking shoes 8 out of engagement with the picking rolls 11, and this without interfering with the running parts of the loom. (B. S. Roy & Son, Worcester, Mass.)

GLEASON'S PICKER CHECK.

The object is to produce a picker check that shall bring the shuttles to a quick and easy stop without any rebound.

The illustration shows a vertical section of the check as attached to the under side of the shuttle box.



A bracket 1 is attached to the under side of the shuttle box 2 and a screw threaded hole is cut in said bracket for receiving a stud 3, which has a collar 4. A ratchet wheel 5, two friction washers 6, 7, and a spring washer 8 are fitted to go on the stud 3 on one side of collar 4, and a lever 9 is fitted to swing on the stud 3 on the other side of said collar 4.

A double ended pawl 10 is held on a screw stud 11, and a hole 12 is made in the lever 9 to receive a spring 13, which tends to press on one side of this pawl 10. Pressure is applied to ratchet wheel 5 between the collar 4 and bracket 1 by means of spring washer 8, the tension thus produced being regulated by the nut 14.

Weight 15 is adjustable on the lever 9, to regulate power required to return lever 9 to its normal position.

The operation of the device is as follows: The normal position of the lever 9 is vertical, and when the picker is struck by the incoming shuttle, the stick falls back against the horizontal arm at the lower end of the lever, which is bent off so as to cross its path, and the friction on the ratchet wheel 5, which is turned by the pawl 10, brings the picker stick and shuttle easily to a rest without the risk of the rebound.

By reversing the ratchet wheel on the stud and depressing the other end of the pawl to engage with the reversed ratchet wheel, this check can be made applicable to either a right or left hand shuttle box. (Wilkins Mfg. Co., Woonsocket, R. I.)

CONNECTION OF PICKER ARM AND ROLL.

The object is to provide improved means for adjustably securing to the picker arm the support or collar on which the picker roll is mounted.

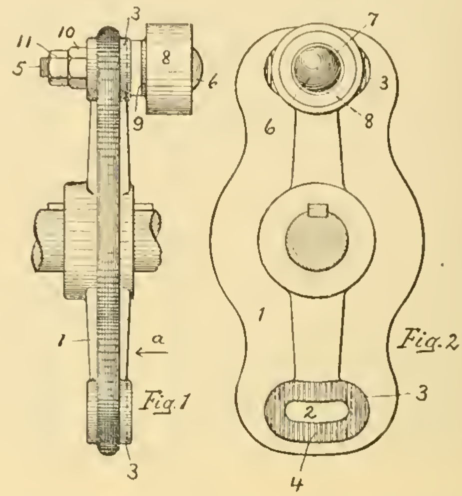


Fig. 1 is an edge view of a picker arm with one roll thereon, shown mounted on the cam shaft. Fig. 2 is a side view of the parts shown in Fig. 1 looking in the direction of arrow *a*, same figure.

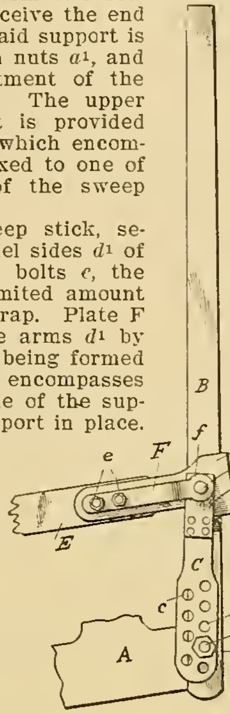
At each end of the picker arm 1 there is provided an elongated transverse slot 2, surrounded on one side by a raised portion 3, which is provided with teeth 4 arranged in parallel rows. A bolt 5 extends through the slot 2 and also through a bushing or sleeve 7. The head 6 of the bolt 5 bears on the outer end of the bushing 7 and has a fin thereon, which extends into a recess in the bushing 7 to prevent said bushing from turning on the bolt. The surface of the inner end of the bushing 7 is provided with teeth corresponding in size to the teeth 4 on the raised portion 3 of slot 2, being adapted to engage with said teeth 4, round the slot 2. A roll 8 (only one roll is shown in illustration) is loosely mounted on the bushing 7, and is held in position thereon by an annular shoulder 9 on the bushing 7 and the head 6 on the bolt 5. A nut 10 on the bolt 5 secures the bolt in the slot 2 and binds the bushing 7 to the toothed part around the slot 2, and a check nut 11 holds the nut 10 in place. The elongated slot 2 permits of adjustment of the bolt 5 to change the position of the bushing 7 and roll 8 as desired. (Crompton & Knowles Loom Works, Worcester, Mass.)

AN ALUMINUM SWEEP STRAP.

The object is to produce a light and durable sweep strap.

The illustration is a side elevation of the sweep strap as connected with the picker stick.

A indicates a stationary bracket secured to the loom (not shown), in which bracket is secured a stud bolt *a*, on which is fulcrumed the picker stick B. C is a raw hide support, the lower end of which is enlarged and provided with two sets of holes *c*, adapted to receive the end of the bolt *a*, on which said support is pivoted by means of jam nuts a^1, and by which proper adjustment of the picker stick is secured. The upper end C^1 of this support is provided with a transverse hole, which encompasses a stud pin *d*, affixed to one of the parallel arms d^1 of the sweep strap.

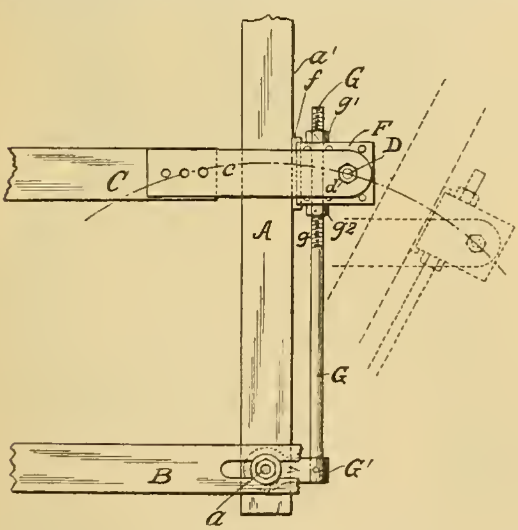


E represents the sweep stick, secured between the parallel sides d^1 of the sweep strap by the bolts *e*, the picker stick having a limited amount of play in said sweep strap. Plate F is secured to one of the arms d^1 by bolts *e*, its body portion being formed with an offset *f*, which encompasses the stud *d* on the outside of the support C to retain said support in place.

The entire sweep strap and the stud *d* is made of aluminum or an aluminum alloy, on account of its light weight and general adaptability for this purpose. By making the raw hide support in two pieces the best possible form of bearing for the coacting parts with the minimum amount of friction and no possibility of binding are obtained. (L. S. Watson Mfg. Co., Leicester, Mass.)

KELLEY'S PICKER ACTUATING MECHANISM.

This picker stick connection provides means for maintaining the striking face of a striker block as carried by the lug strap parallel with the contacting face of the picker stick at all points of their swing,



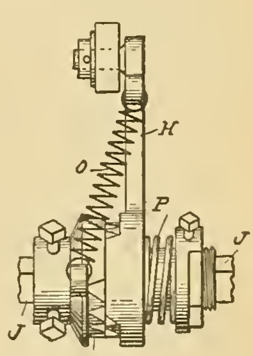
while at the same time permitting a limited swing of the striker block free of the picker stick. This arrangement will result in providing a picker stick connection able to withstand satisfactorily the hard service a picker stick as well as lug strap is subjected to, identical to the jerky character of the operation of "picking." The mechanism also provides means for ready adjustment of the lug strap to any leverage, *i. e.*, power for picking required.

The accompanying illustration is an elevation showing the lower portion of a picker stick in vertical, *i. e.*, picking position, and having Kelley's actuating mechanism applied thereto, another position of the parts (picker stick, etc., at rest), being indicated in dotted lines.

A indicates the picker stick, which is pivoted at its lower end *a* to a fixed part *B* of the lay sword. *C* is a portion of the sweep stick, having suitably connected to it the lug strap *c*, the latter loosely spanning the former and projecting beyond it. This lug strap end *c*, is formed of two plates, rigidly connected at their outer ends by means of a bolt *D*, having a spacing sleeve (not shown) thereon, and a nut *d*. Upon this spacing sleeve is loosely mounted between the strap plates a striker block *F*, provided with a removable striking face *f*, of leather, which forms a flat bearing surface of substantial extent to contact with the edge *a'* of the picker stick. For conveniently carrying as well as positioning the lug strap *c* and at the same time for maintaining the striking face of the striker block *F* parallel with the contacting face of the picker stick *A* at any point of their swing, a supporting mechanism is provided, comprising a swinging arm *G*, pivoted concentrically with the picker stick at *a* by means of an attached piece *G'*, so as to swing with the latter, and which is so connected with the striker block *F* as to maintain the latter in fixed relation thereto in their joint movement around the pivot *a*. This connection is effected directly and adjustably by passing the screw threaded end *g* of the swinging arm through a drilled hole in the striker block *F* and rigidly securing the same thereto at a properly adjusted height from the pivot *a* by means of nuts *g'*, g^2, on the threaded end of the arm, which end is arranged parallel with the contacting edge *a'* of the picker stick, while its pivotal end is mounted upon the common pivot *a*. It will be readily seen that by means of the construction of a picker actuating mechanism thus described, the striking face of the block *F* is at all times maintained square with the contacting edge *a'* of the picker stick, thus distributing the strain and wear of the jerky action of picking upon all parts of the picking mechanism. (W. H. Kelley & Co., Reading, Pa.)

ATTACHMENT TO THE PICKING MECHANISM.

To prevent breakage of the picker stick and its coöperating parts, in case said picker stick is accidentally locked against movement.



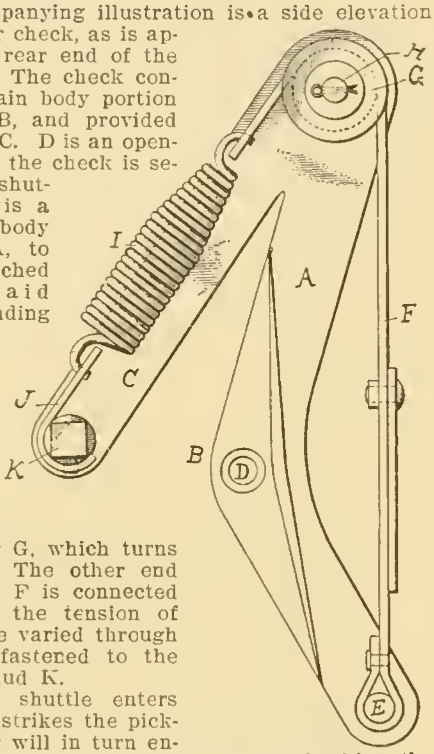
By means of the illustration, which is a side elevation of this attachment, we see that the hub of the picker shaft arm H is formed with teeth, which are normally in engagement with corresponding teeth in a clutch member I as fastened to the picker shaft J. The engagement of these clutch members is maintained by an adjustable spring P.

When the picker stick is locked in case of any obstruction, the teeth of the clutches are disengaged from each other by the action of the picking mechanism, the spring P being compressed, and thus the picker stick and its coöperating parts prevented from breakage.

After the picker stick has been liberated from its obstruction, a spring O, as attached to the clutch members, returns them to their normal (locked) position. Spring O, however has been lately omitted by the builder of the attachment, thus making the latter more simple and less expensive. (Ephraim M. Keffer, Hespeler, Ont.)

A YIELDING PICKER CHECK.

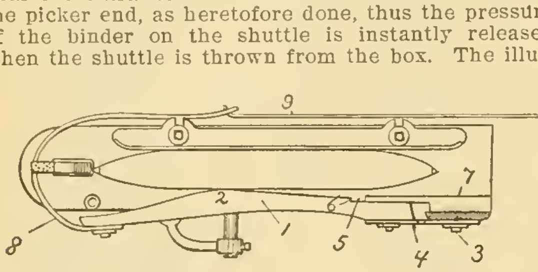
The accompanying illustration is a side elevation of this picker check, as is applied to the rear end of the shuttle box. The check consists of a main body portion A, bent at B, and provided with an arm C. D is an opening by which the check is secured to the shuttle box. E is a stud on the body portion A, to which is attached strap F, said strap extending over a roller G, which turns on stud H. The other end of this strap F is connected to spring I, the tension of which can be varied through strap J as fastened to the adjustable stud K.



When the shuttle enters the box and strikes the picker, the latter will in turn engage the spring yielding strap F, thus checking the shuttle gradually. (Homer F. Livermore, Boston, Mass.)

SHUTTLE CHECK FOR KILBURN LINCOLN LOOMS.

In this shuttle check, the shuttle binder is pivoted near the entrance of the shuttle box instead of near the picker end, as heretofore done, thus the pressure of the binder on the shuttle is instantly released when the shuttle is thrown from the box. The illustration is a plan view of the shuttle box with the top removed, showing the shuttle held by the binder and its co-operating parts.



The shuttle binder 1 having the swell 2 is pivoted at 3 to the wall of the shuttle box, the hinge or pivot 4 being of a flexible nature, thus permitting a slight lateral movement of said binder. To permit adjustment of the binder, a space 5 is left between the end 6 of said binder and the wall 7 of the shuttle box.

A check strap 8 is attached at one end to the shuttle binder, its other end passing behind the picker, is fastened to a connection 9, which extends across the back of the lay and in turn is connected to a like strap on the opposite shuttle box. When the shuttle enters the box, the picker stick strikes the strap 8, thus compressing said strap, in turn drawing the binder into the shuttle box to bear said binder against the shuttle. This pressure is instantly released the moment the shuttle is ready to be picked, *i. e.*, the picker stick starts. (Kilburn, Lincoln & Co., Fall River, Mass.)

SHUTTLE MOTION FOR C. & K. SWIVEL LOOMS.

The object of the mechanism is to provide a bearing for the swivel shuttle independent of the bearing of the "horse shoe" gear, and to reduce the bearing of the same and bring it nearer the central portion thereof, to lessen the friction.

Fig. 1 is a front view of a portion of the swivel shuttle motion, showing one of the shuttles at its lowest point of movement. Fig. 2 is a vertical cross section on line 3—3, Fig. 1, looking in the direction of arrow *a*, same figure.

1 indicates the back box plate, having in its lower portion a series of openings 2 of equal diameter and of equal distance apart. A face plate 4 extends over the back box plate, being secured thereto by screws 5, and has a series of openings 4′ in its lower portion. The openings 2 are provided with passage ways

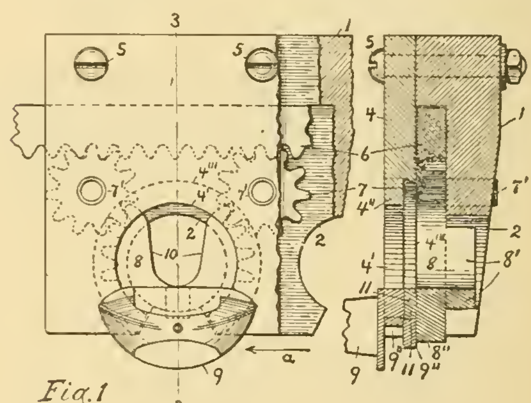


Fig. 1 Fig. 2

(shown in dotted lines Fig. 1) for the entrance of the warp threads from below into the openings 2 when the shuttle is in its upper position.

The front portion of the back plate 1 is cut away, as shown in Fig. 2, to leave a space between the back plate 1 and the face plate 4 for the horizontal moving driving rack 6, the pinions 7 and the horse shoe gears 8. The pinions 7 are mounted on pins 7′, extending transversely through the back plate 1 and the face plate 4, as shown in Fig. 2.

The horse shoe gears 8, which move the swivel shuttles 9, have a hub 8′ thereon made integral with the tooth portion 8″, as shown, and are provided with the U-shaped opening 10 therein. The hub 8′ on the gear 8 extends into and has its bearing in the circular hole 2 in the back plate 1. On the front of the tooth portion 8″ of the horse shoe gear 8 is a projection 11, which extends into a correspondingly shaped recess in the lower surface of the shuttle 9 to cause it to move with the gear 8 as the same is operated by the pinions 7 and the rack 6.

The inner end or lower part of each swivel shuttle 9 has an annular groove 9′ therein, into which extends the edge around the opening 4′ in the front plate 4, said edge 4″ around the opening 4′ in the front plate 4, forming a bearing surface for the swivel shuttle 9 to travel on, independent of the horse shoe gear. The projection or flange 9″, forming the lower side of the groove 9′, extends into and travels in the undercut channel 4‴, around the opening 4′ in the front plate 4.

By making the horse shoe gear 8 with the extended hub 8′ at its central portion, which has its bearing in the opening 2 in the back plate 1, the bearing surface, and consequently the friction, is reduced, and by making the swivel shuttles with the annular groove therein, into which extends the edge around the opening on the front plate, an independent bearing for the shuttle is provided, and the shuttle is not rigidly secured to the horse shoe gear, but only connected with it through the projection 11 thereon, extending into the recess in the shuttle, previously referred to, so that the shuttle can be readily detached from the gear by removing the front plate 4. (Crompton & Knowles Loom Works, Worcester, Mass.)

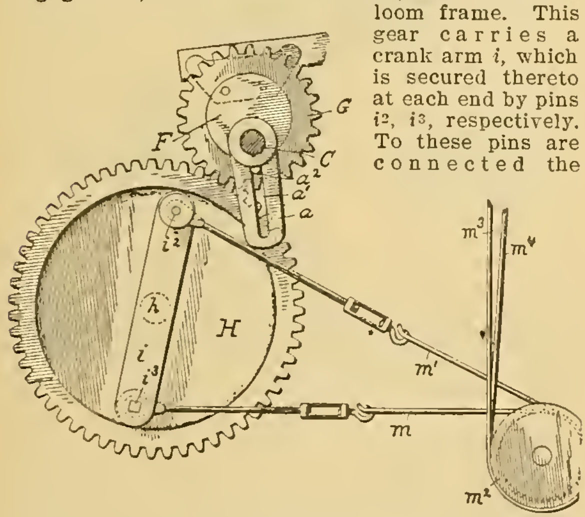
SHUTTLE DRIVE FOR NARROW WARE LOOMS.

The object of this mechanism is to provide means whereby the shuttles are started promptly on the formation of the shed, and this with constantly increasing speed, which in turn is gradually stopped after the shuttle passed through the shed.

The illustration is a side elevation of this driving mechanism, shown detached from the loom.

The crank shaft C passes through an eccentric F, on which is loosely mounted the driving gear G. On this gear G is fixed a pin a^2 which enters the slot a^1 in arm a, secured to the crank shaft C.

In mesh with the gear G is the motion transmitting gear H, mounted on a stud h, as fast on the loom frame. This gear carries a crank arm i, which is secured thereto at each end by pins i^2, i^3, respectively. To these pins are connected the



straps m, m^1, by which motion is imparted to the shuttles through disks m^2, and straps m^3, m^4, as connected to a second disk (not shown) for reciprocating the rack bar of the loom.

How the Speed of the Shuttles is Varied: As the crank shaft C revolves, the eccentric relation between the shaft C and pinion G causes the pin a^2 to travel in the slot a^1 of arm a, and a consequent decrease of motion is thus continuously imparted to the gear H and arm i as the latter approaches its position of most effective motion transmission. As the pin a^2 travels toward the outer extremity of the slot a^1, a gradual increase in the motion imparted to arm i takes place until the shuttle passes through the shed, and when the action is repeated. (Insinger Loom Co., Phila., Pa.)

SHUTTLES.

HALL'S SELF THREADING SHUTTLE.

The invention here presented is a small fitting (a threader), which can be applied to all classes of shuttles at small expense, by means of which the shuttle may be threaded with the filling either from bobbin or cop.

Of the accompanying illustrations Fig. 1 shows the threader before it is applied to the shuttle, and Fig. 2 the threader applied to the shuttle.

The new threader consists of a small and light steel plate, with flange and point adjusted in such a way that the filling from the cop or bobbin in the ordinary shuttle when drawn through a slot in the shuttle is guided down and out through the eye at the side of the shuttle, and once having passed through the guide, the shuttle cannot become unthreaded by any back throw or balloon of the thread.

The advantages claimed are: (1) The avoidance of the unhealthful practice on the part of the operators of sucking through the ordinary eye by the mouth the small wad or ball of the filling twisted up and placed at the inside of the eye by the finger. (2) It avoids the necessity of looking up the threading hook by which the filling is hooked through the eye of the shuttle where the placing of the eye or eyes will admit of this method of threading. (3) It is a means of saving of waste, as there is no wadding into a ball of the filling, in order to get it through

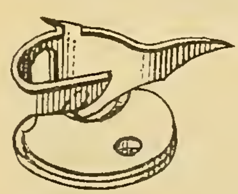


Fig. 1.

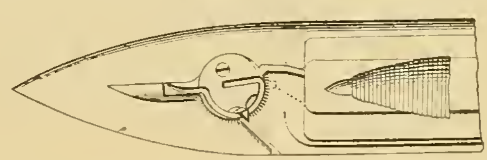


Fig. 2.

the eye. (4) It affords to the filling a tension which otherwise could not be had except by some special tension device. (Cloth woven with shuttles to which this tension is applied shows practically a perfect selvedge.)

The threaders take up but small space in the delivery or eye end of the shuttles. It is not a plate on top, but is sunk below the top of the shuttle thus avoiding the chance of wearing down of the point of the shuttle and exposing the threader, a feature which is liable to cause smashes or cutting of the warp threads during weaving.

The shuttle is not weakened by the application of this threader, as the cuttings made in the shuttle in order to receive this threader are small, as are also the slots for the passage of the filling. (Jas. H. Billington Co., Philadelphia, Pa.)

AHERN'S SHUTTLE CATCH.

The same is an improvement upon the construction of that class of loom shuttles most widely used, its object being to overcome the defects of this old style of shuttle in applying the top spring and bottom catch.

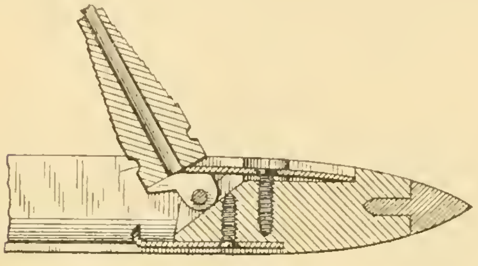


Fig. 1.

In order that the invention may be clearly understood, we will first describe the old style of shuttles, to the improvement of which the present invention relates, and this in connection with the accompanying illustrations.

Fig. 1 is a section view of the ordinary shuttle, showing the bottom catch and the top spring each

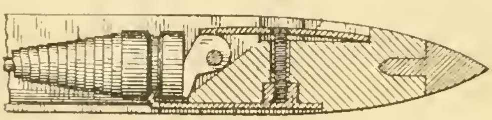


Fig. 2.

separately held in place by a simple wood screw, screwed into the wood at the end of the shuttle. These wood screws of necessity pass within a short space of one another, and are dependent for their stability upon the wood that holds the thread of the screw. Should the boring of the wood, made to receive the screw, be a trifle too large, or the constant action of raising and lowering the spindle, cause the screw to strip out of the wood, great difficulty is found in plugging up the hole made thus, or in finding a larger screw to properly re-adjust the spring and catch. The liability of the simple wood screw to work loose or to strip out of the wood is the frequent cause of "smashes," and unless the spring and catch are properly adjusted and can be kept tight, the spindle is apt to fly up and cut the warp.

Fig. 2 is a sectional view of the Aherns Patent Catch and Spring. It is a simple device to connect the top spring and bottom catch by one machine threaded screw. This screw passes through the shut-

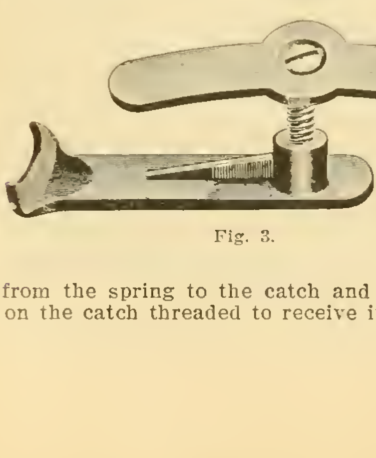


Fig. 3.

tle from the spring to the catch and screws into a lug on the catch threaded to receive it.

The advantages are obvious. There is but one screw and that a machine thread. It is easy to tighten or loosen the pressure of the spring on the spindle head. The screw is in no manner dependent upon the wood for its support, but is really a bolt passing through the shuttle. It makes the cutting out of the warp or smashes, by reason of the spindle flying up, practically impossible.

Fig. 3 shows the bottom catch and top spring connected by the machine threaded screw or bolt before being placed in shuttle, showing that it is in no way dependent for support upon the wood that surrounds it. (Jas. H. Billington Co., Philadelphia, Pa.)

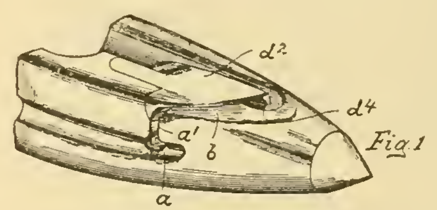
SELF THREADING SHUTTLE FOR NORTHROP LOOMS.

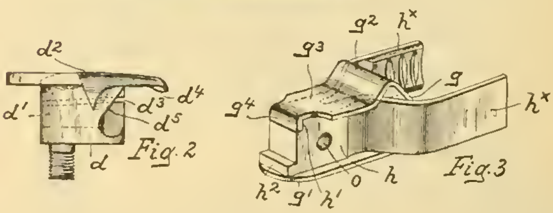
The object is to simplify the construction of the threading device, also providing means for relieving the jar on the holder for the filling carrier when the latter is put in place in the shuttle.

Fig. 1 is a perspective view of the threading end of the shuttle, Fig. 2 a view in elevation of the threading block and Fig. 3 a perspective view of the new device for holding the filling carrier.

This latter device consists of a holder h, made as a block having parallel upright sides and flat parallel top and bottom faces. At its rear end this holder has a transverse shoulder h' formed in its top, and a lip h^2 projects from said end at the bottom to enter an extension of the recess in the shuttle body, the front end of the holder having two grooved spring jaws h^x, to receive the annular projections on the head of the filling carrier, which is thus engaged and held securely in position in the shuttle.

An inclined directing plate or guide g, assists in directing the filling carrier into position, the guide being located between the jaws and is made of re-





silient metal, the lower end of the guide being bent back at g' to extend beneath the holder h. The upper end of the guide is bent down at g^2, and then rearwardly extended, as at g^3, upon the top of the holder, a transverse down turned lip g^4 engaging the shoulder h' and positively locking the holder and guide together, the bend g^2 permitting the guide to spring or yield somewhat under impact of the filling carrier head. By this construction a single screw, passed through the holder at o into the walls of the shuttle body, serves to retain the holder and guide in place, doing away with a separate screw for the latter, at the same time making the spring better adapted to stand the strain of the blows as caused by change of filling carriers.

At its forward end the shuttle is provided with a new threading device, made in one block d, and having a thread passage d' (see dotted lines in Fig. 2), one side of said passage being slotted at d^3 to form a thread entrance. The head of the threading block is downturned as at d^4, an inclined horn d^5 opposite the slot d^3 guiding the thread to the side delivery eye a. A clearance space b for the thread is provided underneath the flared head d^2, and between the downturned end d^4 and the eye a.

As the thread is drawn off the filling carrier, on the first shot of the shuttle, it passes under the end d^4 and into the thread entrance d^3. As the shuttle returns, said thread passes beneath the head d^2 into the clearance space b, the horn d^5 guiding it to the bottom of the passage d', from which it passes to the delivery eye a, the wall a' of the shuttle body helping to guide said thread into the eye. The tip d^4 prevents the thread from jumping out when once threaded. (Draper Co., Hopedale, Mass.)

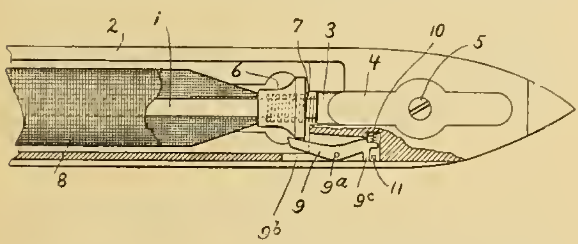
ATTACHMENT TO C. & K. SHUTTLES.

The object is to provide an attachment to a shuttle which will operate upon exhaustion of filling to effect either the stoppage of the loom or the automatic replenishing mechanism, as the case may be.

The accompanying illustration is a top plan view of this shuttle, showing a portion of it in section.

The spindle 1, as mounted in the body 2 of the shuttle, has its head 3 held in place by the usual spring 4 and screw 5, and is provided upon its base portion near the head 3 with a "follower" 6 backed up by a spring 7. A controller 9 is pivoted to the shuttle body at 9^a in the manner which adapts the same to swing horizontally, the said controller 9 occupying a slot 9^b, which is formed in one side of the shuttle body at the end of the latter at which the shuttle spindle is pivoted. Controller 9 is backed up by a spring 10, the latter being located between one arm of the controller and the wood of the shuttle body. The controller is formed with an engaging end 9^c, which normally is caused to project outward beyond the side of the shuttle body by the action of the spring 10. The outward movement of the said engaging portion of the controller 9 is limited by means of a stop pin 11, with which the controller engages.

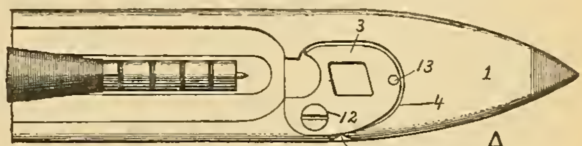
In applying a cop 8 to the spindle, said cop is pushed on until the follower 6 rests on the head 3, and so long as the quantity of yarn contained in the cop upon the spindle is sufficient to keep the follower 6 in the position in which it is shown in the illustration, the said follower, by its engagement with the tail of the controller 9, will retain the said controller in its retracted abnormal position. As the fill-



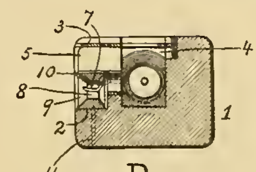
ing becomes used up and thus the base portion of the cop sufficiently unwound, the follower 6 moves lengthwise of the spindle blade, under the action of the spring 7, far enough to clear or escape from the tail of the controller 9. As soon as the follower has thus cleared or escaped from the said tail of the controller 9, the spring 10 acts to project the engaging portion 9^c of said controller into position to engage in the flight of the shuttle with the usual feeler, and thus stop the loom or operate the filling supplying mechanism in case such is used. (Crompton & Knowles Loom Works, Worcester, Mass.)

SERGESON'S SELF THREADING SHUTTLE.

The novelty of this shuttle consists in providing a threading arrangement, whereby the shuttle is more conveniently threaded and this without liability of the yarn returning into the shuttle after having been once drawn off of the bobbin or cop. To accomplish this, a specially shaped threading eye, in connection with a suitable guide plate for the filling, is provided, said threading eye and guide plate being so



A



B

C

placed in the shuttle as to form a continuous passageway for the filling.

The details of the arrangement are best shown by means of the accompanying illustrations, of which Fig. A is a top view of that portion of a shuttle containing the threading mechanism, portion of the latter only being shown. Fig. B is a cross section of the shuttle through the centre of the threading arrangement, and Fig. C is an enlarged perspective view (as compared to Fig. B) of the threading eye.

Numerals of reference indicate the parts as follows: 1 indicates the body of the shuttle. Fitted into an opening in the side of said body 1 is the threading eye 2, and on the upper face of said body, above said eye, is the guide plate 3. In said body, below guide plate 3, is the channel 4, into which the filling thread is introduced after being run off from the bobbin or cop in the shuttle. In the side wall of the body 1, between said plate 3 and the upper side of the periphery of said eye 2, is the throat 5, which is in communication with the terminal of said channel 4.

In the upper wall of the eye 2, which is of substantial thickness, is the throat 6, which extends obliquely from the upper side of the periphery of said eye inwardly and is then deflected horizontally, as at 7, to the central opening 8 of said eye, thus forming a communication between the throat 5 and said central opening, which in turn opens into the outside of the shuttle. The outer face of the eye 2 is countersunk, as at 9, leaving the flat rim 10 at the periphery. The eye is secured to the shuttle by means of the screw or pin 11. The guide plate 3 is secured to the shuttle by means of the screw 12 and the tension post 13, said post rising from the interior of the shuttle and being connected with the guide plate 3. The shuttle is threaded by having the filling pass, from the bobbin or cop as the case may be, under the plate 3 and around the post 13, through the channel 4 until it reaches the throat 5, when it descends the latter and enters the throat 6, and traversing the latter is passed into the eye 2, and from there out of the shuttle. It will be noticed, that should the portion of the filling outside of the eye run around said eye, the countersink 9, assisted by the obliquely extending throat 6, will keep said portion of filling at the periphery of the eye, especially on the rim 10, and so prevent it from reëntering the throat 6, and hence it cannot return through said throat, the throat 5, and the channel 4 to the bobbin or cop, but, on the contrary, retains its proper position in the eye 2 of the shuttle, so that the filling will be properly run off without liability of tangling with the bobbin. (R. Sergeson & Co., Philadelphia, Pa.)

SERGESON'S LOCKING DEVICE FOR SHUTTLES.

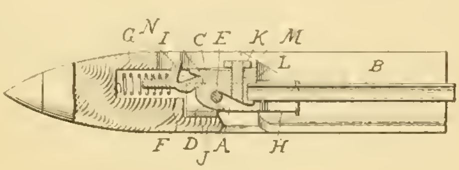
The object is to provide a locking device for the spindle for holding the same securely either in its raised or lowered position.

The illustration is a longitudinal sectional view of a portion of a shuttle, clearly showing this locking device.

Examining the illustration, we find that the head C of the spindle B, has on its under side a heel D and open slot A, through which is passed a pin E. The rear of said spindle head C is provided with a recess I, adapted to receive the bearing piece F, which is kept pressed against the head C by spring G.

In order to securely hold the bobbin on the spindle, clamps H are provided, adapted to engage the bobbin head, the ends of the shanks of said clamps being connected by a transversely extending plate J, which prevents said shanks from closing on each other when the bobbin is removed from the spindle. The tendency of the spring G is to press upwardly against the back of the spindle head C, and thus throw down the spindle B, so that said head is loose on the pin E, and thus is liable to be lifted and displaced while the spindle is improperly located. To prevent this, a crossbar K is provided, and which is connected with said head by means of a screw or pin L, whereby said crossbar may be turned so as to extend parallel with said head or in the position at a right angle thereto, it being noticed that the portion of the body of the shuttle at the adjacent sides of the channel or opening occupied by the head C has offsets or shoulders M thereon, on which the ends of the crossbar K are adapted to bear, and whereby the spindle B is restrained from being lowered when in operative position, thus positively preventing disconnection of the spindle from the pin E.

Should it be desired to remove the spindle, the crossbar K is simply given a quarter turn, whereby it clears the offsets or shoulders M and occupies a position parallel with the head C. Now the spindle



is thrown down by the action of the spring G, and the back of the head C rises, when the head can be raised by hand clear of said pin and so removed therefrom, thus permitting ready removal of the spindle from the shuttle.

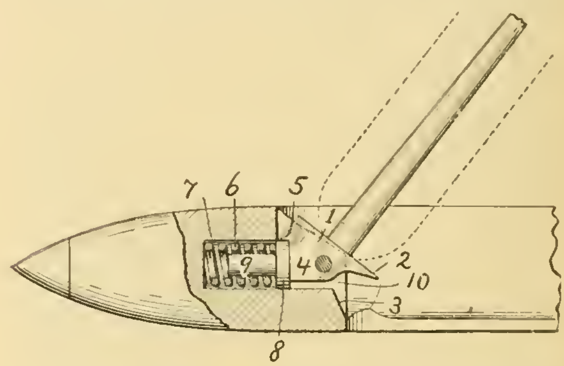
In order to replace the spindle, the head C is reapplied from the under side thereof, the slot A being in somewhat vertical position, so as to pass over the pin E, after which said head is lowered on said pin, and the spring G and bearing piece F are applied in position so as to bear against the head when the spindle is lowered. The crossbar is again turned at a right angle to the head C, so that its ends overhang the shoulders M, thus preventing the disconnection of the head from said pin, while, however, allowing the proper motions of the spindle with the bobbin thereon.

The upper wall of the recess I, is extended in the direction toward the bearing piece F, so as to form the tongue N, and in replacing the spindle head in position as before stated, the adjacent limb of the piece F enters the recess I, so that when the spindle is raised, said tongue freely overhangs said limb and places the piece in its normal position, said piece N and head forming a knuckle, which causes the piece to yield in the subsequent out and in motions of the spindle, while the tongue prevents upward disconnection of the piece, the pressure of the piece being directed on the head. (R. Sergeson & Co., Philadelphia, Pa.)

DUDLEY'S SHUTTLE.

The object is to so construct the base of the spindle and its co-operating parts that the cop can be placed snug against the base of the spindle, thus giving a firm support to the cop.

The illustration is a side view of a shuttle, partly in section, showing the spindle in its raised position.



The base 1 of the spindle has a downwardly-extending toe 2, which, when the spindle is closed, bears against a shoulder 3 of the shuttle body. The heel 4 of the spindle forms a rectangular point, and is provided with a shoulder 5. A spring 6 is placed in the cylindrical cavity 7 of the shuttle, and a disk 8, provided with a stud 9, bears on the coiled spring 6. When the spindle is in its closed position, the spring 6 forces the disk 8 against the face 10 of the heel 4, and thus securely holds the spindle closed. The spindle in turn is held in its raised position by the disk 8 bearing against the shoulder 5, as is shown in the illustration. (S. A. Dudley, Taunton, Mass.)

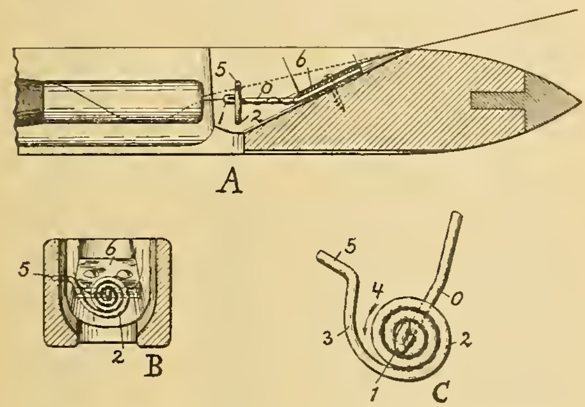
TENSION DEVICE FOR AUTOMATIC LOOM SHUTTLES.

The object is to provide an automatic threading tension device to loom shuttles, by means of which the delivery of filling at the first throw of the shuttle and at each subsequent throw is controlled by frictional resistance.

Fig. A is a longitudinal sectional view of part of the shuttle, showing, in solid lines, the filling-end extending from the bobbin through the tension device, and indicating in broken lines the position of the filling-end as it enters the spiral of the tension device. Fig. B is a transverse sectional view of the shuttle, showing the spiral guide of the tension device, and Fig. C is a perspective view of the latter.

The new tension device consists of a wire rod *o*, the forward end 1 of which is bent and doubled on itself, and then wound to form the spiral 2, the plane of which is at right angles to the axis of the rod *o*, the spiral being sufficiently open to allow the passage of the filling end. After bending the wire to form two turns, the same is bent into larger curve 3, forming the guide to the entrance 4, and then bent sharply to form the end 5, which is secured in the side of the shuttle, while the wire rod *o* is secured to the head of the shuttle by means of the clamp plates 6.

In mounting the device in the shuttle the end 1 is placed on a line with the axis of the bobbin, forward of, but near the end of the bobbin, so that the filling end as it is drawn from the end of the bobbin passes in the shape of a cone to the opening in the spiral, the said opening forming the apex of a cone, of which the end of the bobbin forms the base. By this arrangement the filling end is drawn against and around the end of the bobbin in frictional contact with the thread on the full fresh bobbin, and when part of the thread has been delivered, the filling end is delivered while in frictional contact with the exposed end of the bobbin. By placing the end 1 near the end of the bobbin, ballooning of the filling end,

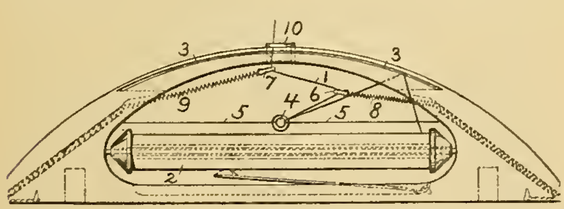


which is the main cause of the kinking of the filling in weaving finer qualities of cloth, is prevented.

On the first throw of the shuttle, the filling end will pass around the end of the shuttle and be guided into the entrance 4, and around the two turns of the spiral 2, at the same time winding spirally around the wire rod *o*, and thus immediately controlled by the frictional resistance of the thread on the bobbin and on the wire rod *o*. (Joseph E. Tichon, New Bedford, Mass.)

SHUTTLE FOR NARROW WARE LOOMS.

Heretofore the length of the bobbin as used in connection with these shuttles has been limited on account of the unsatisfactory angle of pull on the



thread in unwinding from large bobbins. To overcome this disadvantage is the object of this shuttle, which is shown in its top plan view in the accompanying illustration, clearly showing the new method of unwinding the thread from the bobbin.

The thread 1, as coming from the bobbin 2, passes up through an arched guideway 3, down to the guide eye 4, as supported yieldingly by suspension cords 5, then through the right and left tension eyes 6 and 7, secured respectively on the ends of the springs 8 and 9, and out of the shuttle through drawing off eye 10.

It will be seen that by means of the arched guideway 3, the angle, as formed by the thread unwinding from the bobbin, is kept constantly uniformly short (as near 90° as possible), since the thread travels in said arched guideway, and thus constantly changes its point of angle of pull conforming to the respective position of its point of unwinding on the bobbin. (Schaum & Uhlinger, Phila., Pa.)

HEDDLES, HARNESSES, REEDS AND TEMPLES.

FEHR'S FLAT STEEL HEDDLE.

This heddle is especially adapted for weaving cotton and silk fabrics, and is made out of one piece of cast steel, which construction prevents the warp threads from catching in the eye, since the eye is one solid piece of cast steel, and is not filled out with solder. A view of the heddle is given in the accompanying illustration, which shows very clearly its construction. The heddle is very thin and the holes at each end, by which it is supported in the harness frame, together with the eye of the heddle, are made by swageing.

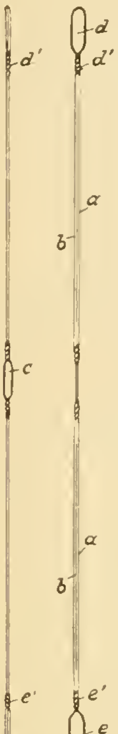
Owing to its smoothness, and being perfectly flat, the heddle offers almost no friction to the warp threads, said heddle turning only enough to allow the thread to pass through the eye. In connection with cotton fabrics as high as 40 heddles per inch per shaft may be used, whereas in connection with weaving silks, as high as 60 heddles per inch per shaft can be used.

Owing to the peculiar style of construction of this heddle, the same can be quickly transferred and counted off. Unlike other wire heddles, which come in bunches, these heddles, for the sake of convenience for handling in the mill, are threaded on rods previous to shipping. (Steel Heddle Manufacturing Co., Philadelphia, Pa.)

THE "HOWARD" TWIN STEEL WIRE HEDDLE.

These heddles are specially designed for use in connection with fine, high textured textiles, and are also known as German heddles, for the fact that originally they were introduced in this country from Germany, the home of high textured fabrics. These German heddles at once met with such favor in this country, in place of the domestic heddles, that the Howard Bros. Mfg. Company at once grasped the idea not only to improve upon their construction, but at the same time manufacture them on a more economical basis, by machinery complete, as compared to the German method of partial hand work, in turn producing a more uniform and reliable article.

The accompanying illustration shows this German or Twin tempered steel wire heddle in two positions, Diagram A showing the heddle in its position when on the Harness frame, *i. e.* with its open thread eye towards the fell of the cloth. Diagram B shows this heddle turned 45°, and being more particularly given to assist in describing the construction of this heddle, which is made of two parallel wires *a*, *b*, tinned or soldered together. The thread eye *c* is formed by then separating said wires, the end eyes *d* and *e*, as required for the heddle bar or rod (not shown) to pass through, being formed by throwing the ends of the wire back on the main wires, and twisting, as at *d'* and *e'*. After thus producing the heddle on one machine, they in turn are taken to another machine for soldering the eyes after they are twisted, in order that the heddle presents a perfectly smooth surface throughout, without any possible chance for catching or chafing the warp threads; permitting their use in connection with the most delicate, high textured, cotton, woolen, worsted and silk fabrics. (Howard Bros. Mfg. Co., Worcester, Mass.)

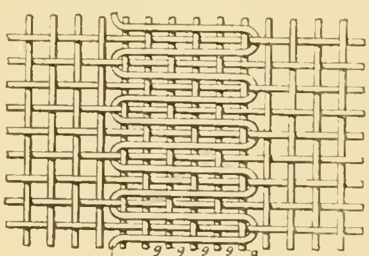


A B

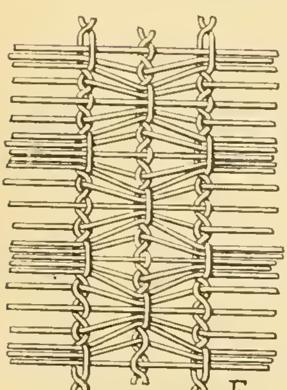
METAL DOUP HEDDLE.

The doup needle in this heddle as carrying the whip thread, is connected or pivoted to the heddle strips in such manner as to be tilted toward one or the other heddle strip by their alternate operation, being thereby caused to pass alternately on one side or the other of the standard warp thread or threads extending between the heddle strips.

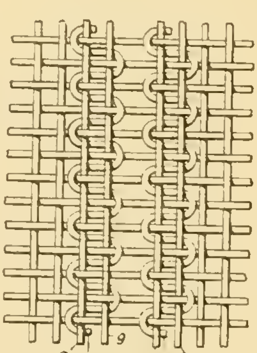
Of the accompanying illustrations, Fig. A is a front view of the attachment, and Figs. B and C front views of a portion of the attachment when the same is lifted to throw the whip thread to one side or the other, respectively, of the standard warp thread or threads.



D



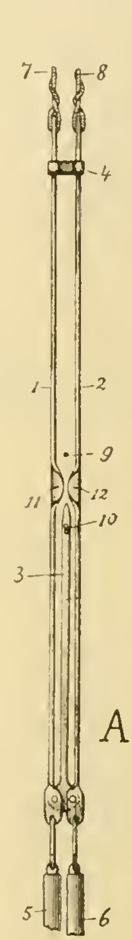
E



F

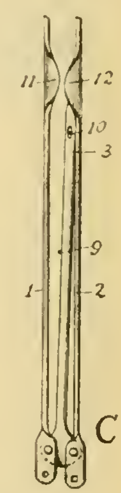
A description of the construction and operation of the heddle is best given by quoting numerals of reference accompanying said illustrations, and of which 1 and 2 indicate the heddle strips, 3 the doup needle, pivoted at its lower end to both heddle strips, and 4 is a connecting device, joining the two heddle strips and holding them a definite distance apart while permitting them to have independent vertical movements. 5 and 6 are weights secured, respectively, to the lower ends of the heddle strips 1 and 2, which weights however if desired may be dispensed with. 7 and 8 are the cords attached, respectively, to heddle strips 1 and 2 and leading to the jacquard machine or harness frame of the loom. 9 represents the standard warp thread or threads, as the case may be, extending between the heddle strips 1 and 2. 10 represents the whip thread extending through the eye of the needle 3. 11 and 12 are thread guides projecting inwardly toward each other from the heddle strips 1 and 2 respectively.

The operation of the heddle is thus: Assuming the device to be in its lowered position, as shown by means of Figs. 1 and 2, the lifting of cord 8 lifts the whole attachment, comprising both heddle strips and the needle. Initially, however, the strip 2 lifts a short distance independently of strip 1, causing the needle to be thrown to the left, as shown in Fig. B, and as the whole device is lifted, the whip thread 10 passes to the left of the standard warp thread or threads 9; guide 11 keeping the standard warp thread or threads from catching between strip 1 and needle 3.



A

B



C

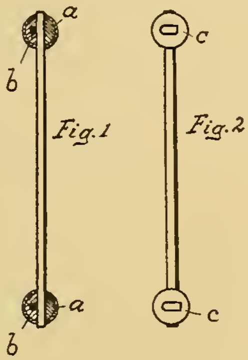
The respective pick of filling is then inserted, the tension upon cord 8 released, and when in turn by gravity, the device descends to its original position.

For producing the next pick (twist) the cord 7 is lifted, which first throws the needle 3 to the right, *i. e.* against strip 2, and then lifts the whole device, causing this time the whip thread 10 to pass to the right of the standard warp thread or threads, in order to produce the required twist effect in the fabric, the procedure itself being readily understood by means of consulting Fig. C.

Of the accompanying diagrams of woven leno fabrics, Fig. D shows such a one as produced by means of one whip thread 10, working against six standard or ground warp threads 9. Diagram E shows the use of two sets of doups *a* and *b* respectively, one whip thread working against one standard warp thread in either instance, each attachment (*i. e.* doup) being operated upon independently from the other. Diagram Fig. F shows the formation of a centre selvage as can be readily produced by means of the new heddle, one whip thread working in this instance against two standard threads. (Horace H. Sutcliffe, Frankford, Pa.)

STRENGTHENING DEVICE FOR REEDS.

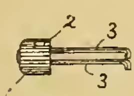
The object is to strengthen the reed at its ends, the mode of construction being clearly shown by means of the accompanying illustrations, of which Fig. 1 is a section of a reed, showing one of the reed strips grooved for the reception of a wire, and Fig. 2 is an end elevation showing the mode of fastening this wire to caps.



One of the strips *a* of the reed bar is formed with a groove, for the reception of the wire *b*, and which projects beyond the ends of the reed bars and extends through a cap *c* put over the ends of said reed bars. Each wire is then bent over and soldered to the caps. (The Luther Reed Manufacturing Co., Fall River, Mass.)

CAP FOR LOOM REEDS.

The novelty consists in providing means for holding the heading bar of the reed more securely in place; thus strengthening the union thereof to the reed ribs.



This feature is accomplished by means of an attachment to the reed as shown in the accompanying illustration, the affair in question being a cap and two holding staples. One of these attachments is used each on the top and on the bottom at either end of the reed.

For adjusting this attachment to the reed, the heading bar of the reed is cross grooved to provide therein a slot or recess, while the cap 1 is similarly provided with a groove 2 and is fitted over the heading bar with its open end on the reed rib end, its slotted portion admitting the neck or reduced part of the heading bar and its body part in the recess previously referred to. When the cap is thus put on, its outer end is to be substantially flush with the outer edge of the heading bar, and when through suitable openings in the end face of the cap are put the staples 3, whereby the cap is secured firmly to the end of the reed ribs by embedding said staples 3 in a body of pitch and rosin placed in the hollow chamber of the reed rib and allowed to harden about the staples. For securing these staples 3 more positive in place, the same are turned at the ends for engagement with the cement to thus better hold against withdrawal. Instead of the cement being employed, a pointed staple may be used and driven into the end of the reed rib; but the use of cement is preferred, as it gives a firmer hold, besides permitting of being heated to allow withdrawal of the staple at times for purposes of repairing the reed, and, too, it adds solidity and strength to the whole connection for resisting strain and consequently displacement, while arrangement of the caps in grooves of the heading bar for engagement therewith prevents the ribs of the reed from drawing apart. (Luther C. Baldwin, Providence, R. I.)

LACKEY'S HARNESS FRAME AND HEDDLE.

The objects are to provide plenty of room for the heddles to move in, at the same time preventing the warp threads from catching.

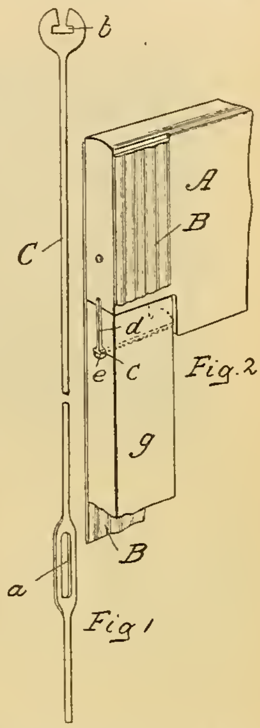


Fig. 1 shows part of one of these heddles, and Fig. 2 portion of the harness frame.

The harness frame is composed of a top and bottom piece, alike in construction (the top piece A only being shown), and side pieces B (only the upper portion of the left hand side piece being shown). The beddles C are made of flattened wire, having warp eye *a*, and at each end an open slot *b*, which conforms with the supporting rail *c*, having a web *d*, fitted to a recess in the edge of the cross piece A, the rail *c* having a T-shaped extension *e*. The side walls B of the frame are composed of two metal strips, leaving a space between, and into which is fitted strip *g*.

When it is desired to fill the frame with heddles, the strip *g* is removed, thus exposing the T end of the rail *c*, when the heddles can be easily put on or removed as the case requires. (Lackey, Hopkins & Perkins Co., Philadelphia, Pa.)

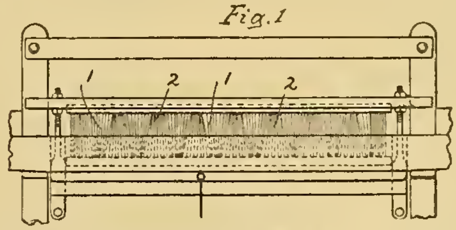
REED AND REED MOTION FOR SPECIALTIES.

The object is to provide means whereby the warp threads extend in curves in the plane of the fabric, in this manner producing novel effects to the cloth.

Fig. 1 shows the construction of the reed and the method of mounting the same in the loom. Fig. 2 shows one of the effects produced in the fabric, the nature of which, to a certain extent, can be varied.

Examining illustration, Fig. 1, we find that the dents of the reed are arranged in sets, indicated respectively by numerals 1 and 2, said dents extending at varying distances from each other, *i. e.*, the dents of one set diverge at the top and converge at the

Fig. 1



bottom, while the dents of the next set are arranged in the opposite way.

A vertical motion is imparted during weaving to this reed, in this manner diverging the respective sets of warp threads (more or less) towards or away from each other, thus producing the required effect to the fabric. On the backward movement of the lay, the reed is every time raised to its highest position in order to permit the shuttle to pass freely through the shed. On the forward beat of the lay, in turn, the reed is lowered, according to the pattern

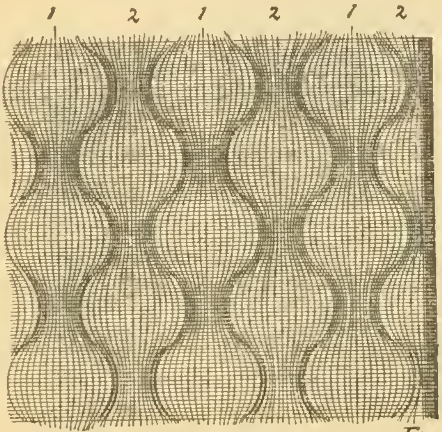


Fig. 2

required, to regulate the proper position of the warp threads, in order to produce the curved lines previously referred to, as shown in Fig. 2, for the sake of one example.

The mechanism for raising and lowering the reed as required by the effect in the cloth, is controlled by indications on the pattern chain. (Crompton & Knowles Loom Works, Worcester, Mass.)

FEHR'S HEDDLE FRAME.

This frame is characterized by the manner in which the heddle bars are secured in said frame, and which allows them to be easily taken off so as to add or take away the required number of heddles when making up a set of harnesses for a new structure of cloth.

The construction of this frame, *i. e.* the attachment of the heddle bars to the side frames is shown in the accompanying illustrations, of which Fig. 1 is a portion of a side vertical frame, as used in connection with a similar frame (on the other side) to connect the two horizontal wooden (top and bottom) pieces of the heddle frame, the portion shown including a portion of the strap, shaped for receiving one of said horizontal frame pieces and the grooves for the attachment of one end of a heddle bar. Fig. 2 is a hook, having one end threaded, which is secured in the vertical frame portion and holds one end of the heddle bar. Fig. 3 is a nut with a fastening device shown in connection with it.

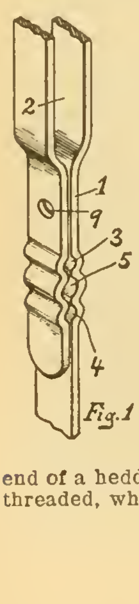


Fig. 1

Fig. 2

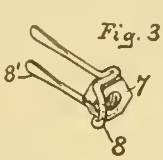


Fig. 3

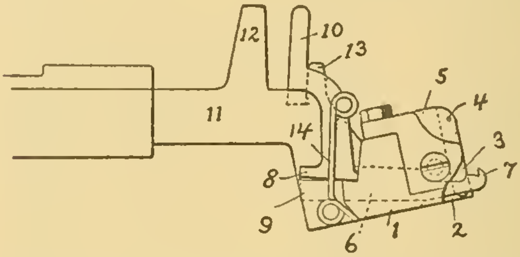
Referring to the illustrations, 1 indicates a portion of one of the vertical frames, which is bent so as to form a loop 2 for inserting one end of the horizontal pieces, the former being bent to form two small holes 3 and 4 and a larger hole 5 between them. The threaded end of the hook 6 is inserted into the hole 5 and the nut 7 fastens it, said nut being prevented from unscrewing after having been set properly, by means of a bent wire piece 8, whose ends form two shanks 8', which fit into the holes 3 and 4 respectively, on the vertical frame piece 1, the ends extending past the frame being bent back over opposite sides of said frame piece, which prevents any longitudinal movement of the hook 6. The sides of the holes 3, 4 and 5 are clamped together by means of a screw fitting into the hole 9 which also clamps the loop of the vertical frame piece onto its respective horizontal piece. (Steel Heddle Manufacturing Co., Philadelphia, Pa.)

THREAD CUTTING ATTACHMENT TO DRAPER TEMPLES.

The object is to provide means by which the filling thread of the discharged filling carrier is engaged (for the purpose of severing) with greater facility and accuracy than heretofore.

The illustration is a side elevation of a temple provided with the new thread cutting device, part of the cap and pod being shown broken away in order to show the cutting arrangement.

The pod 1 of the temple is slotted at 2, to receive an upright steel blade 3, secured by stud 4 in the



cap 5. In slot 2 is also placed a bar 6, bifurcated at its inner end to straddle the blade 3, said bifurcated end being formed as an upturned hook 7, projecting beyond the face of the pod 1. The outer end of bar 6 has a laterally extended shoe 8, which slides on the ear 9 of the pod, and is upturned to form a heel 10, which in turn slides on the top of the temple shank 11, between an abutment 12 and a lug 13. Spring 14 maintains the heel 10 in normal position.

The operation of the cutting device is thus: When the lay beats up, the hook 7 is brought into position beneath the filling thread, said thread being caught and held by the upturned hook 7. As the lay continues its forward movement, an actuator as fast on the lay (not shown) engages with the heel 10, moving the same forward against the action of spring 14, the hook 7 in turn drawing the thread across the blade 3 and severing it.

The spring 14 gives a yielding movement to the heel 10 when actuated, so that it is not brought up with a heavy shock against the abutment 12 as the lay completes its forward movement. (Draper Co., Hopedale, Mass.)

JACQUARDS, CARD STAMPING AND LACING MACHINERY.

THE C. & K. JACQUARD FOR TWO WEAVE FABRICS.

In these Jacquard machines two cylinders are employed for coöperation with the needles, one of the cylinders carrying the pattern for the border and the other carrying the pattern for the body of the goods.

The gist of the improvement consists in devices to bring automatically the respective cylinders into action, alternately, at the required times.

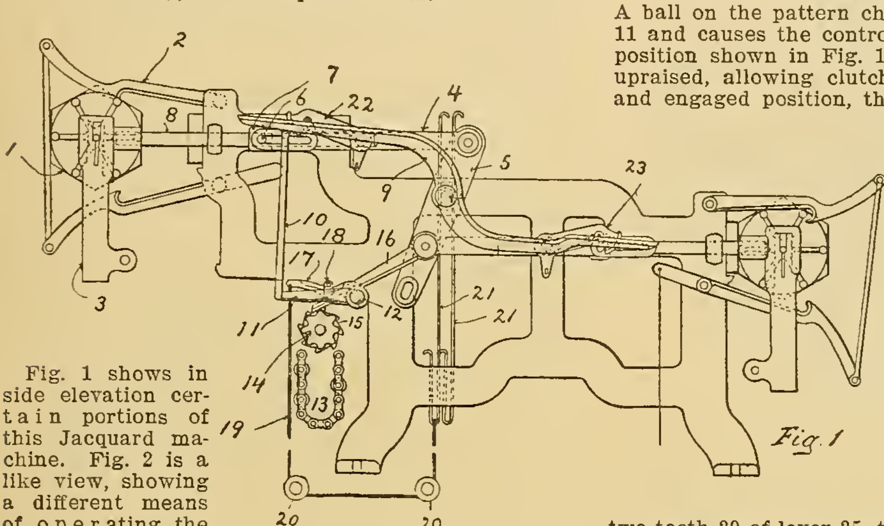


Fig. 1

Fig. 1 shows in side elevation certain portions of this Jacquard machine. Fig. 2 is a like view, showing a different means of operating the pattern lever.

The mechanism is shown in connection with a double action Jacquard machine, where also two sets of griff blades are used; however, said mechanism may also be used with single lift Jacquards. (For a general idea as to the operation of these machines,

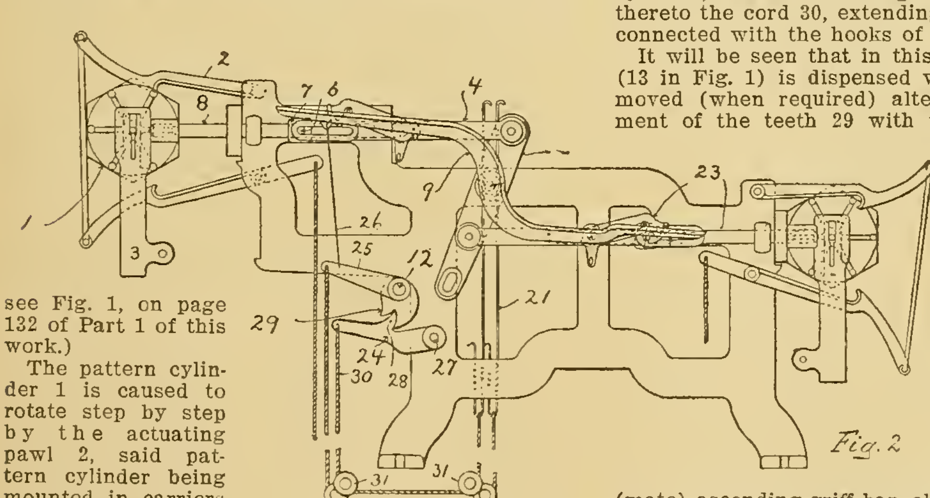


Fig. 2

see Fig. 1, on page 132 of Part 1 of this work.)

The pattern cylinder 1 is caused to rotate step by step by the actuating pawl 2, said pattern cylinder being mounted in carriers 3. With these carriers 3 is combined a mechanism consisting of clutch devices or actuators 4, connected to rocker arm 5, and being supported by pins 6, projecting from collars 7 fast on slide rods 8.

During the outward movement of the actuator, if the shoulder of its slot comes against the pin 6, it acts to force the left hand carrier into the position shown in Fig. 1, and remains in this position so long as it remains unclutched from its actuator.

The controlling lever 9 is connected by a rod 10 with the pattern lever 11 as hung on stud 12, the said lever being acted upon by a pattern chain 13 passing around a pattern barrel 14 and having connected therewith a ratchet 15. The pattern chain 13 is advanced by means of pawl 16 pivoted to one end of rocker 5. In connection with pawl 16 a pawl lifter 17 is employed, on which bears a pin 18. A cord 19 has one end connected with pawl lifter 17, and extends around pulleys 20, the other end being connected with one of the hooks 21 of the Jacquard machine. A ball on the pattern chain raises the pattern lever 11 and causes the controlling lever 9 to assume the position shown in Fig. 1, thereby holding clutch 22 upraised, allowing clutch 23 to occupy its lowered and engaged position, the clutch remaining in such position until locked to permit the other card cylinder to operate.

In the mechanism shown in Fig. 2, numeral 24 indicates a locking arm, by means of which the arm 25 is held in either of its extreme positions until a shift thereof is required to be made. This arm 25, when raised, operates through a wire 26 to raise the controlling lever. The locking lever 24 is pivoted on pin 27, and has a toe 28 engaging with two teeth 29 of lever 25, the said toe 28 engaging the teeth 29 alternately to hold the lever 25 in its two extreme positions. For the purpose of operating the locking lever 24 automatically, when desired to disengage it from the lever 25 to permit the position of the same to be altered in order to operate the other card cylinder, the said locking lever 24 has connected thereto the cord 30, extending around pulleys 31 and connected with the hooks of the Jacquard.

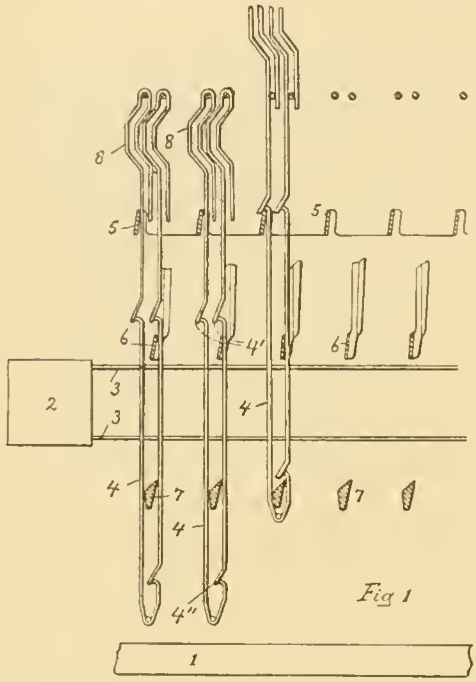
It will be seen that in this case the pattern chain (13 in Fig. 1) is dispensed with, the lever 25 being moved (when required) alternately by the engagement of the teeth 29 with the toe 28 of lever 24. (Crompton & Knowles Loom Works, Worcester, Mass.)

HOOK GUIDE FOR C. & K. OPEN SHED DOUBLE ACTING JACQUARDS.

The object of this guide (one for each hook) is to prevent the respective crook of a descending hook from catching with its (mate) ascending griff bar, obviating the necessity of an extra beat of the card cylinder for obtaining the same result, which feature in turn would reduce the speed of the machine.

Fig. 1 is a vertical section of portions of an open shed, double acting Jacquard machine, showing this guide applied to the hooks.

1 indicates the bottom board, 2 the card cylinder, 3 the needles, and 4 the hooks, each one provided, respectively, with the three crooks 4′ and 4″. 5 indicates the bars of one of the two movable griffs,

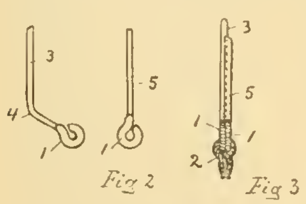


shown raised, and 6 the bars of the other movable griff, shown in its lowered position. 7 indicates the bars of the stationary griff.

The hooks 4, as engaged, respectively, either by griff bars 5 or 6, are bent at their upper end to form a cam or guide 8 which serves as a switch to guide the nooks, so that when a hook, by the weave, has to descend, its free crook will not come in contact with the (mate) rising griff bar; the guide 8 thus preventing any liabilities of mispicks.

The hooks 4 thus referred to, and made of one piece of wire, can, with advantage, be made in two parts, as is shown by referring to Figs. 2 and 3, of which Fig. 2 shows the lower limbs of the two hooks as united by means of the neck cord to act in unison, Fig. 3 being a detail view of said ends fitted together and united by its neck cord.

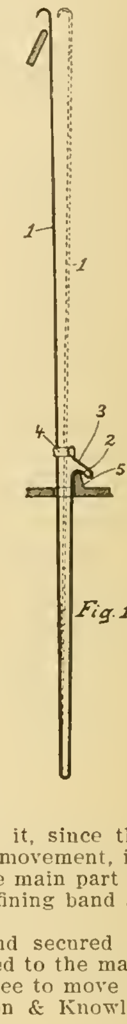
Each limb of the two hooks as thus united by the neck cord is formed of a piece of wire, the lower end being bent into an eye 1, the neck cord 2 being adjusted to both hooks, *i. e.*, to the two eyes 1. The lower limbs of one of the hooks 3 are bent, as at 4, in order that when in position for use the eyes 1 may be brought into apposition with each other, so that the corresponding neck cord may be passed through both eyes 1, as is clearly shown in Fig. 2. The lower limb 5 of the other hook is straight. Thus it will be seen that tbe two hooks act in unison, as if made from one piece of wire, as done heretofore. In order that the eyes may fit closely together, they are flattened transversely, as is shown in Fig. 2.



This construction of a double hook made in two pieces has the advantage of being cheaper to manufacture; again, if one section breaks or is rendered useless for perfect work, only this section needs to be replaced. (Crompton & Knowles Loom Works, Worcester, Mass.)

HOOK FOR C. & K. JACQUARD MACHINES.

The object of the construction of this hook is to reduce the friction between the hooks and their guide plate, and also to require less power on the part of the needles, as actuated upon by the Jacquard card, to press the hooks away from the knives of the griffe, and thus prevent the liability of holes being punched in the cards by the needles, due to excessive resistance of the hooks.



The details of the construction of the hook are best shown by means of the accompanying illustration, which is a side view of a hook, shown in connection with a cross section of its griffe knife and a cross section through a portion of its guide plate.

Referring to the illustration, 1 indicates the hook which is of the usual construction, except that its crook portion 2 has its projecting end 3 bent backwardly toward the main part of the hook 1, and then bent upwardly, the end of which is parallel with the main part of said hook 1 to form an attaching end for a confining band 4. One end of the confining band 4 is secured upon this free end of the hook 3, the other end being left open, to loosely hold the main part of the hook 1, and allow said hook to move freely in it, as shown in dotted lines.

By thus placing the confining band 4 above the lift bar 5, the former cannot come into contact with said lift bar, and thus friction and wear are prevented, but which otherwise is the case, provided the confining ring is placed below the lift bar 5 as previously has been done. By leaving the confining band open, so that the main part of tbe hook 1 can move freely in it, movement is given more easily to it, since the bottom end is used as a pivot for the movement, instead cf the confining band, in case the main part of the hook was secured also to said confining band as was formerly the case.

Instead of having the confining band secured to the end 3 of the hook, it may be secured to the main part of the hook with the said end 3 free to move in the open confining band 4. (Crompton & Knowles Loom Works, Worcester, Mass.)

THE VERDOL JACQUARD MACHINE.

This machine is distinguished from the regular Jacquard machine principally in the manner in which the hooks of the machine are actuated to produce the desired pattern, that is, a continuous sheet of perforated paper with the pattern stamped out on it, is used instead of a set of separate cards laced together, which condition, of course, requires the use of other methods of actuating the hooks of the machine from that employed for the regular Jacquard, and for which reason a description of this machine will be of interest.

The sheet of paper used for the pattern is thinner than regular Jacquard cards, being reinforced for about one-half inch on each edge of the sheet, which is the portion subject to the most wear during weaving. The machines are all fine index, and are made in different styles, single lift, double lift, rise and fall, etc., being suitable for all kinds of fabrics from coarse damasks to fine upholstery goods.

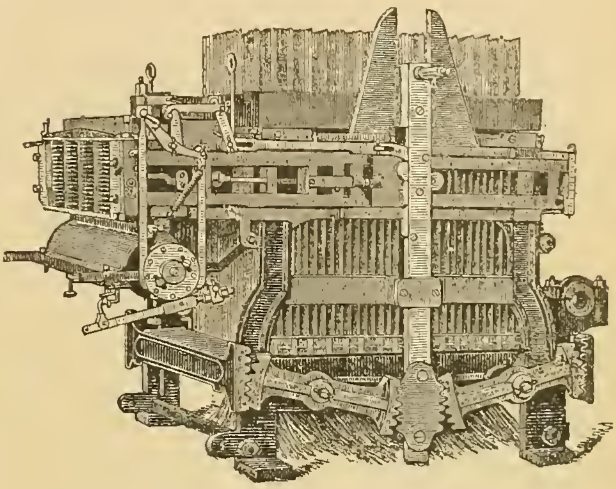
Two sets of needles are employed, one set working the other set, which in turn actuates the hooks of the machine, so that they may be operated upon by the knife box (griffe). The first set of needles stand vertically, being made of very fine steel wire, and have a loop made in the proper portion of their length, through each of which a corresponding needle from the other set of needles, as placed horizontally, is passed, so that the first set of needles has only to be actuated very slightly in order to raise or lower the ends of the push wire which is connected with the horizontal needles, passing through the loops of the needles thus actuated, sufficiently to have said horizontal needles actuated by the front edge plates on the machine and thus in turn allow the hooks to escape the movement of the knife box. The pressure required to raise the vertical needles is very slight, which thus allows the paper, on which the pattern is stamped out, to be made comparatively thin, since it receives practically no wear from pressing the needles. The paper has peg holes punched out on each edge, there being three holes along the edges of what corresponds to each card, so that in case one set of holes becomes worn, by simply moving a screw on the cylinder carrying the pegs, one of the two remaining sets of holes can be used, and the sheet presented to the needles as previously done with the first set of holes.

The construction and operation of the machine is best explained by means of the accompanying illustration, which is a perspective view of the machine, showing particularly the arrangement of the mechanism for feeding the perforated pattern sheet for actuating the needles of the machine.

The pattern sheet is run on the curved plate, shown under the front edge plate, said curved plate being perforated in that portion which is situated directly under the lower ends of the vertical needles, there being a corresponding hole for each needle. The pattern sheet is moved forward by two pegged wheels, one for each edge, the pegs entering the holes in the sheet, and as said wheels receive an intermittent rotation, the pattern wheel is taken forward intermittently. As each portion of the sheet, corresponding to a regular Jacquard card, comes over the perforated portion of the plate, its motion is stopped for a short space of time, and the plate is moved slightly upwardly, thus pressing the sheet against the lower ends of the needles and raising them, except where holes are punched in the sheet, in which instance the corresponding needles pass through them and are not raised. The needles thus raised, in turn raise the ends of the horizontal needles passing through their loops, and the ends of these slightly raised needles are then in direct line with the solid portions of the front edge plate, which is now given an inward motion and thus pushes the push wires, which in turn push the needles in their path, inwardly. The needles thus pushed inwardly, in turn push their corresponding hooks away from the bars of the knife box, and consequently said hooks are not raised, in other words, a hole in the sheet indicates that the proper hook will be raised, and a blank means that the hook will not be raised.

The horizontal needles which were not raised by their corresponding vertical needles, as explained, are not acted upon by the front edge plate, but as the said plate moves forward, these needles pass in the open slots of the plate especially made for this purpose.

The Verdol machine offers the advantage that the fabric can be woven in the loom, either face up or face down, with the one set of cards, by simply reversing the front edge plate, and when consequently a hole in the sheet will then indicate that the proper hook of the machine will not be raised, a blank in the sheet indicating the reverse effect to a respective hook. Hooks and needles in



this Jacquard machine can be readily changed when so required for one reason or the other.

The cylinder carrying the pattern sheet makes $\frac{1}{9}$ of a revolution for every pick, said motion being obtained from the vertical pawl shown connected to suitable mechanism.

Among the advantages claimed for the machine are the economy in the price of card pattern material, no lacing of cards, as well as less space required for the cards on the machine as well as when stored. This machine, although new here, has been successfully introduced for some time all over Europe. (Verdol Jacquard Machine & Card Cutting Co., Paterson, N. J.)

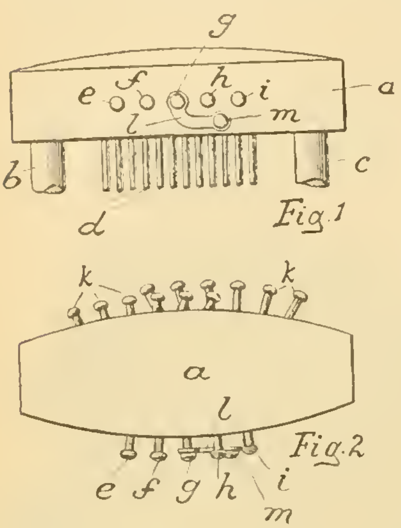
ROYLE'S PUNCH HEAD FOR CARD STAMPERS.

The object of the new arrangement is to relieve the strain upon the hand of the operator in manipulating the punch keys.

Fig. 1 is a view in front elevation of the punch head, and Fig. 2 is a view of the same in its top plan.

The punch head is denoted by *a*, the rods for raising and lowering it by *b*, *c*, and the gang of punches by *d*. The keys on the front of the head, which are intended to control the punches for punching the peg and lace holes in the card, are denoted by *e*, *f*, *g*, *h*, *i*, and those on the opposite side of the punch head for controlling the punches for punching the pattern holes in the card are denoted as a whole by *k*.

In order to bring the punch keys on the front of the head, which, as previously stated, control the punches for punching the peg and lace holes in the card, within convenient reach of the operator while the fingers of the hand are manipulating the keys *k* on the opposite side of the punch head, a lateral extension *l* is provided, being fixed to the end of the middle key *g*, and its free end carried into such position with relation to the two keys *h* and *i* to the right of it—for example, to the position *m*—that the thumb of the right hand of the operator may cover at the same time the two keys *h*, *i* and the end *m* of the extension which controls the third key *g*, while the thumb of the left hand of the operator readily controls the other two keys *e* and *f* at the left of the centre. This enables the right hand of the operator to be thrown over into the natural position on the head to permit the free operation of the fingers of the hand in manipulating the keys *k* at the back, and the strain heretofore caused—and which has had a tendency to distort the hand of the operator by daily manipulation of the keys—is avoided, in turn materially lessening the wear upon the muscles and nerves of the operator. (John Royle & Sons, Paterson, N. J.)



ROYLE'S CARD LACING MACHINE.

In connection with this machine, the cards are fed to the lacing mechanism by hand; a variable reciprocatory movement of the lacing needles being arranged to coact with the variable feed of the cards, to account for the difference in the length of stitches required in lacing said cards. The construction and arrangement of the shuttles is such as to permit free access to the same, and the cards to be laced are so positioned on the machine as to be easily and accurately conveyed by the operator to the feeding mechanism.

The illustration is a right-hand side elevation of the machine, clearly showing the operation of the same.

The cards are fed step by step to the stitching mechanism by a pair of endless chains—one on each side of the machine, only one C being visible—provided with pegs *c*, adapted to enter the peg holes in the cards. These two chains are mounted upon sprocket wheels c^1, arranged in pairs at or near the opposite ends of the machine and actuated by a pawl c^2, carried by a rocking arm c^3, connected by a rod c^4 with a vibrating lever c^5 in position to be engaged by a cam disk c^6, operated from the driving shaft R. The vibrating lever c^5 is operated in a direction opposite that in which its cam c^6 operates it by a spring c^7, fixed at one end to the lever and at the opposite end to the frame of the machine. The sprocket wheels c^1, at the rear end of the machine, are mounted in bearings supported by a pair of arms D, pivoted to brackets a^4, attached to the rear end of the frame A of the machine, and having their lower ends provided with adjusting nuts *d*, working on threaded stubs d^1, extending through slots *a* of the brackets a^4, so that the tension of the feed chains may be at all times adjusted and chains of different lengths employed to suit cards of varying widths.

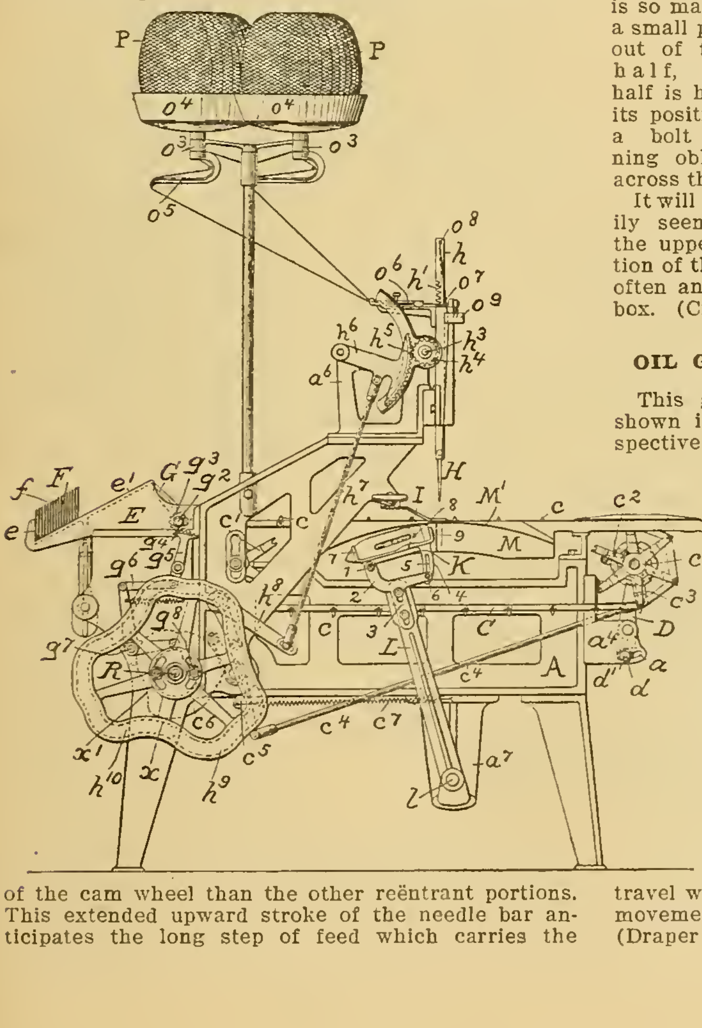
The card holder E is provided with a lip *e* at its front end, which forms an acute angle with the floor e^1 of the holder, so that when the cards F are stacked on the holder, ready to be fed to the feed chains, the upper edges *f* will project slightly one above another, thereby enabling the operator to readily grasp with the thumb and forefinger a single card at its upper edge without any delay in separating it from the card adjacent thereto. From their position on the holder E the card is placed on the auxiliary feeder G, which rests normally with its face inclined toward the holder E, and is provided with spring retaining hooks, beneath the free ends of which the card is passed in applying it to the auxiliary feeder. The auxiliary feeder G is fixed on a rock shaft g^2, provided with a pinion g^3, which engages a toothed sector g^4 on a vibrating arm g^5, which arm is connected by a link g^6 with one arm of a bell crank lever, pivoted to the frame at g^7 and operated by a cam g^8, actuated by the driving shaft R.

The lacing needles H are adapted to reciprocate the needle bars *h*, having series of teeth h^1 thereon arranged to gear with pinions arranged at suitable intervals along a rock shaft h^3, supported in bearings in brackets a^6. The shaft h^3 is rocked to reciprocate the needle bars, and hence the needles, by means of a pinion h^4, carried thereby, and arranged to engage a toothed sector h^5 on a swinging arm h^6, connected by a rod h^7 with one arm h^8 of a bell crank lever, the other arm of said bell crank lever being arranged to engage a cam groove h^9 in the side of a cam wheel h^{10}, operated from the drive shaft.

The shuttles I are each mounted in a tilting holder K, supported by a rocking arm L, each of the arms L being fixed to rock with a shaft *l*, supported in a bracket a^7, depending from the frame A. The arm carrying the middle shuttle has an operating rod connected therewith above the rocking shaft *l*, the opposite end of said rod being connected with an eccentric, carried by the drive shaft R. This rod thus serves to rock the three shuttle supporting arms L in unison. The shuttle holder K is hinged at 1 to a base piece 2, the stem 3 of which is fixed to the rocking arm L in adjustment longitudinally of the arm, and the rear end 4 of the holder is provided with an elongated slot 5, through which an adjusting screw 6 extends to lock the holder to the base piece or shuttle holder support in the desired tilting adjustment.

The shuttle holder K is provided with a finger 7 for holding the nose of the shuttle against the side wall of the raceway and with a lip 8 for holding the body of the shuttle at its rear end against the side wall of the raceway and with a retaining lip 9 at its rear end, which acts in conjunction with the finger 7 to hold the shuttle against longitudinal displacement in the holder. The side wall M, in proximity to which the shuttle is intended to travel, holds the shuttle against displacement in that direction, and the top wall M^1 of the raceway, prevents the shuttle from displacement in that direction when the shuttle holder is tilted into its position to bring the shuttle into operative position in the raceway. The shuttle is removed from beneath by tilting its holder K downwardly at the heel, and then lifting the rear end of the shuttle out of engagement with the lip 9. The tilting adjustment of the holder on its support thus performs two functions, *i. e.*, the heel of the shuttle holder may be tilted downwardly, so that the shuttle itself may be removed from its holder without disturbing any other parts of the machine, and at the same time this tilting adjustment coacts with the adjustment of the shuttle holder support itself to place the shuttle in the exact position required with respect to the raceway, so as to make it work with the least possible friction and catch the loop of the needle positively. The lacing cord is led from the core of the ball P down through the stem of the cup o^4 and socket piece o^3 to guides on a curved arm o^5, attached to the stem of the cup o^4 or to the socket piece, and thence leads to a tension device o^6 on the needle bar support, thence to a guide o^7 onto the needle bar support in proximity to the needle bar, thence up and through an eye o^8 at or near the upper end of the needle bar, and thence downwardly through a guide o^9 to the needle.

The shuttles being driven directly from the drive shaft by an eccentric thereon, will be caused to complete a reciprocating movement for each revolution of the drive shaft, and as the needles are operated by the cam h^{10} on the shaft R in order to impart to them a reciprocating movement for each movement of the shuttle, the cam h^{10} is provided with three radially extended portions and three reëntrant portions alternating with the extended portions, so that in one revolution of the cam h^{10} the needle has imparted to it three vertically reciprocating movements. By thus operating the needle through an independent operating mechanism, a longer movement in an upward direction intermediate two successive shcrter movements in an upward direction is imparted to the needle, and thereby cause it to draw an additional amount of cord from the supply balls to accommodate the longer stitch, which occurs between the two lace holes at the opposite edges of a card. This is accomplished by making one of the three reëntrant portions of the cam wheel h^{10} extend (the portion denoted by x) nearer the centre

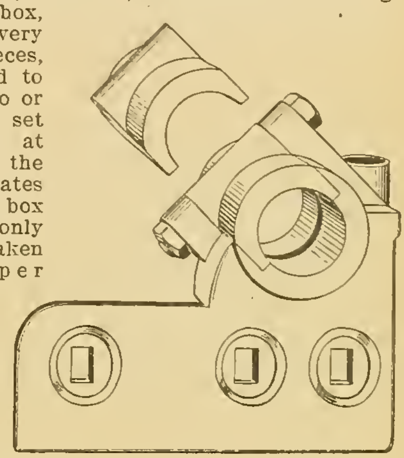


of the cam wheel than the other reëntrant portions. This extended upward stroke of the needle bar anticipates the long step of feed which carries the card a distance equal to the distance between the lace-holes upon its opposite edges, and which long step of feed is provided for by the portion x^1 of the cam c^6, which permits the operating arm of the lever c^5 to approach nearer to the centre of the cam c^6 than the other reëntrant portions of the cam permit, and hence causes the feed pawl c^2 to engage the ratchet disk a tooth in advance of that which it would ordinarily take, and hence increases the length of feed at that step by the width of that tooth. (John Royle & Sons, Paterson, N. J.)

MISCELLANEOUS.

THE CROMPTON-THAYER CRANK SHAFT BOX.

The distinctive feature of this box, as applied to the Crompton-Thayer Looms, is that instead of being like an ordinary box, divided into two very nearly equal pieces, the upper bolted to the lower by two or more bolts or set screws running at right angles to the line which separates them, this new box is so made that only a small part is taken out of the upper half, which half is held in its position by a bolt running obliquely across the box. It will be easily seen, that the upper portion of this box cannot break loose, which happens so often and is so annoying in the regular crank shaft box. (Crompton-Thayer Loom Co., Worcester, Mass.)

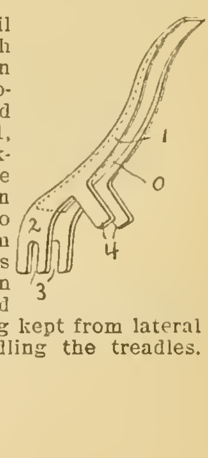


OIL GUARD FOR THE SHEDDING CAMS.

This guard is built by the Draper Co., and is shown in the accompanying illustration in its perspective view.

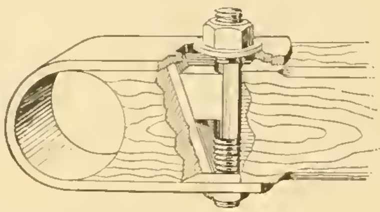
The object of said guard is to prevent the cams from throwing oil upon the warp during the running of the loom, thus obviating grease spots which had to be removed later on from the cloth.

One of these oil guards is used for each cam and comprises an elongated plate o, provided with downturned strengthening flanges 1, which are gradually extended as at 2, and are provided with open slots 3, which fit into projections on the cam treadles. The guards rest by their own weight on the cams and travel with them, each guard being kept from lateral movement by two ears 4, straddling the treadles. (Draper Co., Hopedale, Mass.)



THE CROMPTON-THAYER LAY CONNECTOR.

This new lay connector as used on Crompton-Thayer looms, is shown in the accompanying illustration, and has for its merit the fact that it is adjustable, that is, the band around the crank arm or around the lay pin may be tightened or loosened by the weaver very easily, by simply tightening or loosening the bolt that lifts or depresses the wedge or cam, which is shown quite clearly in the illustration, then tightening the other bolt causes the strap to clinch the connector. Thus, it is very easy for any weaver to tighten or loosen the band at either end of the lay connector without calling upon the services of a loom fixer. (Crompton-Thayer Loom Co., Worcester, Mass.)

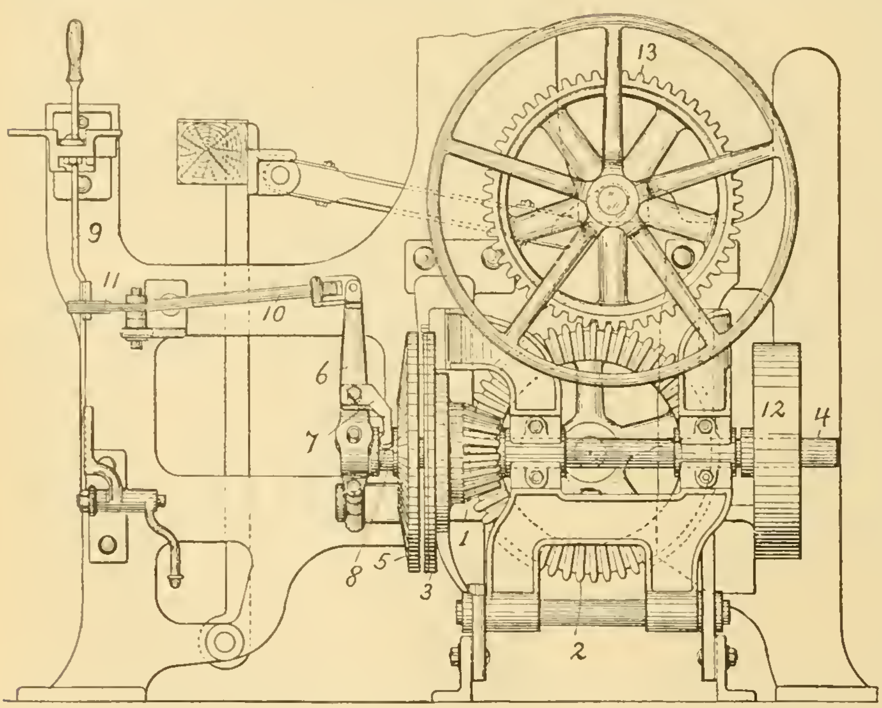


DRIVING MECHANISM FOR C. & K. LOOMS.

The object is to provide to their heavy looms (which require considerable strength on the part of the weaver to push back the lay after the loom is stopped to insert new filling, etc.) means whereby this mechanism is easier reversed, thus permitting the weaver to more easily turn the lay back by hand when so required.

The illustration is a right hand end view of a loom showing this mechanism and its connection with the shipper handle, by which it is operated.

The bevel gear 1 (loose on shaft 4), which drives the gear 2, has attached thereto a friction disk 3,



said gear 1 being provided with an oil reservoir which acts to lubricate the shaft 4 on which the disk is mounted. A second friction disk 5 is slidably mounted on shaft 4 so as to be moved into and out of engagement with the disk 3 through lever 6, carrying the forked arm 7, which engages the grooved hub 8 on the disk 5. The lever 6 is operated by the shipper lever 9 through the connector 10 and angle lever 11.

The operation is as follows: Power is communicated to the cross shaft 4 through belt pulley 12, and the friction disk 5 revolves with shaft 4, and when the loom is in operation the friction disk 5 will be in engagement with the friction disk 3, causing said disk and bevel gear 1 to rotate with the disk 5 and the shaft 4 and communicate motion to the gears 2 and 13.

When the shipper lever is moved to stop the loom, the friction disk 5 is moved out of engagement with the friction disk 3, leaving the friction disk 3 and bevel gear 1 stationary, while the shaft 4 and the friction disk 5 continue to revolve. This will permit the weaver to more easily push the lay back, when so required, since for this purpose he, in pushing back the lay, will only have to reverse the gears 2 and 13, and the bevel gear 1 and friction disk 3 without moving the shaft 4.

In starting up the loom by moving the shipper lever, and causing the friction disk 5 to move into engagement with the friction disk 3, the momentum of the revolving shaft 4 will cause the loom to start more quickly than if the shaft 4 were stationary at the time the loom is started, and the bevel gear 2, meshing with the bevel gear 1, will tend to crowd or push the gear 1 outwardly, thus securing a better friction between the two disks. (Crompton & Knowles Loom Works, Worcester, Mass.)

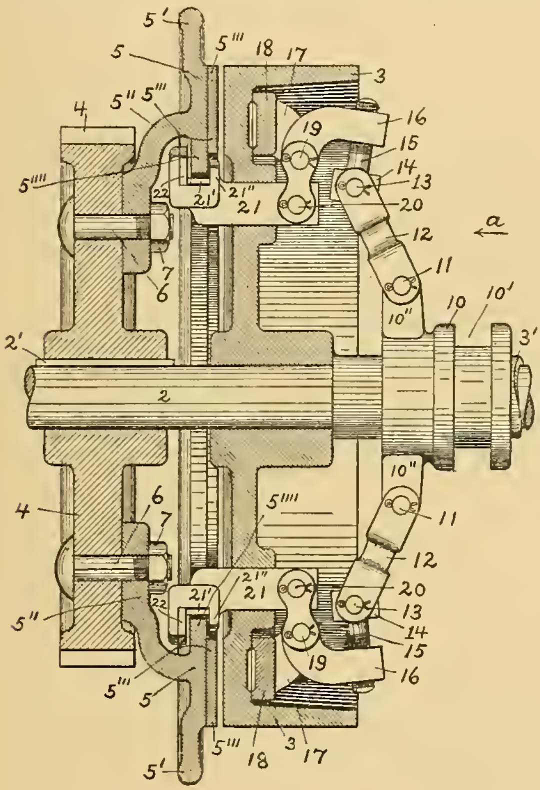
FRICTION PULLEY FOR C. & K. LOOMS.

In previous constructions of friction pulleys considerable leverage is required to maintain the loose pulley in contact with the friction pulley, in order to drive the loom, this leverage in turn causing friction on the bearings of the driving shaft, and consequent waste of power, as well as an end thrust to the shaft when the loom is started. The object of the new friction mechanism is to provide means for drawing the loose pulley against the friction surface and locking it in its position when in contact with the friction surface.

The illustration is a sectional view of the new friction pulley mechanism, showing the driving pulley out of engagement with the friction disk. Examining this illustration we find that on the driving shaft 2 is loosely mounted the driving pulley 3. 4 is a driving gear, secured on the shaft 2 by a spline 2′.

The friction surface is made in the shape of a circular disk 5, provided with a hand wheel 5′, and having the arms 5″ secured by bolts 6 and nuts 7 to the gear 4, and with a friction surface consisting of a ring of leather 5‴, secured on the face of the disk 5, adjacent to the driving pulley 3, which is loose on shaft 2, and adapted to be moved thereon in the direction of the length of the shaft. A friction band wheel (not shown) is secured to the gear 4, and around said wheel passes a friction band, which is brought into engagement with said friction wheel when the shipper is thrown off.

The mechanism for moving and locking the driving pulley 3 consists of a collar 10, loosely mounted on the turn down hub 3′ of the pulley 3, and having an annular groove 10′ therein, said collar also having oppositely extending lugs or ears 10″, to each of which is pivotally connected by a pin or stud 11, one end of a connector 12, forked at each end. The opposite forked end of each connector 12 is pivotally connected by a stud 13 with the head 14 of a bolt 15. Each bolt 15 is screwed into the outer end of a curved rocking lever 16, which is pivoted at its inner end on a stud 19, supported between two arms



17, extending out from a plate 18, secured by bolts to the pulley 3. A stud 20 pivotally secures the forked end of each rocking lever 16 to one end of a sliding bar 21, which extends in the forked end of the lever 16, and has its bearings in an opening in the pulley 3. The opposite end of each sliding bar 21 has an open end slot 21′ to extend over and receive an inwardly projecting annular flange 5⁗ on the friction disk 5. The end of this sliding bar 21, by means of the slot 21′, receives the annular flange 5⁗ of the friction disk 5, so that sliding movement of the bar 21 in either direction positively moves the friction disk or pulley either into or out of engagement with each other by the walls of the slotted ends of the sliding bars engaging opposite sides of the flange, and also that the flange of the friction disk remains at all times in engagement with the slot 21′ of the sliding bar 21, thus insuring positive action of the friction disk upon any movement of the sliding bars. Within the open end slot 21′ of each sliding bar 21 is secured a piece of leather 22.

The operation of the locking mechanism for moving the pulley is as follows: The drawing forward of the shipper lever by the weaver to move the pulley 3 into contact with the friction surface 5‴, will move the collar 10 in the direction of arrow *a*, and cause the rocking levers 16, through connectors 12 and bolts 15, to be moved on their pivotal supports, and move the sliding bars 21 to cause them to engage the annular flange 5⁗ on the friction disk 5, and move the driving pulley 3 on the shaft 2 into engagement with the friction surface 5‴ on said friction disks 5. This movement of the collar 10 brings the studs 11 into alignment with the studs 13 and holds the rocking levers 16 and sliding bars 21 to lock the pulley 3 to the friction disk. When the shipper lever is moved into the opposite direction to stop the loom, the collar 10 is moved into the position shown in the illustration, and if the pulley 3 and friction surface 5‴ do not disengage readily, the lip 21″ on the sliding plate 21, coming into contact with the flange 5⁗ on the friction disk 5, will force the pulley 3 away from the friction disk 5. (Crompton & Knowles Loom Works, Worcester, Mass.)

TILTING REED MECHANISM FOR C. & K. LOOMS.

In weaving chiffon, gauze, veiling, and other extremely light fabrics, a mechanism is provided to the loom for compensating for irregular filling, as well as for a lost pick, the reed being so constructed that it will always spring back a short distance in beating up the filling, except when the filling breaks or runs out, in which case it does not spring back as far, so as to make up for the lost pick.

The object of the new device is to improve upon the mechanism thus explained, by providing means so the filling is beaten up by the reed when it is in a sloping position, the warp threads having a tension sufficient to cause the fabric to slide up the incline made by the reed at each pick.

In case the filling then breaks or runs out, the fabric then does not slide up the reed as far, thereby making up for the lost pick and preventing thin places in the fabric, the reed at the same time taking an upright position on the lay while the shuttle is passing across.

Of the accompanying illustrations, Fig. 1 is a side view of the lay, the lay sword, reed, as well as the new mechanism, showing also a portion of one of the side frames of a loom, showing the reed in its sloping position. Fig. 2 shows the lay in its rear position with the tilting reed in its upright position.

1 indicates a portion of the loom side or frame, 2 the lay sword, mounted at its lower end on the shaft 3, supported in bearings 4′ on the stand 4, bolted to the frame 1. On the upper end of the lay sword 2 is secured the lay 5 and the hand rail 6. Rocking motion is communicated to the lay in the ordinary way.

A stand 7, having an elongated slot 8 therein, is secured to the lower part of the frame 1. A stud extends through the slot 8 and is adjustably held therein by means of a collar or washer and a nut. Pivoted on the stud, thus referred to, is an arm, having a boss 9 on its outer end to receive the lower end of a rod or connector 10. On the lower end of the connector 10, below the boss 9, is adjustably secured by a set screw 11′ a collar 11. A spiral compression spring 12 encircles the connector 10 between the boss 9 and a collar 13, adjustably secured on the connector 10 by a set screw 13′. The upper end of the connector 10 is pivotally attached to a stud 14 on a rearwardly extending arm 15 on the tilting frame carrying the reed 16. The tilting reed frame, only one end of which is shown in the

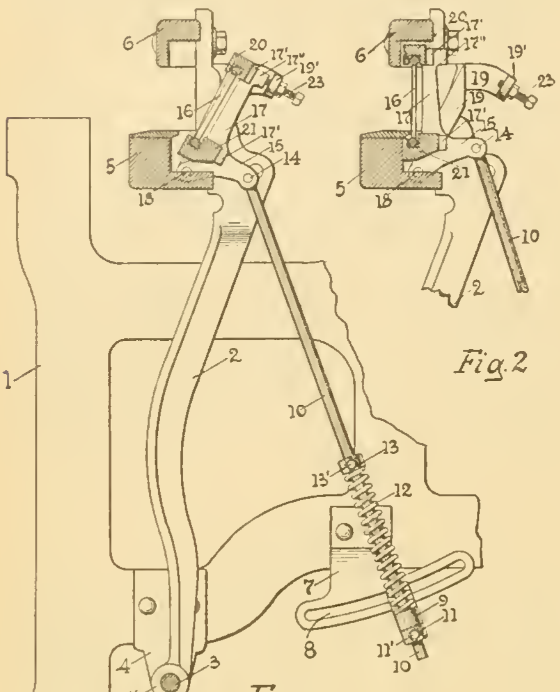


Fig. 1   Fig. 2

drawings, has in this instance an end bar 17, which is pivotally mounted at its lower end in this instance on a stud 18 in the lower end of a bracket 19, secured by a bolt to the rear of the lay horn. The top bar 20 and the lower bar 21 of the tilting reed frame are grooved longitudinally to receive the upper and lower edge of the reed 16 and hold the same in the tilting frame. The ends of the bars 20 and 21 are secured by screws to inwardly extending lugs 17' on the end bar 17. The end bar 17 has an outwardly extending projection 17", which in the backward tilting of the reed is adapted to engage an adjustable screw 23 to limit the tilting movement of the reed. The screw 23 is in this instance adjustable in and out in an extension 19' on the bracket 19.

The operation of the mechanism is thus: On the rearward motion of the lay, the spring 12 on the lower end of the rod 10 holds this rod and prevents its lower end from being moved through the boss 9, and consequently the tilting reed will be moved from its inclined position (shown in Fig. 1) into its upright position (shown in Fig. 2) preparatory to the throwing of the shuttle. As the lay beats forward, the tilting reed moves with it, and the rod 10 moves up through the boss 9, until the collar 11 engages said boss 9 and prevents any further upward movement of the rod 10, so that the rod holds the tilting reed and its supporting frame and brings it into an inclined position, as shown in Fig. 1, as the lay continues to move forward to its extreme forward position. The inclined position of the reed causes the fabric to slide up the incline made by the reed, however, if the filling breaks or runs out, the fabric does not slide up the reed as far, thereby making up for the lost pick and preventing thin places in the structure. (Crompton & Knowles Loom Works, Worcester, Mass.)

NEEDLE OPERATING MECHANISM FOR C. & K. LAPPET LOOMS.

This mechanism provides means whereby the range as well as variety of movement of the needle bars in a lappet loom are greatly increased, with the result that a larger range of patterns can be woven than heretofore possible. Two pattern surfaces are provided, each having varying heights and a separate lever, which, through a joint connection, operates the needle bar, having thereon the needles which carry the lappet threads longitudinally in the loom.

The movement of either lever or both levers, by the action of their respective pattern surfaces, communicates a longitudinal movement to the needle bar, thus placing the needles carrying the lappet warp threads in varying positions over the sheds of the regular weaving warp threads, and thus interweave said lappet warp threads on the surface of the fabric so as to produce the desired design. Different elevations of the two pattern surfaces are generally used to produce any desired figure by the resultant movement of the needle bar.

One of the pattern surfaces for operating its respective lever may be provided for several successive picks or movements of the pattern surface with elevations of the same height, so that the lever will remain at rest, while the other pattern surface, which operates the other lever, may have elevations of varying heights, so that the movement of the needle bar will be governed only by the lever of the latter pattern surface.

Again, the two pattern surfaces may be provided with elevations of varying heights, and when in turn the two levers of said pattern surfaces will act, through the connection to the needle bar, to communicate to said needle bar a

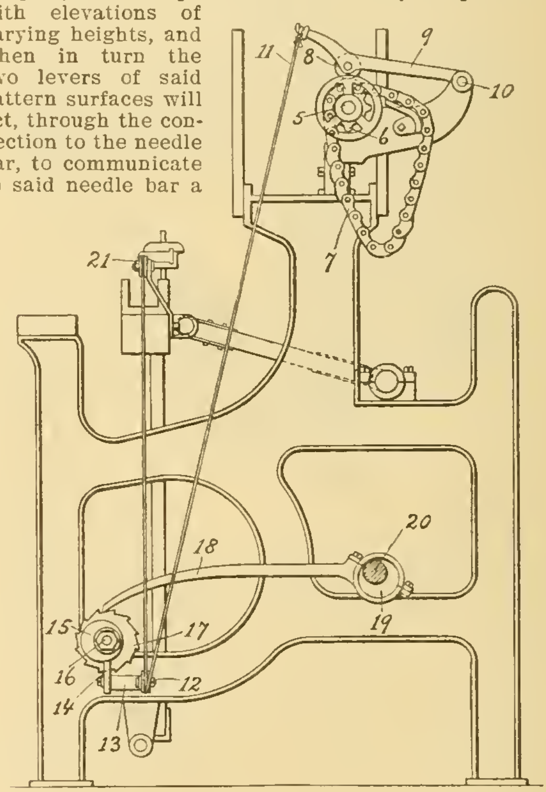


Fig. 1.

movement equal to the combination of movements produced by each of said levers.

In order to give this increased movement to the needle bar over that produced by the movement of one lever only, the needle bar is flexibly connected to both levers by having the connection, which is fastened to the top lever, extend down and around a pulley secured on the bottom lever, then up again, over a pulley situated on the lay, and connected to the needle bar. The movement of the pulley on the lower lever in the loop of the connection, by means of combined action of both levers in this instance, produces the increased movement of the needle bar over that produced when only using one lever.

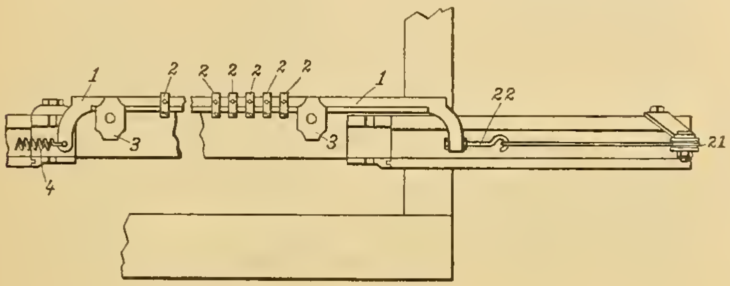


Fig. 2.

Of the accompanying illustrations, Fig. 1 is an end elevation of a loom frame and lay showing the improvements applied. Fig. 2 is a plan view of a portion of the loom frame and lay, the needle bar and connections, detached from the loom.

1 indicates the needle bar, which carries the clamps 2, holding the lappet thread needles, said needle bar 1 sliding longitudinally in the slides 3. To one end of the needle bar 1 is attached a spring 4, also fastened to the loom, which acts to pull the needle bar back toward its original position after having been pulled in the opposite direction by the connection at the other end. The mechanism by which the needle bar is raised and lowered in order to weave the lappet threads into the cloth, is not shown in the illustrations, as the connection is the same as for ordinary lappet looms.

The connections of the pattern surfaces to produce the desired pattern on the cloth are given as follows: On the shaft 5, which is driven by means of suitable connections with gearing on the loom, is fixed the pattern chain cylinder 6, and carrying the pattern chain 7, which is composed of links of varying heights. Resting on the pattern chain directly over the chain cylinder is a bowl 8, carried by the lever 9, which has one end pivoted on the pin 10, the other end being connected to a flexible connection 11. This connection 11 extends downward to a pulley 12, situated on one end of the angle lever 13, said angle lever being pivoted at its other end to a projection on the loom frame, and carries a plate 14, near the central angle in its length. Directly over this plate 14 is a cam 15, fixed on the shaft 16, said shaft being properly set in bearings and also carrying the ratchet wheel 17. This ratchet wheel is rotated by means of the pawl 18, which receives its reciprocating motion from the eccentric 19, fast on the bottom shaft 20, to which it is connected. Through the rotation of the ratchet wheel 17, the cam 15 is also revolved, and being in contact with the plate 14, on the lever 17, presses the lever down according to the outline of the cam, and hence the pulley 12 is also moved downward.

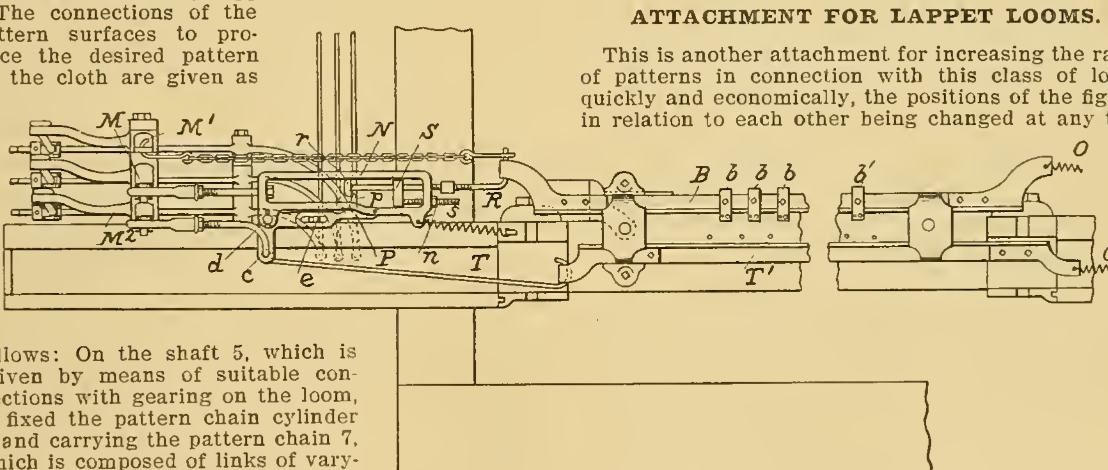
As stated before, the connection from the top lever is passed under this pulley and up to the pulley 21 on the lay of the loom, in turn passing over the pulley and being connected to the needle bar 1, through the link 22, so that any movement of the connection 11 will be transmitted to the needle bar 1.

Hence we have two pattern surfaces, viz., the pattern chain, and the cam, the levers which are operated by them being connected to the needle bar by the flexible connection 11. A movement of either lever or both will cause the needle bar 1 to be pulled outward, after which the spring 4, on the other end of said needle bar, will bring it back into position and also hold the levers 9 and 13 in contact with their pattern surfaces. To illustrate the variation which may be obtained by the use of two pattern surfaces, let us take a concrete example. Suppose the bottom lever is pressed down half an inch by the cam, and the position of the top lever is not disturbed, then through the connection 11, previously described, the needle bar will be moved outward half an inch. Now suppose that at the same time the lower lever is moved down, the top lever is raised by the chain, then the combined movement of the levers will be transmitted through the flexible connection to the needle bar. (Crompton & Knowles Loom Works, Worcester, Mass.)

ATTACHMENT FOR LAPPET LOOMS.

This is another attachment for increasing the range of patterns in connection with this class of looms quickly and economically, the positions of the figures in relation to each other being changed at any time by stopping the loom for a brief period and simply adjusting a special device supplied to the loom, without in any way manipulating or changing the pattern card or chain.

The accompanying illustration is a top plan view of the needle bar, showing the locking, adjusting and releasing devices and their connection with their operating mechanism.



Examining the illustration, we find that the lappet thread needles are attached to clamps *b*, and by them are secured to the bar B. By the action of a spring O, this bar always has the tendency to assume its extreme right hand or normal position, which it will do when not acted upon by the operating parts at its opposite end. The new device itself comprises a rod R, held in, and arranged to slide through, a hole in the end of the frame N and also through a hole in the stop block S, which is capable of adjustment longitudinally of this frame between its two sides. The rod R is provided with a projection or head *r* upon its left hand end, and its opposite end is attached to the bar B. When the bar B is in its normal position, and the pattern chain operates the bell crank M, the frame N is reciprocated and with it the bar B, to which the frame is connected by the rod R. During this time a series of figures are woven into the fabric, and when completed, the bar B, with its attached needles, is raised, and the pattern chain operates the bell crank M′, whereby the bar B is pulled to the left, and through its attachment to the bar B, the rod R will also slide to the left through the hole in the frame N and block S until the head *r* strikes and passes over the projecting lip *p* of a latch P, which will yield by reason of its connection with a spring O′ through the rod T and sliding bar T′. The lip *p* will then engage the back side of the head *r* and hold the bar B in that position in relation to the frame N.

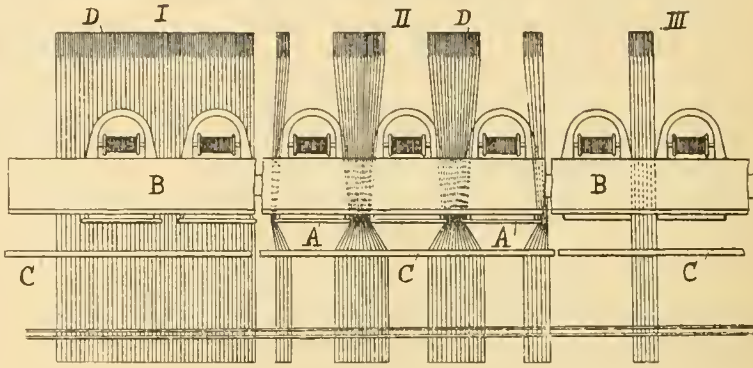
While in this position the pattern chain again operates the bell crank M, causing the bar B to reciprocate and weave another series of lappet figures. As soon as that series of figures is completed, the bar B is again raised and held in this position until the portion of plain fabric is woven. Then the lip *p* of the latch P is withdrawn from the head *r* by the action of the bell crank M^2, which is connected with one arm of a bell crank lever *c*, pivoted in the frame N at *d*, while the other arm of the lever *c* is provided with a stud which engages a slot *e* in the latch P. The bar B thus released is pulled back again to its normal position by the spring O, which position is determined by the stop block S, against which the head *r* of the rod R is brought to bear and when operation is repeated.

If it is desired to weave a piece of fabric with each adjacent pair of longitudinal lines of figures nearer together or farther apart, all that is necessary to do is to change the position of the stop block S in the frame N by turning the adjusting screw *s* in or out in a threaded hole in the end of the frame N, and when the block S is in the desired position, turn up the check nut *n* to prevent any accidental movement of that screw, thus doing away with the necessity of changing the pattern chain so as to vary the amount which it will pull the bar B when it is shifted from one position to another. (Pierce Mfg. Corp., New Bedford, Mass.)

CLOSE SETTING OF FIGURES IN SWIVEL LOOMS.

The object is to provide means whereby the figures produced in the fabric are closer set than is possible in common swivel looms.

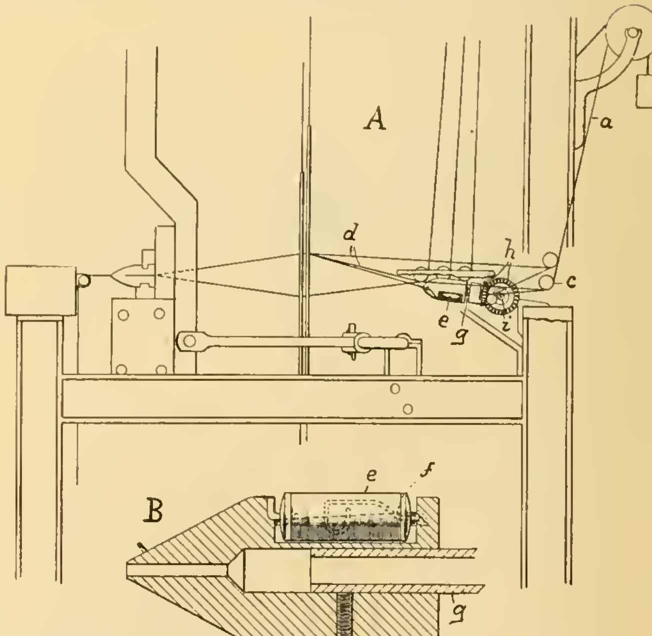
The accompanying illustration is a three-part plan view of the swivel rack with the improvement applied; Part I showing the swivel rack in its normal position; Part II showing the rack lowered ready for the swivel shuttle to operate; and Part III showing the swivel rack lowered but not provided with the improvement.



The improvement consists of a series of tapered plates A, secured to the back of the swivel rack B, one of said plates being so placed between such warp threads as to produce one set of figures in the cloth, said plates being adapted to pass between these warp threads when the swivel rack is lowered. When the respective threads for forming the shed for the passage of the swivel shuttles are raised and the rack is lowered, as shown in section II, it will be seen that the tapered plates A confine a large number of the warp threads into the proper space between the shuttles, which threads, after the shed is closed, spread out again into their proper position before the reed C, as the latter beats up the filling to the fell D of the cloth. (Joseph Wadsworth, Paterson, N. J.)

ATTACHMENT TO SUSPENDER LOOMS.

The attachment has for its object to wind (and thus cover and in turn strengthen) each of the two



outer rubber strands as situated at either edge of the web, with a cotton or linen thread, in order to protect said rubber strands from the abraiding action of the reed during weaving.

Diagram A is a side elevation of portion of a loom, showing the new attachment applied thereto, and Diagram B is a central longitudinal section (more in detail) of the new attachment as it is situated in the loom in rear of the harnesses, and of which there is one required for covering each rubber strand.

The rubber strands *a*, as coming from their beam spool *b*, in their travel to the harnesses for weaving, pass under the guide roll *c*, and then along with the regular warp threads *d*, to the harnesses, for weaving into the fabric. Previous to reaching the harnesses, the two outside ends on either side edge of the fabric, each passes through the core of one of the new attachments (see Fig. B), of which thus four are required for each web. These attachments correspond in their construction and operation, and carry mounted in them a spool of cotton or linen thread *e*, to which tension is applied by spring *f*. A hollow shaft *g* (through which the respective rubber strand passes) gives this spool carrier a rotary motion through the rotation of pinions *h* by means of shaft *i*, and thus winds or coats the rubber strand with the cotton or linen thread as coming from spool *e*. (Russell Manufacturing Co., Middletown, Conn.)

SIZING OF COTTON YARNS.

Sizing is one if not the most important department in a cotton weaving mill, since upon it depends quantity as well as quality of work turned out, requiring for this reason: (1) the proper ingredients to be used, (2) the greatest care and attention on the part of the operator, (3) the most approved machinery; for unless warp yarn is properly sized and handled, it will not weave well.

The object of sizing is to form a film on the surface of the yarn prior to weaving, which besides giving additional strength to the thread, in order to withstand the tension necessary for weaving, at the same time prevents the loosely adhering fibres from rubbing up, and thus causing what is generally known among weavers as "buttoning," which is produced by rubbing action of the heddles and the reed during weaving, especially when dealing with single yarn and more so in connection with high textures.

Another important reason for sizing, in connection with a great many fabrics, is to give additional weight to the goods, produced by the addition of some percentage of foreign matter to the yarn, and what is done by saturating the yarn with some suitable adhesive material of considerable specific gravity, the constituents of the composition depending, amongst other things, on the use which is to be made of the yarn and the class of fabric which has to be produced from it.

Yarns for bleaching or dyeing should be only very lightly sized, and besides only the best quality of size used, since otherwise the goods, when finished, will be faulty in appearance, for the reason that the fibres and the size will be differently affected in these processes.

The less twist in the yarns the more readily the latter will absorb size, for which reason a soft twisted thread, produced from a strong and coarse fibred cotton, should be used when heavy sizing is required.

The size must be of such a character that it will adhere firmly to the yarn, both while wet or dry and retain this attachment to the yarn during weaving. For this reason, the size, whether for light, medium or heavy sizing, must therefore be of uniform thickness and consistency throughout, in order to saturate the yarn thoroughly.

The quantity and strength of the size to be put on to yarn depends upon circumstances, and can only be regulated by experience; but when this is once determined upon, the operator of the slasher must look after and keep the temper of the size regular and at one thing. The yarn after being sized must not be allowed to go on to the loom beam until perfectly dry. When the slasher is standing, the yarn should be taken out of the boiliug size, by winding the roller that keeps the yarn submerged out of the size box, since otherwise the ends of that portion of the warp thus remaining in the size box will all get glued together.

The weight of size which can be added to a yarn depends upon the class of yarn, the class of cloth into which it has to be woven, the amount of twist in the yarn, the kind of size used and the manner in which the same is applied.

The materials used in sizing may be classed under different headings, according to their respective properties; but this classification cannot be strictly adhered to, as some bodies come under two or more of the following headings:

1st. Adhesive bodies.
2nd. Softeners.
3rd. Weighting bodies.
4th. Antiseptics.

(*1*) *Adhesive bodies:* These are flours of some sort, such as corn, farina, wheat, rice, etc., the first two, corn starch and potato starch (farina) being the ones most frequently used, some mills preferring one kind, some the other. Both flours refer to "light sizing" and require the addition of a softener, to counteract the harshness they give to the yarn if used alone. Wheat flour is extensively used for "heavy sizing," since it fixes weighting substances well and at the same time leaves the warps less harsh than other starches. Rice starch is much crisper than wheaten flour; it produces a thicker paste, but is less adhesive than the latter, and for heavy sizing the wheat flour is often adulterated with it. For light sizing it can be used alone, as a much smaller quantity will produce a thicker paste than that of wheat flour.

(2) *Softening bodies:* The adhesive bodies previously mentioned, if used alone, and more so if combined with weighting bodies, will make the yarn hard and harsh, besides when dry brush or crumble more or less off the yarn. If yarn is made harsh by the size, this feature enters into the cloth, and if the size brushes off by friction on the threads, it will be readily seen that the advantages aimed at in sizing have become lost. To avoid such results, substances technically termed softeners are added into the mixing, these softeners being of an oleaginous character.

Tallow is the most common softener used, there being mutton and beef tallow, and of which beef tallow is the better of the two, as it is not so liable to become rancid as mutton tallow. Tallow varies considerably in color, freedom from gritty matters, melting point, smelling, etc., however it is easy to distinguish good from bad. Tallow, exposed to the atmosphere, should not darken in color, for if it does, it is a sign of inferior quality and should be promptly rejected. The same with rancid tallow, which on account of its odor will be readily detected. A good valuable tallow should not contain water to any perceptible degree, since this will reduce its softening properties. This adulterant, as a rule, can be detected by the feel, but if in doubt liquefy a sample of it and when the water and oil will show itself distinctly. A high melting point, about 110° F., is also a necessary feature for a good tallow.

Other softening agents sometimes used are: Japan wax, which gives most excellent results, but is rather expensive; Paraffin wax, which is cheaper than the former, but cannot be used when cloth later on has to be dyed, bleached or printed, owing to its color and chemical action; Castor oil, is a good softener; Soap is also very frequently used as a softener, although its true action when used for this purpose is not generally known. Soap besides being a softener also has the power of making China clay boil thinner. However there are also objections to the use of soap in size mixings, viz.: the same cannot be used to any extent in mixings which contain antiseptics without making the size lumpy; and, soap being of a frothy nature, it will rise in a scum or froth in the boiling vat. Soft or hard soaps, if used, must be of good quality and not dark in color. If soap is to be used, add only a small amount, and that to the China clay when the latter is being boiled separately from the other ingredients.

There is also a class of patent softeners in the market trading in many instances under high sounding names. In most cases the name being the greatest thing about it, some of them being composed of the most veritable rubbish, and in instances loaded excessively with water. Never use any of these preparations without first consulting a competent chemist, in order to ascertain whether its use will be economical or not.

(3) *Weighting bodies:* Amongst these we find—China clay, or Kaolin; Baryta, or heavy spar; French chalk, or talc; Plaster of paris, or gypsum; Steatite, or soapstone; Sulphate of soda, or Glauber's salt; Magnesium sulphate, or Epsom salts; Barium chloride.

The principal ingredient in use is China clay or Kaolin, which is a white or greyish-white body, having a soft, smooth feel to the fingers when rubbed. It is found only in few countries, and is the result of decomposition of felspathic rocks. It is an aluminium potassium silicate, and contains naturally 12 to 13 per cent. moisture on the air-dried sample. The qualities of this body upon the market are very varied, and it is not always the whitest and the best looking variety that is the purest.

(4) *Antiseptics:* These are a class of bodies which are introduced into the size in order that the growth of mildew may be prevented. Their function is a destructive one, and wherever the spores are allowed to germinate, a tender yarn is the result.

The article most frequently used is Chloride of Zinc, or Muriate of Zinc, which fulfills two purposes, viz.: as an antiseptic for the prevention of mildew, and as a weighting body, hence its superiority over other substances used as antiseptics only. It is placed on the market in two forms, liquid and solid, and is prepared by dissolving zinc in muriatic acid, and as there is always some little free acid present this is neutralized by means of soda ash; the slight trace of iron that may be present is precipitated out, the liquor allowed to settle, then run off into vats to age. It is a pale yellow liquid, and the color should only show slightly by transmitted light. It should be perfectly free from iron and free acid. It is precipitated in the form of an oxychloride when water is added to it, and the white turbidity or milkiness is re-dissolved in excess of the chloride of zinc. It attacks iron with great rapidity, and should never be allowed to come in contact with that metal, as it at once begins to take it in solution. The liquid is often of 49° B., or a specific gravity 1.51, or a gallon weighs $15\frac{1}{10}$ lb. At this strength it should contain from 44 to 45% of pure zinc chloride. It is liable to adulteration, the chief adulterant being common salt. The solid form is simply the liquid form evaporated down until the solution attains a temperature at which the percentage of the zinc chloride is a constant, when it is then packed in lead-lined casks and hermetically sealed. At the destination the stuff is dissolved in water and made to a convenient strength.

Other antiseptics are carbolic acid, salicylic acid, arsenious acid, and perchloride of mercury, which however are of little, if any consequence for sizing.

A blue dye is sometimes used in very small proportions for the purpose of tinting, *i. e.* correcting a tendency to yellowness in the size mixing, and when said blue dye changes it to a bluish white.

CYLINDER SLASHING OR SIZING MACHINE,
For Sizing or Starching the Yarn Preparatory to Weaving.

The Ordinary Cylinder Slasher consists of a machine with suitable iron frame made either continuously or in sections, containing one or two copper cylinders of different sizes made from the best heavy copper; also a starch box with the necessary sizing roll and the other attachments required for carrying the yarn through the machine with as little tension or strain as possible. It must also be remarked here that it is very desirable to dry the yarn at as low a steam pressure on the cylinders as possible, to preserve its elasticity and strength.

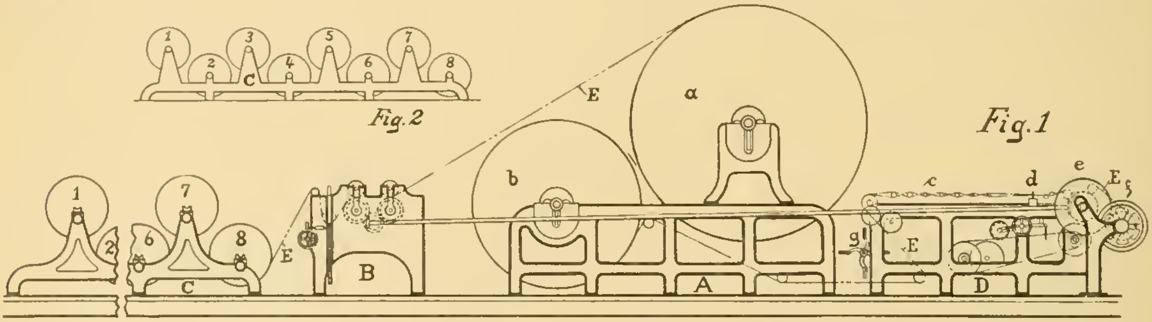


Fig. 1 shows, in its side elevation, the latest make of the Cylinder Slasher as built by The Textile-Finishing Machinery Co., Providence, R. I. Examining this illustration we notice that the side frame of the machine is made (if so desired) in sections, a feature which has the advantage over the continuous-frame machine that it makes it easier to erect and align such a machine in the mill.

Section A of the machine carries the two drying cylinders *a* and *b*, the usual standard measurement of which is 7 and 5 feet diameter respectively × about 60 inches face each. They are strongly, and at the same time lightly constructed, the heads being made of steel properly braced, while the joint between the copper shell and head are so made, that by having the edge of the copper turned and held between the head on the outside and a ring on the inside, with through bolts, that it is quite impossible to blow it out, even under excessive pressures.

These cylinders are also fitted with patent spiral scoops (see special article on these spiral scoops in the chapter "Finishing Machinery") which take out every bit of water and air so that the lowest amount of steam pressure can be used in drying the yarn, which in turn means that the yarn is dried at a very low temperature and the size not baked on.

The other sections of the machine are:

B is the section for holding the size box, which is usually a double jacketed copper box and contains seamless copper electro plated balanced rolls.

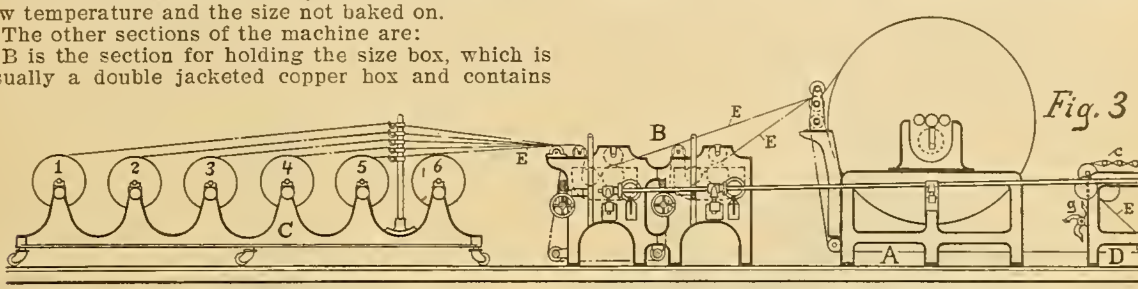


Fig. 3

C is the creel section, which in the usual construction of the machine provides bearings in its side frames for holding eight beams, arranged in 2 rows of four beams each. Only beams number 1, 7 and 8—are shown (besides portions of beams number 2 and 6) the central portion of the creel section being shown broken out, in order to bring the diagram of the complete Slasher within compass of the width of the page. In order to illustrate the complete creel section, detail illustration Fig. 2 is given (being drawn on a reduced scale to Fig. 1) and which will at once explain itself by means of numerals of reference selected tó correspond with those used in connection with Fig. 1.

D is the head stock, *i. e.* head section of the machine, the frame work of it holding the rods *c* and reed *d* (expanding comb) both being necessary for separating the sized threads, also the mechanism *e*, for winding the yarn on the loom beam *f*. Fans *g*, at the entering-end of the head stock, are placed there for cooling purposes.

The run of the yarn, as taken from the beams in the creel section C—then passing through size box B—then in turn nearly all around drying cylinders *a* and *b*—then through the head stock D—and finally on the loom beam *f*, is shown by means of broken line E.

For regulating the speed of the machine and also for removing as far as possible the tension on the yarn, special drivings and friction devices are used, known in the trade as the McCarthy Friction Drive and the Pacific Wind.

The McCarthy Friction Drive is a mechanism for driving the Slasher Cylinders direct from side shaft, thus enabling all tension required to drive cylinders to be removed from the yarn, in turn allowing very light warps to be sized and dried without breakage or excessive strain. It is provided with friction attachments to regulate perfectly the speed of the cylinder to accommodate the sets required to be dressed. In making up sets for weaving, experience has proved that the ordinary arrangement of slasher can do good work to a certain limit, but when that limit is reached, it becomes necessary to use some such arrangements as the McCarthy Drive to do satisfactory work at a certain and constant speed. This arrangement will dress yarns of any number of threads, doing its work thoroughly and perfectly. It can be readily attached to any yarn slasher and requires but little out-lay. Its importance can be readily understood by those having experience with light warps or a small number of ends.

The single cylinder slasher, frequently termed à "Tape Dresser" is shown in its end elevation in Fig. 3. While very similar to the double or two cylinder slasher, it is gotten up especially for dressing warps or yarn for ticking, ginghams and all pattern work where it is desirable to use lease reeds at the size box. The particular machine represented was designed to take the place of what has been largely known as a "Scotch Tape Dresser." In this illustration A is the drying section, with its drying cylinder; B the size box (2 compartments in this instance); C the creel frame (6 beam-feeding), and D the first portion of the head stock (this being done in order to bring illustration within compass of the page) and which is identical with the one shown in connection with Fig. 1, and consequently will explain itself. E indicates the run of the yarn through the machine.

For preparing the starch for both these machines, the Textile-Finishing Machinery Co. make a size or starch kettle herewith represented in Fig. 4 that consists of an iron kettle with cover, mechanical means for boiling and stirring the size which consists of hollow stirrers with holes for delivering the steam to the size or starch and distributing it evenly through mass. By means of this size kettle the boiling can be done in half the time and one half the expense necessary

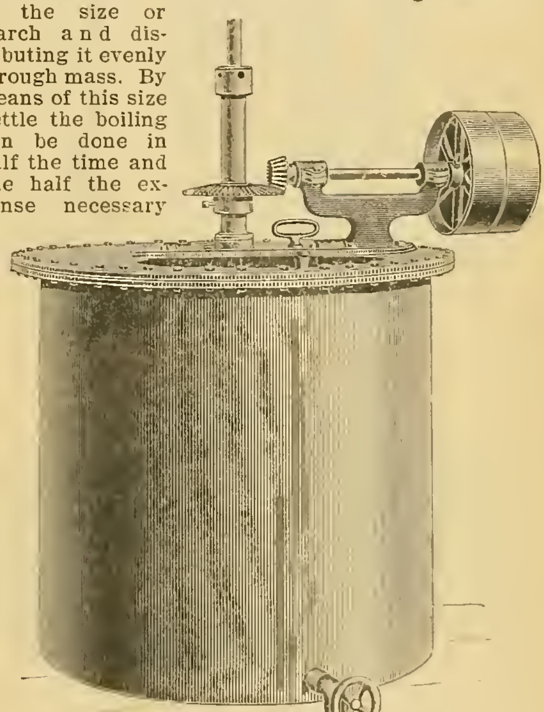
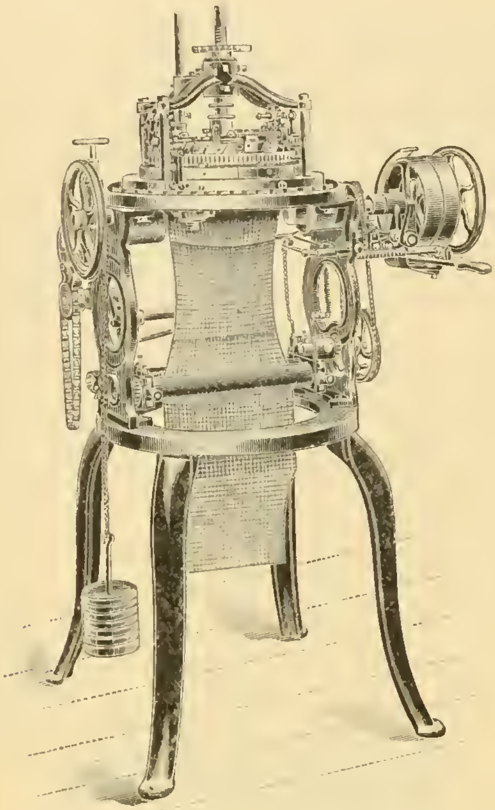


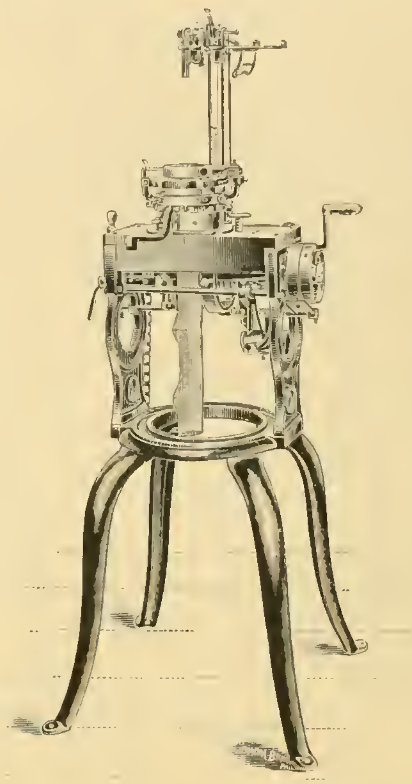
Fig. 4.

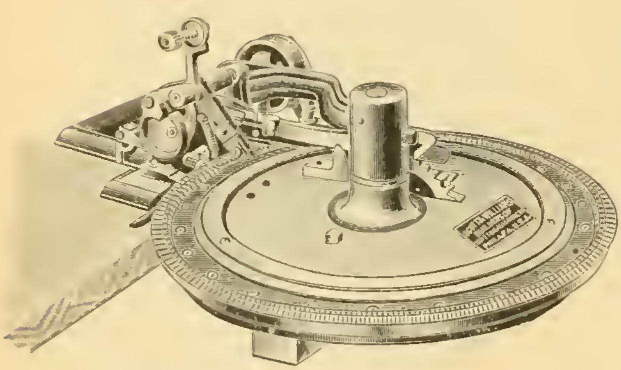
in any other arrangement now in use; again size thus prepared in one of these kettles is sure to be in proper condition for perfect sizing of the warp. Size unless well boiled retains a granular nature and in turn causes faulty cloth, a feature prevented by the use of one of these kettles. (The Textile Finishing Machinery Company, Providence, R. I.)

SCOTT & WILLIAMS

Builders of Circular Machines for Underwear and Hosiery







Improved High Speed Rib Knitting Machines for Underwear, Hosiery, etc.

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Loopers Fitted with Elastic Stitch Attachment

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KNITTING.

Knitting forms one of the great divisions of fabric structure, and differs radically in the principle of producing the fabric, from that of weaving, being based on the principle of forming a fabric or web by means of a series of interlocked loops from one or more continuous threads. Different systems of interlocking the loops produce different styles of stitches, each being best suited for certain kinds of fabrics, etc.

The operation of knitting is done by means of knitting needles, there being two general styles in use, *i. e.* the latch needle and the spring beard needle.

THE PRINCIPLE OF THE LATCH NEEDLE.

Plain Stitch: The principle of knitting or making a stitch on the latch needle can be best explained by means of the accompanying illustrations Figs. 1 to 6, which are sections taken from the machine, showing the successive positions of the yarn and needles during the operation of making a stitch, also the general construction of a specimen of a latch needle. With reference to Figs. 1 to 4, only one needle has been used and the stitches shown as made by that needle, although it must be understood that each needle on the machine makes in turn a similar stitch from the same thread, and that the different loops or stitches, shown in these illustrations as different threads, are really only different portions of the same continuous thread, the stitches shown being made, one at a time, for every course, considering the yarn carrier as feeding one thread. In the illustration, 1 indicates the body of a latch needle, having a hook 2 formed at its upper end, the needles being only placed horizontally in the illustrations for clearness, as they work vertically in the circular knitting machine and at an angle in the flat knitting machine. Near the upper end of the needle is a pivoted latch 3, which is made so as to either rest over the end of the hook 2 and thus close the latter, or is turned backward to leave said hook open.

Fig. 1 is a diagram, showing the position of the needle and a loop *b* resting on it, when said needle is in its normal or resting position, the stitch *a* having been made previously by this needle. It will be noticed that the loop *b* is resting on the back turned latch 3, thus leaving the hook open. Fig. 2 shows the needle as it would be when raised to its highest position, in which it is seen that the loop *b* is resting on the needle behind the latch and the yarn *c* has been deposited in the hook of the needle. The needle is now given a downward movement and the latch and loop take the position shown in Fig. 3, said loop practically remaining stationary while the needle moves, thus causing said loop to close the latch as the needle slides in the loop. The loop *b* is now free to slide over the end of the closed hook, with the newly deposited yarn *c*, which also forms a loop, resting in the closed hook. The needle descends further until the loop *b* finally slides over the end of the hook, or is, what is technically termed, "cast off," as shown in Fig. 4. After casting off the loop, which we now call a stitch, the needle returns to the resting position, shown in Fig. 1 and the loop *c* takes a similar position of the loop *b* in that diagram.

Figs. 5 and 6 are given to show more in detail the construction of the latch needle, Fig. 5 showing the needle with the latch closed, and Fig. 6 showing the latch open.

By using a set of needles, as is done in a knitting machine, a series of loops are formed at every course, and on the next course new loops are drawn through these, thus interlocking them and making a uniform web.

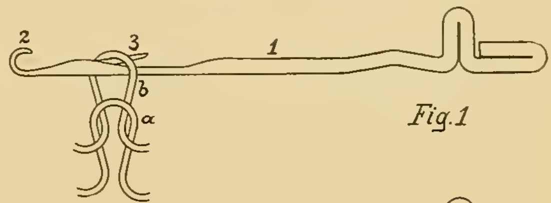


Fig. 1

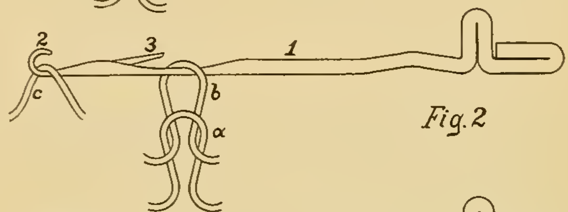


Fig. 2

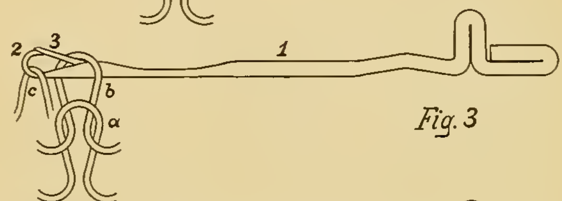


Fig. 3

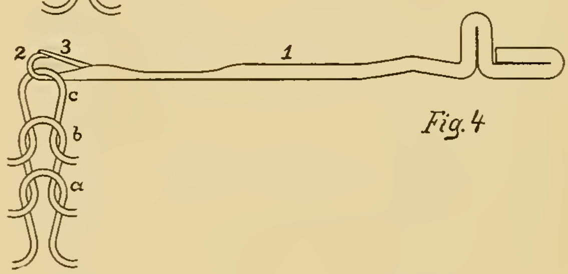


Fig. 4

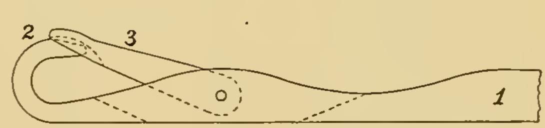


Fig. 5

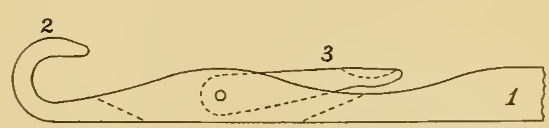


Fig. 6

This system of knitting with one set of needles will produce a "plain" stitch web, a diagram of a portion of which is shown in Fig. 7. It will be noticed that all of the loops *a* of the stitches are on the back of the web. In a knitted fabric however the loops are straighter than they are round, as shown in the diagram, hence they produce a smooth and even surface. The sides or converging portions *b* of the stitches are

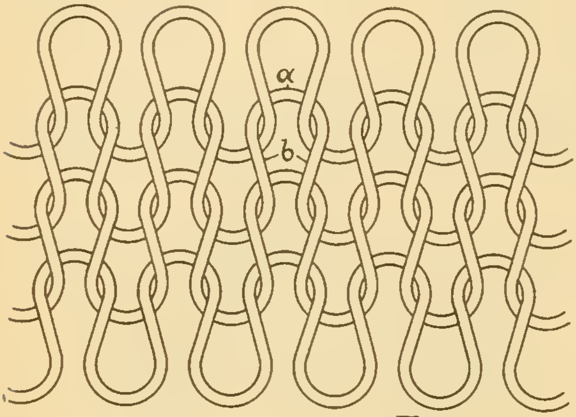


Fig.7

all on the face of the web, and being close together in the fabric, will form a rib or raised line for every vertical row of stitches, said raised lines being close to each other.

Owing to the smooth inside surface of the web produced, this style of stitch is used almost exclusively on fabrics worn next to the body, such as underwear, stockings, etc.

The Rib Stitch: The operation of knitting by means of two separate sets of needles is best shown in connection with Figs. 8, 9, 10 and 11, which are diagrams representing the four principal positions which the needles occupy during the making of the stitch. The action of the needles is similar to the one already explained, and the two sets work in conjunction with each other. Only one needle from each set is shown, and the web produced is shown twisted out of line, in order to see the stitches to better advantage. In the illustrations, 1 and 2 indicate the body of the vertical and horizontal needles, respectively. 3 and 4 are their respective hooks, and 5 and 6, their latches. Each needle makes a stitch from the same yarn, as shown by the loops made from the yarn *b*, yarn *a* having been previously deposited and stitches formed. Fig. 8 is the normal position of the needles and loops, in which it is seen that the loops of the yarn rest on the back turned latches of the respective needles. These needles are, at the proper time, moved upwardly and outwardly and the loops rest behind the needles, as shown in Fig. 9. At this time, the yarn carrier deposits the course of yarn *c*, which rests on the projecting ends of the horizontal needles. Then the vertical needle 1 starts downwardly, as shown in Fig. 10, and has its hook 3 catch the yarn *c*, as deposited on the horizontal needles, and draw a loop. Just after this, the horizontal needle 2 draws inwardly and catches the same yarn in its hook, and as the two needles continue to move away from each other, the respective loops, resting behind the latches, close said latches by coming under their back turned ends, thus enclosing the new loops of yarn *c* in their hooks, and having the loops which are resting on the needles free to be cast over their hooks when said needles have moved sufficiently far. This position is shown in Fig. 11, where the needles have moved downwardly and inwardly, respectively, as far as possible, thus casting off the loops of the yarn *b* and making stitches. The needles then assume again the positions shown in Fig. 8, the loops of the yarn *c*, of course, taking the place of the loops of yarn *b*, and the procedure is repeated.

The appearance of the web made with two sets of needles is different from that made with one set and is known as the "rib" stitch. A rib fabric is characterized by the fact that each side presents a similar appearance, that is, each side contains rib lines with a small space between each rib line. The rib lines on one side of the fabric come opposite to the spaces on the other side, which can be readily understood by referring to diagram Fig. 12, which represents a portion of the web. It will be noticed that every alternate loop *a* horizontally, is on the back of the web and therefore the converging parts *b* of the stitch will be on the face and make vertical rib lines with the successive stitches drawn through them. The loops *c* of the stitches, between those just referred to, are on the face of the web and consequently the converging parts *d* of the stitches will be on the back and form rib lines there. As the loops on both sides of the web form smooth places, it will readily be seen that by the stitch thus explained, these smooth places occur just opposite to the rib lines on the other side of the web, and also come between the rib lines on the same side of the fabric. Owing to the elasticity of this style of web, it is used for making tops for half hose, wrists of undershirts, etc. The stitch thus explained is known as the 1:1 rib stitch. Other varieties of this stitch are derived by combin-

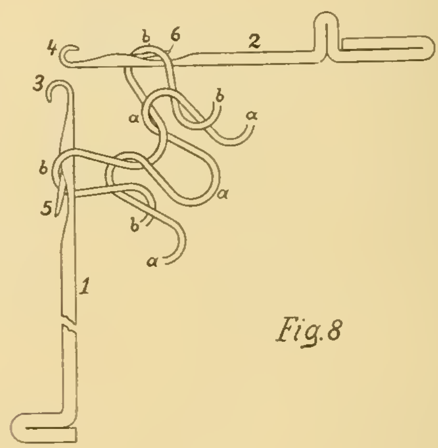


Fig.8

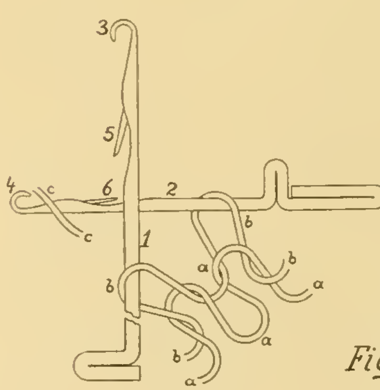


Fig.9

ing the action of the two sets of needles either 2:2, 3:1, 4:1, etc., etc., by what we mean that for instance with the 2:2 rib stitch, 2 rib lines alternate with 2 smooth spaces on either side of the fabric, the rib lines on one side of the fabric being directly opposite the smooth spaces on the other side of the fabric. It will be readily understood that in order to produce this stitch, two needles from one set must be placed side by side to alternate with two needles of the other set.

In order to produce a 3:1 stitch, three needles of one set must be placed side by side to alternate with one needle of the other set. The fabric produced will, of course, show a predominance of rib on one side and smooth portion on the other. It thus will be seen that the varieties in rib stitches may be obtained by simply arranging the two sets of needles according to the stitch desired.

The Tuck Stitch: This stitch is derived from the rib stitch, and forms the third foundation stitch, the plain and rib, as previously explained, being the other two. The tuck stitch is made from two sets of needles, and on the same machine as used for the rib stitch, by actuating certain cams. With the rib stitch, each loop on each needle is cast off after every course of yarn has been deposited in the hooks, as was explained, while with the tuck stitch, the loops on the vertical needles are cast off after every course of yarn has been deposited, but the loops on the horizontal needles are only cast off after every other course, thus making two loops to be cast off at the same time, instead of separately, in turn resulting in half the number of stitches being made by the horizontal needles, as are made by the vertical needles.

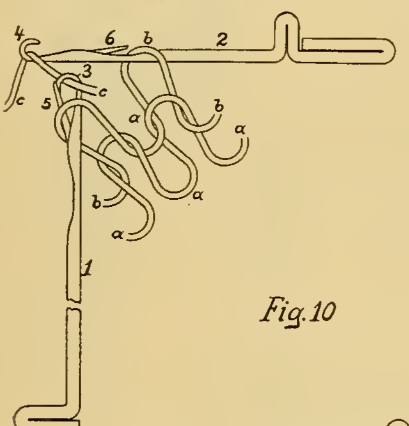


Fig. 10

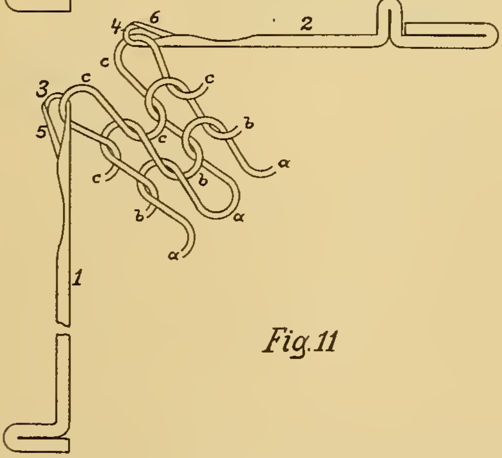


Fig. 11

Since both loops are always cast off of the needle with only one loop remaining in the hook of the needle, only one loop forms a stitch, the other simply being bound in with the stitch.

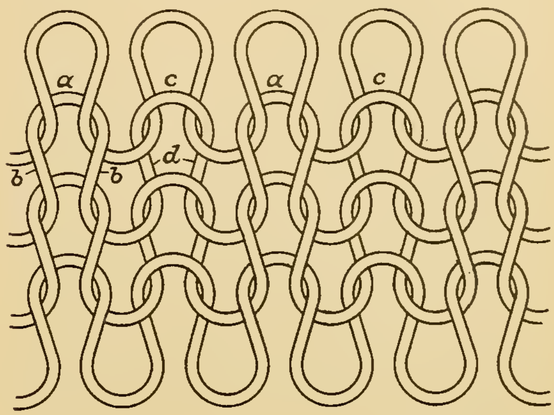


Fig. 12

A diagram of a portion of a web made with the tuck stitch is shown in Fig. 13, from which the method of interlocking the loops is easily seen.

In the diagram, the stitches *a* are made by the vertical needles, therefore the loops are on the back of the web as in the rib stitch. The stitches *b* are the tuck portion and contain two loops cast over one stitch, said loops being on the front side of the web, indicating that the stitches were made by the horizontal needles. This style of stitch gives wider fabric than the rib stitch, and is used a great deal for making ladies' underwear in connection with the rib stitch, the latter being used when knitting the waist portion of a fabric, and also for the wrists or ankles of fabrics.

As previously mentioned, the stitches explained comprise what is termed the three foundation stitches and are found separately or combined in all knitted fabrics, either in the original form or a modification of them. Different combinations of stitches produce varied effects in the fabric, and variations of the stitches can be made which produce more or less fancy effects. On special machines, made for the purpose of producing fancy effects only, an almost unlimited variety of fabrics can be knitted, and it might be said that the range in knitting is practically endless.

Mock Rib Stitch: Again, derivations of a foundation stitch may be used for regular work, as, for example, the mock rib stitch. As its name indicates, it is used in place of a rib stitch, because it can be knitted on the same machine as the plain knit stitch, whereas the rib stitch requires a rib machine. This, of course, saves an outlay of rib machines and is done more in machines using spring beard needles than those using latch needles.

SPRING BEARD NEEDLES.

These needles differ materially from the latch needles in their method of operation, although the same styles of stitches are produced on them. The chief difference between the two styles of needles is in their hooks, which necessitates entirely different operations in order to produce a stitch, which in turn must be obtained by differently constructed machines. In making stitches on the latch needles, it is the separate movement of each needle which performs the operation of knitting, said needles working in a limited space, while with spring beard needles, said needles do not move separately, but revolve bodily with the cylinder on which they are fastened. Their spring beards have to be actuated and the loops of yarn have to be moved on the needles by means of special wheels, suitably placed on the machine.

The method of making a stitch with spring beard needles is shown in the illustrations, Figs. 14, 15 and 16. In the same, 1 indicates the body portion of the needles, having spring beards 2, made at the top ends to form hooks. The portion of the body of the needle just under the end of the spring beard is slotted out, so that the end of said spring beard may enter it when pressed against the body of the needle. This makes a smooth surface from the body of the needle to the spring beard and allows a loop to pass more freely when the same is to be cast off. Fig. 14 shows the needles with work on them and in condition to receive more yarn, the course *a* having been completed, while the course *b* is resting in the hooks of the needles. Yarn *c* is shown deposited on the outside of the hooks, but the former only remains in that position for a moment, since it and also the loops of the yarn *b* are moved down on the needles, the loops *b*

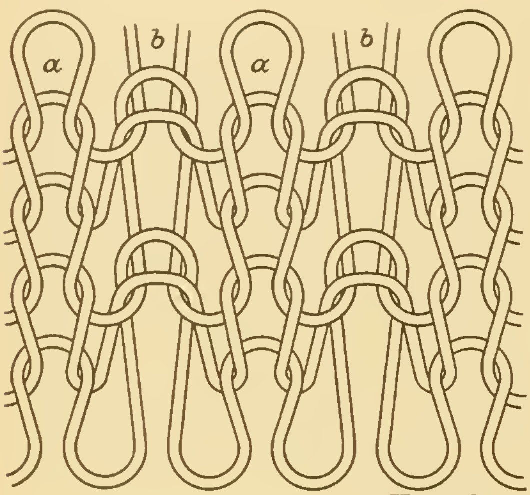


Fig.13

resting on the needles as shown in Fig. 15, while the yarn *c* goes up under the spring beards of the needles and rests in the hooks. This movement is made by means of a special wheel or burr, as will be mentioned more in detail later on, in the article on the "Spring Beard Needle Circular Knitting Machine," said burr being situated on the machine. The casting off of the loops of yarn *b* now begins, and to do this the spring beards are pressed against the body of the needles and the loops *b* moved upwardly over the ends of the depressed spring beards, as shown in the side view of a needle in Fig. 16, and are then again acted upon by a burr which casts them over the tops of the needles and over the yarn *c*, thus making it into loops. This last position is shown by means of the front view in Fig. 16, and the needles are again ready to receive yarn as soon as they come to the feeding arrangement. A continuation of these operations produces a plain knit fabric, the appearance and construction of which has been previously explained.

Having thus given a concise, but at the same time thorough, illustrated description of the principles of knitting, we next will take up the most prominent makes and varieties of knitting machinery in this country, starting with such as use the latch needle and quoting the spring beard needle knitting machine, later on, and closing the descriptive matter on the subject of knitting with the machinery and processes relating to the trimming, *i. e.* finishing of knit goods.

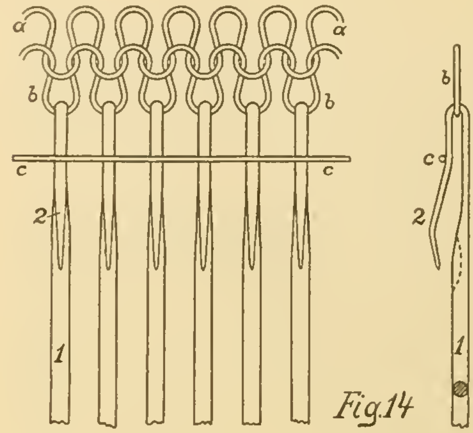


Fig.14

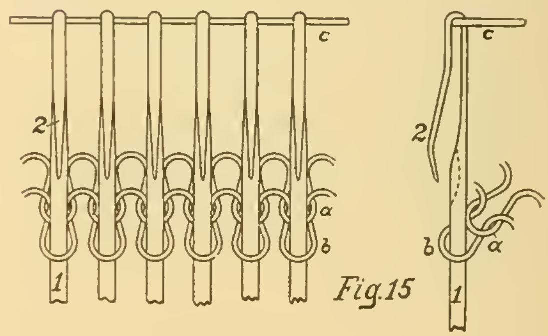


Fig.15

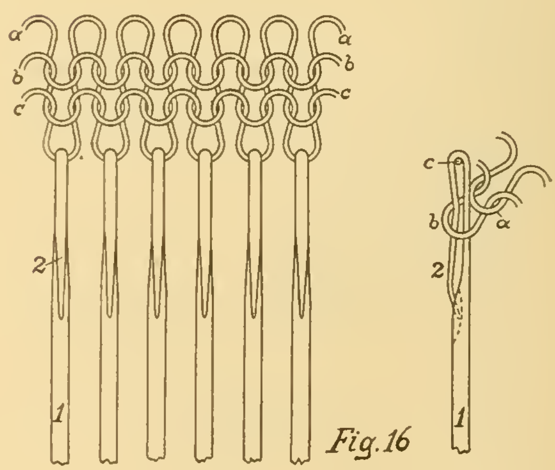


Fig.16

A most important item for knitting, with reference to quality and quantity of work produced are perfectly wound bobbins or cones, for the needles to take their supply of yarn from, and which subject has been explained in the chapter on "Winding."

BRINTON'S RIB TOP MACHINE.

This machine, as its name indicates, is used for knitting the tops for half hose and is known as a full automatic rib machine. As will be seen from its perspective view, shown in Fig. 1, a single feed is used, that is, one yarn carrier is used to feed the yarn, from one, two or more cones, as required to produce the proper weight of fabric to the needles.

The machine consists essentially of a head motion for performing the knitting operation, a pattern motion for producing the welts and slack courses in the desired positions on the plain rib tops, and a take-up motion for giving an even tension to the knitted fabric, with any length of stitch used in its production.

The Head Motion contains two separate sets of needles, but which work in conjunction with each other, the needles being placed alternately in the proper working positions in the machine. One set of needles, known as the *Dial needles*, are placed horizontally in the head and rest in grooves in the dial plate, said needles being placed radially from the centre of the dial plate. This dial plate is circular, being provided with radial grooves on its top surface for holding the dial plate needles, and is held in position in the machine by having a shaft from the yoke extending vertically through it with a collar attached to the lower end. The dial plate is prevented from turning, by means of two projections on the side of the plate, which rest in slots provided for them on the frame, and hence the dial plate needles receive no rotation.

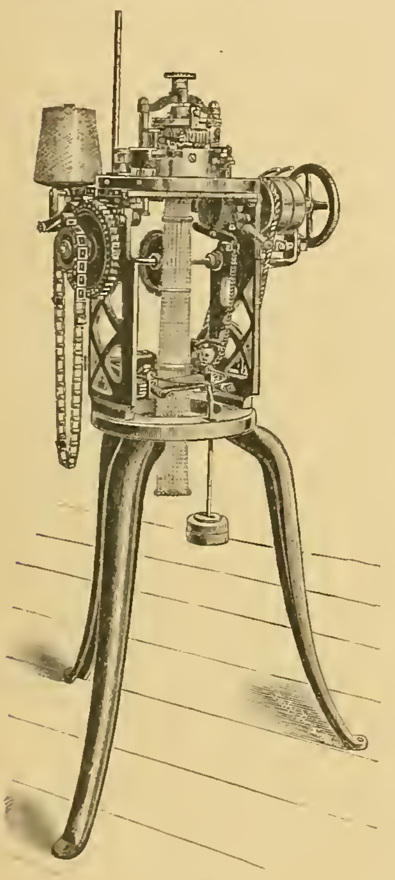


Fig. 1.

Situated directly above the dial plate is the dial cap, which is secured to the shaft extending from the yoke and thus it receives its rotation. The under side of the dial cap is made with a cam groove for receiving the upwardly projecting shanks of the dial plate needles, said cam giving the required horizontal movement to the dial plate needles for knitting.

In order to explain the operation of the dial cap cam on the dial plate needles, and also to show the proper outline of the cam groove, Fig. 2 is given, which is a view taken from the under side of the dial cap. The cam revolves in the direction of the arrow and the dial plate needles are operated by the inside surface of the groove. The cam A is made movable, being centred at B, in order to change from the plain stitch to the welt.

The method of making a stitch may be seen by examining the outline of the cam groove.

First, consider position as indicated by 1 on the cam groove. It will be noticed that at this point the groove is beginning to curve outwardly from the centre of the dial cap. As the motion of the needles is controlled by the cam groove, the needle acted upon by this point of the cam will be moved outwardly until the point 2 acts upon it. During this time the latch of the needle, which was closed by the last inward movement of the needle, is opened by being forced against the stitch in the hook of the needle, said stitch, when the point 2 acts, resting on the needle behind the open latch. When the latch was opened by the stitch, the yarn carrier, situated on the dial cap, deposited new yarn into the open hook of the needle, the yarn carrier being placed on the dial cap so as to deposit yarn at a point just in front of the point 2. From the point 2 to point 3, the needle is drawn inwardly in order to have the stitch, as resting behind the latch on the needle, slide over the hook (thus closing the latch), and be cast off, thus completing a single knitting operation by the dial needle. From the point 4 to point 1, the needle is at rest, when it again performs the same operation as described and makes another stitch. It will be noticed that only one needle has been referred to in connection with the operation, although the cam, as it revolves, acts upon each needle in succession in the same manner as described.

The movable cam A, as shown in full lines, is in the position for giving the plain stitch, while the position shown in dotted lines is for making the welt. The cam is operated from the pattern wheel through pin G (corresponding to pin G in Fig. 6). The welt is made by having the needle move outwardly only half way in order that the stitch in the hook may just open the latch without sliding behind it, so that the yarn carrier may deposit another stitch, thus having two stitches in the hook when the needle is drawn back by the cam. This half way movement of the needle is obtained by having the cam A move only half way in, which is controlled by the pattern wheel. Before the cam A comes around again to the needle, said cam, that is, the groove, has been moved entirely in, so that the needle is not moved outwardly and thus loses a stitch, this being repeated again, in order to make two lost stitches which form the welt. It will be understood that the cylinder or vertical needles, not yet referred to, are always in operation during this change of working by the dial plate needles.

The plate C is made adjustable with screws and is used to regulate the length of stitch taken by the dial needles. For a long stitch, the nose D is set farther in towards the centre of the dial, so that the needles will be correspondingly pushed farther in and thus draw a longer length of yarn with them, in this manner producing the longer stitch. By setting the nose D outwardly, a shorter stitch is obtained, as in this case, the needles do not go in as far and consequently take less yarn for a stitch. The rings E and F are used to prevent any possibility of the needles flying out when they should be at rest.

The set of needles used in connection with the dial needles are known as the *Cylinder needles* and are placed vertically in the grooves of a needle cylinder for holding them. The body of the needles extends below the dial plate, in fact, the needles go entirely below said plate when they are at rest, and only slightly above when in the highest position, in order to catch the yarn which was laid on the dial needles. The cylinder needles are placed so that each needle rises between two dial needles and draws down enough yarn to allow of a stitch by a needle from each set.

These cylinder needles, as was intimated, receive a vertical movement, in order to perform the knitting operation, said movement being obtained by means of a cam groove, placed on the cam cylinder which revolves about the needle cylinder, the cylinder needles having projecting shanks near the bottom of their lengths, which run in the cam groove. The cam cylinder is attached to the cylinder needle cam ring, which receives a positive rotation, and through this ring the cam cylinder and also the dial cap, containing the dial cam, are given a rotary movement.

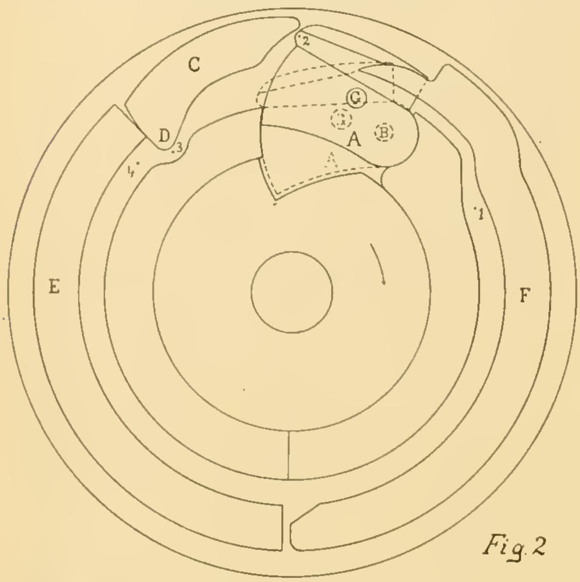


Fig. 2

A development of the cylinder needle cam is shown in Fig. 3, that is, the groove is shown in one plane, whereas in the machine it is circular, the two ends shown, forming a continuous groove on the cam cylinder.

Referring to the illustration to explain the method of operating the cylinder needles for knitting, 1 indicates the point which starts the needle upwardly to open the latch of said needle, the stitch in the hook in this instance acting to open the latch in the same manner as with the dial needles. When the point 2 acts upon the needle, said needle goes to its highest point with the latch open and the stitch resting just below the latch on the needle. Before the needle starts down again, the yarn carrier has deposited the yarn on the projecting dial needles, so that the cylinder needle in coming down catches the yarn in its hook to form a new stitch when the stitch in back of the latch closes said latch and is cast off.

Point 3 indicates the part of the cam for casting off the stitch by bringing the needle to its lowest position. This movement of the needle corresponds to the inward movement of the dial needle, that is, the stitch below the latch, when the needle goes down, slides over the latch, thus closing it and then slides entirely off of the needle. From point 3 to point 4 the needles rise to a resting position, attained at point 4, and in which position they remain without the aid of a top guard until arriving again at point 1, thus completing the cycle of operation for one stitch.

The loose or slack course is made in the fabric by means of these cylinder needles. A slack course is simply a long stitch and is obtained through the cam A. This cam is made vertically movable and is operated from the pattern wheel as will be explained later. By moving it downward, a longer stitch is obtained, because the needles are drawn down farther and consequently take more yarn. After the long stitch is made, the cam A is raised to its normal position and the plain stitch is again made. The cams B and C are used as guards to prevent the needles from flying upwardly and opening the latch, and consequently losing a stitch, when they should be partly down with the latch closed.

It may be mentioned that the dial plate cam is set so that the point 2 leads the point 2 of the cylinder cam a short distance. This is necessary in order that the cylinder needles shall descend slightly in advance of the dial needles drawing inwardly, in order that said cylinder needles may catch the yarn as resting on the projecting dial needles before it is drawn inwardly by said dial needles.

Pattern Wheel. This wheel, as its name indicates, is used to produce the pattern, that is, to put the welts and slack courses in their proper positions in the half hose tops. Fig. 4 is a side view of a pattern wheel with operating levers, said wheel being driven by the ratchet teeth on its circumference, as will be subsequently explained. The figure also shows the pattern chain cylinder which is positively driven from a wire-point clothed wheel in contact with the moving fabric as the latter is being drawn down by the take-up motion. There are three rows of screw holes around the pattern wheel, the holes being made radially over each other and receive screws according to the pattern desired. These screws actuate a vertically movable bob pin through levers, which in turn actuate the movable cams on the dial plate and on the cylinder cam through lever connections. By placing a screw in hole No. 1, a loose course is made by moving the cam A, Fig. 3, on the cylinder cam lower, so as to get a corresponding movement of the cylinder needles. A screw in hole No. 2 of the pattern wheel will bring both cams to their normal positions and thus produce plain work. No screws in any of the three holes will make the tuck stitch for the welt, that is, the movable dial cam will go in half way and cause the double stitch.

A screw in hole No. 3 will cause the dial needles to remain at rest, that is, in an inward position, so that they will lose the necessary stitch for the welt.

In order to show more in detail the connection between the pattern wheel and the movable cams,

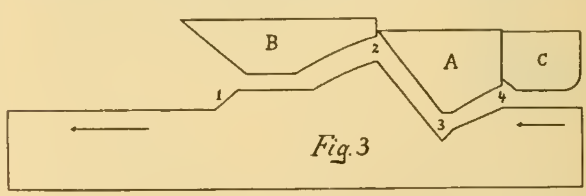


Fig. 3

diagrams Figs. 4, 5 and 6 will be referred to. Fig. 4 will be used to show how movement is given to the bob pin. Fig. 5 shows the diagram of the levers, as actuated by the bob pin, for operating the movable cylinder cam; and Fig. 6 shows a diagram of the levers, as actuated by the bob pin, for operating the dial cam.

Referring to Fig. 4, the pattern chain cylinder A is fast on the shaft B which is driven through gears and a measuring wheel from the take-up of the knitted fabric, which is clearly shown in Fig. 1. The pattern wheel C is loose on the shaft B and is driven by the reciprocating pawl D. As was mentioned, on one side of the pattern wheel, the pattern screw pins are placed in rows of holes 1, 2, 3 respectively, while on the other side, a screw pin is used, being placed in row 2, in order to throw the pattern wheel out of action. This is done by having the pin come under the arm E and raises it, which in turn comes under the pawl D and raises it out of contact with the ratchet on the pattern wheel C. Before the pawl D can again engage the ratchet, the arm E must drop. This is accomplished by having a raiser F on the pattern chain F′ come under the lever G and raise it. This lever is centred at H and has an upwardly projecting arm I, which is attached to the rear end of the arm E, so that when the lever G is raised, arm I goes slightly backwards, carrying the arm E with it, thus taking it off of the screw pin which previously raised it, and allowing the pawl D to again engage with the ratchet.

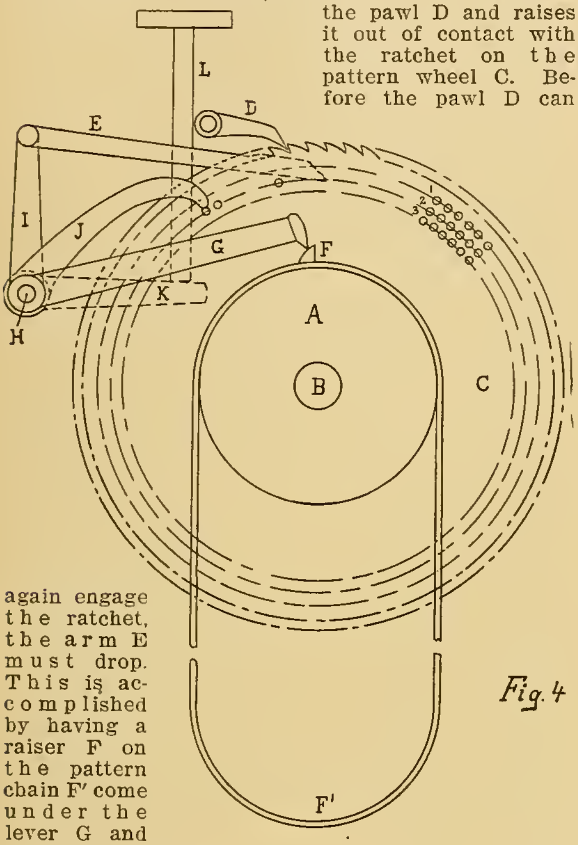


Fig. 4

Centred at the same point H, but not connected with the lever G, is an arm J with its other end resting on the pattern screw pins of the pattern wheel C. On the same collar with this arm J is the arm K which supports the bob pin L. By placing the pattern screw pins in different holes on the pattern wheel, when it revolves, the arm J is given an upward or downward movement to correspond to the placing of these pins, and through the arm K, the bob pin L is raised or lowered accordingly.

It was mentioned that when a screw was in the top hole of the pattern wheel, the movable cylinder cam was operated to make the slack or loose course stitch. Referring to diagram Fig. 5 for the details of this operation, this motion is placed on the cam cylinder and consequently revolves with it. The diagram shows more the action of the parts on each other than their relative positions on the cylinder. A top finger A projects from the cylinder and is fastened to a rod B, the lower end of which carries a small gear *b*, which meshes with a similar gear *c* on the end of the rod C, this rod C also carrying a projecting finger D situated just under the finger A. Secured to the top of the rod C is a lever E carrying at its end a projecting screw F. As the cylinder revolves, the finger A strikes against the bob pin (previously explained) and is pushed in. This action gives the rod B a left hand movement, the rod C a right hand one and consequently the lever E is moved inwardly, causing the projecting screw F to come in contact with an inclined surface plate G and pushes it down against the action of the spring H which is on the screw I connecting the plate G with the movable cam J. By thus lowering the cam J with this movement, the desired loose course stitch for the fabric is obtained. To get said cam to its normal position, a screw pin is put in the second hole on pattern wheel, which causes the bob pin to be struck by the finger D and thus throw the projecting screw F off of the inclined surface plate G, and when the spring H raises said plate and the cam J to their normal positions.

The method of operating the movable dial cam is similar to the one just described and is shown in diagram Fig. 6. As was mentioned, the dial cam is used to make the welt, and first has to go in half way for one stitch and then entirely in for two stitches. A finger A is used for the half way movement, while a longer finger B makes the entire movement. This motion is also situated on the cam cylinder. A spring controlled rod C has a stop piece D at the bottom, which is held first by the inner end of the finger A and when that is released, by the finger B, the tendency of this stop piece D being to revolve past the fingers. Secured to the top of the rod C is a lever E which is connected at its other end to a link F, the other end of said link being attached to a peg G projecting up from the movable dial cam H (see A, Fig. 2) as pivoted at I.

When the bob pin is struck by the finger A, the stop piece D is released until it comes to the finger B, the movement of the rod C being transmitted, through the levers shown, to the cam which is moved half way in to give that stitch. On the next revolution of the cylinder, the finger B comes against the bob pin (see L, Fig. 4) and the stop piece D is entirely released, thus giving a rotary movement to the rod C which in turn, through the levers shown, moves the cam H entirely in and causes the lost stitch. When two stitches have been lost, the cam is brought to its normal position by having a finger J as attached to the rod C, strike against the bob pin and cause the rod C to revolve in the opposite direction to its first movement. This causes the levers mentioned to move the cam H out to its normal position for plain knitting. It will be seen from the foregoing explanations that it is necessary for the pattern

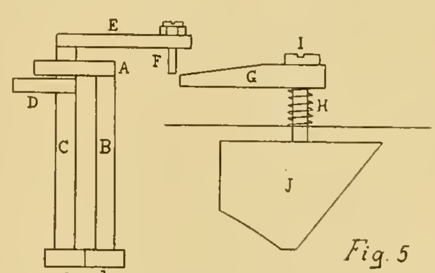
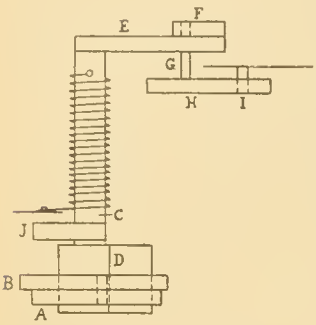


Fig. 5

wheel to revolve when putting in the special stitches, but for the plain stitch, its use becomes unnecessary.

The Take-Up for the knitted fabric may be best explained by referring back to Fig. 1, the take-up being shown near the frame stand. It consists principally of a swinging frame carrying a pair of fluted rolls between which the fabric is held. These rolls are geared from a shaft having a grooved pulley attached to it. Another grooved pulley on the driving shaft of the machine drives the bottom pulley through a rope when the tension is sufficient, because the bottom pulley is carried by the swinging frame. The rolls are weighted by weights shown in front of the machine. This weight acts to put tension on the fabric and as the latter is being produced, the weight descends, carrying the swinging frame with it. When the latter has descended far enough to cause the rope to grip the pulleys, the fluted rolls are revolved through gearing from the pulley, and thus work themselves up on the fabric, carrying the swinging frame with them. As soon as the rope becomes slack again from this movement, the revolutions of the rolls stop and the swing frame begins to descend again. In this manner a constant and even weight is put on the fabric, which in turn will give a smooth fabric.



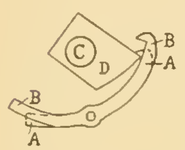


Fig. 6

Stop Motions are also provided on the machine, one for controlling the feed of the yarn and another for controlling the delivery of the fabric, in either instance the absence of material causing the machine to stop with the brake applied. These stop motions, *i. e.* their construction and operation, form later on the subject for four special articles; said stop motions having nothing directly to do with the principle of knitting of the machine, their chief function being to insure a perfect fabric, reduce waste of yarn to a minimum and production of the machine at the same time to its maximum capacity. (H. Brinton & Co., Philadelphia, Pa.)

BRINTON'S RIB TOP MACHINE, WITH KNEE AND ANKLE SPLICE.

This machine is of the same pattern as the Rib Top machine previously explained, with the exception that an extra attachment is provided for splicing, so that the explanations given for the different motions of the latter machine will apply also to this machine with Knee and Ankle Splice attachment, and consequently only an explanation of the splicing attachment is necessary.

This machine is used principally for making Misses' Ribbed stocking legs with reinforcements at the knees and ankles, however, Leggins, Wristers, etc., may also be made on the machine by changing the pattern wheel and length of pattern chain.

In order to make a splice in the fabric, *i. e.* produce a heavier and stronger section in the fabric, an extra thread is fed to the single yarn carrier of the Rib Top machine at the proper time. After making the splice, said extra thread is withdrawn from feeding. When this extra thread is fed to the yarn carrier for insertion into the fabric, the rib stitch which is being made must be longer than for a single yarn, as otherwise the fabric would be too tight. For this reason, the movable cylinder cam must be lowered in order to make the slack course stitch during the time of splicing.

A special attachment for making the splice is shown in the accompanying illustration Fig. 1, which is a side view with the parts shown in the position when the extra thread is being run. The attachment is secured on the cam cylinder by screwing the post A into the cam cylinder and by having the piece B screwed to the side of said cylinder, thus having the attachment revolve with the cam cylinder, it being placed radially from the hole in the yarn carrier which is also carried by the cam cylinder. The device consists principally of a pair of jaws C and D which are pivoted on top of the post A, the movement of said jaws being similar to a pair of scissors.

The extra thread to be inserted into the fabric with the regular yarn is passed between the ends E of the jaws C and D. These ends are held normally in contact with each other by means of a rod F being passed through the jaws C and D on the opposite side of the pivot from the ends E, and having a spring placed on one end of said rod to press these ends toward each other. By having the ends E thus in contact with each other, the thread is gripped by them and prevented from being delivered until released. Secured to the piece B is a projection G in which a lever H is centred at I, this lever H extending up and between the outer ends of the jaws C and D and having a portion J on each side near the top beveled in order that it may more easily spread the jaws C and D when pushed in. To also assist in this, the inside surfaces of the jaws are beveled near the ends. The top end of the lever H has a thread guide K through which the yarn is threaded in its passage to the ends E. A pin L is situated on the lever H about half way down its length, which is directly under a beveled side of a lever M as pivoted at N, the other end of said lever carrying a screw O which presses against the inclined surface plate G shown in Fig. 5 of Brinton's Rib Top Machine (see page 195) at the proper time, thus lowering the movable cam J in the same figure, in order to make the long stitch for the splice.

The action of the device is as follows: When the splice is called for, a bob pin is struck by the inside surface of the lower end of the lever H, thus forcing that end outwardly, which in turn forces the upper end inwardly, causing it to wedge itself between the jaws C and D, against the action of the spring on the rod F, and thus open them, which action also causes the ends E to open and free the extra thread. The thread is now allowed to pass along with the regular thread, it being held up in contact with said regular thread by means of a wire P and held down on the other side of the ends E by a wire Q. At the same time, the pin L comes against the bevel end

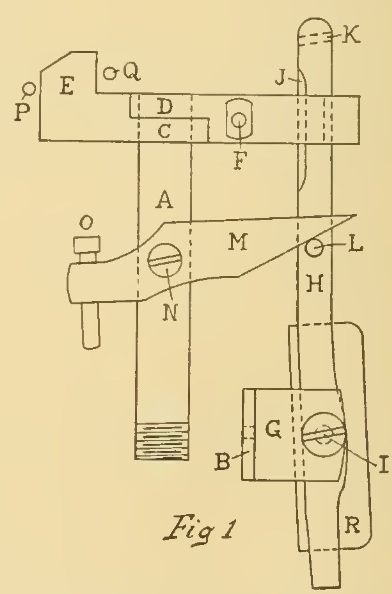


Fig 1

of the lever M and forces it up and consequently the other end carrying the screw O down, thus making the long stitch, as explained.

When the splice has been made a bob pin comes in the path of the outside edge of lever H and throws it in and the top end out. The jaws C and D, thus being freed, come together and the ends E grip the thread. The pin L is also brought from under the lever M and the screw O releases the cam, in this way making the regular stitch again. The bob pins mentioned are controlled by the pattern wheel.

Two rows of holes are provided on the pattern wheel, but on the opposite side from the regular pattern holes, these holes being nearer the centre of the pattern wheel than the regular pattern holes. A screw in the outer row of holes will cause a lever resting on said screw to raise a specially shaped bob pin, as situated on the cam cylinder ring, which will throw the bottom end of the lever H out when it comes around and consequently the top end will move in, thus causing a feed of the extra yarn, while a screw in the inner row of holes on the pattern wheel will cause a lever to raise another specially shaped bob pin, which will in turn, as the cam cylinder revolves, throw the lower end of the lever H inwardly and the top end out, thus stopping the feed of the extra yarn as explained.

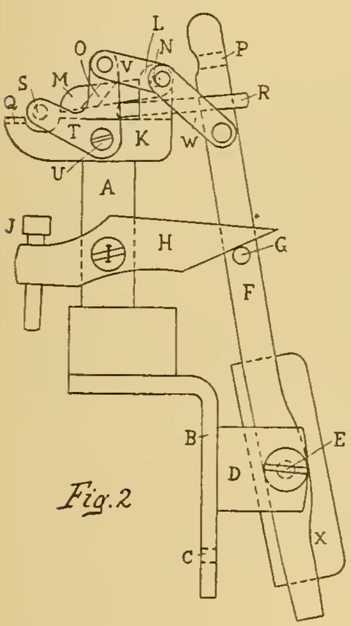


Fig. 2

A pressure spring R is placed on the bolt at I, and presses against the lever H, in order to hold it in the desired position when moved by the bob pins.

The cone for the extra yarn is placed directly over the centre of the revolving mechanism and revolves with it, in this manner allowing the feed to cease without tangling and breaking the yarn from the cone.

Another construction of a splicer, to be used with the same machine, is given in connection with Fig. 2, the same, although very similar in construction to the one previously explained, however is at the same time more positive in its action. The illustration is a side view of the device which is also secured to the cam cylinder and thus revolves with it. The device consists of an upright post A, having a flange B at the bottom, which is attached to the side of the cam cylinder by passing screws through the holes C into the cam cylinder. The flange B is also provided with a projection D which is used as a pivot at E for the lever F. About half way up the length of this lever F is a pin G, which comes under one end of the lever H as centred at I, when the lever is moved in, and consequently causes the projecting screw J on the other end of the lever H to move down and press against the inclined surface plate (G in Fig. 5,—see page 195 for it) thus lowering the movable cam J in said Fig. 5, in order to make the long stitch for the splice, this portion being identical with that previously explained in connection with the other splicer.

Situated on top of the post A (see again Fig. 2 of this article) is the yarn feeding arrangement for the extra yarn and which consists of a specially shaped piece K, the outer end of which is made with an upwardly projecting arm L for holding one end of the yarn guide M as pivoted at N. This yarn guide M is made with a slanting hole O through which the extra yarn passes from the guide eye P in the lever F to the guide Q as situated on the piece K. Resting on the top side of the piece K and just under the yarn guide M is a slide R, the outer end of which is made to fit over the lever F and hence it receives a forward and backward movement to correspond to the movement of the lever F. A forward movement of the slide R will put said slide in the position shown in the illustration, that is, it comes under the yarn guide M and raises it slightly, against the pressure of a spring which tends to hold one end of the guide M in contact with the top surface of the piece K. It is this motion which produces the feed of the extra yarn, for in this case the extra yarn which is resting in the guides P, O and Q was gripped by having the yarn guide M pressing against the top surface of the piece K with the yarn between them, and when the yarn guide M is raised by the slide R, the yarn is released and free to be carried along by the regular yarn in the yarn carrier to the needles. In order to insure enough friction between the regular yarn and the extra yarn, to be able to carry it forward to the needles, when said extra yarn is free to move, a pin S is provided, which is secured in one arm of the elbow lever T as centred at U. The regular thread is passed behind and under this pin S in its passage to the yarn carrier, and by depressing the pin S said thread is brought down into contact with the extra thread, this contact being sufficient to cause the extra thread to travel along with the regular thread and be fed with it. The downward movement of the pin S is obtained by having the other arm of the elbow lever T connected to the lever F through two links V and W, so that as said lever F moves in, the vertical arm of the elbow lever T is moved in and consequently the other arm carrying the pin S is moved down.

It will be seen from the foregoing explanation, that when the top part of the lever F is moved in, the extra yarn is fed to the needles, thus producing the splice, and when it is moved outward, the slide R is withdrawn from under the yarn guide M which then falls under the action of a spring and grips the yarn, thus causing it to break out at the needles and cease to be fed. At the same time the pin S is raised, bringing the regular yarn out of contact with the extra yarn, also the lever H is released, thus allowing the movable cylinder cam to rise again to its original position for the plain rib stitch. The inward and outward motions of the lever F are controlled by the pattern wheel, in the same manner as explained in connection with the previous splicer. (H. Brinton & Co., Philadelphia, Pa.)

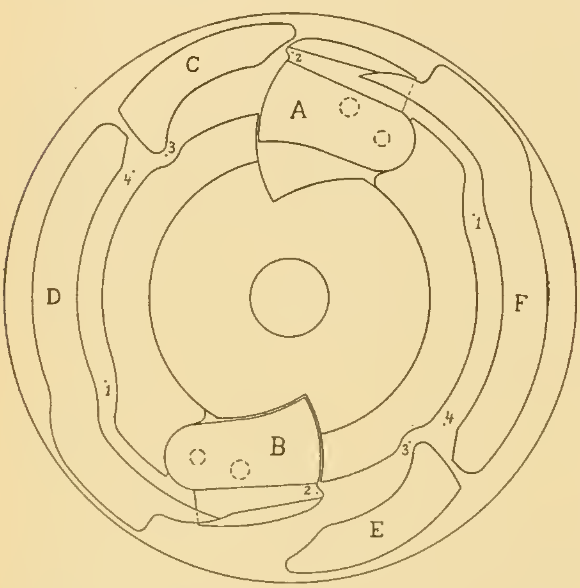
BRINTON'S AUTOMATIC SLEEVER.

While the Automatic Sleever is in the same class with the Rib Top Machines which have been explained before, and its motions are similar, yet it differs from them materially in that it is a two feed machine, that is, two yarn carriers are used and consequently the cam outlines for the two sets of needles are different from those shown for the single feed Rib Top Machines.

Sleeves for underwear are the principal articles made on this machine, although it may be used for half hose tops if required, a greater production being obtained than with a regular Rib Top Machine, owing to the double feed.

With a single feed machine, one stitch is made for every revolution of the cylinder, whereas with a double feed machine, the needles make two stitches for every revolution of the cylinder. The two yarn carriers are placed opposite to each other on the cam cylinder. The dial plate cam, for operating the dial needles, is simply a condensed form of two cams from a single feed machine, the operating part of the single feed cam remaining unaltered while the part for the needle rest is replaced by another operating part of a single feed cam, although the needle rest is not entirely abandoned, but is greatly reduced.

The groove outline for a two feed dial cam is shown in the accompanying illustration. It will be noticed that there are two movable cams A and B, corresponding in their construction with each other, and which have the same outlines as that used on a single feed machine. Cam A will be used as the welt cam, and cam B as the tuck cam, both cams being operated from the pattern wheel. The points 1 indicate the parts of the cam outline at which the needles are started to open, that is, begin to move outwardly. Points 2 are the portions which open the latches of the needles as they are operated upon, and push the stitches over the latches so that they rest on the needles behind said latches. Points 3 cast the



stitches off of the needles, and thus close the latches of said needles, the yarn carriers having deposited yarn in the hooks of the needles when they were open. From points 4 to 1, the needles are at rest, the operations of the needles being the same as for the single feed, but it will be noticed, as was mentioned, that the needles rest only for a short space as compared to the single feed. The same cam rings C, D, E and F, on the outside of the cam groove, are used to keep the needles in their proper positions, as was explained in connection with the single feed in the article on the Rib Top Machine. With reference to the cylinder or vertical needles, the cylinder cam for operating them is also made to give two stitches in one revolution of the cylinder, or in other words, two single feed cylinder cams are made into one with a slight difference, which is that only one movable cam is provided for making the loose course stitch.

The stitches are made by the cylinder needles in the same relation to the dial stitches as explained in connection with the single feed, that is, the stitches by the cylinder needles are made slightly in advance of those by the dial needles.

In making a sleeve on this machine, a welt is first made, then the plain rib stitch is knitted to make the lower end of the sleeve. After the plain stitch, the tuck stitch is made for the first portion of the upper part of the sleeve and then a looser tuck stitch is put in for the upper portion of the sleeve.

In order to make the different stitches, the positions of the different movable cams must be ascertained. It may be mentioned that the welt cam will be considered as leading the tuck cam in making the stitches.

First, to make the welt, the dial needles must go outwardly only half way for one revolution of the machine, then remain in for two revolutions, so as to lose those stitches, while the cylinder needles are continuing their regular stitch. In accomplishing this, both movable cams must be considered. Considering the welt cam A as making the first stitch, it must move in half way, in order to make the tuck stitch for the welt. The next stitch will be made by the tuck cam B and then the needles must be in, therefore the tuck cam must be entirely in. On the next revolution of the cylinder, the welt cam must also be entirely in, to make up the two lost stitches by the dial needles. The following stitch by the tuck cam will be plain, and so on, both cams making plain work until another style of stitch is needed.

Second, this plain stitch work is made in the same manner as with the single feed, that is, the movable cams are placed outwardly to their farthest positions, in order to have the dial needle latches open with the stitches then resting behind them on the needles, so that said stitches may be cast off at every operation of the needles. The cylinder needles are working plain and continue to work in this manner until the loose tuck stitch portion of the sleeve is required.

Third, the regular tuck stitch is now made, in order to give more elasticity to the sleeve than at the wrist. In order to make this stitch, which is the same as the tuck stitch used in connection with welts, the welt cam continues to make a plain rib stitch while the tuck cam is moved half way in and remains in this position until another style of stitch is required. By following the action of each cam on the dial needles, we see that the welt cam first puts in a plain rib stitch, that is, the needles move out to their farthest position, causing the stitch, or in this case two stitches in each hook, to open the latches and rest behind said latches; at the same time the hooks receive new yarn from the yarn carrier. The two stitches are then cast off at the point 3 following the welt cam in the outline shown in the illustration. The needles are then acted upon by the tuck cam which moves said needles half way out, thus opening the latches for another stitch without removing the first stitch from the hooks. The next revolution of the cylinder causes the welt cam to move the needles entirely outwardly, and consequently the point 3, following said cam, casts off two stitches over the single stitch as placed in the hook of the needle by the yarn carrier. This operation of the needles continues until the desired length has been knitted.

Fourth, the loose tuck stitch is made so as to give more elasticity than the regular tuck stitch. This stitch is made by having the dial needles continue to make the tuck stitch while the movable cam on the cam cylinder causes the cylinder needles to make the long or loose course stitch, said cam being lowered in order to do this. The loose stitch is only made on every other stitch because only one movable cam is provided on the cam cylinder and two courses are made by the cam outline. This stitch is not always made use of in making a sleeve.

These different portions of the sleeve are automatically made by using a pattern wheel which is the same type as that shown in Fig. 4, in connection with a former article, *i. e.* Brinton's Rib Top Machine (see page 195), the chief difference in the two wheels being, that this wheel is provided with four rows of holes for the pattern screws, while the first only contained three. This pattern wheel in turn operates a hob pin through levers similar to those explained in connection with said Fig. 4, just referred to, and by means of the bob pin, the three different movable cams are operated.

A screw in hole No. 1 of the pattern wheel, raises the bob pin to its highest position, which causes the projection on the cam cylinder, as connected to the movable cylinder cam, to operate said cam and cause the long stitch for the loose tuck work.

A screw in hole No. 2, which puts the bob pin in the next highest position, causes said bob pin to strike a projection on the cam cylinder which operates the tuck cam for making the regular tuck stitch.

A screw in hole No. 3 causes the bob pin to be struck by projections connected to each cam, which puts them all in their normal positions for plain rib knitting.

A screw in hole No. 4 causes the bob pin to be struck by one projection from the welt cam, to make the lost stitch hy the dial needles, and by two projections connected to the tuck cam in order to make a lost stitch. In this case one projection is struck slightly ahead of the other.

No screws in any of the holes cause the bob pin to go to its lowest position and be struck by a projection connected to the welt cam, the cam in this instance being moved half way in, in order to make a tuck stitch for the welt.

The order of the different operations explained is governed by the fabric, and has to be arranged so as to make continuous working. (H. Brinton & Co., Philadelphia, Pa.)

BRINTON'S AUTOMATIC RIB SHIRT OR BODY MACHINE.

This machine, as will be seen from its perspective view, as shown in the accompanying illustration, is larger than the machines previously described, containing in this instance eight feeds. The principle of construction and operation of the machine is similar to the Automatic Sleever, just described, that is, two sets of needles are used and tuck and welt cams are used on the dial cap cam. These cams are placed alternately around the dial cap and are equally spaced from each other.

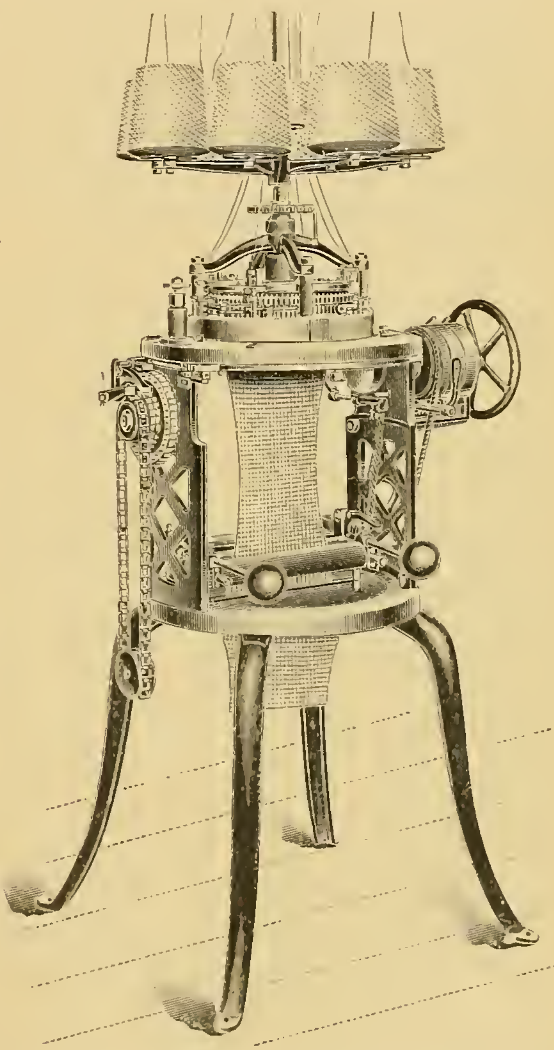
Only two styles of stitches are required to be made in connection with the knitted fabric on this machine, a pattern chain and pattern wheel being used to change from one stitch to the other and back again to the first stitch. For making undershirts, the plain rib stitch is used for the neck, the tuck stitch for the body, and the plain again for the bottom.

It will be seen that, for example, in an eight feed machine eight courses of stitches are made for every revolution of the cam cylinder and consequently eight stitching outlines on the cylinder cam, each complete in itself, *i. e.* containing points 1, 2, 3 and 4 as shown in Fig. 3, as given in connection with Brinton's Rib Top Machine (see page 194) must be provided for the cylinder needles, the same being true also for the dial needles.

To make the plain rib stitch, all of the movable cams on the dial cap cam must be in their farthest positions from the centre of the dial cap.

To make the tuck stitch, every other cam must remain in the outward position while the tuck cams, as placed between them, must be moved half way in. In this manner the tuck stitch is made by the cams as explained in connection with the two feed Automatic Sleever.

In order to make a change from one style of stitch to the other, a raiser is placed on the pattern chain, which, through lever connections explained when treating the rib top machine, sets the pattern wheel in motion, and which in turn operates a lever connected to operate the bob pin, and raise it. This causes a projection from the top of the dial cap to be struck, thus pushing it in. The inner end of the projection is connected to a movable ring which in turn operates levers as are connected to the movable dial cap tuck cams, thus throwing them half way in, the other cams remaining in their same positions.



The pattern wheel continues its revolution until a pin on the opposite side of the wheel from the pattern pins, comes under a lever which raises the reciprocating pawl out of contact with the teeth of said pattern wheel and thus stops it.

When a sufficient length of one style of stitch has been knitted, a raiser on the pattern chain again starts the pattern wheel in motion, which is pegged properly to give the bob pin the correct movement to change the positions of the tuck cams and thus change the style of stitch.

The needle protector on this machine consists of a loose ring placed on the cam cylinder ring, and having upwardly projecting pins against which pins from the cam cylinder fall after being released by the needle protectors when yarn accumulates between the needles and protector. This action gives motion to the movable ring, causing a pin to strike a projection from the knock off motion, which in turn through levers shifts the belt from the tight to the loose pulley, thus stopping the machine. (H. Brinton & Co., Philadelphia, Pa.)

BRINTON'S FULL AUTOMATIC SEAMLESS KNITTING MACHINE.

The knitting machine is a different type of machine from the rib machines as previously explained, although the principle of knitting remains the same in both types of machines.

A perspective view of this knitting machine is shown in Fig. 1, in which only one set of needles is employed, *i. e.* the cylinder needles, the dial needles, as used in the rib machine, being replaced by sinkers, one sinker taking the place of each dial needle. These sinkers are used to push the stitches away from the needles after they have been cast off by said needles, and also to hold the work down.

This machine is used to complete the knitting of half hose after the tops have been made on the Rib Top Machines, and also to make stockings, in the latter instance requiring no tops from the Rib Top Machine.

In order to knit half hose, the tops are first placed on the cylinder needles, the cylinders carrying the needles being easily removable from the machine so that a top may be placed on one cylinder while another is working. The end of the rib top containing the slack course is placed on the needles, each loop being placed over a cylinder needle. The cylinder is then ready to be placed in the machine, being placed over a binding ring which secures it in the machine. This is known as locking the cylinder and is done by simply pulling a lever up. In order to place the raised needles down into the cylinder cam groove, which were raised in order to allow the needle cylinder to be placed in the machine, a jack cam for pulling down said needles is thrown inwardly so as to act upon them. The needles by thus being lowered, are placed in their working positions and the machine is then ready to start.

The plain stitch is first made by continuous circular knitting in one direction until the heel has to be knitted. The heel is made by giving the cam cylinder a reciprocating motion, that is, one revolution in a right hand direction and then reverse the direction of motion for the next revolution. In this manner only one-half of the needles work, the remaining half being raised out of working position, thus producing the fullness for the heel. The heel is shaped properly by raising a needle out of action from each side of the working needles after every course, until the smallest part or bottom is made, then a needle is added at each end until the heel is finished. After completing the heel, continuous knitting is made until the toe has to be made, the remaining needles having been lowered. The toe is made in the same manner as the heel, and on its completion the machine is automatically stopped, so that the operator may replace the empty cylinder with a new one containing a half hose top.

To make the plain stitch on the machine, the cylinder needles are raised successively by the cylinder cam in order to have the stitch in each hook open the latch and allow new yarn to be put in said hook when the needles descend. The sinkers are also moved in and out during a course by means of a cam groove on the dial cap. The yarn carrier as used in this machine consists of a ring shaped piece situated above the dial cap and having a hole in the side through which the yarn is passed. The ring also acts as a guard for the hooks of the needles which are partially raised when in the resting position. The hole in the yarn carrier is made in the same vertical line with the central point of the centre cam on the cylinder cam and the outward point of the dial cap cam, although this cam is given a little play on either side of the carrier eye. This causes the yarn to be deposited on the sinkers when the needle is up and the sinker is partly out of the way. As the needle comes down, the yarn catches in the hook and is drawn down; at the same time the sinker moves inwardly and pushes the cast off stitch away from the needle. The cylinder cam is made with a needle rest for a little over half of the inner circumference of the cam. The dial cap cam is made to have all of the sinkers in an inward position except a few where the yarn carrier is depositing yarn, and which are in the outward position, that is, the part which pushes the stitch inwardly is in this position. To make the heel, the same plain stitch is made, but only part of the needles are used. A reversing motion for the cam cylinder, as was mentioned, is brought into action in order to give one revolution in one direction and then reverse the motion for one revolution. The cam cylinder is driven from a bevel gear which in turn receives its motion

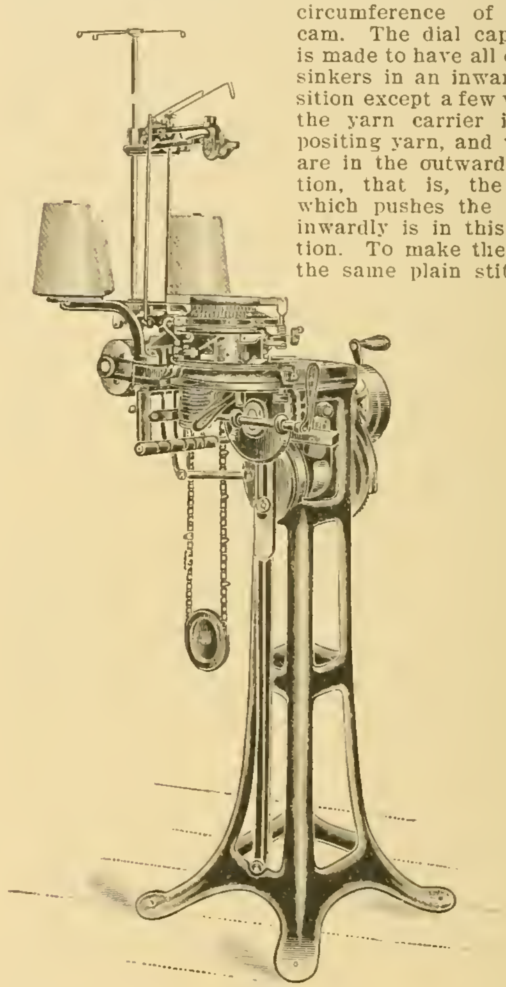


Fig. 1.

from either of two sources through a clutch. When the clutch is in contact with a continuously revolving piece, the cam cylinder is revolved in one direction, and when the clutch is in contact with a piece which receives a forward and backward revolution, the cam cylinder is consequently given a similar movement. The continuous revolution is gotten directly from the driving shaft of the machine. The backward and forward motion is gotten through a toothed segment which is given a backward and forward movement through a crank pin as driven from the driving shaft of the machine.

Making the stitch by the cylinder cam requires careful study, so that a development of the cam outline, as given in Fig. 2, will be used to more clearly explain the operation. In order to have only a certain number of needles working for making the heel, it is necessary to raise the others out of the cam groove. These needles which are to remain out of action by being raised, are made with longer butts or shanks than the other needles, the two kinds being known as long and short butt needles respectively. In order to raise them, the jack cam A is brought into action, *i. e.* pushed into the inner circumference of the cylinder cam, so that as it revolves, the long butt needles are pushed up, said needles being held in this raised position by means of a spring placed around the needle cylinder, the short butt needles remaining untouched. The cam cylinder in making cam D, thus releasing the upper pick I which descends and rests on top of the shanks of the other needles in the same manner as the upper pick C on the opposite side. In this way a needle from the other side is placed out of action.

The other working needles are acted upon by the stitch cam F, which carries them to their highest positions 9 with the latches open and the stitches resting on the needles below the latches. At the middle of the top cam D, yarn is deposited and as the needles are forced down by the under side of the stitch cam E, they catch the yarn in the hooks for a new stitch. At the point 10, the stitch is cast off, and the end cam J then raises the needle to the resting point 1. In this manner, the stitches are made for the heel, raising a needle at each end, one at a time, for every movement of the cam cylinder. When sufficient needles have been raised out of action for the first portion of the heel, these needles which were placed out of action are brought down again, one at a time, at each end and at each movement of the cam cylinder. This is accomplished by means of the lower picks K and L in connection with the same pieces as used for placing them out of action.

It was mentioned that one needle was replaced into working position at one time, which is true, but it is gotten by replacing two needles at one time and then taking one away. This is necessary, because

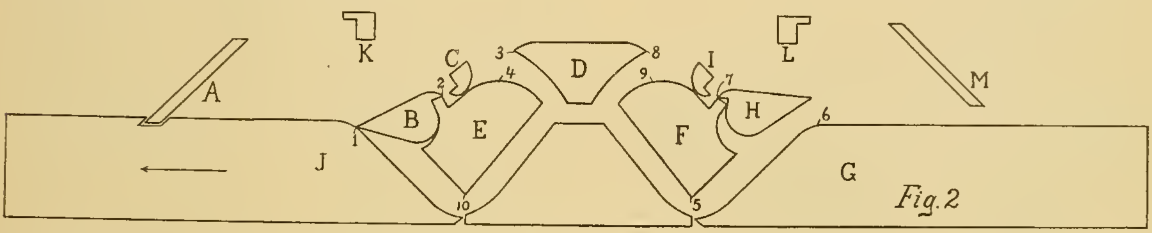


Fig. 2

the backward and forward movements, only operates these short butt needles which are down in working position. For example, the cylinder is revolving in the direction of the arrow, then a needle, after being passed by the point 1 of the needle rest, is moved upwardly by the switch cam B to the point 2, at which point it comes on the small projection of the upper pick C and is raised by it as the cylinder continues to revolve. The projection on the pick C is just large enough to hold one needle. At the point 3, the upper pick comes to the top cam D and the needle is placed in its highest position by said cam, thus raising one needle out of action. After the upper pick C has been moved up, the other needles are acted upon by the stitch cam E and the latches of the needles opened by the point 4. The upper pick C returns to its original position when the needle is off of the projection. When the middle of the top cam D is acting on the needle, yarn is being deposited by the yarn carrier. This cam starts the needle down and enables the under side of stitch cam F to complete this movement, the stitch being cast off the needle, at the point 5. The end cam G then raises the needle up to its resting position at point 6, the switch cam H being easily raised from the under side by the needle, so that it does not interfere with the needles. The point 6 passes all of the working needles and then returns on the backward motion of the cylinder. As the cam goes back in the opposite direction from the first movement, a needle moves up on the switch cam H to the point 7, at which point it comes on a projection of the upper pick I, which is raised as the cam cylinder continues its revolution. At the point 8, the needle is placed in its highest position by the top the upper picks still continue to operate and take one needle up each time.

The lower picks K and L must be released before they can operate on the needles. In the free position, they are situated above the shanks of the inoperative needles, that is, the projections from said picks. When the cam cylinder is moving in the direction of the arrow, the lower pick K comes with its projection over the top of two needle shanks (the size of the projection only allowing two), and as the cylinder continues to revolve, the needles are forced down by the pick into working position. On being released by the needles, the pick K assumes its original position after resting under the shanks until they are passed. As the cylinder returns on its backward movement, the upper pick I takes one of the returned needles back again out of working position, thus leaving the one needle.

On this same backward movement, the lower pick L brings down two needles, one of which is placed back again out of working position by the upper pick C on the next forward movement of the cylinder. These operations continue until the heel is completed, when the clutch is thrown in with the continuously revolving piece and the cylinder consequently given a continuous revolution. At the same time, the lower picks are caught and held until the proper time, during the making of the toe. All of the needles which were out of operation are brought down by the under side of the pull down cam M, which is thrown into the path of the butts of the needles, and the same plain stitch is made as at first.

While making the heel, an extra yarn or splice is run with the regular yarn in order to make that portion of the half hose or stocking stronger and heavier. To allow for this extra yarn, the stitch must be made longer, and to accomplish this, the needle cylinder is raised slightly. This causes the sinkers and needles to be raised, and as the needles go down to the same position as at first, the yarn as laid on the sinkers is drawn down the extra length that the sinkers were raised.

After making the plain part of the foot, the toe is made in the same manner as the heel. On completing the toe, the machine automatically stops off and is ready to have a new cylinder replace the empty one.

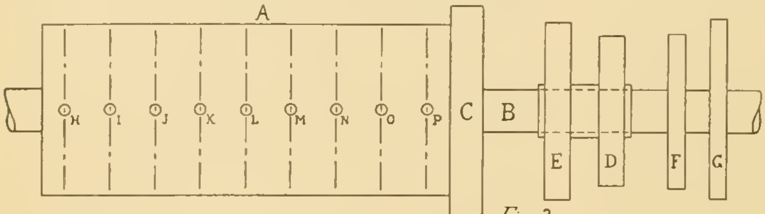


Fig 3

The method of obtaining these different movements for the several operations as explained, is shown by means of Fig. 3, which is a diagram of a pattern drum as used instead of the regular pattern wheel of the rib machines.

The drum A is a cylindrical piece, mounted on a shaft B and contains nine rows of holes, of these rows some containing more holes than others, extending around the drum, each row being in one plane perpendicular to the axis of the cylinder and equally spaced from each other. These rows are used to fasten the raisers for the pattern to the drum by means of screws. These raisers are of different shape for the different rows, according to the pattern desired. The pattern drum is given rotation by means of a ratchet C on the drum which is operated by a pawl. A regular pattern chain on the sprocket D is used in connection with the pattern drum to give the desired lengths of fabric of the different stitches. This pattern chain sprocket D is revolved by the ratchet E as operated by a pawl. A raiser on the chain pushes a lever up, which causes another lever to come up under the pawl for operating the ratchet C, and raise it out of action. This causes the pattern drum A to remain stationary and allows the yarn carrier to put in the required number of courses of that special stitch. The chain continues to revolve and causes the raiser to move from under the lever mentioned, which movement causes the ratchet to be operated by the pawl and consequently rotate the pattern drum again.

Near the end of the shaft B are placed two cams F and G for shifting the clutch levers, the cam F operating a lever to move the clutch into contact with the reciprocating motion for the cam cylinder. The cam G operates a lever for moving the clutch into contact with the continuously rotating wheel.

Each of the nine rows of holes of the pattern drum A forms a pattern surface with the cams screwed to them, for operating certain mechanisms in the machine.

The pattern surface indicated by row H is used for making a longer stitch while making the heel and toe in order to allow for the splice. This is done by operating a lever which raises the needle cylinder, thus producing the longer stitch as was explained.

Row I is used only when making ladies' hose for the purpose of shaping the stocking. The needle cylinder is raised in order to make a loose stitch which is gradually tightened as the stocking is made, by lowering the needle cylinder.

Row J is used for splicing the heel and toe, the cam placed on it being partly plain surface and partly inclined. The plain surface puts the extra yarn into contact with the regular yarn in order to create friction sufficient to carry it forward. The inclined surface separates the extra yarn from the regular yarn, but does not detach it. This splicing motion is situated above the machine and consists of a trough in which the extra yarn is passed, the end of which trough is provided with a cutting arrangement for this yarn when sufficient has been run. The trough is raised and lowered so that the extra yarn comes in contact with the regular yarn at the proper time and is then withdrawn. Friction and tension devices are also provided for the yarn.

Row K is used to bring the lower picks into action, which is done by moving a projection into the path of a finger situated on the cam cylinder. This action acts through a lever to release the picks so that they are free to work.

Row L is used to put the lower picks out of action by moving a projection into the path of the finger so that it is raised by striking against it.

Row M is used in connection with making the splice by releasing the take-up spring of the feeding mechanism through suitable connections. This allows the yarn to be fed.

Row N is used to stop the machine when the half hose is completed, its use being unnecessary when making ladies' hose as the needle cylinder does not have to be changed.

Row O is used to give a kick off to the drum, that is, the drum is moved an extra distance in order to be in the proper position to give a required movement to the levers which will bring the take-up spring down more quickly.

Row P is used to operate the bob pin through proper levers. The bob pin operates the jack cams for raising and lowering the back half of needles when making the heel and toe of the half hose or stocking. (H. Brinton & Co., Philadelphia, Pa.)

SCOTT & WILLIAMS' RIB FRAME MACHINE,

For Making Rib Tops for Men's Half Hose, Rib Legs for Misses' and Children's Hose, Sleeves for Underwear, Leggings, Toques, and Such.

Of the accompanying illustrations, Fig. 1 shows a perspective view of this machine as built either with one or two feeds, in all sizes and gauges from 3 to 6 inches diameter. The smaller sizes are used for children's ribbed hosiery; intermediate sizes for men's half hose and misses' ribbed legs, and sleeves for undergarments; whereas the larger sizes are built for the making of toques and leggings.

Single feed machines are invariably used for making ribbed hosiery, toques and leggings, whereas two feed machines are principally used for the making of sleeves for undergarments, and sometimes for the making of ribbed hosiery legs, particularly where fancy stitches are required.

This machine can be also fitted with lace attachment for fancy hosiery; high splicing attachment for re-inforcing the heels and knees of children's hosiery; or thread changing attachment for the making of toques, leggings and bicycle hose. The machine itself is built after the well known principle adopted by manufacturers for so many years in which the cam ring revolves and the cylinder is stationary.

Fig. 2 represents a side view of a portion of this rib machine showing the card roller for measuring the length of the fabric with the chain for automatically changing the various stitches described as follows:

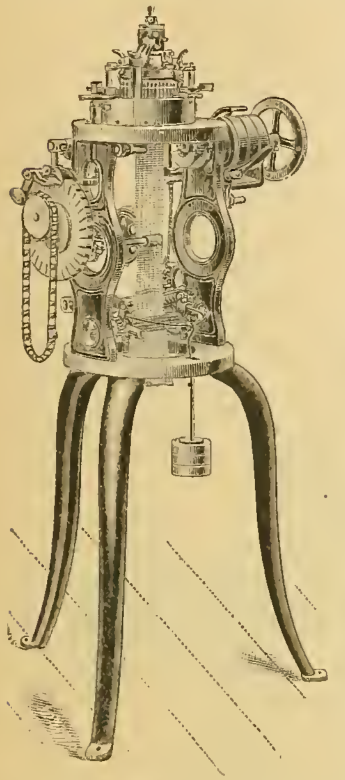


Fig. 1.

A represents a lever which is actuated by a cam on the bottom of the cam ring. This lever moves the pawl B, which in turn revolves the pattern wheel C which is drilled for small pins or studs of various heights for raising or lowering the disk D, which operates upon the slack course, welt and lace levers.

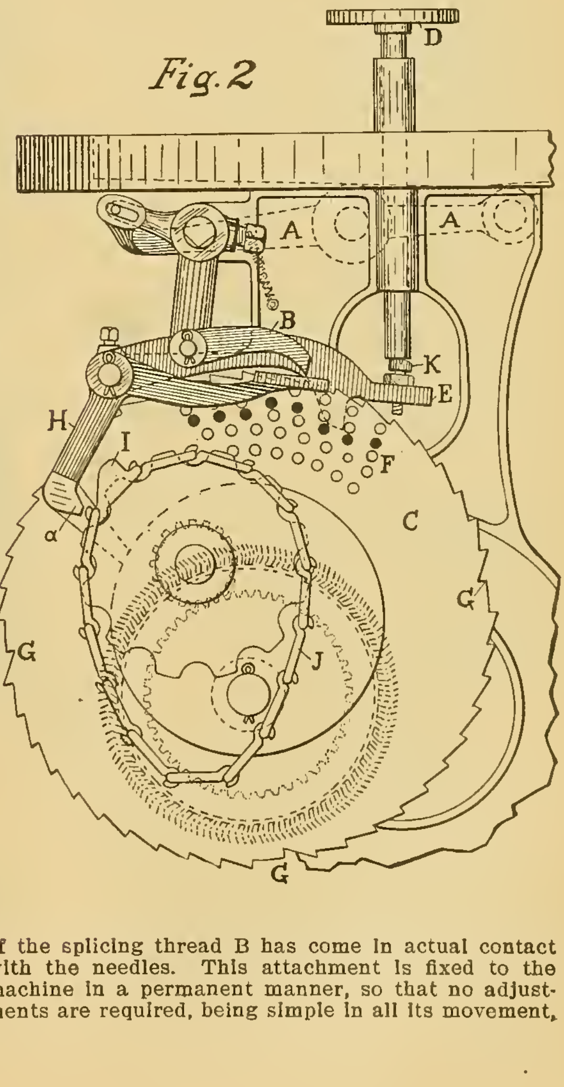
Lever E receives motion from small pins or studs as placed in the holes F, as are found all around the face of disk C, only a portion of these holes being shown in the illustration. By thus placing a pin in either one or the other of these rows, any design of fabric can be made. Thus for "welting," it would be necessary to place the pins sufficiently high to bring the disk D in alignment with the top or welt levers of the machine, the slack course being made on the third row of pins. The pattern wheel C is divided into an equal number of stops by means of a low tooth, which will stop the wheel as each tooth G is brought under the lever B, which is held out of the path of the low tooth by lever H, until such time as a high link I is brought under lever H, at *a*, which permits lever B to engage with the low tooth in the pattern wheel C, and revolving it throughout any of the patterns (position of pins in wheel) that the wheel may be set to. The length of the fabric is measured by the contact of the fabric with a carded wire roller, which transmits its movements to the chain J, through which the length of the pattern is secured by the addition of the various numbers of links.

For making a regular plain hose, one high link I only is required in the chain, whereas in the event of a fancy pattern or high splicing, it will be necessary to use a series of high links, so that the pattern wheel C can be put in operation at any time a change in pattern is necessary.

Lever E is fitted with an adjusting stud K, so that the height of the disk D can be changed to suit the various heights of the automatic levers of the cam ring. The take-up of this machine is of the well known balanced type so long employed on this class of machinery.

The Splicer. Fig. 3 represents the splicing attachment for the high splicing of the knees and heels of the ribbed legs (enlarged compared to Fig. 2). In this illustration, A represents the main knitting thread as being fed to the machine; B, the extra, or splicing thread, which is usually of a much finer count than the main knitting thread. C represents a bracket fitted to the cam ring for carrying the splicing attachment, and D the splicing lever mounted on the thread guide of the knitting machine. E and F represent levers through which the splicing device is operated by coming in contact with a small disk (D in Fig. 2). This splicing attachment is so arranged that the operator can set the machine for half round splicing at the knee and heel or for all round splicing at the knee with half round splicing at the heel, the disk being so constructed, that by the placing of the pins in the pattern wheel, the setting of the machine for any pattern required can be accomplished with little or no trouble. The splicing thread B is fed to the needles by contact or friction with the main knitting thread A, and can be broken out by the spring lever G, at each half turn through the lever I, which is operated by levers E and F. Lever I performs two functions, one of them being to raise the thread breaking lever G through a small projection H, the other to slacken the thread B, in order to enable the main thread A to carry it to the knitting needles, thus avoiding the yarn being drawn directly from the bobbin until such times as the end

Fig. 2



of the splicing thread B has come in actual contact with the needles. This attachment is fixed to the machine in a permanent manner, so that no adjustments are required, being simple in all its movement, requiring absolutely no attention whatever except through the thumb nuts J, which act upon the spring K, thus breaking the thread through the means of a spring at each half revolution.

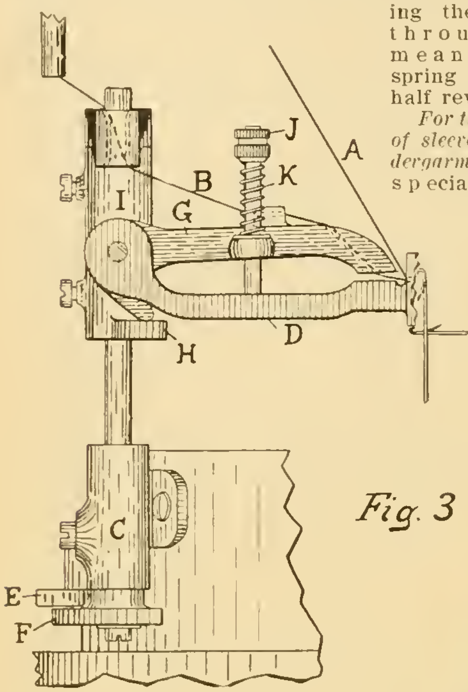


Fig. 3

For the making of sleeves for undergarments, no special attachments are necessary, except that the two feed machine is required so as to enable the machine to make the shape of the sleeve by the automatic tuck stitch attachment.

The striping attachment fitted to this machine for the making of toques, leggings and such is practically a duplication of the splicing attachment as shown in Fig. 3, with the exception that both threads are placed through two levers G, being operated or moved at opposite time, so that as one thread is clamped out, the other is permitted to be fed to the needles.

The production on this machine varies according to the gauge, and the length of the fabric to be knitted. The speed of a machine for the making of ribbed legs should be about 175 revolutions per minute, and the speed for making sleeves without the welt attachment about 220 revolutions per minute. (Scott & Williams, Philadelphia, Pa.)

SCOTT & WILLIAMS' RIB KNITTING MACHINERY

For All Kinds of Underwear, Union Suits and Undervests and Drawers for Men and Women; Sweaters, Tam O'Shanters, etc.

Fig. 1 shows in perspective a regular body machine as built by Scott & Williams, for shaping the garments by what is known as the tuck or royal stitch. This machine is built after the well known type of stationary cylinder and dial, permitting the use of what is known as the balanced take-up, which will be hereafter explained. Fig. 2 shows a side elevation of the machine, giving in detail the automatic mechanism controlled by the knitting of the fabric. Fig. 3 is a sectional view of the sectional cap with its cams for the making of tuck and fancy stitches. Fig. 4 is a plan view of a portion of the cap showing the automatic levers, disk for moving same, and the movable cams, showing the positions of the cams clearing the needles, and the position when tucking on the needles for the making of shaped goods or fancy stitches. Fig. 5 shows a sectional view of the sectional cam ring, with its cylinder, gear ring and bed plate. Fig. 6 shows a side elevation of the section upon which is mounted a complete set of cams for securing the various lengths of loops for the various weights of yarn used.

The general adjustment of a machine of this character is as follows: In order to knit the fabric tighter or slacker, it can be accomplished by two movements, either by depressing or raising the draw down cam C in Fig. 6, or the rais-

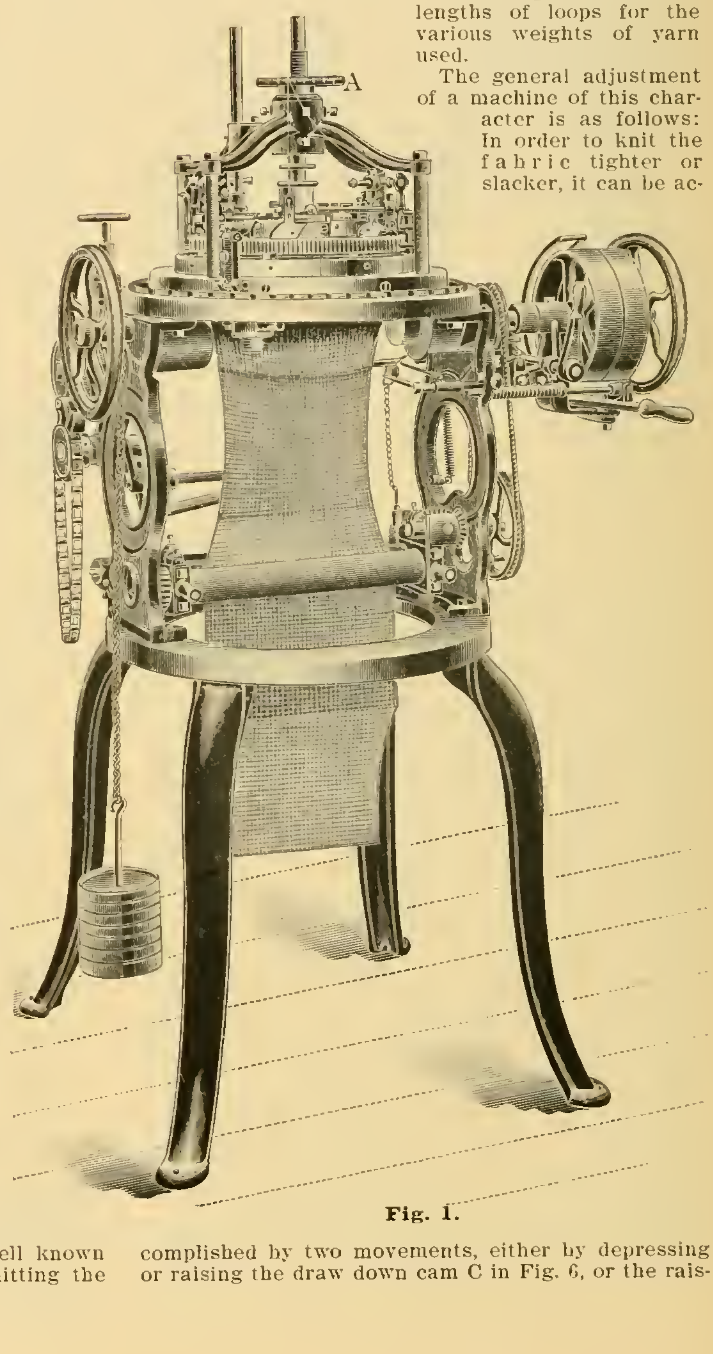


Fig. 1.

ing of the entire spindle B, as shown in said illustration, by the turning of the threaded index wheel A in Fig. 1.

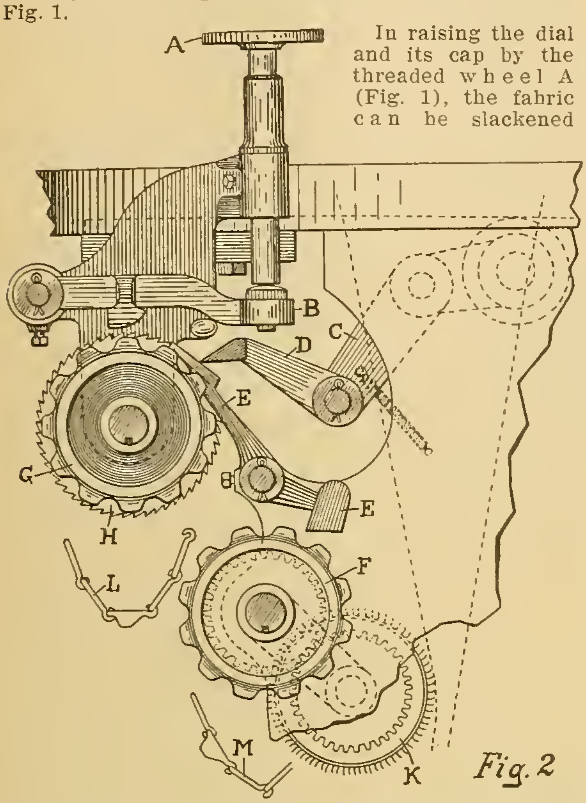


Fig. 2

In raising the dial and its cap by the threaded wheel A (Fig. 1), the fabric can be slackened without disturbing the adjustment of the cam C (see Fig. 6) thus quickly securing any ordinary adjustments that may be required. It is well, however, to see that the dial is not too close to the cylinder so as to permit an easy passage of the fabric, as it is being knit by the needles. If the adjustment required is more than can be conveniently accomplished by the raising or lowering of the dial and its cap, recourse can be had to the adjustment of the the cam C (Fig. 6).

After the adjustments of the various stiffnesses by this cam C it is necessary to ascertain that each one is drawing exactly the same amount of loop, so that the fabric will have a smooth appearance on its face. This can easily be accomplished by marking the yarn a given distance from the needle carrier on each feed. Turn the machine by hand, until the marked places reach the guide, then it will be seen that the cam drawing the longest loop will have the mark much nearer to the guide than the cam drawing the shorter loop. Adjustment thus can be made so accurately that absolutely no difference can exist.

Another important point in this machine is the setting of the cap which operates the dial needles. In a well adjusted machine this should bear a relation to the cam ring which operates the cylinder needles. Care should be taken to see that the cylinder needles draw down in their proper time so that it lands its thread upon the dial needle with the latch open just to the rear of the dial needle rivets. This relation is governed by the circumferential adjustment of the cap of the centre spindle.

The next adjustment to be taken into consideration is the setting of the yarn guide. As this adjustment plays a very important part in the results of the machine, particularly as to menders, the guide should be set sufficiently high to permit the dial needles to pass under without coming in contact with it. The adjustment of the yarn guide should be such as to permit the cylinder needles to close as soon after the guide has passed, as is possible without coming in contact with the guide. The forward end of the yarn guide should be sufficiently long to have the hooks of both sets of needles covered before the latches pass from under the stitch so that it will be impossible for the latches to close before the guide has covered the needles, thus causing drop stitches.

In the event of the machine running off the fabric, through the breaking of the yarn or any other cause, the best thing to do is to introduce the old or previously knit fabric upon the cylinder needles. This is accomplished by placing the fabric underneath the dial with the left hand, and drawing it through between the cylinder and dial by the aid of a needle. The first insertion of the fabric should be done right from one of the sides of cylinder and dial dogs, having it to pass between each, inserting the fabric on the cylinder needles, as close to the edge as possible. A portion of the cylinder needles between each of the feeds is so arranged as to permit the running on of the fabric. After this is accomplished, turn the machine sufficiently far to make another insertion, seeing that the thread guides are re-threaded as each guide comes to the beginning of the running on, repeat this operation until the fabric has been set upon all the cylinder needles, grasp the fabric by hand and place a similar amount of weight upon it, as the machine is turned for each insertion, and the cylinder needles have been fully pressed up, place the other hand on the fabric through the take-up, turn the machine a few revolutions by hand, after which see that all the dial and cylinder latches are open and the machine will be ready for knitting.

The machine is fitted with what is known as a sectional cam ring shown in Fig. 5; A being a sec-

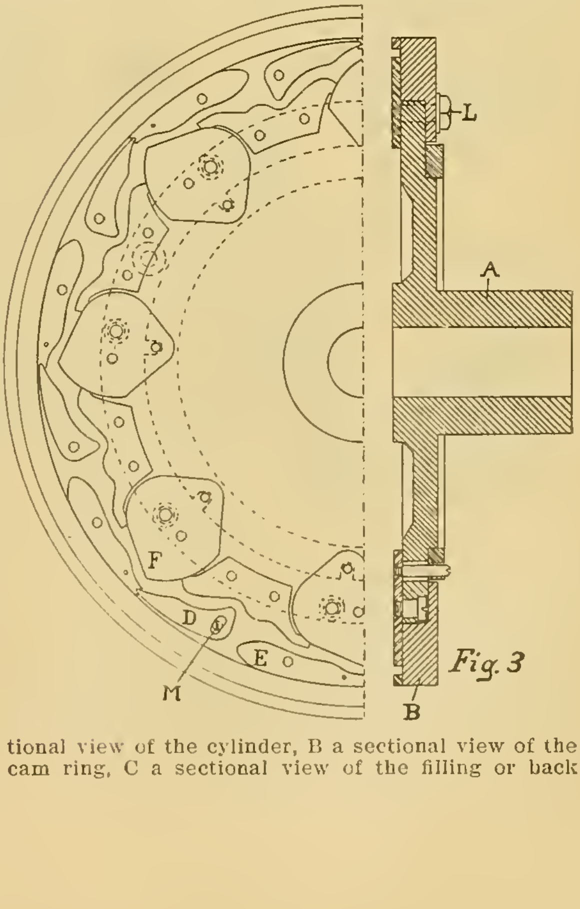


Fig. 3

tional view of the cylinder, B a sectional view of the cam ring, C a sectional view of the filling or back ring, D a sectional view of the gear ring, F the retaining screw for all of these parts, E a sectional view of the bed plate.

In the event of the taking out of a section, unscrew the retaining screw F. Lift out the filling ring C, draw away from the cylinder the cam ring B, and lift it entirely out of the gear ring. This section has the entire set of cams for one feed mounted thereon, as is shown in Fig. 6. With this device it is possible to uncover the entire length of the cylinder, so that any repairs can be easily made.

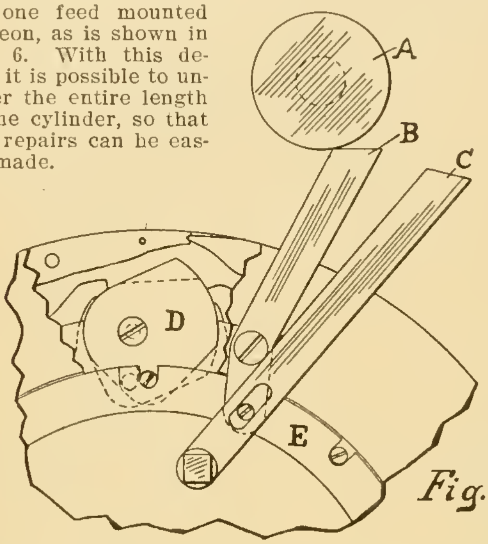


Fig. 4

Fig. 6 shows the adjustment of the draw down cam for the various numbers of stitches. C is the draw down cam, B is the adjusting block upon which the cam is mounted, A the adjusting screw for the various adjustments required.

Fig. 4 is a plan view of the cap, showing one of the automatic tucking cams with the levers and operating disk when changing the levers to the various stitches to be formed. The cam D, shown in this illustration in full lines, is the clearing point, the dotted line is what is known as the tucking point.

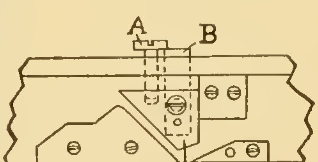


Fig. 6

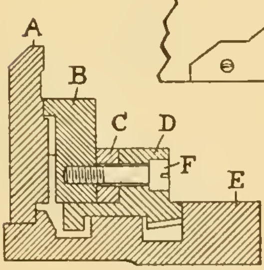


Fig. 5

This cam is controlled by an automatic ring E, which is under control of the levers B and C. The cams are so arranged that by the action of the levers B and C, one or more cams may be automatically placed to a tucking point, thereby forming many of the lace stitches now in use, also the royal stitches for shaping a garment.

Fig. 3 is a plan and sectional view of the cap with the cams mounted thereon. A, being a large hub retaining part of the cams; B, being a removable section upon which are mounted cams D and E. By the taking out of the screw L it is possible to lift the entire outer ring of the cap with their cams mounted thereon clear of the dial, so that any repairs may be made without having to dismantle the machine. The cam D is known as the dial stitch cam, and has an adjusting screw M, for setting this cam to the various lengths that it is desirable to draw. Cam F, the movable or swivel cam, in Fig. 3, was fully explained in connection with details given with reference to Fig. 4.

Fig. 2 is a side elevation of the controlling and measuring mechanisms for the various lengths desired, aud also the various stitches to be formed. A in this illustration represents the disk which acts upon the automatic levers for changing the cams to their various positions. B is the lever upon which the chain L acts with its highest link, thereby causing the disk A to change the automatic levers according to the height that they are set. C is a racking lever which racks the rack wheel H, causing the sprocket wheel G upon which the chain L is mounted, to revolve a portion of a revolution or sufficient to pass under the various heights of links desired to produce the various stitches. E is a balanced lever which throws the racking pawl D, into action at three determined times by the chain M as is mounted on the sprocket wheel F. This chain controls the length of the knitting only, and is driven by actual contact with the fabric through the card wheel or drum K, thus insuring every garment being of a proper length. (Scott & Williams, Philadelphia, Pa.)

BRANSON'S 15/16 AUTOMATIC KNITTING MACHINE.

When a knitting machine is spoken of as being a ¾, ⅞, or $\frac{15}{16}$ automatic machine, as the case may be, by that is meaut that the production of a half hose or stocking is not completed automatically by said machine, but requires more or less attention from the operator to make the different parts of the stocking, and the more attention that is required on the part of the operator, the less automatic the machine is. This construction ($\frac{15}{16}$ automatic) is advantageous in several ways, since the work required by the operator only takes a few seconds to perform, and the construction of the machine is in almost all cases greatly simplified by eliminating parts required to make the machine full automatic. Besides this, the operator's attention is directed more to the machine than in the full automatic, and any bad work is more readily detected with a consequent saving of waste fabric.

In the $\frac{15}{16}$ automatic machine, the operator has to attend to the machine only twice during the complete knitting of the stocking, that is, at the beginning of the toe and at the beginning of the heel, and three times in connection with half hose. The details of the construction and operation of the machine are best given by means of the accompanying illustrations, of which Fig. 1 is a perspective view of this machine, Fig. 2 is a development of the cam cylinder, showing the pickers in the lowered or needle raising position, Fig. 3 is a development of the cams in a portion of the cam cylinder, showing the picker in the raised or normal position and in which position the raised needles are brought down while knitting the last portion of the heel or toe. Fig. 4 is a detail of one of the needle controlling devices and the turret lever controlling it.

Being a knitting machine, only a set of cylinder needles are used, and a set of sinkers for aiding in casting off the stitches from the needles as the latter are lowered, is used in connection with them. The cam cylinder, carrying the cams for operating the needles, has an upright piece, carrying the yarn carrier ring, attached to it, as seen in Fig. 1. The cam cylinder receives a continuous circular motion for the leg and foot portions of the stocking, and a reciprocating circular motion while making the heel and toe. These two motions are successively given to the cam cylinder by means of a clutch arrangement, which throws one motion out at the same time that the other is thrown in. The continuous circular motion is gotten directly through bevel gears from the shaft to which the driving pulley is attached, while the reciprocating motion is obtained from a continuously rotating gear, having a crank arrangement which oscillates a toothed segment back and forth, the latter being in mesh with a gear which is loose upon the shaft, but may be thrown into working engagement by means of the clutch referred to. The clutch is operated by hand, the lever for this purpose being shown just under the main frame piece at the right side of the illustration, being marked A.

One of the main features of the machine is the pattern arrangement, which includes the means for measuring both the length of the stocking and the size of the foot, and an arrangement controlling the making of the heel and toe. This latter arrangement consists of a cam drum which is secured to a ratchet, in fact two ratchets, although one of the ratchets has the major portion of its periphery made smooth or without teeth. The teeth are properly disposed about the circumference and are used to hasten the rotation of the cam drum at certain points. This hastening is obtained by having the pawl, which engages the teeth, oscillate back and forth over the ratchet for every revolution of the cam cylinder, while the pawl which actuates the regular ratchet, only oscillates back and forth once for every five revolutions, and besides this, the teeth on the former ratchet are coarser than those on the regular ratchet. The cam drum consists of a drum with two projections on its periphery and one cut out place in which a lever falls at the proper time. The teeth on the auxiliary ratchet are made to come under the pawl at the same time that the cam drum produces a movement of any levers, the object of this being to have the movement made quickly and more positively than could be obtained with the slow motion of the regular ratchet. The ratchet is only in motion during the knitting of the heel and toe, it being stopped by having a few teeth cut out of its periphery and thus giving the pawl nothing to work on.

Referring to the cam drum again, the first projection on it to act is the one to reverse the position of the pickers on the cam cylinder, at the completion of half of the heel or toe, and thus have the needles brought back into working position, one at a time, as will be explained later. The next projection operates at the completion of the heel and toe, and causes three movements at one time. These movements are to put the needles, which were raised, again into working position by throwing into action the pull down cam for one revolution; to throw the clutch so as to produce continuous circular motion, the levers for this purpose being shown at the front of the machine; and to actuate a scissor arrangement to cut out the extra yarn which is fed while making the heel and toe, this motion being located above the machiue at B. At the same time a lever, working on the cam drum and connected from a shaft to the pawl for operating the ratchet of the measuring chain (at the back of the machine—not shown) falls into the cut out portion on the cam and allows the pawl to engage the ratchet and hence actuate said chain. Also at the same time, the blank space on the regular ratchet of the cam drum is under its pawl which ceases to operate it, and thus only the measuring chain is working. To start the regular ratchet again, which will be when a heel or toe is started again, the handle C extending up from the pawl must be actuated by hand to push the blank space on the ratchet, past the pawl.

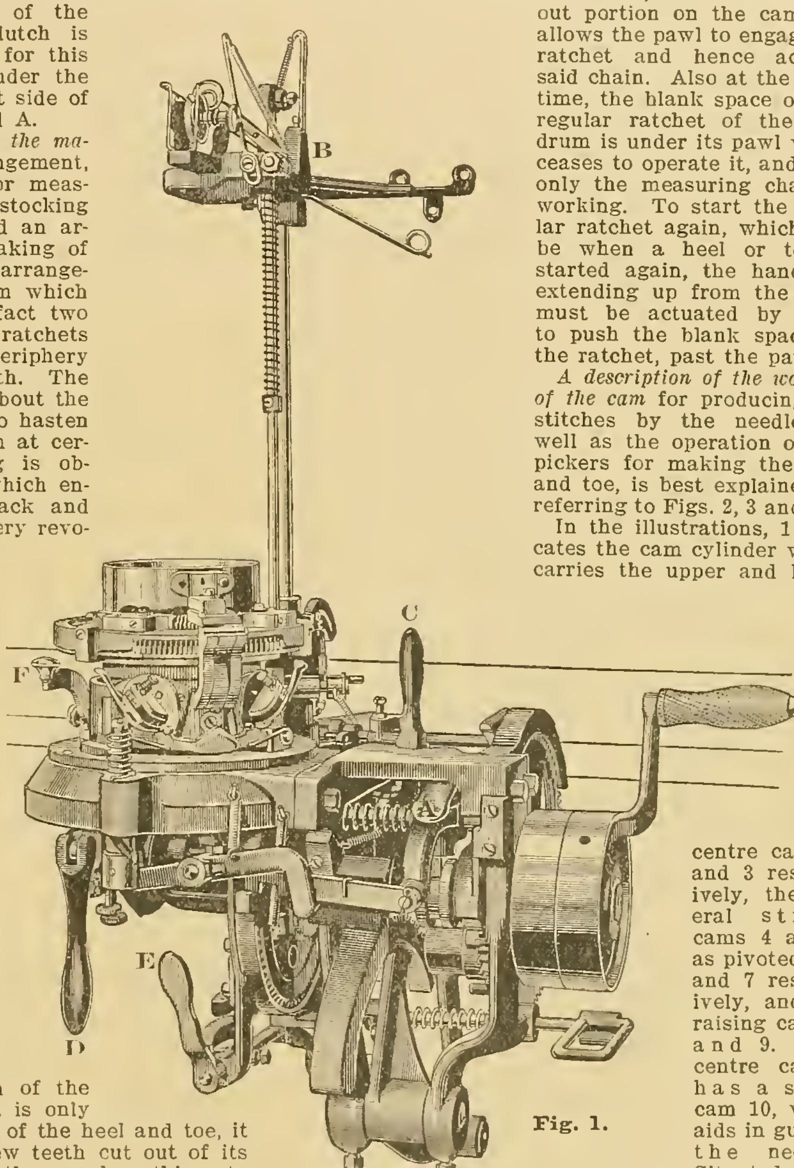


Fig. 1.

A description of the working of the cam for producing the stitches by the needle, as well as the operation of the pickers for making the heel and toe, is best explained by referring to Figs. 2, 3 and 4.

In the illustrations, 1 indicates the cam cylinder which carries the upper and lower centre cams 2 and 3 respectively, the lateral stitch cams 4 and 5 as pivoted at 6 and 7 respectively, and the raising cams 8 and 9. The centre cam 2 has a swivel cam 10, which aids in guiding the needles. Situated also in the cam cylinder are the turrets 11 and 12, for carrying the pickers 13 and 14 respectively, said pickers being secured to pivoted arms which are capable of working in the oblique slots of the turrets, *i. e.* the pickers can be moved up and down along the slots. The position of the pickers shown in Fig. 2 are for raising the needles successively out of action while knitting the first portion of the heel or toe, the turrets 11 and

12 carrying said pickers, being held down against the action of a spring by having projections 15 on the plates 16 of the turrets, caught and held by shoulders 17 on spring actuated turret levers 18, the normal tendency of the turrets being to revolve so that the shoulders 19 on the plates 16, will rest against the pins 20, thus placing said turrets in the positions shown in Fig. 3, *i. e.* the position for returning the raised needles, one at a time, into working position while making the last portion of the heel or toe, and also the position which they occupy while continuous circular knitting is being made.

We will follow the movement of the needles while making three portions of the stocking, that is, the leg portion, the first portion of the heel, and the last portion of the heel. Consider first the regular knitting for the leg with the cam cylinder revolving in the direction of the arrow. The pickers will be in the raised position and out of the path of the needles, as shown in Fig. 3. As the cam cylinder revolves, the resting portion of the cam 8 will act on the needles to keep them stationary until the first part of the stitch cam 4 acts upon them which starts to raise them, the highest point 21 in turn raising them to their highest position, with their hooks open to receive new yarn and the previous loops resting on the needles below the latches. As the cam cylinder continues its motion, the needles strike the swivel cam 10 and push it over against the stitch cam 5, thus providing a guide for the needles to the stitch cam 5, which latter, being pivoted, will be moved by the needles to make the groove between the stitch cam 5 and centre cam 3 sufficiently large for the butts to pass in, the guard cam 22 limiting the movement of the stitch cam 5. The point 23 on the stitch cam will cause the stitch to be cast off of the needle, and then the raising cam 9 will raise the needle to the resting position, with the latch of the needle open and the loop resting on it. The tendency of the stitch cams is to assume the positions shown in the illustrations, which positions will be necessary while making the heel and toe. The action of the cams, as just explained, will continue until the heel is ready to be made, and then the turrets have to be turned a quarter of a revolution to put the pickers 13 and 14 in the lowered position, shown in Fig. 2, said turrets being held by the turret levers 18, as previously explained. The cam cylinder will now make the reciprocating movement, and one-half of the needles around the cylinder will have to be raised and remain out of working position during the entire knitting of the heel.

For the sake of a starting point, we will suppose that the reciprocating movement of the cam cylinder is in the direction of the arrow, then as the motion continues, the first part of the stitch cam will come in contact with a needle and raise it until the cut out portion on the left side of the picker 13 comes in contact with the butt of the needle, said cut out portion only being large enough to hold one needle, and as the motion of the cam cylinder continues, the picker has to give way by being carried upwardly in the line of the slot and also has a turning motion about its axis, which places said needle in a position to be acted upon by the top side of the cam 2 and thus place it out of working position. The remainder of the needles follow the regular path, as explained for the regular knitting, since the picker, when it descends after being liberated from the needle, rests on top of the butts of the needles and does not affect their movement. On the backward reciprocation of the cam cylinder, the picker 14 raises a needle out of action in the same manner as the first picker did, the remaining needles following the regular path. This motion continues until the first portion of the heel is made, then the turrets are automatically released by having the turret levers 18 depressed, said turrets being actuated by springs to assume the raised position shown in Fig. 3. Now the needles which were taken up by the picker 13 will be brought down one at a time, by picker 14, and vice versa those needles raised by picker 14 will be brought down by picker 13. The cam cylinder, in moving in the direction of the arrow, will cause the picker 13 to come against the butt of a raised needle on the right hand side and lower it, in turn springing back to its normal position, the needle of course then being the first to receive yarn from the carrier. When the backward reciprocation of the cam cylinder takes place, the picker 14 will bring down a needle, and this motion will continue until all of the needles are down again which had been raised. The half of the needles which were raised at the beginning of the heel are now automatically lowered at the same time that the continuous circular motion is given to the cam cylinder, the extra yarn used in the heel being also cut out at this time. The same action of the cams and pickers takes place when knitting the toe, which explanation need not be repeated here.

The practical operation of the machine is as follows: The needle cylinder is secured in the machine by

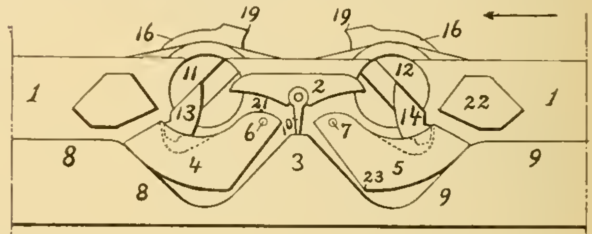


Fig. 2

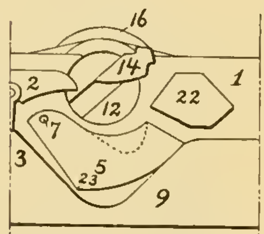


Fig. 3

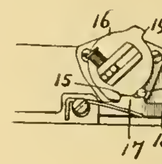


Fig. 4

means of the lever handle D, shown at the left hand side of Fig. 1, which operates the clamping ring to hold the cylinder. The half of the needles which are up are then brought into working position by the pull down cam, and the machine is started by shifting the belt to the fast pulley, this being done by the handle E. The measuring motion, *i. e.* measuring chain, is in motion while the ratchet on the cam drum is idle. This continues until a high link on the chain comes under a lever and raises it, by which the machine is stopped, which means that the leg portion of the stocking or half hose, as the case may be, is completed and the heel is now ready to be made. The stocking is shaped at the ankle by links on the same chain, but working another lever. The operator now raises one-half of the needles out of working position by pressing down on lever F. This lever is connected to the needle lifting ring of the cam cylinder, and consequently when it is operated, the needles resting on it are raised, said ring being immediately lowered by a spring. The lever handle C, as connected to the pawl for operating the regular ratchet on the cam, is then pulled to get the blank space on said ratchet from under the pawl, so that the latter may operate, and at the same time the pawl for operating the ratchet on the measuring motion is raised out of contact with it, so that only the cam is in motion during the knitting of the heel.

The pickers are then turned down by hand and caught under the levers mentioned, in which position they will raise a needle out of action for every oscillation of the cam cylinder. The extra yarn is pieced in with the regular yarn.

The operator then throws the clutch for producing the reciprocating motion by means of lever A at the same time that she operates the lever E to start the machine. This work requires only a short time and the machine now continues to knit, raising the needle out of action at every reciprocation until the first portion of the heel is made, and then a projection on the cam actuates the turret levers 18 which hold the turrets 11 and 12 down and thus releases them, putting the picks 13 and 14 in position for drawing the needles successively down into working position. At the completion of the heel, the clutch is moved automatically to produce continuous circular motion and at the same time the extra thread is cut out, and the other half of the needles lowered by a pull down cam; the motion of the cam drum is stopped and the rotation of the measuring chain begun. The foot portion of the stocking is now made and on its completion the machine automatically stops. The size of the foot portion can of course be made any length by simply building the chain to suit the requirements. The same operations are now gone through with for the toe, as explained for the heel, it being kept in mind that the heel and toe are made with the cam drum working, while the leg and foot of the stocking are made with the measuring chain working. (Branson Machine Co., Philadelphia, Pa.)

BRANSON'S AUTOMATIC SHIRT MACHINE THREE COLOR STRIPER.

This arrangement is used to produce different colored horizontal stripes in fabrics such as sweaters, bathing suits, skating caps, hosiery, etc., and is attached either to machines of large (shirt) or smaller (stocking) diameter. These knitting machines have the regular set of cylinder needles, but sinkers are not used in connection with them, but instead, the needle cylinder grooves for the needles are so made at the top as to aid in casting off the stitches when the needles go down, a positive take-up motion for the fabric being used to keep the proper tension on the work. The regular cam is used on the cam cylinder, which causes the needles to raise successively to open their latches and slide the loop below them, so as to receive new yarn and then descend below the top of the needle cylinder to cast off the stitches, after which the needles are raised slightly to a resting position, with the loops of yarn resting on the latches, to prevent them from flying about on their pivots and frequently causing stitches to be lost.

The striping arrangement, as attached to the machine, is characterized by its simplicity and positive working, and by its almost unlimited range of patterns which it is capable of producing. It consists principally of two motions, *i. e.* the yarn carrier motion which is attached to the side of the revolving cam cylinder, and the pattern motion to actuate the yarn carrier motion, and which is located on the body portion of the machine.

The details of these two motions, as well as their operation, are best shown by means of the accompanying illustrations, of which Fig. 1 is a side view of the pattern motion, Fig. 2 being a top view of the movable slide and cam, and Fig. 3 is a side view of the yarn carrier motion.

The operation consists in lowering the different yarn carriers of the latter motion into the path of the raised needles, so that the yarn may be caught by them, said carriers being lowered according to the pattern desired, only one carrier being in the lowered position at one time. The yarn carrier arrangement is attached to the cam cylinder, directly in the radial plane from the centre of the cylinder with the highest point of the raising cam, which of course is necessary in order for the yarn to be deposited in the hooks of the needles.

Referring to Fig. 1 for the pattern motion, 1 indicates the sprocket for carrying the pattern chain 2, said sprocket having secured to its shaft 3, a ratchet 4, the teeth of which are wide enough to accommodate two pawls 5 and 6. The object in having two pawls is to allow a measuring chain 7 on the sprocket 8 to be used in connection with the regular color pattern chain, said sprocket 8 being on the same shaft 9 with the measuring fabric roll and hence is driven continuously. Both pawls 5 and 6 are connected to ends of springs 10 and 11 respectively (only one of which can be shown in Fig. 1, one being situated behind the other), the other ends being attached to a part of the framing of the machine, so that the tendency of the pawls is to have their ends in contact with the ratchet 4. Near the lower end of the pawl 6 is a pin 12, against which presses one end of the pivoted lever 13, said lever being pivoted on the shaft 3, and having its other end connected to a vertical lever 14, the top end of which is connected to a horizontal lever 15 as pivoted at 16, the other end of said lever resting above the measuring chain 7. The normal position of the levers will

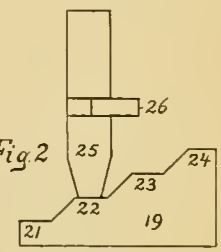


Fig. 2

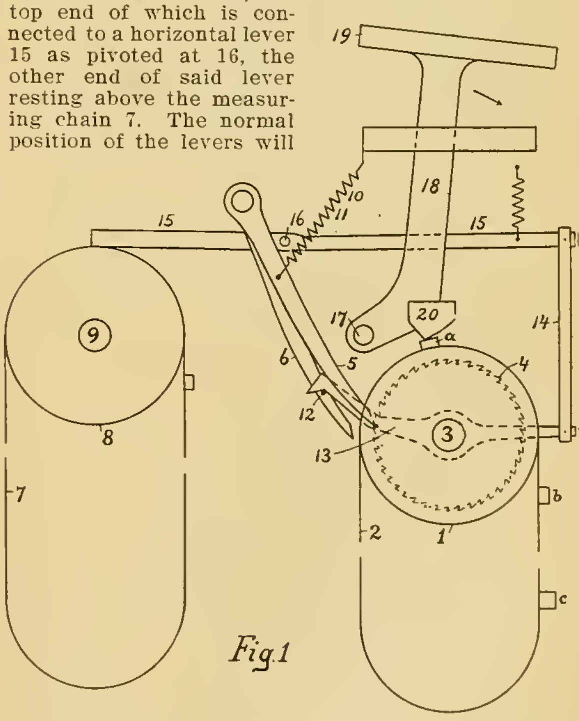


Fig. 1

cause the lever 13 to press the pawl 6 out of contact with the ratchet 4.

Pivoted at 17 on the machine is an upright lever 18 which carries the actuating cam 19 for the yarn carriers, at its top end, the lower end being provided with a piece 20 which is acted upon by the high links of the color pattern chain 2 to actuate the cam 19 at the top. This lever 18 is spring controlled and its normal tendency is to move in the direction of the arrow. The shape of the cam 19 is shown in the top view (Fig. 2) from which it is seen that it is made up of a series of steps 21, 22, 23, and 24 which press against the movable slide 25, according to the links on the pattern chain 2. This movable slide is located on the bed plate of the machine and has a slanting projection 26 on it, which comes under the different vertical pieces 27, 28 and 29 (see Fig. 3) when actuated by the cam 19. These three pieces are carried in a frame 30, which is secured by screws to the side of the cam cylinder, and have attached to their upper ends, the rear ends of the yarn carriers 31, 32 and 33 respectively, the latter being pivoted at 34 with their front ends, made circular with holes 35, 36 and 37 respectively, running through them for guiding the different yarns to the needles. The vertical pieces 27, 28 and 29 have springs attached to them on the rear sides (not shown) the other ends of which are fastened to the lower portion of the pieces 30, and thus they tend always to keep said vertical pieces in their lowest position, or in other words, the yarn carrier guides 35, 36 and 37 above the needles of the cylinder. However, the vertical pieces 27, 28 and 29 are provided with pins 38, 39 and 40 respectively, which, when the vertical pieces are successively raised, are pushed up above a spring controlled plate 41 and rest on its top edge, thus being prevented from falling until the plate 41 is moved outwardly by another pin coming up. When the plate 41 does move out for an instant, the pin which was resting on it is freed and thus allows the spring controlling the vertical piece (either 27, 28 or 29 as the case may be) to drop it down, and hence only one vertical piece is up at one time, or only one guide is down in the path of the needles.

These vertical pieces are raised as they revolve with the cam cylinder by having the projection 26 on the slide 25 come in their paths, said slide, as previously mentioned, being actuated by the cam 19. Three different heights of links on the pattern chain (see *a*, *b* and *c* respectively) are used for the three different colors of yarn. When the step 21 of the cam 19 is in contact with the slide, the projection 26 is said to occupy a "neutral" point as seen in Fig. 3. Step 22 will cause the projection 26 to raise the vertical piece 27 which controls the middle yarn guide 35. Step 23 will cause the projection 26 to raise the vertical piece 28, which controls the yarn guide 36, which is the one in front of the other two, and step 24 will cause the projection 26 to raise the vertical piece 29 which controls the back yarn guide 37. A common link on the chain 2 allows the slide 25 to assume the "neutral" position and the successively higher links put the slide successively under the vertical pieces 27, 28 and 29. The projection 26 is not required to remain under the vertical piece after once raising it, since the latter is supported by means of its pin resting on the edge of the plate 41, and hence only one special link in the chain is required to make a change, the length of fabric knitted by this yarn being governed by the number of common links following the high link, until another size of high link is put in the chain for another color. This of course simplifies building the chain and it is not necessary to keep a large stock of special links on hand.

The pawl 5 is actuated to drive the ratchet 4 so that a link on the chain 2 will come under the piece 20 for every revolution of the cam cylinder and hence one course of one color may be inserted to produce a pin stripe. The number of courses may be increased by simply adding common links after the high link. When large stripes are to be produced or where it is desired to knit the body of the fabric in one color and have a special border, the measuring chain 7 is used in connection with the pattern chain. The measuring chain is always working and when it is desired to make a large stripe a special link with a side projection is put in the pattern chain 2, which, when it comes around, presses the pawl 5 out of contact with the ratchet 4, and hence stops its motion, said ratchet remaining stationary until a high link on the measuring chain 7 comes under the horizontal lever 15, which through the series of levers explained, raises

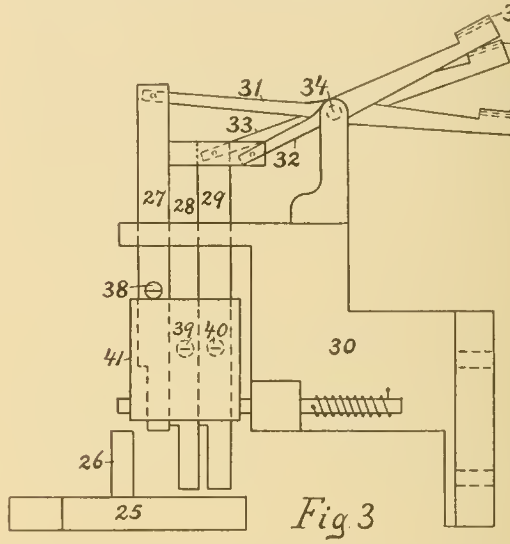


Fig 3

the arm 13 off of the pin 12 and allows the spring 11 to pull the pawl 6 into contact with the ratchet 4 which starts the latter, thus taking the projection on the chain from under the pawl 5 and allowing it to again engage the ratchet 4. The pawl 6 is thrown out of contact as soon as the link on the chain 7 passes from under the lever 15. When the changes of color are made in the fabric, the yarn is not cut out but simply hangs and is knitted in again when called for, and the loose yarn afterwards has to be trimmed off of the fabric. (Branson Knitting Machine Co., Philadelphia, Pa.)

THE WILDMAN MFG. CO.'S CHAINLESS MEASURING DEVICE.

In this device a pattern wheel or disk takes the place of the pattern chain as used in connection with other automatic knitting machines for producing variations in the pattern of the knit fabric and to which pattern chain an uninterrupted motion is imparted, requiring in turn a long pattern chain. In the Wildman Mfg. Co.'s measuring device, the use of this long pattern chain is overcome, by providing means whereby the pattern wheel or disk may be permitted to remain in a state of rest while no change is to be made in the pattern of the fabric knitted, consequently permitting the use of a small pattern wheel. The same as in machines as using pattern chains, the actuation of the pattern wheel is automatically controlled by the fabric itself.

The device is furnished with a series of plates, representing a measuring value of either 1, 2 or 3 inches, and when consequently the adding or taking away of one of these plates will correspondingly either lengthen or shorten the pattern.

To enable the operator to obtain as fine a measurement as $\frac{1}{32}$ of an inch, either way, the measuring wheel is graduated, the wheel is also grooved its entire circumference, in which are sliding plates, which are arranged to slide backwards or forwards, to lengthen or shorten the pattern to any fraction of an inch. There is also another slotted plate arranged in the device to regulate the amount of courses that may be required between the welt and slack course, this plate, by its movement, putting in one or more courses or taking out one or more.

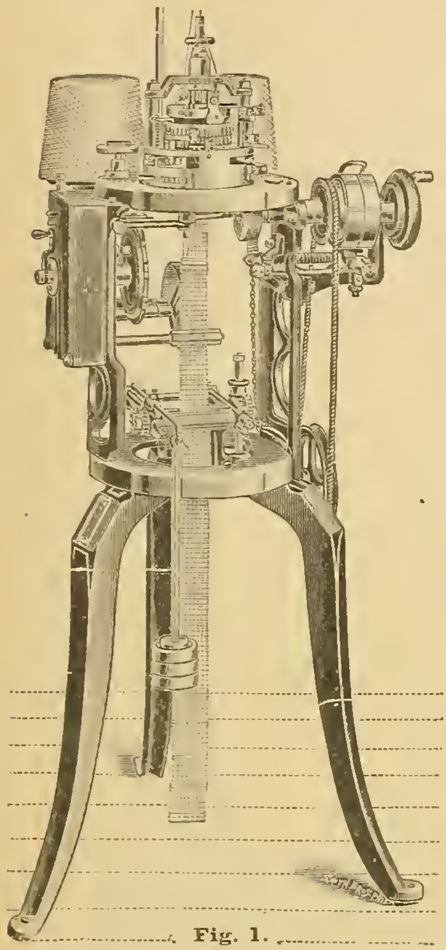


Fig. 1.

Means are also provided for enabling the pattern wheel and the mechanism for operating and controlling it, to be instantly brought to any determined point, as for example into position to commence the making of the pattern.

Of the accompanying illustrations, Fig. 1 is a perspective view of a Wildman Mfg. Co.'s Knitting Machine, showing the measuring device (enclosed in its casing) applied thereto. Fig. 2 is a side elevation of the machine, with parts in section and broken away. Fig. 3 is a face view of the pattern wheel and lever. Fig. 4 is a front view of the enclosing casing of the pattern wheel operating devices. Fig. 5 is an enlarged view of the pattern wheel operating devices as shown in Fig. 2.

A is the framework, and B the head of the machine, in which the movable cams are operated through levers *a*, *b*, actuated by disks S, N, on a shaft *s*, which is raised and lowered by a lever S', controlled by the pattern wheel. The raising or lowering of the shaft *s* changes the positions of the parts S, N, so as to make them actuate the levers *a*, *b*.

C is the take-up for taking up the cloth as it is knitted in the head B, said take-up being operated through a belt or rope from the driving shaft of the machine, as clearly seen from consulting Fig. 1. D is a pattern wheel mounted on a shaft *d* in bearings on the frame A below the base plate A'. This pattern wheel consists of a disk having its periphery provided with projections *d'*, similar to those used in connection with knitting machines, using pattern chains in place of the wheel. The pattern wheel has attached to its outer edge the segments *d'*, which form the operative projections, as shown in detail in Fig. 3. By making these segments detachable they may be easily removed and replaced by others to change the character of the pattern wheel D. E and F are two disks (shown as ratchet wheels), of which the former is the pattern wheel operating the disk or ratchet and the latter is the disk or ratchet for controlling the pattern wheel operating disk or ratchet E. The disk E is carried by the shaft *d* and is provided with ratchet teeth. The disk F, which is of slightly smaller diameter than the disk E, is loosely journaled on the shaft *d* adjacent to the ratchet E, and is also provided with ratchet teeth.

H is a pawl adapted to engage the teeth of both the ratchets E and F. It is pivoted to a slide H' in guides *h* on the frame A of the machine, below the base plate A'. The slide H' is reciprocated by a horizontal lever H^2, pivoted at h^2, below the base plate A', and acting at one end upon the end of the slide H' and at its other end H^3 upon an annular cam H^4, carried by the rotary base plate B' of the knitting head. A spring H^5, between the slide H' and the framework of the machine, returns the slide and maintains the end of the lever H^2 in contact with the cam H^4.

The ratchets E and F are so constructed and operated that the ratchet E will move faster than the ratchet F. The ratchet E is provided with alternate deep and shallow teeth *e'*, e^2, so disposed with reference to the teeth of the ratchet F that when the pawl H engages a deep tooth *e'*, it will also engage a tooth of the ratchet F and will move both ratchets, but when it engages a shallow tooth e^2 it will

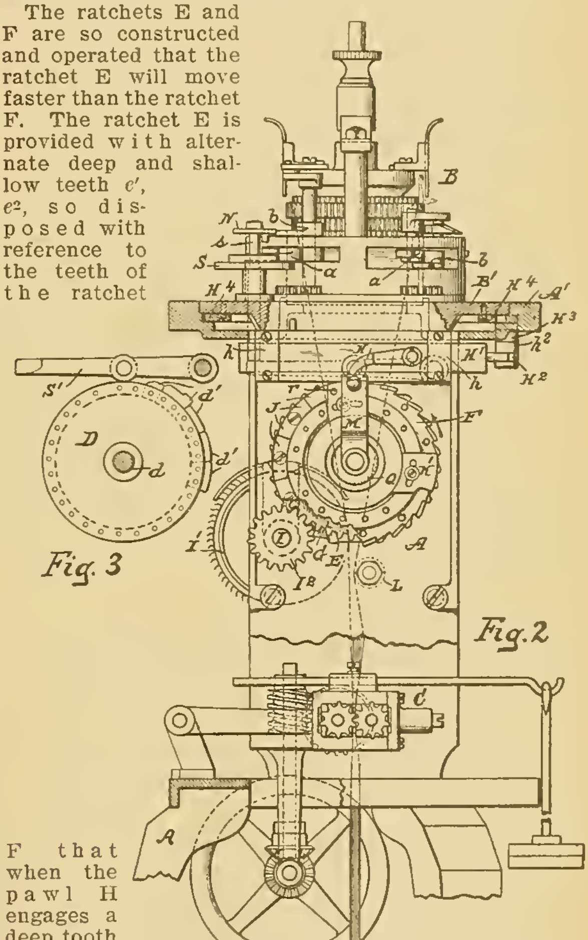


Fig. 3 *Fig. 2*

not engage the tooth of the ratchet F, and consequently will move the ratchet E only. The pawl H therefore moves the ratchet E twice as fast as it moves the ratchet F. G is a gear wheel, journaled on the shaft *d*, between the fast ratchet E and the loose ratchet F, to the latter of which it is secured so as to rotate therewith.

I′ is a wheel provided with pins or teeth carried by the shaft I, and is adapted to make contact with the cloth as it passes from the knitting head to the take-up. (See dotted lines in Fig. 2.) I^2 is a pinion on the shaft I, engaging the gear wheel G, which is loose on the shaft *d*. As the cloth is knitted and is drawn down by the take-up C, it will rotate the wheel I′ and shaft I, from which, through the pinion I^2 and gear wheel G, the ratchet F will be rotated on the shaft *d*.

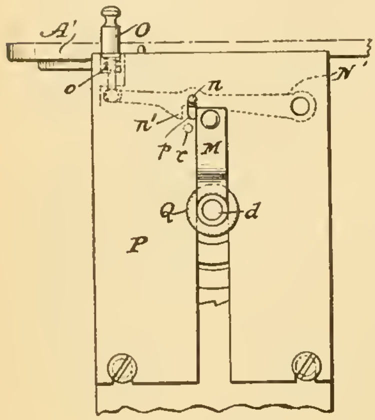


Fig. 4

J is a series of segments, of which one or more may be used, attached to the ratchet F adjacent to the edge, so that their outer faces will be level with the teeth. The pawl H is sufficiently broad that it will make contact with the faces of the segments J, thus preventing it from engaging the teeth of the ratchet F, and consequently while that portion of the ratchet F which is provided with the segments J is under the pawl H, it will not be operated thereby. K is an adjustable segment similar to the segments J, except that it is secured to the ratchet F with provision for circumferential adjustment. The segment K is secured to the ratchet F by a set screw *k*, passing through a curved slot *k*′ in the segment, and engaging a threaded socket k^2 in the face of the ratchet F. The segment K is also provided with a flange, engaging an annular groove 1 in the face of the ratchet. By adjusting the segment K it may be made to overlap the last of the segments J to a greater or less extent. K′ is a similar segment, and of which there may be more than two used, if so required, said segments being adjusted apart from each other, as the pattern may require. The ratchet E is provided at one or more points with places where the short ratchet teeth are cut away, as at *e* (see Fig. 5), so as to present short spaces devoid of shallow teeth, and these spaces *e* are notched.

The operation of the pattern mechanism so far as the same has been described is thus: Supposing the parts at starting to be in the positions shown in Fig. 5, with the pawl H resting on the surface of the segment K and upon the flat portion *e* of the ratchet E above the notch therein, the reciprocation of the pawl H will produce no movement in either ratchet F or E, and, not driving the ratchet E, will not rotate the shaft *d* and pattern wheel D, which therefore will remain at rest, with the lever S′, shaft *s*, and disks S, N, in such positions as may be determined by the portion of the pattern wheel which is acting on the lever S′. As the cloth is knitted, and travels down, it acts on the card wheel I′ and rotates the shaft I and through the pinions I^2 and gear wheel G drives the ratchet F. When the segment K passes from under the pawl H, it permits it to drop into engagement with both the notch of the ratchet E, and the teeth of the ratchet F. The pawl H thus continues to rotate both the ratchets E and F, moving the former with every reciprocation and the latter with alternate reciprocations, and turns the pattern wheel until the segment K′ on the ratchet F passes under the pawl and holds it out of engagement with the teeth of the ratchet F, but without disengaging it from the ratchet E, which it continues to rotate, together with the pattern wheel D, until the part *e* comes adjacent to the segment K′. The pawl now ceases to drive the ratchet E and pattern wheel D until the segment K′, which has been moving slowly with the ratchet F under the action of the wheel I′, passes from under the pawl and allows it to drop into engagement with the notch and the teeth of the ratchet E, when it will continue to rotate both ratchets until the first of the segments J passes under it. The segments J now lift the pawl from engagement with ratchet F. Meanwhile the ratchet E and pattern wheel are driven by the pawl H until the portion *e* of the ratchet E is reached, when the rotation of the ratchet E and the pattern wheel D ceases and the ratchet F rotates slowly under the action of the wheel I′ until the segments J and K pass from under the pawl H and allow it to drop into engagement with the notch *e*′, and when the operations described are repeated.

In the construction shown, the segments and pattern wheel are so arranged that the needles will first knit one or more plain courses, will then form a rib, and while the segment K′ is passing, will form a series of plain courses, and finally, while the segments J are passing, will make a long series of tuck courses. This arrangement is for a knitted sleeve

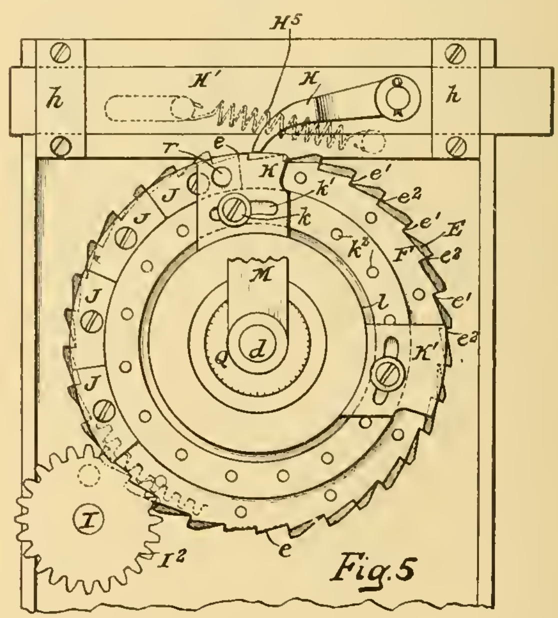


Fig. 5

and cuff, but for other patterns, the parts J, K, K′, may be differently arranged to control the pattern wheel in any way that may be desired, as to make tucks, loose courses, etc.

The segment K′, or both the segments K′ and K may be omitted when the pattern does not require it.

To insure a uniform operation of the wheel I′ by the cloth, a guide L, extending transversely adjacent to the periphery of the wheel I′ is provided. The pattern wheel D and ratchet E are so located with reference to the handle M that they will be at the starting point of the pattern when the handle is turned into the upright position.

O is a push pin extending through the casing P, which encloses the ratchet mechanism, and is connected with the free end of the lever N′. A spring *o* normally holds the parts raised. By depressing the push pin O, the stop *n* will be brought in position to arrest the indicator handle M, and thus stop the pattern wheel D and ratchet E at the starting point. The stop *n* is shown projecting through a slot *p* in the casing P.

To provide for the adjustment of the ratchet F, its hub is extended and provided with a knurled handle Q, by means of which the ratchet may be turned on the shaft *d*. A stop *r* is carried by the segment K and is adapted to strike a projection or lug *n*′ on the lever N′ when the same is lowered. The ratchet F is turned on the shaft *d* until the stop *r* strikes the lug *n*′, and the ratchet is then at the starting point of the pattern. (Wildman Mfg. Co., Norristown, Pa.)

THE WILDMAN MFG. CO.'S SPLICING MECHANISM.

The purpose of splicing, as already before mentioned in connection with the Scott & Williams as well as the Brinton machines, in connection with knitting is to introduce at desired intervals an extra thread, known as a splicing thread, to the regular thread, in order to thus strengthen, *i. e.* re-inforce the knit fabric at such places where said splicing thread is knitted into the fabric.

The object of the Wildman splicer is to provide an arrangement by which the loose end of the splicing thread will never be shorter than a length determined upon, as necessary to insure the splicing thread being engaged and carried into the fabric by the main thread when the latter is moved to contact therewith, *i. e.* to have the splicing thread when broken out of the fabric provided with a loose end, which will reach from the clamp at least to a predetermined point toward the needles, which is sufficient to insure contact with the main thread when the latter is moved to engage and carry it to the needles. This feature is accomplished by the action of the cylinder needles forming the loop, which puts greater strain on the thread, at this point, than there is brought to bear at any other point between the clamp and the place where the cylinder needles are drawing the loop. To retain this long end on the splicing thread, insuring it not being worn off by the action of the main thread, the latter is carried out of contact with the splicing thread; therefore insuring certain feeding of the splicing thread, when the clamp is released and the main thread carried in contact with the splicing thread. The parts of the new attachment are also arranged to facilitate threading of the attachment when the thread has been absent. The device is entirely independent of the thread guide, which may be adjusted in precisely the same way as if the machine had no splicer. The latter may be removed by taking out two screws, which will not affect any of the machine adjustments; and when replaced on the machine again, no adjustment is needed, as the parts are made to fit and ready to work. One important advantage in connection with this splicer is that the operator can see the relative position of the thread carrier and the needles as easily with the splicing attachment in place as without it.

Fig. 1 is a front view of the attachment. Fig. 2 is a side view showing it in relation to the cap plate of the knitting head to which it is secured and to the needles. Fig. 3 is a view similar to Fig. 2 with parts omitted and other parts in section, the parts being however shown in a different position.

The attachment is secured by a bracket *a*, secured to the cap *b* to the knitting head. The bracket *a* has screwed thereto the thread guide *c*, provided with the eye *d*, which directs the thread to the needles. Upon the bracket *a*. and to one side of the arm of the thread guide *c*, a supplemental bracket *e* is screwed, which has attached thereto a pair of guide rods *f*, extending parallel with each other, and held together at their outer ends by a plate *g*, secured thereto by screws. Upon these rods, a block *h* is adapted to slide freely, being operated by a rod *i*, and which effects the throwing in or out of the splicing thread.

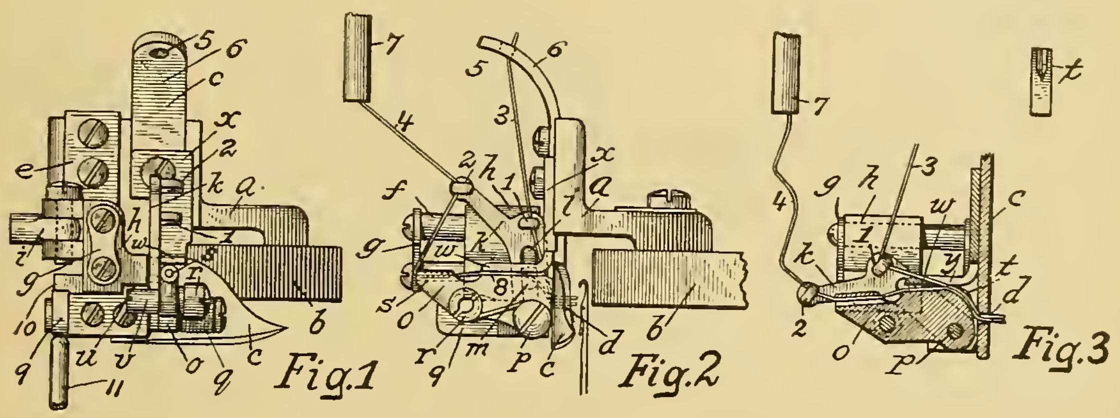


Fig.1 Fig.2 Fig.3

A sweep arm *k* is pivoted to the lower part of the supplemental bracket *e*, and a slot *l* therein receives the elongated head *m* of a pin, journaled in the block, so that as the block moves outwardly, the sweep arm will be swung downwardly from the position shown in Fig. 2 to that shown in Fig. 3, and a reverse movement of the block will return the sweep arm to the elevated position shown in Fig. 2. The sweep arm carries guide eyes 1 and 2 for the main and splicing threads 3 and 4 respectively. A movable guide and clamping arm *o* for the splicing thread 4, is pivoted upon the same pin *p* which pivotally holds the sweep arm *k*, said clamping arm being under tension of a spring *q*, which is coiled around the pin *p* and has its free end engaging a pin *r* on the clamping arm to press the same upwardly. This clamping arm is provided with a guide opening *s* for the splicing thread and at its inner end with a curved V-shaped channel *t*, presenting a rounded path or surface adjacent to the main yarn guide eye *d*, and over which the splicing thread passes to be supported at all times thereon. The clamping arm is moved downwardly to release the splicing thread when splicing is to be done by a cam surface *u* on the block *h*, which engages the extension *v* of the pin *r*, carried by the clamping arm, and forces the same downwardly when the block moves outwardly.

Immediately above the clamping arm, a clamping foot *w* is arranged in fixed position to co-operate with the movable clamping arm to clamp and hold the splicing thread when plain or single knitting is to be done. The upwardly extending arm *x* of the clamping foot is screwed to the arm of the thread guide *c*. This foot is slotted at *y* for the passage of the main thread 3, which passes first through the eye 5 of the guide arm 6, which is formed of an extension of the thread guide *c*, thence through the eye 1 of the sweep arm, then through the slotted clamping foot and the V-shaped groove or channel *t* in the clamping arm, and finally through the thread eye *d* to the needles. The splicing thread 4 passes from the guide tube 7 laterally at an inclination to the guide eye 2 of the sweep *k*, and from this point passes through the channel *s* of the clamping arm, and thence between the clamping face or edge 8 of the clamping arm and the clamping foot, and from here it is deflected out of its straight course and extends downwardly over the curved surface of the channel *t*, lying closely against the bottom of the V-shaped groove. From the groove the splicing thread passes through the thread guide or eye *d* to the needles, it lying just below the main yarn.

Fig. 2 represents the positions of the parts when only the main thread 3 is passing to the fabric, the splicing thread 4 being broken and held by the clamping parts, with a stationary loose end supported on the curved surface or groove. It will be noticed that the loose end of the splicing thread extends over a curved surface between the clamping parts and the needles, and thus, as mentioned at the beginning, insures a loose end being left when the splicing thread is broken out, by the pull at the needles, sufficiently long to be caught and carried into the fabric when the main thread 3 is moved so as to contact therewith.

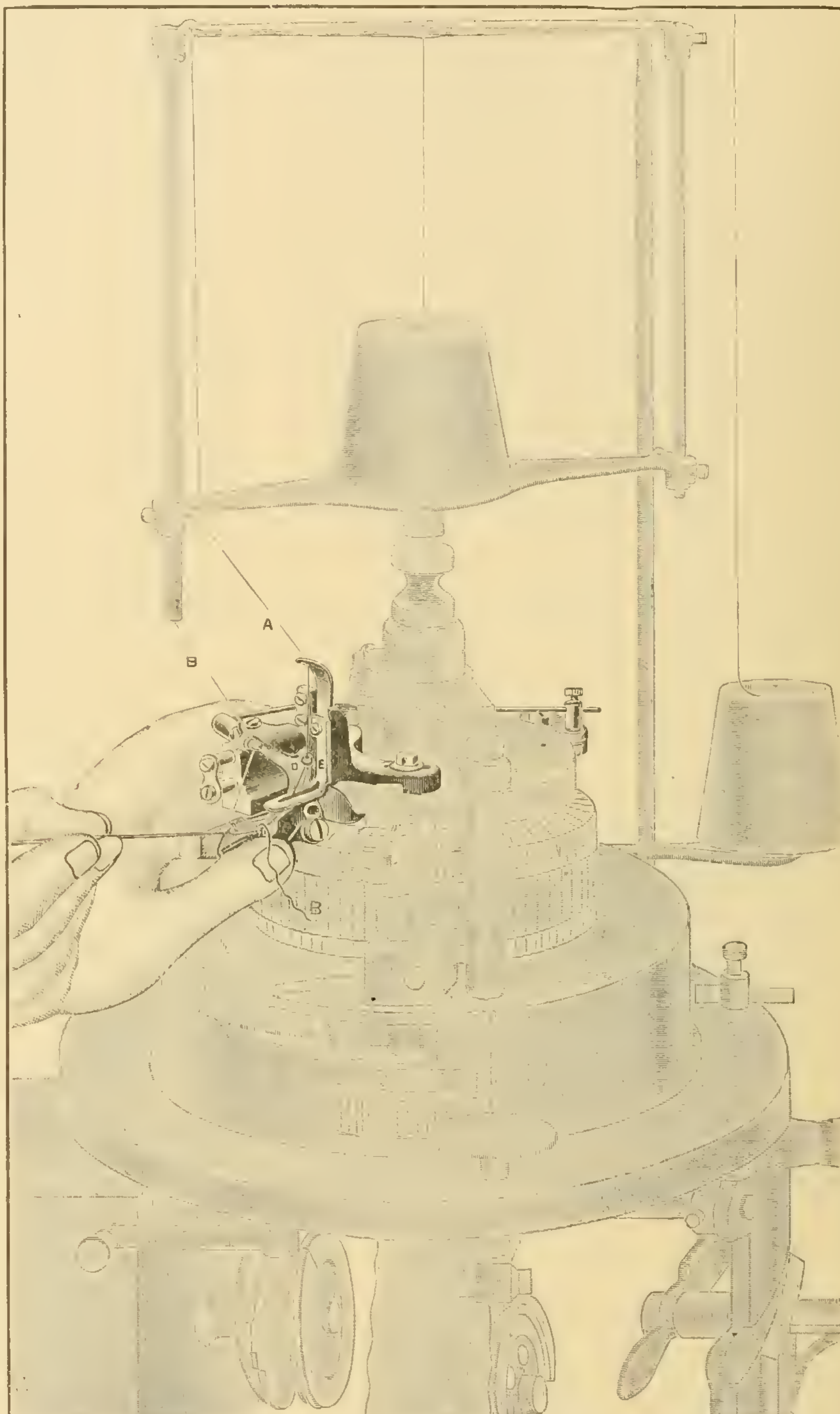


Fig. 4.

To overcome any irregularities in the point of breaking, when splicing is to be resumed, the block *h* is moved outwardly, thus causing the clamping arm to be depressed by the cam surface and the loose end of the splicing thread 4 released. At the same time the sweep arm carrying the main thread is swung outwardly, and the rapidly moving main thread is thus pressed down upon the splicing thread firmly, see Fig. 3, and owing to the curved or bent course for the threads, the contact will be stronger and more certain by reason of the natural tendency of the main yarn to straighten out between the eyes 1 and *d*. This contact of the main yarn against the splicing yarn takes place first nearest the broken end of the splicing yarn and then gradually increasing the contact surface until sufficient grip on the splicing yarn is secured to carry it to the needles, thus avoiding any liability of the broken end becoming doubled or looped, and thus tending to straighten the broken end, which will then go to the needles without becoming looped or bunched.

When, however, the splicing thread is to be thrown in, the outward movement of the sweep arm to carry the main thread into contact with the loose end of the splicing thread will at once provide a slack portion of the splicing thread by freeing it from lateral pull, and this action takes place at the same time the clamp releases the splicing thread.

In order to provide for the knitting of slack stitches where the splicing thread is thrown into work, a pivoted arm 9 is provided, pivoted to the bracket *e* and operated by a lug 10, carried by the block *h*, said arm 9 bearing upon the pin 11, which connects with the stitch cam.

Directions for Threading the Device. This procedure will be readily understood from Fig. 4, showing the splicer prominently contrasting from the knitting machine proper. Letters of reference in this illustration indicate thus: A (= 3 in Figs. 2 and 3) the main thread; B (= 4 in Figs. 2 and 3) the splicing thread; D (= *k* in Figs. 1, 2 and 3) the sweep arm as pivoted to the lower part of the supplemental bracket of the device, and E (= *x* in Figs. 1 and 2) the upwardly extending arm of the clamping foot.

To thread the main thread, depress the thread clamp and thread the yarn through slot in presser foot, thence through hole in yarn guide in the ordinary manner.

When afterwards required to thread the splicing thread, depress thread clamp with thumb of left hand, as shown in illustration. Take an ordinary cylinder needle in your right hand, and reach with it back under the presser foot and draw the main thread forward between presser foot and thread clamp, and put the loose end of the splicing thread through the loop formed in the main thread when drawing forward, as shown in illustration. After this is done, let go of the main thread with the needle and take hold with the fingers above the yarn guide at point A, and draw the main thread taut. This operation will draw the splicing thread to the proper position. Be sure that in drawing the loop for threading, that the main thread is in the circular groove at the inner end of the thread clamp (see *t* in Fig. 3). (Wildman Mfg. Co., Norristown, Pa.)

THE WILDMAN MFG. CO.'S STOP MOTION
For Knitting Machines using Rotary Bobbins.

In connection with this stop motion the bobbin stand revolves in unison with the revolutions of the machine without supporting the bobbins directly on the revolving parts of said machine, thus preventing objectionable vibrations and increased wear of the revolving parts of the knitting machine, resulting frequently in imperfect knitting and rapid destruction of the working parts. In connection with the new stop motion, a stand or support is used to sustain all the weight of the bobbins, bobbin-stand, stop motion, and connections, and to give greater stability and steadiness to the revolving bobbins, stop motions, and other parts.

Of the accompanying illustrations, Fig. 1 is a side view of a Wildman Mfg. Co.'s knitting head with the stop motion in place. Fig. 2 is an enlarged view, as compared to Fig. 1, of the stop motion head and upper structure. Fig. 3 is a detail front view of the feeler finger, guard and adjacent parts, and Figs. 4 and 5 being detail views relating to the knot catcher.

The same as two bobbins only are shown in connection with Figs. 1 and 2, four feeds with their respective stop motions can be used.

Examining the stop motion more in particular with reference to Fig. 2, we find that the yarn from the bobbin passes first through the thread gauge O, thence through shearing device 1 to feeler finger 2, sweep 3, eye 4, and thence to the needles through the hollow axis of the bobbin stand 5. The thread gauges O, shears 1 and feeler fingers 2, with their guide fingers 6, are all supported from the stop motion head.

The sweeps 3 consist of wires having a semicircular bend at 7, fitting over their pivot pins 8, which extend through the arms 9 of the block 10, secured to the reduced extension 19 of the standard 20.

The sweeps 3 are held in by their bent portions engaging the upper wall of the arms 9. The inner ends of the sweeps engage the hooked ends of the rods 15, which extend down into the stop motion head so that their lower hooked ends may engage detent levers 16, pivoted within the stop motion head at 17, the lower arms of each of said detents engaging normally the shoulder of the movable shear blade which is pivoted at 1^x and is under tension of the spring 11, tending constantly to close the shears 1 and sever the yarn, which tendency is resisted by the detent 16. The rods 15 are held in proper position by the collar 10^x, fixed to the standard, and which collar affords a backing for the rods.

When the sweep 3 is pulled down, owing to the yarn becoming taut, the detent lever 16 will be withdrawn from the movable shear blade, and the same will close under the action of its spring 11. The same result will be accomplished when the thread fails, for then the feeler finger 2, which is pivoted to the stop motion head at 12, will fall and its lower eccentric end 22 will engage the detent lever 16, and throw it out of connection with the movable shear blade. When this shear blade moves, a pin 13 thereon will operate the swinging lever 14, which is pivoted centrally of the casing 27. This lever carries on its under side a pin which will operate a spring pressed detent, pivoted within the casing, whereupon a catch lever 18, pivoted within the casing previously referred to, will be released. This catch lever 18, has a shoulder, adapted to hold pin 21, which extends up through a slot in the bottom of the casing from a tripping lever 23. This tripping lever is pivotally supported on the standard by its hub 24, fitted to turn about the standard 20. The tailpiece 25 of this lever, carries a catch pin 26 rigidly, which extends downwardly therefrom and is normally engaged by a spring pawl 28, pivoted in a slot 29 of the block 30, which is fitted to slide on the standard, and is attached to the hollow stand 31 of a tripping foot 32, having a series of pins 33 extending down through the arms of the bobbin stand. The said stem encircles the standard 20, and it and the tripping foot are thus arranged centrally of the bobbin stand and rotate therewith.

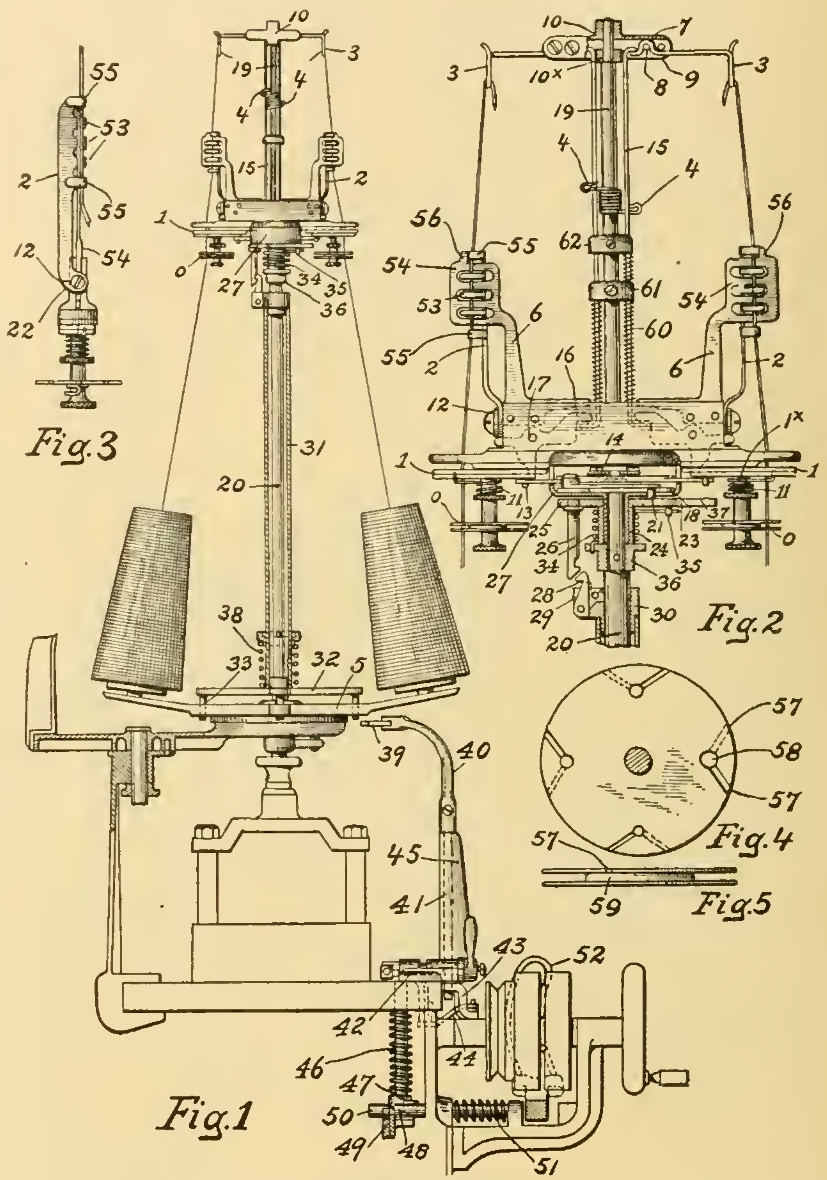
The tripper lever 23, is under tension of a spring 34, encircling the standard 20, one end engaging a pin 35 of the lever and the other end being held by a collar 36, secured to the standard 20.

It will now be understood that the release of the catch lever 18, as described, when the shears operate will allow the pin 21 and the tripping lever 23 free movement under the action of the tripping spring 34, and the catch 26 will be withdrawn from the pawl 28, thus allowing the tripper foot 32 to fall by gravity to thrust the pins 33 downwardly, said momentum of the tripper foot 32 being increased by means of expansible spring 38, so that in the continued rotation of the bobbin stand, one of these pins will be brought into the path of a finger 39, carried by an arm 40, fixed to a rock shaft 41, journaled at its upper end in the standard 45, aud at its lower end in the base plate 42 of the brake device, to which base plate 42, the standard 45 is secured. The rock shaft 41 has fixed thereto an arm 43, which is connected by a link 44 with an arm fixed to the rock shaft 46, extending down through the fixed base ring of the machine. This rock shaft has an arm 47, adapted to engage an incline 48 on the tripper arm 49, which engages the shipper rod 50. The movement of the parts described will release the shipper rod, which under the action of its spring 51 will operate the shipping fork 52. These parts are carried around with the stand as the pins 33 engage said stand, and these pins guide the trip foot and its stem vertically.

For resetting the parts, a handle is provided on the tripper lever at 37, by which it may be turned against the tension of its spring and made to engage the latch lever 18, after which by sliding the tripper foot and its stem vertically, the spring pawl will engage the catch pin 26, and thus hold the tripper foot up ready for another action.

The shears are automatically reset upon the operation of the tripping mechanism.

In order to arrest the machine quickly when the power is thrown off, a friction brake is employed, comprising a brake shoe, adapted when operated to engage the rotary flange of the knitting head, which is carried by a shaft, under tension of a spring, in the base 42, and held inactive by a latch pin, engaged by a catch, secured to the rock shaft 41, so that when this shaft 41 is operated to shift the driving means, the catch lever previously referred to, will release the latch pin previously referred to, and the shaft previously referred to, being free to rotate under the action of its spring, will apply the brake shoe to the rotary base flange.



The arm of the stop motion head, directly above the shears 1, is provided with a guide eye, to which a narrow slit extends diagonally, which in turn serves to hold the thread in position between the shear blades.

The feeler fingers 2 fall in a direction opposite to that in which the head rotates, and they therefore operate transversely of the stop motion head. By reason of this there will be no pressure on the yarn due to centrifugal force exerted through the feelers, and the machine can be run at any desired speed, and at the same time the feelers can be made sufficiently heavy to fall quickly when released. The feeler has a plurality of fingers 53, extending in one direction to pass into a plurality of openings formed in the guides or guards 54, and it has an upper and lower finger 55, extending in a direction at right angles to the fingers 53 and at points above and below the guide. This arrangement permits threading to be readily performed, while preventing the thread from coming out when once inserted.

The feeler finger is pivoted eccentrically, as shown in Fig. 3, and in falling its eccentric portion 22 will operate the detent 16.

The guide arm has a stop 56 for the upper end of the feeler finger to prevent its upper end from springing out, due to centrifugal force.

A knot catcher, as shown enlarged in Figs. 4 and 5, as compared to illustrations Figs. 1 and 2, is also provided to the mechanism, said knot catcher comprising two disks, having slots 57 extending inwardly from the edge and terminating in the eye 58. The disks are placed one over the other with the eyes in line, but with the slot in one inclining in a direction opposite to that in the other. The disks are placed apart by a block or piece 59, which leaves a space between them, and in threading the yarn is passed through one slot, then through the space between the disks, and through the other slot to the eyes.

The rods 15 controlled by the sweeps 3, are pressed by springs 60, and these are independently adjustable by collars 61 and 62, on the extension 19 of the standard 20, the lower collar 61 having an opening through which the spring for the upper collar 62 passes.

The rotary bobbin stand is supported axially over and independent of the knitting head, this feature making it also independent of the spindle, which is part of the knitting head. (Wildman Mfg. Co., Norristown, Pa.)

THE WILDMAN MFG. CO.'S STOP MOTION,
Applied to the Acme Knitting Machines.

The stop motion as explained in the previous article, employed in connection with knitting machines using rotary bobbins, like for example the Wildman Mfg. Co.'s machines, is herewith shown applied to knitting machines, in the operation of which said bobbins do not revolve, *i. e.* remain in a stationary position during the operation of the machine, like for example the Acme knitting machine, such application requiring special devices and arrangement in connection with said stop motion, in order that the same can be associated with the let off mechanism of said make of machines.

Of the accompanying illustrations, Fig. 1 is a plan view, parts being in section, of such portions of an Acme machine (as built by the Mayo Knitting Machine and Needle Co., see pages 218-219) as necessary to be given to show the action of the Wildman Mfg. Co.'s stop motion upon it. Fig. 2 is a side view with parts broken away, and parts being in section, of the knitting machine, showing the stop motion and its application to the knitting machine in perspective. Fig. 3 is a detail view in section, with parts in elevation and parts omitted for the sake of clearness, said view being taken from a point at the right of Fig. 2. Fig. 4 is a view of a detail with reference to Fig. 2.

Before explaining the connection and operation of the stop motion to the knitting machine, it will be advisable to first give a description of the let-off mechanism of the latter, quoting numerals of reference in the illustration, in connection with the explanations given, and of which, 1 indicates the head of the machine, the movable parts of which are driven through gearing 2 from main driving shaft 3, journaled in a bracket 4, shaft 3 carrying fast and loose pulleys 5, 5′. 6 is the belt shifting fork as carried by a block 7, which is slidably mounted on a rod 8, extending out from the frame 9 of the machine. A spring 10 is arranged between the belt shifting block 7 and the frame 9, to keep the former with the fork 6 pressed toward the left, Fig. 1, and thus keep the belt on the loose pulley 5′. The shifting block 7 is guided in its movement by rod 11, extending out from the side of the frame of the machine, and engaging a groove 12 in the top of the block 7.

For operating the belt fork against the pressure of the spring 10, a rock shaft 13 is provided, which is journaled in bearings 14 on the frame of the machine, and has a hand lever 15 for operating it. The shaft 13 at its rear end has an arm 16 projecting inwardly when the parts are in the position shown in the illustrations, having pivotally connected thereto a link 17, the other end of which is pivoted to the belt shipper block 7. The arrangement of these parts is such, that when the rock shaft 13 is turned to move the arm 16 into the position indicated in Fig. 3, said position will be maintained by the parts because the pivot point of 16 will be level with or slightly below the centre of the rock shaft, and the tendency of the spring exerted through link 17 will be to hold the parts locked in this position.

The stop motion, as shown in connection with Figs. 1 and 2, briefly described, comprises head 18 (see 27 in previous article), supported on a standard 19 (see 20 in previous article), said stop motion head containing mechanism controlled by either a feeler finger 20 (see 2 in previous article), or a sweep 21 (see 3 in previous article), so that when either of these devices are operated, caused by the breaking or running out of the thread, the mechanism within the stop motion head, will cause a vertical rock shaft 22 to be operated, the lower end of said rock shaft being journaled in the bracket 23 and carrying a trigger 24, which will release a lever 25, pivoted to said bracket and arranged to be under tension of the spring 26.

The connection of the stop motion thus referred to, and the let off of the machine is thus: The lever 25 previously referred to, is connected by a link 27 to a carrier 28 in the form of a plate arranged to

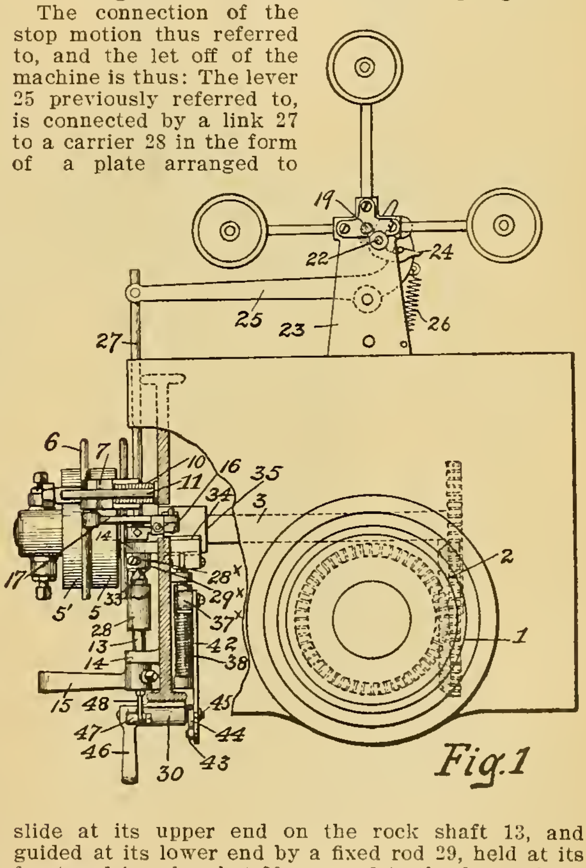


Fig.1

slide at its upper end on the rock shaft 13, and guided at its lower end by a fixed rod 29, held at its front end in a bracket 30, secured to the front of the frame, and at its rear end said guide rod is supported in an ear 30′ of a bracket 31, fixed to the frame of the machine by the bolt 32. This carrier plate 28 has thereon a conical shaped let off pin 33, so arranged that when the carrier plate is moved toward the rear of the machine, when the stop motion proper operates and pulls on the link 27, the let off pin will strike a stud 28x on a collar 29x, fixed on the rock shaft 13 by the said screw, and the rock shaft will be turned through a sufficient arc to carry the point 16 (see Fig. 3 more particularly) above the horizontal plane of the centre of the rock shaft, up to the point 16′, and immediately the spring 10 exerts its force, and thus shifts the belt from the fast pulley to the loose one.

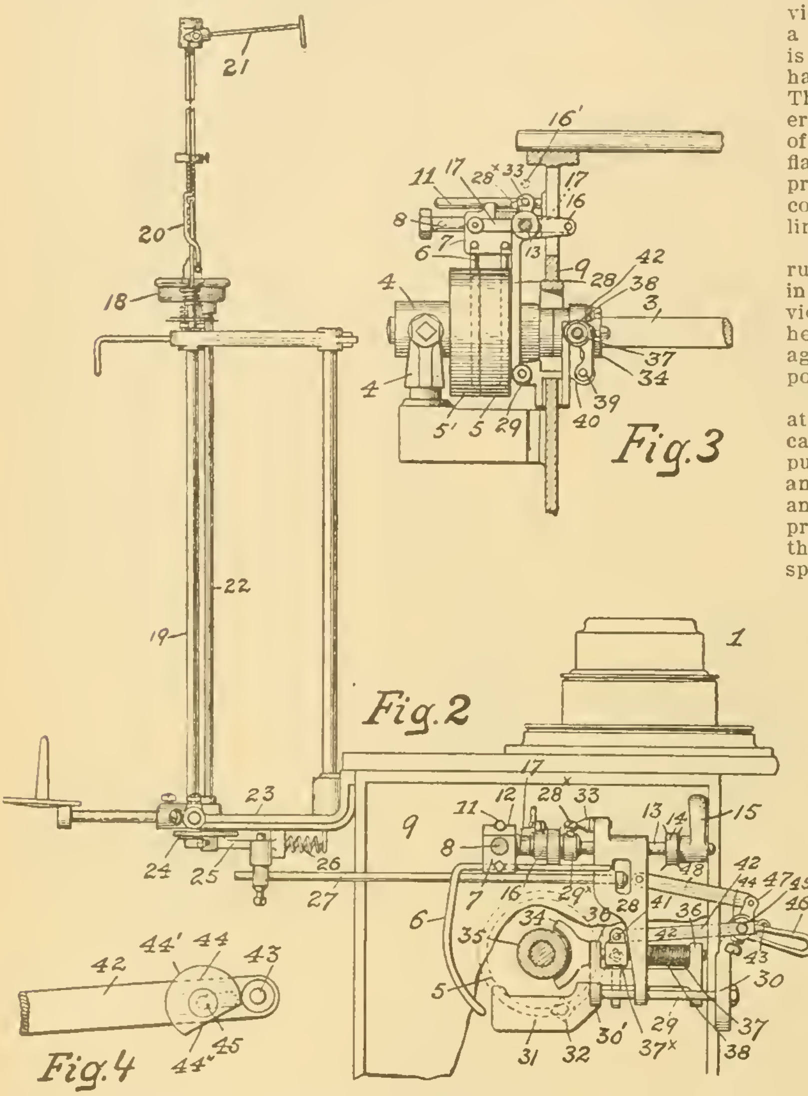


Fig. 2 Fig. 3 Fig. 4

A brake to stop the revolution of the machine quickly upon the operation of the stop motion and let-off is also provided, the same comprising a brake shoe 34, adapted to engage a collar 35 on the main drive shaft 3 of the machine, the said brake shoe having its stem 37 guided in ears 36 of the bracket before described. Stem 37 has an arm 37x fixed thereto, and a spring 38 surrounds the shank, and constantly exerts its force, tending to press the brake shoe 34 against collar 35 of the shaft 3. The arm 37x has a sliding connection also with a second guide rod 39, held in ears 40 of the bracket 31. To the arm 37x of the brake stem is pivoted at 41 a link 42, which at its forward end is provided with a roller 43, bearing on a cam 44 on a rock shaft 45, which is journaled in the bracket 30 and has a hand lever 46 fixed thereon. The cam 44 has part of its periphery 44′ concentric with the centre of the shaft 45 and another part 44″ flattened. The hand lever 46 is also provided with an arm 47, which is connected with the carrier 28 by a link 48.

When the knitting machine is running normally, the parts will be in the position shown in the several views, the brake being off and being held off by the roller 43, bearing against the high part of concentric portion 44′ of the cam.

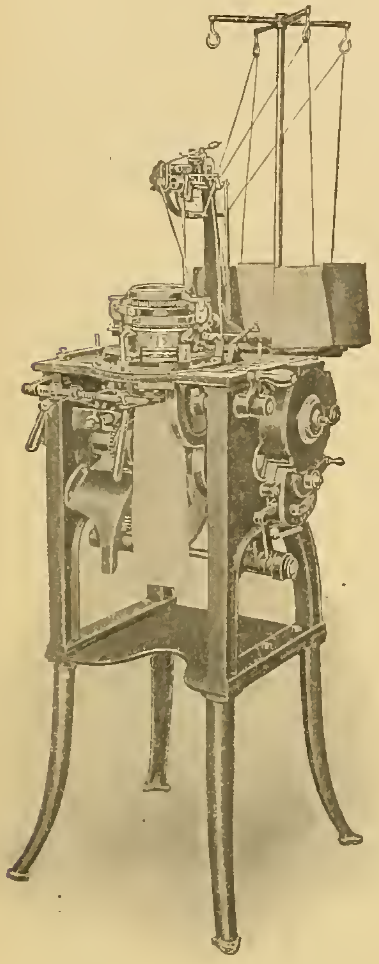
As soon as the stop motion operates, and the link 27 is pulled, the carrier plate 28 is operated, first putting in motion the let off mechanism, and then through link 48 and shaft 45 causing the cam to present its low or flat portion to the roller 43, thus allowing the spring 38 to exert its force, moving the arm 37x and forcing the brake shoe or fork against the brake surface of collar 35, fast on the main drive shaft 3 of the machine. By operating the hand lever 46, both the brake shoe and the carrier 28 are reset into normal position, ready again for automatic operation.

The parts when operated as before described, having rendered the machine inoperative, it will be impossible to start the machine again unless the stop motion is again reset, due to the fact that the let off pin 33 obstructs the movement of the screw 28x until the carrier 28 is moved forward by setting the stop motion. The brake 34 also remains in action against the brake surface of collar 35, fast on the main drive shaft 3 of the machine, until the stop motion is reset, for, as before mentioned, the brake is controlled from the carrier 28, and until the latter is moved forward upon the resetting of the stop motion proper, the brake remains in action. (Wildman Mfg. Co., Norristown, Pa.)

THE ACME KNITTING MACHINE.

The same is shown in its perspective view in the accompanying illustration, and is what is technically known as a fully automatic seamless Hosiery Knitter, its vital parts being the cam cylinder, needle cylinder, and skeleton cylinder. The skeleton cylinder adds greatly to the durability of the needle cylinder and cam cylinder, and permits of a more substantially built machine than could be had otherwise.

The machine is built in one-fourth inch sizes, from 2″ up to 4¼″ diameter, with any number of needles desired up to eighteen to the inch, varying in gauges from twelve to forty-eight. Any of these machines can be readily changed at the mill from one gauge to another, of from one number of needles to another by changing the needle cylinder and a few cams, and from one size to another by changing the whole head. The most practical speed at which the machines are to be run is from 240 to 260 revolutions per minute. The stitch taken by the machine can be varied, and readily changed from long to short, or vice versa. The machine is also supplied with a device for reënforcing heel and toe, the stitch being automatically loosened to accommodate the extra thread in the heel and toe, and again tightened without cutting the fabric, the reenforcing thread being automatically slackened to make sure it is fed into the needles.



The feed movements which control the measuring device of the machine are positive, securing the same number of courses in the same size stocking, raising and lowering always the same number of needles in the heels and toes, so that these parts of the stockings are always uniform.

The pattern mechanism or measuring device consists of gears and disks, which are graduated to permit easy and accurate setting.

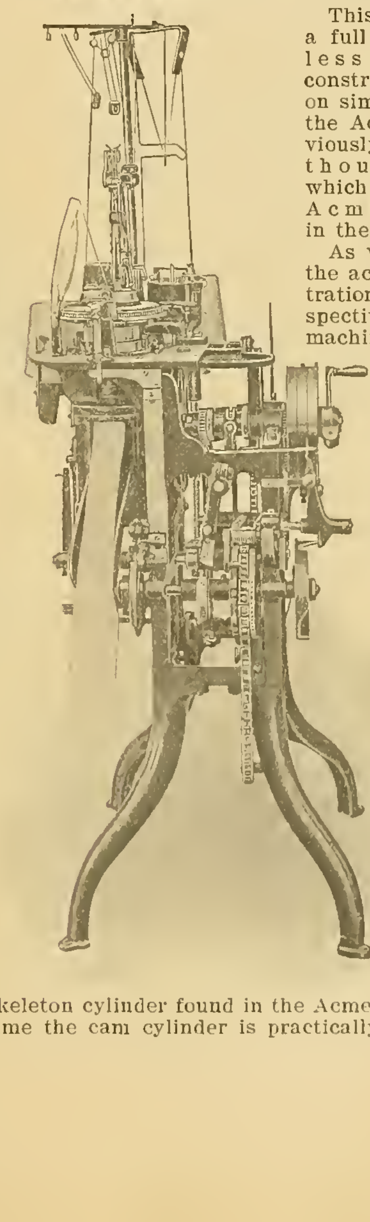
Besides being built as a plain machine, the Acme can be equipped with double sole, lace, yarn changer and tipper attachment. Also it can be built to make a change of yarn automatically at the heel, so as to make the leg of a stocking of one color, and the foot of another, and at the same time, to reënforce the heel and toe automatically.

The double sole attachment automatically runs an extra thread into the back of the ankle and the bottom of the foot, and the extra thread goes in and out of directly opposite needles, so as to make a perfectly straight line where the reënforcing thread goes in and out on the back of the ankle and bottom of foot. The lace attachment makes a variety of lace stitches down the front of the leg and foot of a stocking. The yarn changing attachment makes a complete change of yarn in the heels and toes automatically, and this same attachment can be arranged to plait a cotton thread with a worsted thread. The tipping attachment is used mostly on small sizes of machines for automatically tipping the heels and toes of children's goods.

The machine is also supplied—if desired—with a stop motion, which automatically stops the machine before making the heel of a stocking, so as to allow a change of yarn by hand to be made, and thus a stocking with the leg in one color and the foot in another color can be produced. Also a stop motion can be put on the machine to stop it before making both the heel and toe, and thus allow a change of yarn for these parts to be made by hand, in these instances however reducing the machine to a partially automatic machine only. The transfer device used, when making any kind of transferred goods is simple, easy and quick to operate, and makes the machine an especially serviceable one for this class of work. (Mayo Knitting Machine & Needle Co., Franklin Falls, N. H.)

THE HEMPHILL KNITTING MACHINE.

This machine is also a full automatic seamless hosiery knitter, constructed practically on similar principles as the Acme machine previously explained, although some parts which appear in the Acme are eliminated in the Hemphill.



As will be seen from the accompanying illustration, which is a perspective view of the machine, chain links are employed for a measuring device instead of the gears and disks, as in the Acme. The construction of the head of the Hemphill does away with the skeleton cylinder found in the Acme, and at the same time the cam cylinder is practically dispensed with, and the needles and sinkers easy of access. The former can be removed directly from the machine without removing its head, whereas to remove sinker, a coiled wire spring (placed around the outside of the head to keep them in proper place) is simply expanded with the left hand, removing or replacing sinkers at will with the other hand.

This machine also can be equipped with a double sole, yarn changing, or yarn changing and plaiting attachment. Its speed is lessened before changing from circular to reciprocating motion, and again increased after changing from the reciprocating to circular motion. It is equipped with a transfer device for making rapid and perfect transferred work possible. (Mayo Knitting Machine & Needle Co., Franklin Falls, N. H.)

TAYLOR'S STOP MOTION.

This motion is designed to be attached to any make of knitting machine in which the cone, carrying the yarn, does not revolve, the object of the motion being to automatically stop the machine when a thread breaks in its passage to the needles from the cone and also when the thread does not come off of

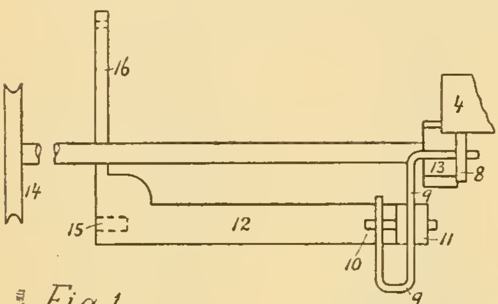


Fig. 1

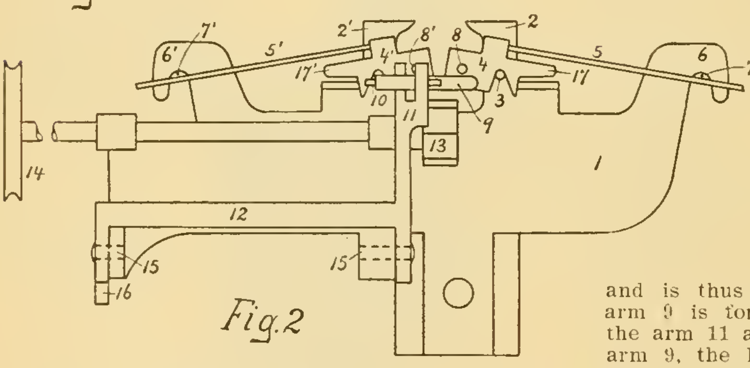


Fig. 2

the cone properly, *i. e.* tangles or is held by knots or lumps being in the yarn. Every stop motion is made to control two threads, independently of each other, and is situated about a yard above the top of the knitting machine, on a stiff rod. The motion consists principally of a special shaped casting, with two detector wires suitably placed on it, which operate a small lever at the proper time to lower it into the path of a revolving ratchet wheel, which in turn pushes it outwardly, thus raising a projection on the same piece, and this motion is transmitted through a chain and lever to the knock off lever on the machine.

The details of the motion are shown in the accompanying illustrations, of which Fig. 1 is a partial top view of the stop motion and Fig. 2 is a back elevation, showing the parts in the position which they occupy when the thread is feeding properly to the needles of the machine. The two detecting arrangements for the stop motion are identical, both acting on the same lever which through its connections stops the machine when either thread breaks, for which reason only one of the detector arrangements will be referred to.

Referring to the illustrations, 1 indicates the casting or main piece of the stop motion, having an upright piece 2 in which is secured a pin 3, extending through it and projecting on both sides so as to act as a pivotal support for casting 4 which has a vertical hole through it, thus allowing it to fit down over the upright piece 2. This casting 4 carries a pair of detector wires 5 which extend past a hook 6 on the casting 1, one wire being on each side of the hook, the thread 7 for knitting passing over said wires and under the hook 6, the casting 4 and wires being so balanced that the tension on the thread is sufficient to keep the wires in the position shown, when running properly. A movable weight is applied to one wire to regulate the balance when necessary. A wire 8 projects outwardly from the casting 4 and extends directly over a pivoted lever 9, the latter being pivoted by a pin 10 in the upright arm 11 of the angle lever 12 and is so balanced that the end situated under the wire 8 is always up when the thread is running properly. Situated just below the lever 9 is the revolving ratchet wheel 13 which is driven through a pulley 14 from a similar pulley on the shaft of the machine by means of a band, said ratchet being the part to actuate the stop motion when a thread breaks.

The angle lever 12 is pivoted to the casting by means of screws 15 and has an arm 16 extending outwardly, to the end of which is attached one end of a chain, the other being connected to a pivoted lever on the frame of the machine, said lever being in turn connected to the knock off lever of the belt shifter, which by pulling down releases its hold on the shifter and allows a stout spring to move the shifter.

The action of the stop motion is as follows: When a thread 7 breaks, the detector wires 5 are thrown upwardly by the greater weight on the other side of the pivot 3, and the wire 8 moves downwardly, taking the arm 9 with it, which comes in contact with the ratchet wheel 13 and is thus moved outwardly by it. When the arm 9 is forced down, it hits against a part of the arm 11 and thus when the ratchet moves said arm 9, the latter acts as a solid lever with the arm 11, so that the latter is moved outwardly at the same time. This action causes the angle lever 12 to move on its pivots 15 and thus raise the arm 16 of the lever, which movement, through the chain and levers explained, stops the machine. Owing to the manner of balancing the different levers, they will assume their normal positions, when the thread is replaced between the hook 6 and the wire 7.

When the thread is caught by a knot, etc., the tension on said thread will be sufficient to pull the wires 5 down past the end of the hook 6; so that the thread will slide off of said wires and at the same time the pivot of the casting 4 is changed to the point 17 which then makes the action of the motion quicker. The casting 4 may be easily raised off of its pivot and cleaned without trouble. (James Taylor, Philadelphia, Pa.)

RUTH'S STOP MOTION.

The object of the mechanism is to automatically stop the machine with the brake applied, when one or more threads as fed to the machine break during the process of knitting, by shifting the driving belt from the fast to the loose pulley. The construction and operation of the device are best shown by means of the accompanying illustrations, of which Fig. 1 is a side view of part of a knitting machine showing the different parts of the mechanism for the stop motion. Fig. 2 is a portion of the thread guide mechanism, showing the parts in the position they occupy when a thread is absent, *i. e.* the thread having broken. Fig. 3 is a view, partly in section, showing more in detail the manner of keeping the driving belt on the fast pulley. Referring to the illustrations, numeral of reference 1 indicates the frame of the machine, and to which is attached a vertical rod 2, carrying guides 3 and 4. Situated in these guides is a vertically movable rod 5 which has a recess 6 cut into it near the top end, said recess being made in order to allow a projection 7 on the latch 8 to hold said rod 5 up. This latch 8 is pivoted at 9 in the guide 3, and the projection 7 is kept in the recess 6 of the rod 5 by means of a spring 10, pressing against it near its lower end, the pressure on said spring being made adjustable by means of screw 11. A finger 12, through which the thread is passed in threading the machine, is journaled at 13 on the guide 3. This finger 12 is connected by means of a rod to a shorter finger 14 which is in a direct line with the bottom end of latch 8.

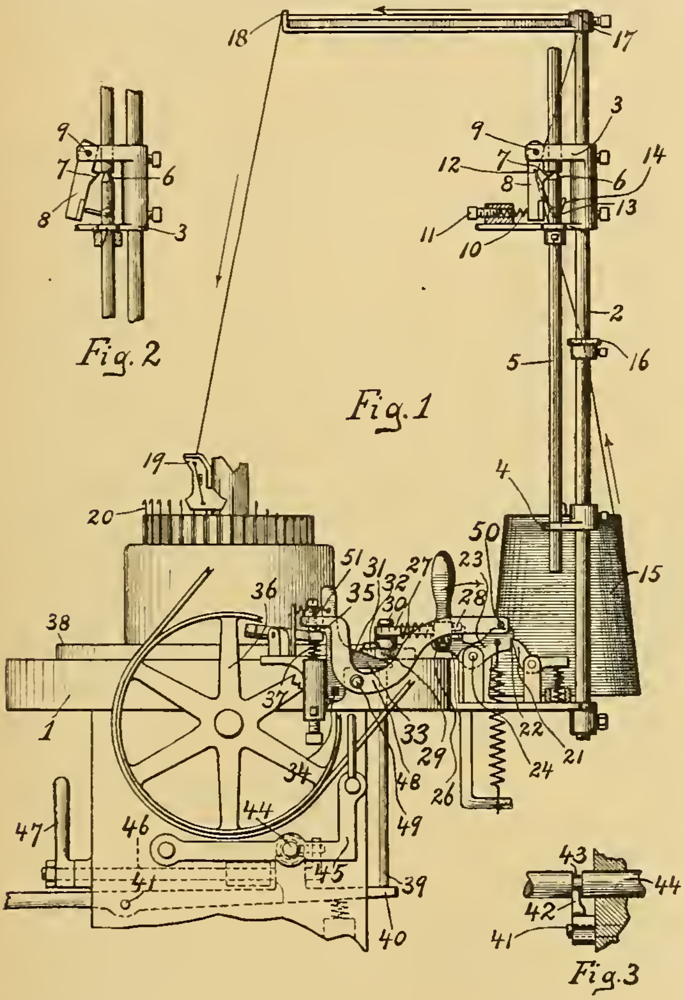


Fig. 2 Fig. 1 Fig. 3

In threading the machine the yarn is drawn off of the cone 15 and passed up through a guide 16 on the vertical shaft 2, up and within contact of the finger 12, to the guide 17 at the top of the rod 2. From there the thread is passed, through guide eyes 18 and 19, to the cylinder needles 20 of the machine. The tension of the thread is sufficient, when working properly, to keep the finger 12 in an almost vertical position; but as soon as the thread breaks, the finger 12 will fall, and consequently the shorter finger 13 comes in contact with the lower end of the latch 8 and pushes it outwardly, thus disengaging the projection 7 from the recess 6 on the rod 5, as clearly shown in connection with Fig. 2. This rod, thus being liberated, will of its own weight, fall upon the horizontally positioned end of a trigger 21 and in turn cause the other end of said trigger to disengage with the recessed portion 22 of the lever 23. This lever 23 is pivoted at 24 and has a spring connected to its outer eud, which tends to draw it down. The other end of the lever 23 carries a block 26 through which a short rod 27 passes, having a nut 28 on the end extending through said block. This rod 27 is connected at its other end to a lever 29 by means of a pin 30. This lever 29 is pivoted at 31 and has one end extending over the inclined surface 32 of the piece 33. This piece 33 is pivoted at 34 and is provided with a tooth 35 to bear down against the outer end of the brake shoe 36.

When the lever 23 is released by the trigger 21, the rod 27 is pulled forward, in a right hand direction, by this motion and by its connection to the lever 29, causes the outer end of said lever to press the inclined surface of the piece 33 down, thus disengaging the tooth 35 from the outer end of the brake shoe 36, allowing a spring 37 to press the iuner end of the brake shoe 36 against the flange 38 of the cam cylinder.

The lever 29 is also made with a recess in its under side to allow a vertical rod 39 to rest in a raised position when the thread is running properly; but when said lever is pulled forward, as explained before, the under side of said lever presses the rod 39 down, and which movement causes a rod 40 as centred at 41 to also be pressed down. This rod 40 carries a piece 42, which fits into a groove 43 (see Fig. 3), on the rod 44 when the machine is running, thus keeping the belt on the tight pulley by means of the shipper lever 45, but as soon as the piece 42 is taken out of the groove 43, a spring (not shown) acts upon the belt fork or shipper lever and which moves the belt from the tight to the loose pulley. Consequently when the lever 40 is pressed down, the piece 42 is disengaged from the groove 43 and the belt shifted, as explained, thus stopping the machine.

It will be understood that the operation of stopping the machine and applying the brake to the cam cylinder 38 are about simultaneous, thus preventing any knitting action of the machine with the thread missing.

When the broken yarn has been repaired, the several parts of the stop motion are returned to their original positions as shown in Fig. 1, after which the belt is shifted from the loose to the fast pulley by means of the rod 46 with its handle 47 thus starting the machine again. When the lever 23 is thus returned to position shown in Fig. 1, it is apparent that the lever 48 is turned upon its fulcrum 49 by reason of the contact between the lever 23 and the stud 50 which projects from the lever 48 and rests upon the lever 23 and operates the brake lever 36 so as to remove the shoe from contact with the flange 38, and when brought into the position shown in Fig. 1 permits the spring 51 to contract and bring the tooth 35 in engagement with the lever 36 so as to retain the latter in position. (Ruth Automatic Knitting Machine Company, York, Pa.)

DUEMLER'S TWO FEED KNITTING MACHINE

For Producing Fancy Effects.

This machine is similar to a single feed knitting machine, except that it has two feeds and extra appliances for producing various designs of knitted fabrics, it being used especially for knitting fancy stockings. The details of the construction and operation of the machine are given in connection with the accompanying illustrations, of which Fig. 1 is a plan view of a portion of a circular knitting machine, showing the principal parts on the cam cylinder. Fig. 2 is a diagrammatic view, illustrating a development of the interior of the cam cylinder and the positions of the parts during the knitting of the foot portion of a stocking. Fig. 3 is an enlarged view of a piece of fabric produced on the machine.

Referring to the illustrations, 1 designates the bed plate, 2 the needle cylinder supported thereby, and 3 the cam cylinder, which is provided with the usual cams, including the oppositely disposed stitch cams 4 and 5 and the raising cams 6 and 7, leading to the resting cam 8. The cam cylinder is also provided with the usual pickers 9, by means of which certain needles are successively moved out of and into action during the reciprocations of the cam cylinder in knitting the heel and toe portions of a stocking.

Two sets of needles 10 and 11 are used, which are alike in every respect, except that the latches of the set 11 are longer than those of the set 10, these needles being arranged in the relation indicated in Fig. 2.

Arranged in the cam cylinder 3, near the raising cam 6, are an additional stitch cam 12 and a raising cam 13, which in conjunction with stitch cam 5 and the raising cam 7, actuate the needles to effect the knitting of two stitches during each revolution of the cam cylinder in the formation of the leg and foot portions of a stocking.

The knitting by the needles 10 is done in the usual manner, while the needles 11 having longer latches will produce a variation from the regular knitting, as will be seen from the following example, the plane where the loops are formed being indicated by the line x—x. Assuming that a white thread 14 is being delivered to the needles through the eye 15 in the yarn carrier 16, at cam 12 and a black thread 17 through the eye 18 at cam 5, then the operation of the machine is as follows: During the knitting of the leg portion of a stocking, the cam 19 is below the resting cam 8, as will be explained later. As the stitch cam 5 passes the needles, the latter are caused

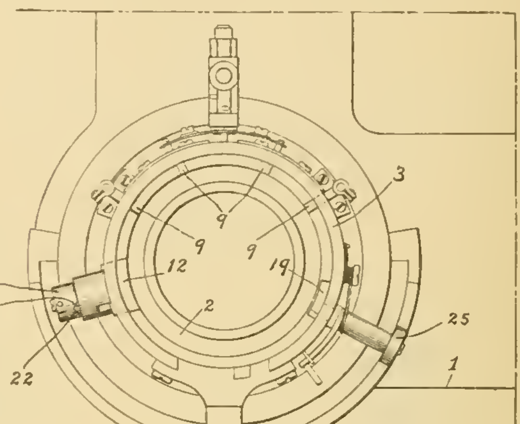


Fig. 1

to engage and knit the black thread 17 into the fabric in the usual manner, and the elevating cam 7 raises the needles to the resting cam 8. At this point the needles are raised, and owing to the length of the latches of needles 10, the black stitch in the hooks is put below the latches thus freeing the latter, as is done in ordinary knitting, while the longer latches of the needles 11 are not freed, but are held by the loop as in a tuck stitch. The needles are next acted upon by the stitch cam 12, where the white thread 14 is delivered to the needles. At this point the needles 10, having their latches free, catch the white thread in the hook and cast off the black stitch in the usual manner, while the needles 11, having their latches engaged by the black loops, merely draw down the black loops and the white thread together without casting off a stitch. These long latched needles 11 now hold both a white and black loop. As the cam cylinder advances in the direction of the arrow, the needles are raised by the cam 20 sufficiently to cause the white and black loops in the hook of the needle 11 to be slid below the latch and thus free it. The cam 5 now meets the needles again, and the latter having all their latches clear of the loops, catch the black thread in the usual manner. The needles 10 will cast off the single white thread, while the needles 11 will cast off both white and the previously formed black loop of the threads. Thus it will be seen that the needles 11 do not knit the white thread 14 but knit a

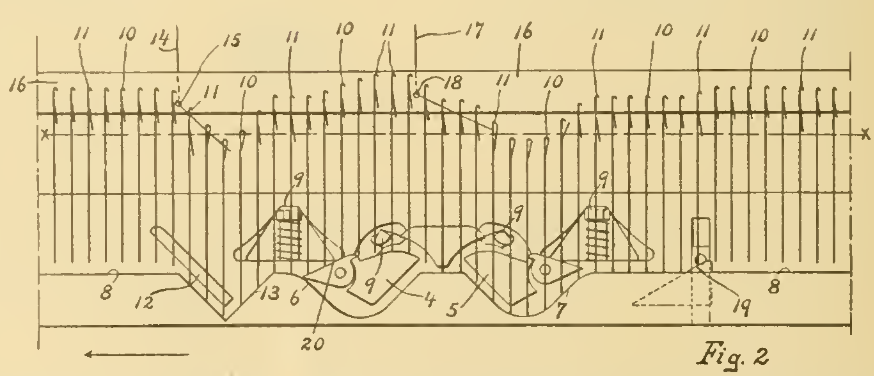


Fig. 2

chain of black stitches down the face of the fabric, thereby producing a longitudinal stripe through the fabric at each point where the needles 11 occur, the needles 10 knitting alternate black and white stitches as shown in Fig. 3. After the completion of the leg portion of the stocking, the cam cylinder is reciprocated to knit the heel, the needles being thrown into and out of action in the usual manner. During this operation the black thread is employed, it being desired to continue the longitudinal stripe along the top of the foot portion of the stocking and omit said stripes from the bottom of it. In order to see how this is accomplished, we will refer again to the illustrations. In the first place the cam 12 must be thrown back out of action so as to knit only one stitch for every reciprocation of the cam cylinder, which is done by turning by hand a collar 21, so that its notch 22 will move out of contact with the projection 23 and thus draw the cam 12 back. The concave portion at 13 in the cylinder cam will not now produce any motion to the needles but will simply pass under them in the same way that the resting cam 8 does.

Fig. 3

In order to knit the longitudinal stitch only on top of the stocking foot, one-half of the needles around the cylinder must knit regularly, while the other half must knit in the same way as for the leg portion. To thus knit regularly, one-half of the needles must be raised sufficiently so that the latches of the needles 11 will have the loop slip below its latch at every stitch in the same way as with the needles 10. To raise half of the needles every time the required extra distance without raising the other half of the needles, the cam 19 is provided, which may be raised above the needle rest cam 8 and thus cause all needles with which it comes in contact to be raised higher, as is needed. Said cam 19 is raised by means of a stationary cam 24 upon which rolls a wheel 25, the wheel being on the same stud with the cam 19. It is spring controlled and when leaving the cam 24 with the continued movement of the cylinder, the cam 19 is dropped again below the surface of cam 8 and the longitudinal stripe made in that half of the foot by the needles 11 with the needles 10 always working plain. Since the action of the cam 19 is not needed during the knitting of the leg portions, the cam 24 is lowered out of action by hand when the foot is completed and again into action when required. (H. Brinton & Co., Philadelphia, Pa.)

BRANSON'S MANTLE KNITTING MACHINES.

Branson's Mantle Knitting Machine for Floating Thread Stitch.

The object of this machine is to produce mantles, which are afterwards treated chemically and used in connection with what is generally termed Welsbach lights.

There are several styles of special stitches used in manufacturing these mantles, the one made on this machine being known as the "floating thread" stitch.

The diameter of the cylinder of the machine is quite small, owing to the small size of the mantles required to be made on it. A special stitch is used in knitting these mantles, which requires a special yarn carrier and special needles placed after a certain system between regular needles, otherwise the machine is similar to a knitting machine, that is, a set of cylinder needles is used and a cam cylinder carrying the cam for actuating said needles. Only continuous circular knitting is required, a feature which greatly simplifies the construction and operation of the machine, which is *full automatic*. Two yarns are fed at the same time from separate holes in one yarn carrier, and it is the method of knitting these two yarns into the fabric which produces the "floating thread" stitch. One thread knits into the fabric after the plain knitting stitch and forms the structure, while the other thread floats behind two of the regular stitches and knits in on every third stitch with the first thread.

The method of making the floating thread stitch, as well as a diagram of the stitch itself are given in the accompanying illustrations, of which Fig. 1 is a cross sectional view of the needle cylinder, also showing the yarn carrier as depositing the two separate yarns in the proper needles for producing the stitch. Fig. 2 is a diagram of a portion of the fabric, showing the interlacing of the two yarns. Besides having the yarn carrier provided with two holes for feeding the two yarns, there are two kinds of needles used in the cylinder, two needles of the regular style alternating with one needle of special construction, which is similar to the regular needle, except that its end carrying the latch and hook is bent back slightly, so that when said needles are raised, their hooks will not be in the circle made by the regular needle hooks and hence they can take a yarn which the regular needles cannot take, by passing said yarn in back of the regular needles but in the front of the hooks of the special needles.

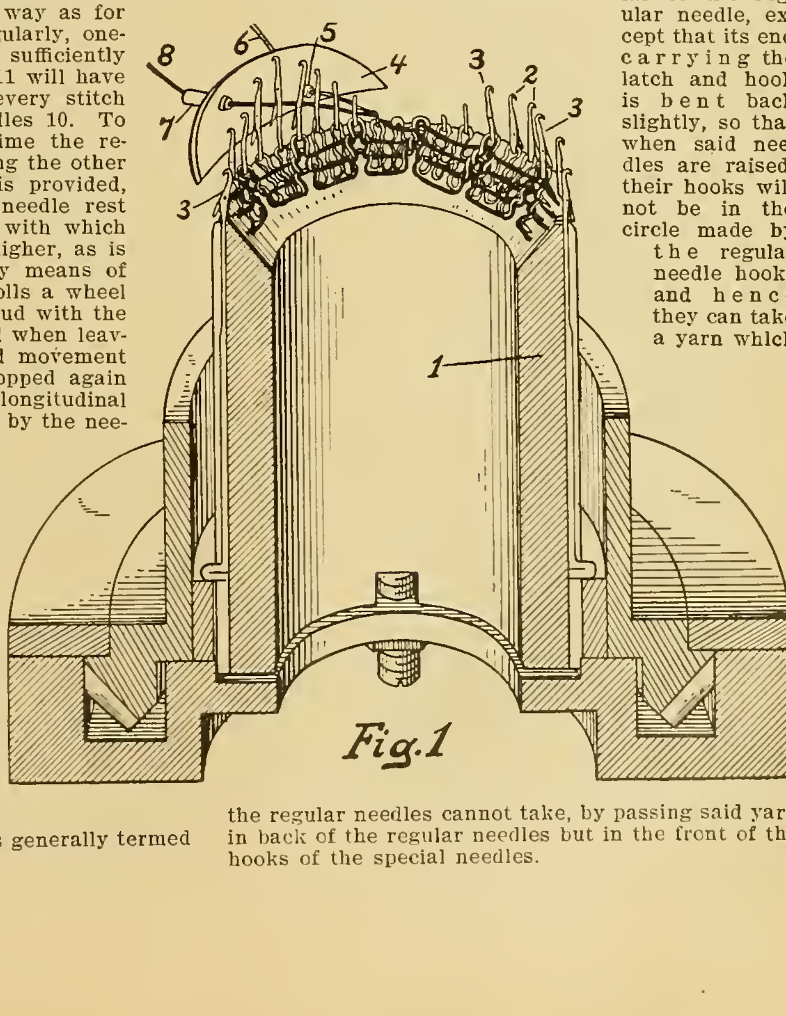


Fig. 1

Referring to the illustrations, 1 indicates the needle cylinder, carrying in its grooves the regular needles 2 and the special or bent needles 3, said needles being placed alternately two of regular and one of special

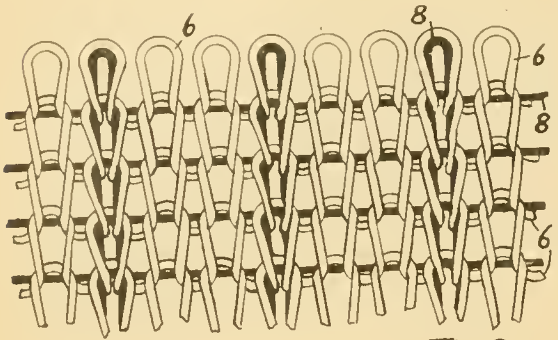


Fig.2

in the grooves of the needle cylinder. The specially constructed yarn carrier 4 is provided, toward the back end and near the bottom, with a guide hole 5 which deposits the yarn 6 in the hooks of all of the needles. This is readily done, because the hole 5 is far enough behind the highest point of the raising cam and low enough to the needles to enable the special needles to descend far enough to bring their hooks back into the circle with the regular needles and receive yarn before having their latches closed.

Situated near the top and at the front end of the yarn carrier 4 is a guide hole 7 for depositing the floating thread 8 in the hooks of the special needles 3, said hole 7 being sufficiently high and in front of the highest point of the raising cam to enable it to deposit the yarn 8 before the regular needles are raised high enough to prevent the yarn from passing over them. The third or special needle, by being bent back slightly at the top, prevents the yarn from being deposited behind it and hence catches said yarn in its hook. Before the needle is lowered by the stitch cam of the cam cylinder, the yarn 6 is also deposited in its hook, thus having said needle to cast off two loops for every revolution of the cam cylinder. This system of using a floating thread will produce a web, shown by diagram Fig. 2, in which it will be seen that the regular thread 6 is knitted plain, while the floating thread 8 only knits in with every third plain stitch, leaving it to float behind the other two.

Chemical Preparation of the Knit Fabric for Mantles. The web in coming from the machine in the form of a tube, is afterwards cut into lengths from eight to nine inches long and each of these pieces is then folded and sewn at the top with a loop of asbestos thread. They are now ready for the chemical treatment, which consists in immersing said pieces in a solution of nitrate of thorium and cerium, after which they are dried and the cotton burned out. In this way, the nitrates are converted into oxides and the shell is then stiffened and is ready to be packed into boxes for shipment. (Branson Machine Co., Philadelphia, Pa.)

Branson's Mantle Knitting Machine for Lattice Stitch.

This machine produces what is known as the lattice stitch, which is considerably tighter and more substantial than the floating thread stitch and in turn will produce a higher priced mantle. The stitch is made by using two sets of needles on the cylinder and a sufficiently high yarn carrier ring to protect the latches from closing, said ring having two separate yarn carrier eyes, and also two cam grooves, one situated over the other on the cam cylinder. The needles of one set are placed alternately with the other set in the needle cylinder. Each set of needles knits the plain stitch, using its respective yarn, and the small float between two needles of one set is stitched in on the inside or back of the intervening stitch of the other set, and vice versa the float from the intervening set is stitched in on the inside of the needles of the first set, thus producing a web somewhat resembling a lattice and hence the name, "lattice" stitch. The method of making the stitch on the machine is best shown by means of the accompanying illustration Fig. 1 which is a development of the working portion of the cam cylinder, showing also the relative positions of the yarn carrier eyes while Fig 2, as given on page 225, is a diagram of the web produced.

Referring to illustration Fig. 1, 1 indicates a portion of the cam cylinder of the machine, carrying the cams 2, 3, 4, 5, 6 and 7 respectively.

Two separate and distinct cam grooves are used for the two sets of needles, the path of the upper set being indicated by a dotted line 8, and the path of the lower set by the dotted line 9. The cam cylinder moves in the direction of the arrow. When the needles of both sets are in a resting position, the hooks of the upper set rest above those of the lower set, and the yarn carrier eye 10 for the upper set is situated above the hooks of the lower set when in their resting position, thus said yarn carrier can deposit yarn in the hooks of the upper needles when they are raised by cam 5, without touching the lower set of needles, and vice versa, the yarn carrier eye 11 for the lower set is placed low enough as to only deposit yarn in the hooks of the lower needles as raised by the cam 2, the upper set being sufficiently high, to be out of the path, and by the time their hooks descend to the line of the yarn, the loops on said hooks have closed the latches and the floats are not caught. When the hook of the upper needle is at its lowest point, *i. e.* casting off, the float of the other thread passes over said hook, owing to its being pulled over by the take-up and consequently

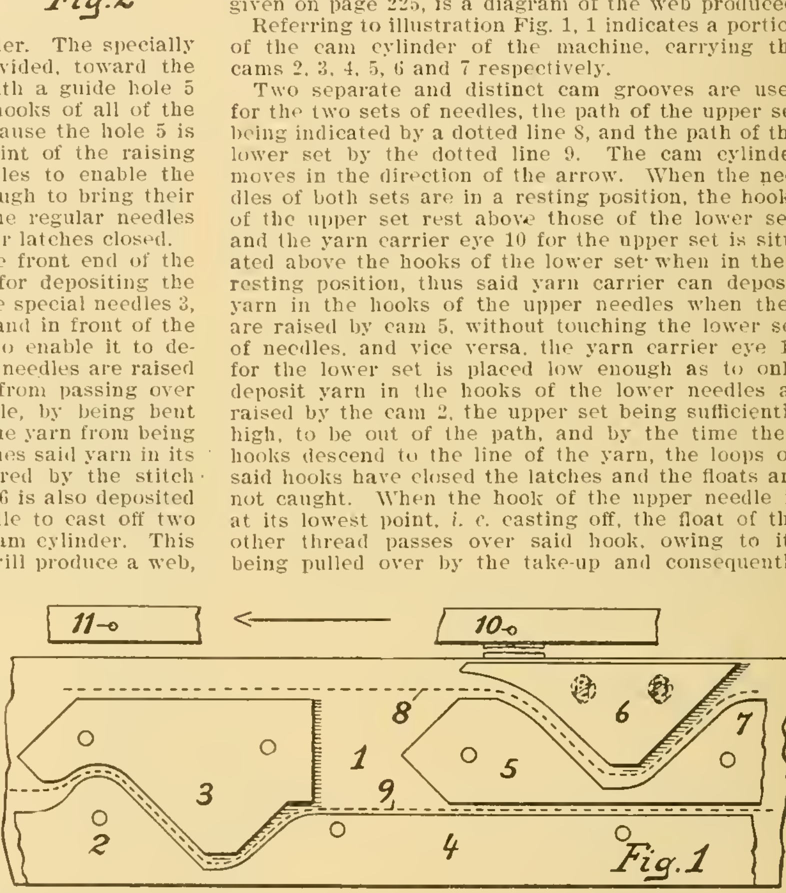


Fig.1

rests on the inside of the web, together with the loop just cast off, and in this manner is stitched in on the back. In a similar manner the floats of the thread of the upper needles are pulled back of the hooks of the lower needles and are stitched in on the back of the web.

It will be noticed that the cams 5, 6 and 7 for making the stitch by the upper set of needles are placed over the resting cam 4 of the lower cams, and vice versa, the cams 2 and 3 are placed under the part of the upper cam groove where the upper needles are at rest, so that only one set of needles will be working at the same point on the needle cylinder at one time, the two sets of needles thus not interfering with each

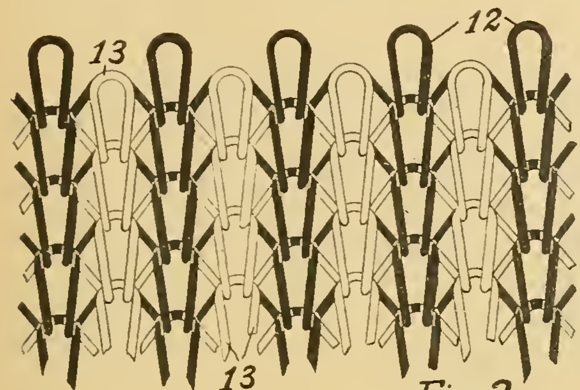


Fig. 2

other. The method of making the stitches by the two cams is similar to the regular plain knit stitch and need not be discussed again.

On examining the diagram Fig. 2, we can readily trace the interlacing of each thread; for instance, take the thread 12, which we will consider as having been knit by the upper set of needles, and it will be seen that it knits after the plain stitch on every other stitch and is caught behind the stitches between them. In the same way, the thread 13 knits plain by the lower set of needles on every other stitch and has its floats caught behind the stitches between them, thus producing the lattice work effect. (Branson Machine Co., Philadelphia, Pa.)

Branson's Mantle Knitting Machine for Honey Comb Stitch.

This machine is another type of mantle knittiug machine, and is used to produce a special stitch in the web, known as the "honey comb" stitch. This stitch is somewhat similar to the lattice stitch, as previously explained, and differs from it by having the short floats of one thread stitched in on the back of the stitches of the other thread, and the floats of the other thread stitched in on the face of the first stitches; while in the lattice stitch, the floats of both threads are stitched in on the back. From this it will be seen that the honey comb stitch is related to the rib stitch, and more so for the reason that a set of cylinder needles and a set of dial needles are used in the machine for making it.

Two separate yarns are used, requiring the use of two yarn carriers, one to feed a yarn to the cylinder needles and one to feed a yarn to the dial needles. The needles of the cylinder set work in the spaces between the needles of the dial set in a regular rib machine. While the dial needles are having yarn deposited in their hooks by one yarn carrier, the cylinder needles at that point receive the yarn but do not knit it in, and in the same way, at the point where the cylinder needles are having yarn deposited in their hooks, the dial needles receive the yarn but do not knit it in.

The method of making the stitch may be best explained by means of the accompanying illustrations, and where a diagram of the web is also given.

Fig. 1 is a development of working portions of the cam cylinder, Fig. 2 is a view, taken of the under side of the dial cap, showing the outline of the dial cap cam, and Fig. 3 is a diagram of the web produced on the machine. Referring to the illustrations, 1 indicates the cam cylinder, carrying the cams 2, 3, 4 and 5 respectively. It will be noticed that the cam 2 is cut away at the bottom as compared to the stitch cam 4, the reason for this being to enable said cam to lower the cylinder needles at that point out of the way of the acting dial needles and yet not lower them far enough to cast off a stitch. The cam 4 is used for making the stitch by the cylinder needles in the regular way, the cams 3 and 5 being used to bring the cylinder needles again to their normal position.

The dial cap is indicated by 6, and carries the cams 7, 8, 9 and 10. Situated on the top side of the dial cap 6 are the yarn carriers 11 and 12, placed oppositely from each other on said dial cap. It will also be noticed in connection with the cams 7 and 9 that the inward point of the cam 7 does not extend as far inward as the corresponding point on the cam 9, which has the effect of drawing the dial needles inwardly at the point where the cylinder needles are taking yarn, but not far enough to cast a stitch off. The cam 9 is the regular stitch cam and makes the stitch in the regular way. The cam cylinder and dial plate revolve in the same direction, the arrows used showing said direction, although the arrow for the dial cap is in the reverse direction to the actual running of the dial, because the latter is shown with its bottom side up, but by turning it over into its running position with the arrow in the same relation

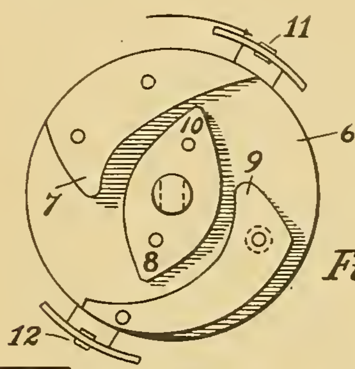


Fig. 2

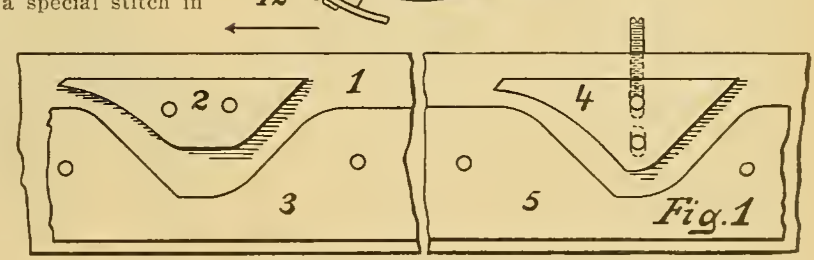


Fig. 1

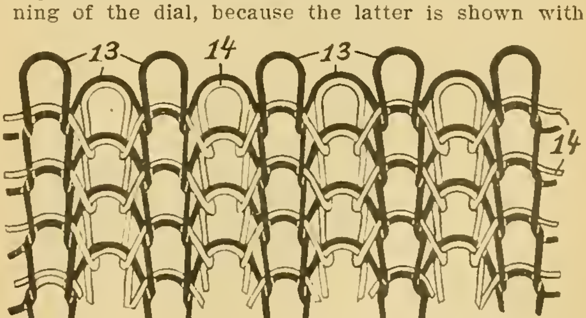


Fig. 3

with it, the direction of the arrow will then correspond to that of the cam cylinder. The dial cap is set in relation to the cam cylinder, so that the inward point on the cam 7 will correspond to the stitch cam 4 on the cam cylinder, and the stitch cam 9 will correspond to the cam 2 on the cam cylinder. In this way, the stitches are made by each set of needles and a web is produced, as shown in Fig. 3, in which the thread 13 is knitted by the cylinder needles and the thread 14 by the dial needles. It will be noticed that the floats of thread 14 are stitched behind the stitches of thread 13, and the floats of thread 13 are stitched in the front of the stitches of thread 14, thus producing the desired web. (Branson Machine Co., Philadelphia, Pa.)

THE "LAMB" FLAT KNITTING MACHINE.

This machine is a type of another style of knitting machine from the circular machines thus far explained, and differs from the latter principally by having its needles set in a straight line rather than in a circle, which construction, of course, demands a different method of feeding the yarn to the needles, that is, the yarn carrier must traverse back and forth across the hooks of the needles instead of in a circle. The machines are made in different lengths of knitting surface, varying from 8 inches to 60 inches, the different sizes being especially adapted for certain kinds of work, as for instance, the smaller size machines are used for knitting mittens, stockings, gloves, etc., while the larger sizes are used for undershirts, cardigan jackets, leggings, sweaters, skating caps, etc. A great variety of knit goods may be made on one of these machines, as will be explained later. The smaller machines are operated by hand power, while the larger ones are driven by belt power except in some cases where hand power is preferred, although the large machines require considerable effort when operated by hand, necessitating the services of a strong man.

A description of the construction and operation of the machine is best given by referring to the accompanying illustrations, of which Fig. 1 is a perspective view of a long Carriage Knitting Machine; Fig. 2 is a perspective view of a knitting machine bed, showing the drop jacks; Fig. 3 is a view, taken of the under side of a portion of the carriage, showing two sets of cams, known as Common Locks or Cams; Fig. 4 is a similar view, showing Automatic Drop Locks; Fig. 5 is a similar view, showing Automatic Tubular Locks; Fig. 6 is a detail view of a common lock, showing the method of actuating the centre cam.

Referring to the illustrations, and especially to Fig. 1, it will be seen that the machine is constructed upon the priuciple of employing two straight, parallel rows of needles, said rows being sufficiently near to each other to make an unbroken tubular fabric when required; but far enough apart to allow the fabric to pass down between them as it is knitted.

The needles composing the two rows are placed opposite to each other, in grooves in a steel needle bed, the two sides of which slope from each other, somewhat similar to the gable of a house, and are separated at the ridge or centre, where the needles form the stitches. The grooves for the needles of one set are placed so as to come opposite the spaces between the grooves of the other set, so that the needles of each set, if so required by the style of fabric knit, will make alternate stitches in the fabric, in the same manner as in circular rib knitting, and also will not interfere with the working of each other, during knitting. The needles are placed in separate grooves with the latches turned outwardly, and also the butts or shanks of the needles, by which they are operated, projecting upwardly, extending sufficiently above the top of the grooves to be actuated by cams. The carriage of the machine has two surfaces which correspond to the two sides of the needle bed, and which fits down on said bed and is moved back and forth across the bed, either by hand or other power to perform its function in connection with knitting. On each under side of the carriage is an automatic cam—one for each row of needles—for operating the needles in and out in their grooves, the butts or shanks of said needles fitting loosely into the cam grooves. The carriage also carries a yarn guide C for delivering the yarn from the bobbin into the hooks of the needles as they are moved outwardly by the cam. The eye of this yarn guide C is situated over the central point between the two rows of needles and hence makes the stitches by each row of equal length. The yarn in coming from the bobbin, passes through guide eyes at A, then through an eye in the end of a spring wire B, before it finally reaches the yarn guide C. The object of this arrangement is to take up the slack in the yarn when the carriage reverses its motion at each end of the machine, and thus makes a smooth selvage on the fabric.

As the carriage is moved over the needle bed, the needles are moved outwardly by the cams, the latches of said needles being opened by the pieces D, to receive yarn from the yarn carrier C, and are drawn in almost immediately after the yarn is deposited.

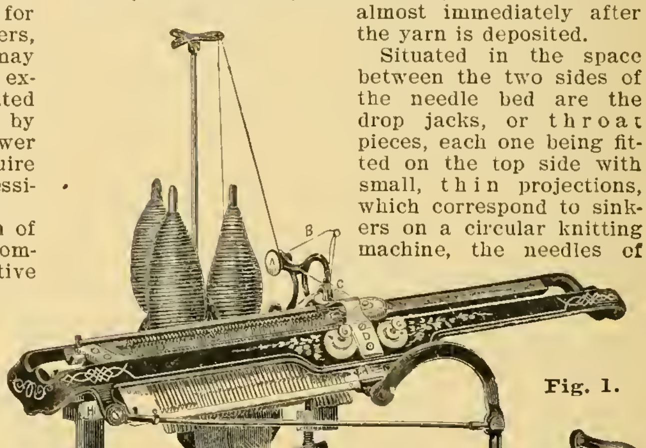


Fig. 1.

Situated in the space between the two sides of the needle bed are the drop jacks, or throat pieces, each one being fitted on the top side with small, thin projections, which correspond to sinkers on a circular knitting machine, the needles of each row working separately between the projections of its respective jack. The object of the projections is to aid in casting off the stitches from the needles as they are moved inwardly after yarn has been deposited in their hooks. These drop jacks are pivoted at the right hand side of the needle bed, as shown in Fig. 2, and may be swung down, as shown, out of the space between the needle rows, so as to make more space to facilitate the work of placing the fabric on the needles when required, such as half hose tops, or for picking in the stitches in knitting fingers and thumbs for gloves and mittens. The jacks are held in position in the space by meaus of a steel spring at the left hand side of the space, and, to drop the jacks, it is only necessary to press this spring back and allow the jacks to swing on their pivot at the right hand end.

There are three principal styles of cams which may be used on the machine for operating the needles, which are the Common Locks or Cams, as shown in Fig. 3, this as previously mentioned, being a view taken of the under side of the carriage; the Automatic Drop Locks, as shown in Fig. 4; and the

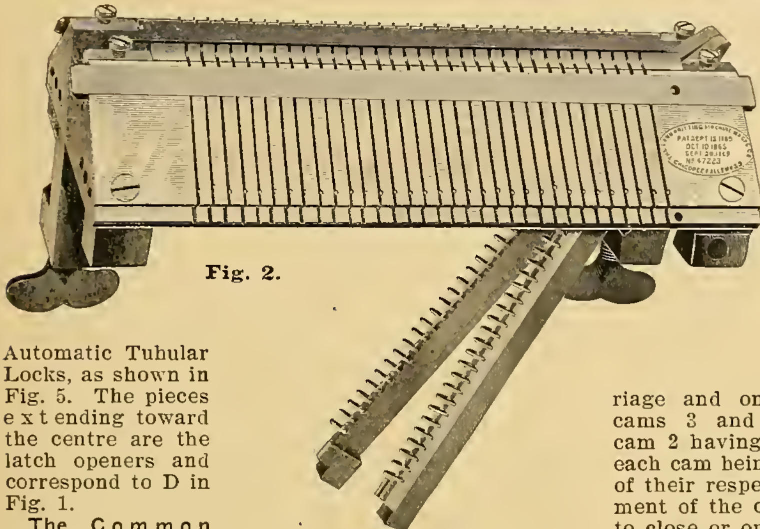


Fig. 2.

Automatic Tubular Locks, as shown in Fig. 5. The pieces extending toward the centre are the latch openers and correspond to D in Fig. 1.

The Common Locks are most frequently used on the machine, unless for some special style of fabric, since by them the greatest variety of stitches can be obtained on the same machine. With this style of locks, cam stops are attached to all four corners of the needle bed for some stitches and only to two opposite corners for other, etc., holes for these being shown in Fig. 2. The object of these stops is to throw the centre cam up or down, putting that cam respectively in or out of working position for operating the needles, that is, when the cam is in its highest position, the groove is closed and the needles are inoperative, and when moved down, the grooves are open and the butts of the needles move in them, thus giving the inward and outward movement to the needles.

By adjusting all four cam stops, the grooves are opened and closed, so as to continuously operate the front row of needles when the carriage is moving toward the left, with the back row of needles inoperative; then when the carriage moves to the right, the back row becomes operative and the front row inoperative, thus knitting a perfect *tubular or circular fabric.*

To operate both rows together in one direction, then only one row in the other, making the double flat web or *Afghan Stitch*, a cam stop is placed at each end of one row of needles with no stops on the other row.

To operate both rows together in both directions, for making the *ribbed or seamed flat web*, no stops are used.

The tuck or half cardigan stitch can also be made, as will be explained later.

To operate forward and back, first one row and then the other, so as to connect the two rows of knitting at one end, and leave them open at the other, forming the *wide flat web*, the locks have to be operated by hand.

Thus, we can produce five different styles of stitches with the same cam. In knitting these webs, if every second, third or fourth needle or combination of them, in one or both rows be not used, an almost unlimited variety of stitches may be produced.

As any number of needles, in one or both rows, can be employed at the start, and the number be increased or diminished at any time, so any size of work, tubular or flat, can be set up and widened or narrowed to any extent.

In order to give a more detailed description of the operation of the cam arrangement, and to explain how the stitch is made by the needles, we will refer to Fig. 6, which is a diagram of a cam, taken from one side of the carriage, showing how the centre cam is actuated to open and close the groove in which the butts of the needles work, the cam on the opposite side of the carriage being similarly constructed and operated, except to make the reverse movements, as will be explained.

Referring to this illustration, 1 indicates a plate which is rigidly secured to one of the under surfaces of the carriage and on which the centre cam 2 and side cams 3 and 4, are movably placed, the centre cam 2 having the greatest range of movement, and each cam being capable of movement in the direction of their respective arrows. The object of the movement of the centre cam, as mentioned previously, is to close or open the groove between the cams so as to make the needles of that row inoperative and operative respectively. The object in having the cams 3 and 4 to be slightly movable when desired, is to vary the length of the stitch made by the needles. These cams are moved by means of eccentrically placed pins 5 and 6, projecting into the slots 7 and 8 respectively, said pins being operated by hand from the pieces G, as shown in Fig. 1, dials being provided on the outside so that all cams may be set similarly to each other and produce a uniform stitch.

The centre cam 2 may be moved up or down by means of a horizontal slide 9 which is moved sufficiently by the different cam stops on the ends of the needle bed. The centre cam has a pin 10, which is placed in the vertical groove 11 of the stationary plate 1 and also in the oblique groove 12 in the horizontal slide 9, and from which construction it will be seen that a horizontal movement of the slide 9 will cause a movement of the pin 10 in the vertical groove and thus move the cam 2 at the same time. The pins 13 on the plate 1 and the grooves 14 in the slide 9 are used to keep said slide 9 in the proper horizontal position.

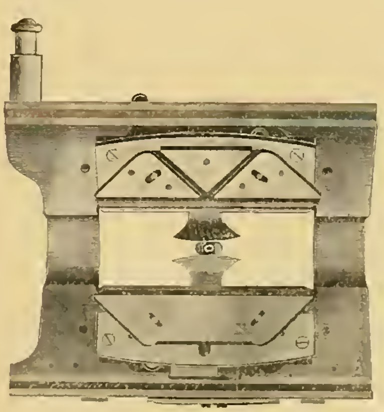


Fig. 3.

The method of making the different stitches will now be explained from the cam outline.

The Rib Stitch. This style of stitch of course requires the use of two sets of needles working in conjunction with each other, for which reason only straight rib work can be made on this machine, as distinguished from tubular rib work. For an example, we will suppose that the carriage is moving in the direction of the arrow and that the cam shown is on the far side of the carriage, provided you were facing the machine. The cam 3 has no part in making the stitch when the carriage is moving in the direction indicated, and the needles fit their respective grooves in the needle bed sufficiently tight to prevent their moving except when actuated by the cam, so that the needles will remain inoperative until the point 15 on the centre cam strikes the butts of the needles, then they will be moved upwardly until the highest point 16 of the cam acts upon them, in which position the needles being acted upon, have their latches open to receive yarn in their hooks from the yarn carrier, with their previous stitch resting on the needle below the latch. The needles from each row are actuated at the same time and in coming to the highest position they form a kind of trough in which the yarn is laid, and as the point 17 of the cam 4 comes in contact with the butts of the needles immediately after the yarn is deposited, the needles of each row are pulled down and when they come below the projections on the drop jacks, corresponding to sinkers, the stitches are cast off, thus completing a single operation of making the rib stitch. On the return movement of the carriage, the cam 4 has no part in making the stitch, and the point 18 first actuates the needles to raise them. The point 19 on cam 3 starts the needles down after yarn has been deposited in the hooks and the previous stitch is cast off in the same way as just explained.

Fig. 4.

The Tuck Stitch. Although this cam can be made to knit a tuck stitch, when it is desired to do a great deal of that work, another cam is used, it being similar to this one, except that the points 20 and 21 on cams 3 and 4 respectively are not so long and besides this, these cams 3 and 4 are capable of a greater range of movement, by means of levers on the outside of the carriage, in the same way as explained.

There are two ways of making a tuck stitch, that is, so far as actuating the needles is concerned. The one explained in circular knitting was to have one set of needles work plain, and to have the other set to move out just far enough to open the latches of the needles without having the loop, which was in the hook, slide behind the latch, in this way casting off two stitches at the same time for every other course. The other way and the one used with this cam is to have one set of needles knit plain, while the other set, instead of not going out far enough for the loop to slip behind the latch, does not pull down far enough to cast off the stitch, although the stitch was behind the latch. On the next course, both stitches are cast off at the same time, thus making the required stitch. It will be seen that more strain is put on the yarn by this latter method, since the loop comes partly on the closed latch, which of course is wider than the body of the needle. The first method of making the tuck stitch can be used on this machine with another style of cam, as will be explained later. For making the tuck stitch on the cam shown, either one of the cams 3 or 4 must be raised to its highest point and the other left down, and for illustration we will consider the cam 4 as raised. The cam on the opposite side of the carriage will of course work plain as usual. As the carriage moves over the needles, the point 15 will start the needles up and yarn be deposited as usual, then the cam 4 will pull the needles down, but owing to its raised position will not pull them down far enough to cast the stitch over their hooks. On the return movement of the carriage, the needles will be moved up and yarn deposited, the other two loops resting behind the latches, and when the cam 3 acts on them, they are drawn down so that the two stitches are cast off at the same time, thus making the tuck stitch. The same operations are repeated and the complete tuck stitch made by the combined forward and backward movement of the carriage.

The Plain Knit Stitch is obtained by using one row of needles at a time and thus we may make tubular work. One row of needles must be inoperative when the other row is working, and to alternately throw one row out of action and the other into action, we have to make use of cam stops for moving the centre cam. The cams on opposite sides are arranged to work oppositely to each other, that is, a cam stop for each cam on the same end of the machine, will throw one centre cam up to close the groove, while the other stop will throw the cam down to open the groove, the same being true at the other end, so that one row of needles will always be working. The method of opening and closing the grooves by actuating the centre cams has been previously explained. The positions of the two cams for this plain knitting are shown in Fig. 3.

The Automatic Drop Locks (see Fig. 4) are only used for making straight work and where both rows of needles are always operated. A variety of stitches may be made with them, such as the plain rib, tuck, and cardigan; and with this style of locks, no cam stops are required, for which reason narrow work may be done without having to give the full sweep to the carriage, as is required when using said cam stops. Another advantage of this style of locks is that the tuck may be made by the first method explained and extra strain on the yarn prevented. The changes necessary to change the style of stitch are made on the pivoted centre cam.

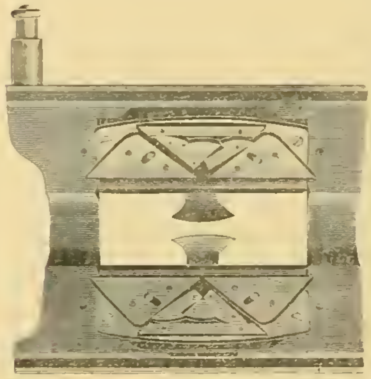


Fig. 5.

The plain rib stitch is made by having the centre cams of both locks held by a lever arrangement in the position shown at the lower side of the illustration.

The tuck stitch is made by releasing one of the centre cams, so that it is free to move, with the other cam held for making the plain stitch.

The action of the cam for making the tuck stitch is automatic and the changes made by the needles themselves. For example, suppose the carriage was moving in a left hand direction, then when the centre cam struck the butts or shanks of the needles, said cam would be pushed down by them, since it is easily moved, and hence the needles would not be raised to their highest possible position, but just far enough to have the loop open the latch but not slide behind it. On the return movement of the carriage, the butts or shanks of the needles strike the centre cam in its lowered position and raise it as the carriage continues its motion. This brings the needles to their highest possible position and the two loops slide behind the latch, being in turn cast off by the

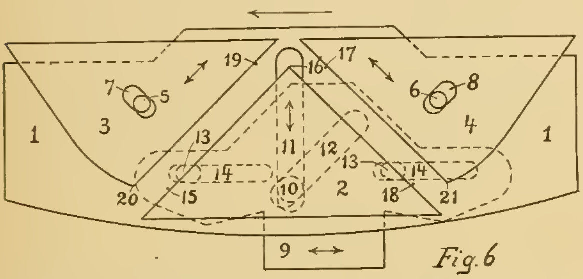


Fig. 6

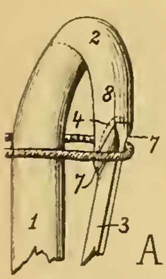
stitch cam. These movements are repeated and the tuck stitch continues to be made by the automatic movement of the centre cam.

The cardigan stitch is made by releasing both centre cams, which then act, as just explained.

The Automatic Tubular Locks shown in Fig. 5, as will be readily understood, are only used for tubular work and no cam stops are required, since the cams are arranged oppositely and while one works with the carriage moving in one direction, the other is inoperative, and vice versa on the return movement of the carriage. (Lamb Knitting Machine Co., Chicopee Falls, Mass.)

KNITTING MACHINE LATCH NEEDLES.

EGLY'S NEEDLE. The object is to provide a needle in which, when the latch is seated in the hook, said latch is laterally sustained in a firm and reliable manner and both its body and pivot are relieved of side strain. This needle consists principally of a hook, a recess in said hook, a latch pivoted to the needle and provided with a tongue adapted to be seated in said recess, said tongue having flanges on opposite sides, said offsets terminating in side walls which converge downwardly on curved lines to the body or side walls of the latch. The flanges are adapted to be flush with the side walls of the hook when the latch is in contact with it; in this manner not only the edges but the sides of said latch and hook forming an unbroken surface, consequently causing no obstruction to the stitch in the act of knitting.



A

The details of the needle are best shown by means of the accompanying illustrations, of which Fig. A is a perspective view of portions of the hook and latch in contact; Fig. B being a detail view of the latch shown in Fig. A. Referring to the illustrations, 1 indicates a knitting machine needle having a hook 2 and the pivoted latch 3, said latch being provided at its upper portion with a tongue 4, having the curved edge 5, while on opposite sides of said tongue are flanges 6, terminating in the rounded portions 7, which are of the same thickness as the adjoining side walls 8 of the hook 2, said rounded portions 7, sloping downward to the body of the latch 3. The hook 2 has a recess in the end, in which the tongue 4 is adapted to enter. The flanges 6 of the latch 3 and also the tongue 4 are made at an obtuse angle with the inside surface of the latch 3, the recess in the hook 2 having a corresponding inclination.

It will thus be seen from the foregoing explanation that by making the outer walls, as 7, of the latch and the other walls 8 of the hook of the same thickness and by curving the outer walls 7 gradually downwardly on each side of the latch, the result will be that when the latch is in contact with the hook there will be no obstruction or sharp edges presented to the stitch or thread, so that the latter will pass freely over the joint between said latch and hook. By making the recess in the hook and providing a tongue on the latch, the material of the hook is not unnecessarily thickened, and at the same time holds the latch laterally without straining it. (Keystone Knitting Machine Co., Philadelphia, Pa.)

B

WOODWARD'S NEEDLE. This latch needle is designed to be used on all kinds of knitting and rib machines, both in the needle cylinder as well as in the dial plate. Different lengths and sizes of needles are used for different classes of work, but the general style of construction is practically the same, and especially the upper portion of the needle, as carrying the latch, the advantages of the construction of the present make of needles over others it is claimed relates more particularly to the means for retaining the latch in the needle whereby the rivet forming the pivot for the latch may be held securely, so that it cannot work loose and project beyond the outer sides of the needle and destroy its usefulness.

The shape of the upper portion of a needle and the method of attaching the latch to said needle are shown by means of the accompanying illustrations, of which Fig. 1 is a side view of the upper portion of a needle, Fig. 2 is a top view of a portion of the needle being partially in cross section, showing the method of inserting the latch pin, and Fig. 3 is a similar view, showing the completed needle after inserting the latch pin.

Referring to the illustrations, 1 indicates the body portion of the needle, having a hook 2 at its top end, and being provided with a slot 3, in which one end of the latch 4 is pivoted on a pin 5, the outer end of said latch being made spoon shaped with a scooped

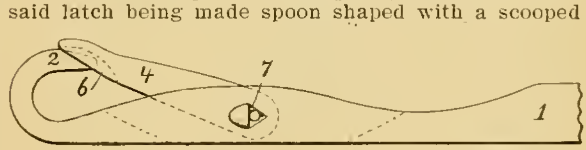


Fig 1

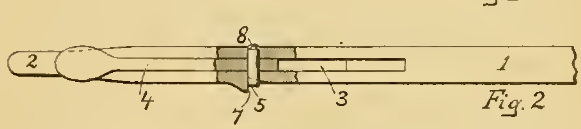


Fig. 2

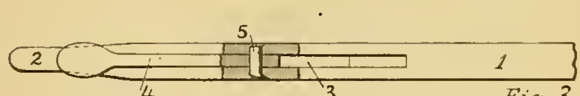
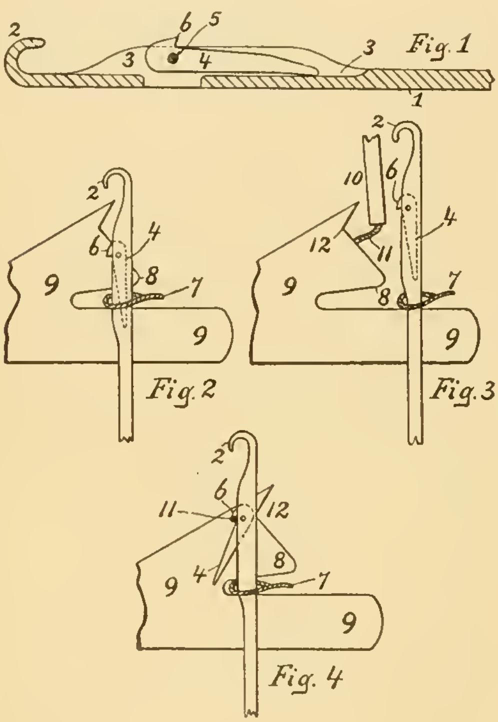


Fig. 3

out portion 6 on the under side to fit over the end of the hook 2. It will be noticed that the portion of the body of the needle back of the latch is cut in somewhat, the object of this being to provide a place for the latch when it is turned back off of the hook by a loop in the hook, so that the portion of the needle at that place will not be excessively large for the loop to pass over, and thus prevent a strain on the yarn. The method of inserting the latch pivot pin 5 in the needle is clearly shown in the cross sectional portions of Figs. 2 and 3, from which it will be seen that a countersink is made in the needle and the metal from said countersink is pressed back at 7. A hole is then drilled in the needle at the edge of the metal 7 and extends almost through said needle, but leaving a burred end 8. The slot 3 is then cut out and the latch placed in it, then the pin 5 is inserted and the metal 7 beaten back over the countersink, the burred end 8 at the same time being beaten straight, thus the pin is imbedded in the needle, making it more or less impossible for the pin to work loose. (Stephen Woodward, Franklin Falls, N. H.)

ANOTHER LATCH NEEDLE. The object of this needle, besides performing the regular knitting operation, is to prevent the loop, which is on the needle, from being cast off in case new yarn is not deposited in the hook of the needle previous to casting off said previous loop, in this manner preventing "press offs" or lost stitches, and consequent losses in the quality of the fabric made. The details of the needle, as well as its method of operation are shown in the accompanying illustrations, of which Fig. 1 is a cross sectional view through the needle, Figs. 2, 3



and 4 being diagrams, illustrating the operation of knitting in connection with a sinker.

The needle is distinguished from others by the construction of its latch. Referring to the illustrations, 1 indicates a portion of the body of a needle, having the regular hook 2, and a slot 3 in which a specially shaped latch 4 is situated, the latter being pivoted in the sides at 5, and resting, when thrown back off of the hook 2, entirely within the slot 3, except a hook portion of it, 6, which projects out from the sides of the needle. With this construction, it will be seen that a loop of yarn which rests on the needle below the latch cannot pass over the hook 2 to be cast off, unless the end of the latch 4 is raised out of the slot 3, so that the loop will slide between it and the body of the needle, and close said latch as the needle goes down.

The latch 4 is raised by means of the new yarn, as will be seen by examining the diagrams Figs. 2, 3 and 4, which show the method of making the stitch in connection with a sinker. Fig. 2 shows the needle in its normal or resting position with the loop of yarn 7 resting on the needle around the lever end of the slot 3. When the raising cam of the cam cylinder reaches the needle, the latter is raised until the latch is clear of the loop 7 as seen in Fig. 3, which is held down by the lower neb 8 of the sinker 9. The sinker is then drawn back to permit the thread carrier 10 to deposit the new thread 11 for a new loop, said thread being laid below the latch hook portion 6. The sinker 9 is then moved forward and by means of its upper neb 12 presses the thread against the needle as seen in Fig. 4. At the same time, the needle descends, and the thread 11, coming into contact with the hook portion 6 of the latch 4, causes the lower end of said latch to move out of the slot 3, which then permits the loop 7 to pass under it, and in turn close the latch as the needle continues to descend. The loop 7 is then cast off, the sinker 9 in the meantime having moved back out of the way of the loop. After casting the loop 7 off, the needle rises again to its normal position, shown in Fig. 2 until the raising cam actuates it on the next revolution. When, however, the feeding thread 11 breaks or is not properly fed to the needle, the lower end of the latch 4 will not be moved out of its slot and consequently the loop will slide over it instead of under, and in turn go again into the hook 5 instead of being cast off over said hook as is done when knitting properly, thus preventing lost stitches, etc. (C. R. Woodward, Nottingham, Eng.)

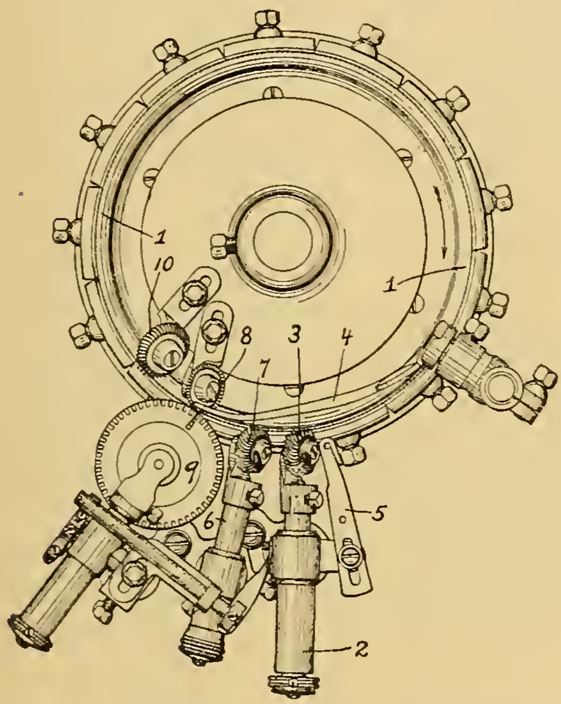
SPRING NEEDLE CIRCULAR KNITTING MACHINE.

Knitting by means of spring beard needles requires a totally different style of machine from the latch needle machines, since the needles make the stitches in an entirely different manner, as has been pointed out at the beginning of the chapter when explaining the principle of this style of knitting. In this machine, the needles are secured in the needle cylinder and have practically no movement except by the revolutions of the needle cylinder itself. The needles are made to perform the knitting operation by means of burr wheels, situated on the machine, which act on said needles at the proper time, each one to perform its respective duty in the operation, there being one burr wheel to feed the yarn and make preparatory loops of it, also acting on the loops of the newly fed yarn to lower them on the needles below the ends of the spring beards, so that they may go up into the hooks of the needles. At the same time a cloth wheel or other arrangement pushes the web down on the needles, so that the previous loops which were in the hooks may be passed over the spring beards and be cast off over the top of the needles by the succeeding burrs in connection with a presser wheel. The first of these burrs to start the casting off is known as the *landing burr* and acts in conjunction with the presser wheel whose duty is to press the spring beards of the needles inwardly as they come around to that point during their revolution, and allow the landing burr to move the loop over said spring beards, so that the other burr known as the *casting off burr*, can complete the operation of casting off.

Another distinguishing feature of this machine, from the latch needle machine, is that the knitted fabric is delivered upwardly from the needles instead of downwardly, and also that the fabric has to revolve bodily with the rotation of the needle cylinder, which is obtained by having a revolving take-up motion which is adjusted to correspond in its revolutions to that of the needle cylinder.

The working of the machine, as well as the adjustment of the several burrs on the frame, are best explained by means of the accompanying illustration, which is a top plan view of the principal portion of the machine, showing the positions of burr wheels in the frame.

Referring to the illustration, 1 indicates the needles which are secured in the needle cylinder, said cylinder being positively rotated in the direction of the arrow. Situated without the needle cylinder, on the frame stand is the *feed burr* stand 2, on the inner end of which the feed burr 3 is journaled on a pin, said burr being set at such an angle that the thin



plates or teeth composing the burr will pass separately in between the spaces of the needles as they come around. Owing to the way in which the burrs are built and the angle at which they are set in the machine, the movement of the teeth, while in the spaces between the needles, will be downward and hence any yarn with which they come in contact will be pushed downwardly also. The needles themselves cause the rotation of the burrs. As shown in the illustration, a *push back* 4 is used to press the web down in front of the feed burr 3, although in many instances a wheel is used for that purpose.

Situated just to the right of the feed burr is the thread guide 5 through which the yarn is fed by means of the feed burr to the needles. The teeth of the feed burr, by entering into the spaces of the needles, carrying the yarn in with them, and thus produce enough slack yarn to properly make a stitch without straining the yarn. Located next to the feed burr stand is the dividing wheel stand 6, carrying at its end the *dividing burr* wheel 7, which is placed at a corresponding angle to that of the feed burr 3. It is used to even the loops formed by the feed burr 3.

The burr 8, known as the landing burr, is located within the needle cylinder and is inclined at such an angle that the movement of its teeth, when in the spaces of the needles, is upwardly and thus it serves to move the loops upwardly over the spring beards of the needles, said beards being pressed inwardly at the same time by a *presser wheel* 9, located on the outside of the needle cylinder, in order to allow the loops to pass over them.

The presser wheel plays a very important part in making different kinds of stitches, since by making grooves in its circumference, according to some pattern, certain loops are prevented from being cast off, because certain beards are not pressed in, and consequently the loops on those needles which are not pressed in, when actuated by the landing burr go up again into the hooks of their needles.

In the case of fancy stitches, it is necessary either to have two feeds and two presser wheels or to have the number of grooves in the presser bear a certain rotation to the number of needles in the cylinder, so that the needle that does not cast off its loop on one course, will cast off on the next course, or according to some other pattern, and vice versa for the needle that does cast off; because it will readily be seen that if the same needles cast off every time and certain needles did not, loops would accumulate in the hooks until they could hold no more.

The presser wheel arrangement in this instance consists of two grooved wheels which are actuated so as to produce the desired patterns, or they may make the regular plain work. For plain knitting, a smooth circumference wheel is used, so that every needle beard is pressed, thus allowing all the loops to be cast off at every course. The loops are only carried up a certain distance on the needles by the landing burr 8, the operation of casting off being completed by the casting off burr 10, which is placed at an angle corresponding to the landing burr. These operations complete one stitch and are repeated on each needle for every revolution of the needle cylinder. Where two or more feeds are used on the machine, a corresponding duplicate set of burr wheels and presser are used on the machine. (Charles Cooper, Bennington, Vt.)

AUTOMATIC STRIPING ARRANGEMENT FOR SPRING BEARD NEEDLE CIRCULAR KNITTING MACHINES.

The object of this arrangement is to produce different colored horizontal stripes in the knitted fabric, so as to make any design by a combination of such stripes, the ends of the yarns, after having been used to make the stripe, being cut off close to the fabric. The arrangement referred to in this instance will feed two different colored yarns.

The details of the mechanism and its application to the knitting machine are best shown by means of the accompanying illustrations, of which Fig. 1 is a top plan view of a portion of the machine, showing the striping mechanism attached; Fig. 2 is a side view of the pattern arrangement, also showing the relation of the yarn fingers to the cylinder needles; Fig. 3 is an end view of the mechanism shown in Fig. 2; and Fig. 4 is a side view of the feeding arrangement which is used in connection with the pattern arrangement, to feed the yarn to the needles and cut out the other yarn which is not required when a change is made in feeding the two yarns.

Referring to the illustrations, 1 indicates the bed plate of the machine, and 2 the cylinder carrying the needles 3. The feed burr or stitch wheel is indicated by 4, the landing burr by 5, presser wheel by 6, and cast off burr by 7, the combined action of which performs the knitting operation in the usual manner.

The striping arrangement consists of a pattern wheel 8 which is provided with rows of holes for the insertion of screws, as at *a*, *b*, *c* and *d* to produce a desired pattern.

Pivotally mounted in front of the face of the pattern wheel 8 are three levers 9, 10 and 11 respectively, which are actuated by the screws in the holes

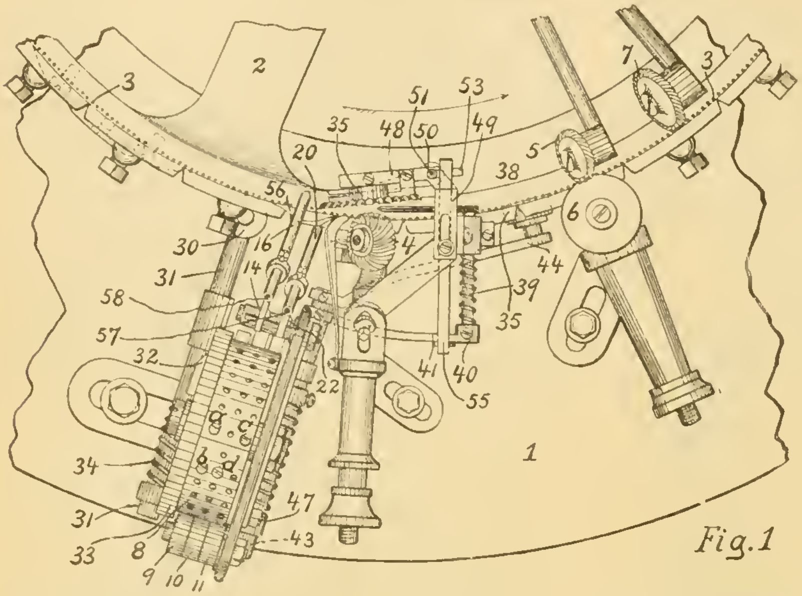


Fig.1

of said pattern wheel. Lever 11 is connected at its lower end to a horizontal rod (not shown), the other end of which is connected to the lower end of a lever 12 as pivoted at 13, the top end of said lever carrying an elbow lever 14 one end 15 of which carries a yarn finger 16 and the other end is provided with a slot 17 in which a pin 18 of the lever 19 works. The lever 10 is connected similarly to the yarn finger 20 through a horizontal rod (not shown), pivoted lever 21, and elbow lever 22 whose slot 23 also has the pin 18 sliding in it. The lever 9 is connected at its lower end to a horizontal rod 24 which has a spring 25 on it which tends to force said rod toward the needle cylinder. The rod 24 and each of the other two horizontal rods, which are not shown, have notches with which a snap catch 26 is adapted to engage. These other two horizontal rods are also provided with similar springs to 25 and tend to force the rods toward the needle cylinder, which would make the yarn fingers occupy the position of the yarn finger 20. The three levers 9, 10 and 11 are actuated from the pattern wheel by having respective projections 27, 28 and 29; projection 27 on lever 9 being slightly lower than the other two so that it may be acted upon first, with the pattern wheel revolving in the direction of the arrow. This is done to enable the rod 24 to raise the snap catch 26 out of the notches of the rods, so that the spring on the rod, which had been moved outwardly by a previous screw on the pattern wheel, may act to place the rod and consequently the yarn finger in its former position, and also to allow a screw which comes around to act on the other lever and push it outwardly. By moving either rod, controlling the yarn fingers, outwardly, causes the respective yarn finger to rise above the needles, and vice versa. Take the pattern arrangement as indicated by the screws *a*, *b*, *c* and *d*, then when the screws *a* and *c* come around, screw *a* will release the snap catch 26 and screw *c* will push lever 11 outwardly, thus raising the yarn finger 16 above the needles as shown in Fig. 2. After the cylinder has completed two courses, the pattern wheel will have brought the screws *b* and *d* into position to act on the levers 9 and 10. Lever 9 will first release the snap catch 26 which will release the rod connected to lever 11 and permit its spring to return it to its normal position, *i. e.* with the yarn finger 16 below the needles. The screw *d* will next act on the lever 10, which action will throw the yarn finger 20 up above the needles. The pattern can of course be regulated as to size of stripes by arranging the screws the desired distance apart on the pattern wheel.

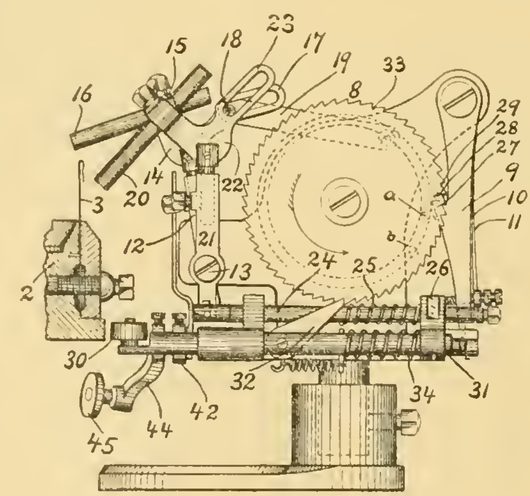


Fig.2

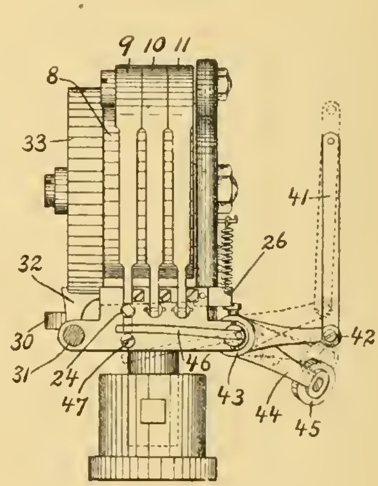


Fig.3

The pattern wheel receives its motion from a special cam on the needle cylinder through the truck 30, rod 31, pawl 32 and ratchet 33, said rod 31 having a spring 34 on it which always moves the rod forward to be acted upon again by the cam on the needle cylinder. The surface of the cam is made so that after said cam strikes the truck 30, the latter will remain at rest for a short period of time and during this time both the yarn fingers 16 and 20 will be in operative positions to deliver the yarn to the needles to form the splice or joining. This splice will be very short and may be regulated by adjusting the cam on the cylinder.

The feeding arrangement is another important point to consider in the mechanism, since by means of it the yarn is guided to the needles and cut out at the proper time. This arrangement manipulates the yarn after it leaves the guide fingers and consists principally of a guide wheel 35 which is loosely journaled and revolves by means of its frictional contact with the web 36, the object of said guide wheel being to guide the yarn, which is to be cut out, into its proper place, that is, to the shearing and clamping devices. The shearing device consists of one stationary blade 37 and a movable blade 38 secured on the end of a shaft 39 to the other end of which is secured an arm 40. This arm 40 has connected to it a vertical rod 41, the lower end of which is attached to a lever 42, this last lever being secured to a shaft 43 which also carries a lever 44 with a roll 45. On the end of shaft 43 is a pivoted lever 46 resting on top of a screw 47 and thus holds the shaft 43 from turning, which is its tendency to do, through a spring on its shaft. The shears are thus kept closed until the lever 46 is moved off of the screw 47.

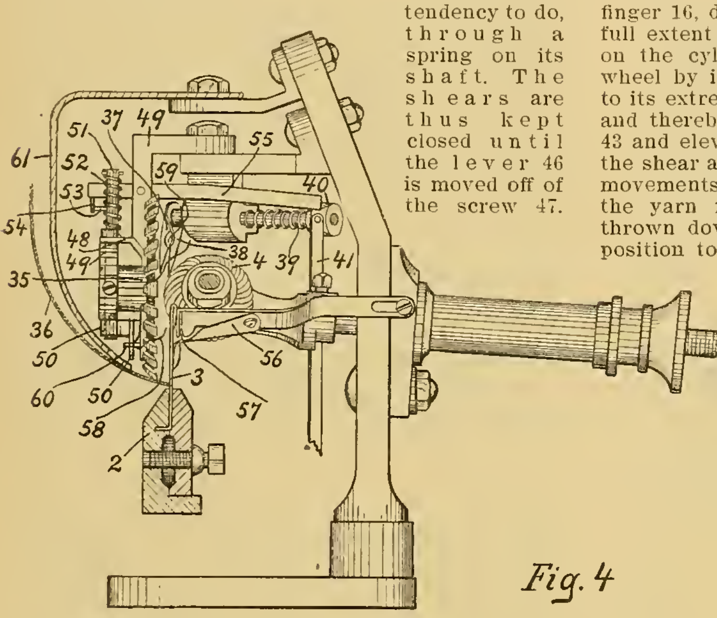


Fig. 4

The lever 46 is controlled by the lower end of lever 9, so that when said lever 9 is actuated by a screw on the pattern wheel, the lever is moved off the screw 47 and the spring on the shaft acts to open the shears through the levers previously explained.

The clamping or holding device for the yarn consists of a stationary piece 48 on the bracket 49, and a movable piece 50 on the lower end of a rod 51 having a spring 52 which tends to keep the two clamping pieces in contact. The rod 51 is provided with a projection 53 and against which a piece 54 on the end of a pivoted lever 55 presses to keep the clamping pieces out of contact with each other at the proper time. The other end of lever 55 rests on arm 40 and when the latter is raised, the piece 54 will press against the projection 53 and thus open the clamp. A specially shaped yarn guide 56 is used, so that the yarn can enter and leave its eye easily when being manipulated by the other arrangements.

The operation of the entire mechanism: To illustrate this point let us consider that a yarn 57, which runs through the yarn finger 20, is being knitted; while yarn 58, which runs through the yarn finger 16, is held in the yarn holder 48, 50. Assuming now that the pins on the pattern wheel are set to change the yarn, when the lifting surface of the cam on the needle cylinder engages the truck 30, the lever 9 will be actuated sufficiently to release the horizontal rod and throw the yarn finger 16 down to a position similar to that occupied by the yarn finger 20. This will result in bringing the yarn 58 between the needles and on the top of the arm of the yarn guide 56, and this yarn 58 will be carried along by the needles to the stitch wheel and knitted conjointly with the yarn 57, thereby forming the splice. This joint knitting will only be accomplished by three or four needles. The lifting surface of the cam on the needle cylinder will now engage the truck 30 and still further rotate the pattern wheel, which will result in lifting the yarn finger 20 to throw the yarn 57 out of action and inside the cylinder, and the guide wheel 35 will then engage this yarn 57 and by its rotation will guide it into the holder and between the blades of the shears. It must be here stated that the movement of the pattern wheel, which results in throwing down the yarn finger 16, does not move the lever 9 outwardly to its full extent; but when the higher surface of the cam on the cylinder engages the truck 30, the pattern wheel by its further rotation moves the lever 9 out to its extreme limit, thus releasing the snap catch 46 and thereby permitting the spring to turn the shaft 43 and elevate the link 41, which elevation will open the shear and also the yarn holder, and these opening movements occur simultaneously with the lifting of the yarn finger 20. When the yarn finger 16 is thrown down, the yarn 58 will also be brought into position to be engaged by the guide wheel 35, and this yarn will also be guided by the wheel between the blades of the shear, the several parts being so arranged that this yarn will reach the shears just as they are opened. The yarn 58 will therefore enter between the blades of the shear in advance of the yarn 57 and 58, which by this time will have been released from the holder 48, 50, will pass up the blades of the shear into the recesses 59. The continued revolution of the cylinder will now bring a cam into position to act on the truck 45, which will result in depressing the arm 44 and rotating the shaft 43 to bring the snap catch 46 back into locking position. The arm 42 will likewise be depressed, which will result in pulling down on the link 41, and thereby rotating the shaft 39 to close the blades of the shear and sever the yarn 57 while the yarn 58, by reason of its lying in the recesses 50, will not be cut. Simultaneously with the cutting action, the outer end of the lever 55 will be free to drop and the spring 52 free to exert its power to move the plate 50 toward the plate 48, and thereby close the yarn holder and clamp the thread 57. As the cylinder continues its movement, the loose end of the yarn 58 will be drawn through the recesses 59 in the shear.

In order to prevent the yarn between the plates 50 and 48 from winding around the hub of the guide wheel 35, a pin 60 is provided, which projects from the plate 48 through an opening or slot in the plate 50.

In order to keep the knitted cloth 36 out of contact with the bracket which supports the guide wheel and yarn holder, a shield 61 is provided. (Chas. Cooper, Bennington, Vt.)

JOINING FABRICS IN "SECTION-FLAT-RIB-KNITTERS."

The object is to produce a smooth, neat edge to the various sections of fabrics knitted side by side in these machines. For this purpose, the fabrics as joining, are united by a connecting thread, which later on, after the fabrics have been removed from the machine, is detached therefrom, by pulling one end of the same transversely of the sections of knitted fabric, and when thus withdrawn, leaves the adjacent ends of said sections with smooth, neat edges, said sections of knitted material being used afterwards in the manufacture of underwear, etc., etc.

Referring to the accompanying illustrations, Fig. 1

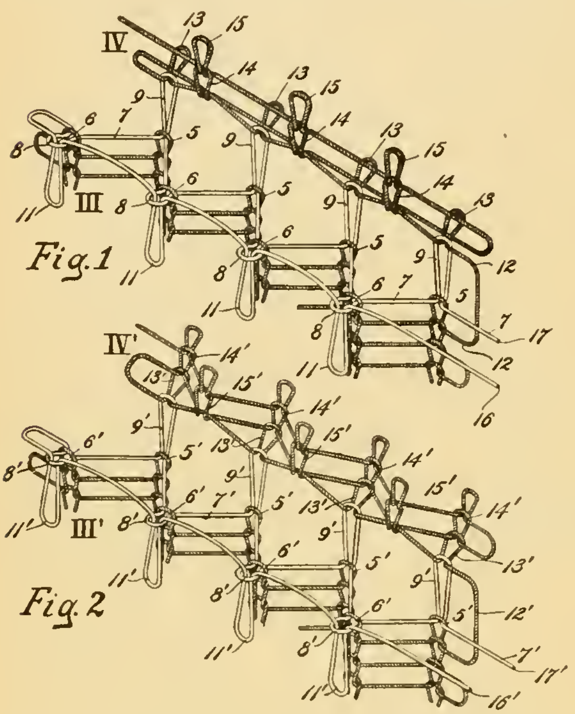


Fig. 1

Fig. 2

is a perspective view, illustrating one method of thus joining two sections of fabric, Fig. 2 showing another method.

With reference to Fig. 1, the two sections of fabric thus to be knitted together are indicated respectively by numerals III and IV. Examining the illustration more particularly, we will see that the final loops upon opposite faces of the one-and-one rib knitted fabric III are indicated by numerals 5 and 6 respectively. 7 is the connecting thread which extends laterally across said sections of knitted fabric from right to left, passing through the final loops 5 and 6 of said fabric III alternately, and forming one course of a one-and-one rib fabric, the loops 9 of said connecting thread extending through the final loops 5, and the loops 8 of said connecting thread through the final loops 6. After arriving at the left hand side of the fabric III, the connecting thread 7 returns, forming one course or series of elongated loops 11, which extend through the loops 8, previously formed by said connecting thread in passing from right to left of the fabric.

The fabric IV is formed by the yarn 12, which is a continuation of the yarn forming the fabric III, as seen at the right hand side of the illustration, and as said yarn passes across the fabric from right to left thereof, it forms in the first course the primary loops 13, which extend through the loops 9 of the connecting thread 7. Upon its return movement from left to right, the yarn 12 forms a second course or series of loops 14, and in returning again from right to left a third course of loops 15, extending through said loops 14, thus forming the regular single loop or plain fabric. The fabric IV is knit for two or three courses with a single loop, and then a one-and-one rib knitted fabric.

With reference to the style of joining two series of one-and-one rib fabrics, as shown in connection with Fig. 2, fabric III′ is joined to fabric IV′ by connecting thread 7′, which in passing from right to left across the fabric forms a course of one-and-one rib fabric passing through the loops 5′ and 6′, forming loops 9′ 8′ upon opposite faces, respectively, of the fabric III′. Upon its return, from left to right, the connecting thread 7′ forms a second course, consisting of long loops 11′, which extend through the loops 8′ previously formed by said connecting thread in passing from right to left of said fabric. The yarn 12′ forming the fabric IV′ is a continuation of the yarn forming the fabric III′, and passing from right to left of the fabric, forms in its first course primary loops 13′, extending through the loops 9′ of the connecting thread 7′, and upon returning from left to right the yarn 12′ forms in its second course a one-and-one rib fabric with loops 14′ and 15′ upon opposite faces, respectively, of the fabric IV′.

It will be noted that the free ends 16 and 17 of the connecting thread 7 with reference to fabric structure shown in Fig. 1, as well as the free ends 16′ and 17′ of the connecting thread 7′, with reference to fabric structure Fig. 2, terminate both upon the same side of the fabric. In removing the connecting thread 7 from the two sections of knitted fabric which it joins together, the free end 16 is first drawn toward the right, Fig. 1, and the loops 11 are withdrawn one after the other from the loops 8 from the right to the left hand side of the fabric. The free end 16 is then passed over to the left hand side of the fabric, and drawn toward the left, thus pulling the loops 8 through the loops 6 until all of the loops 8 are withdrawn through the loops 6 from the left to the right of the fabric. Upon continuing to pull upon the free end 16 toward the left, the loops 9 are drawn up against the under side of the loops 5 until the connecting thread from one side to the other is practically straight and the loops 13 are drawn by the loops 9 up against the loops 5. The connecting thread being now practically straight, from one side to the other of the fabric, is easily withdrawn by a continuation of the pull toward the left upon the splicing thread, thus entirely disconnecting the fabric III from the fabric IV, the loops 13 forming the primary loops of the fabric IV and the loops 5 and 6 forming the final loops of the fabric III. The removing of the connecting thread 7′, which connects fabrics III′ and IV′ (see Fig. 2) is substantially the same as thus described in removing connecting thread 7, as connecting fabrics III and IV. (Charles Cooper, Bennington, Vt.)

RIBBED KNITTED FLEECE LINED FABRICS,

i. e. Ribbed Knitted Fabric Structures Having a Loop-pile Surface Formed for the Purpose of Permitting the Raising of a Superior Nap on the Goods Afterwards.

In this new structure of knit fabrics, the loops which form said pile surface are formed by one of the strands of a compound knitting yarn, this structure being an improvement over the method until now practiced and where the pile surface is obtained from a supplementary yarn engaging with the ribs formed by said main knitting yarn or yarns, a structure which however always resulted in a comparatively inelastic fabric.

When in knitting a plain fabric an elongated loop is cast off of a needle of the machine, together with a loop of ordinary length, both loops will be thrown to the back of the fabric; but in knitting a ribbed fabric the simple elongation of the loop of one strand of the compound knitting yarn would result in the casting of said elongated loop between the front and back ribs of the fabric, so that it could not be acted upon by the card clothing of the napping machine in the after process of finishing the goods.

To overcome this disadvantage we find in the new structure one or more of the strands of the compound knitting yarn projected between the ribs of that face

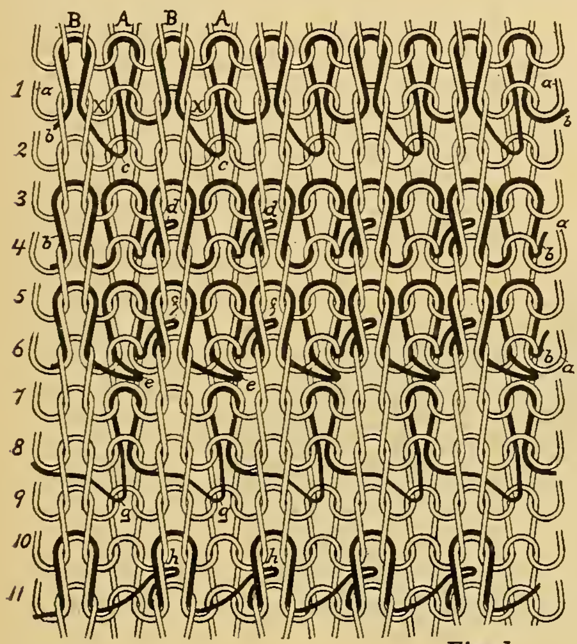


Fig. 1.

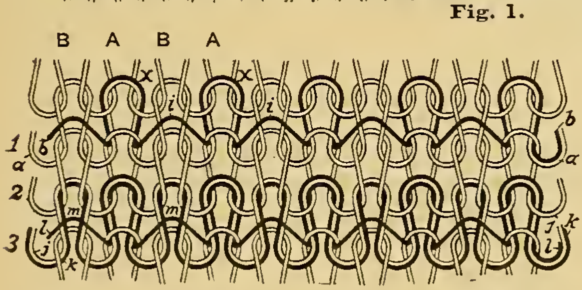


Fig. 2.

of the fabric selected for the pile surface, so as to form loops extending beyond said ribs, and whereby said loops can be properly napped in the process of finishing the goods, without injury to the body ribs of the fabric. The machine used for producing the new structure is such as has its sinkers so arranged that they can act upon one of the strands of the compound knitting yarn without acting upon the other strand or strands of the same.

In order to explain the new fabric structure the accompanying two illustrations are given, representing on an exaggerated scale, in outlines, pieces of regularly rib knitted fabric, showing, in full black, various ways of interlacing one of the strands of a compound knitting yarn as introduced specially for the formation of pile or fleece to the fabric during finishing (napping) the goods.

Numerals of reference in both illustrations (1 to 11 in Fig. 1 and 1 to 3 in Fig. 2), as will be readily understood, indicate successive courses of loop-formation in the structure, and letters of reference A and B, the respective ribs—Face and Back—characteristic to plain ribbed knit goods (see Fig. 12 on page 191 explaining the principles of knitting.) The stitches in the ribs A are drawn in one direction or to one face of the fabric and the stitches in the ribs B are drawn in the opposite direction or to the other face of the fabric, the yarn in the sinker-wales X extending from ribs of one face of the fabric to ribs of the other face, the same as is practiced with common plain ribbed knit fabrics.

As mentioned before, a compound knitting yarn however is used in connection with the new structure, the minor threads of said compound thread being indicated by letters of reference *a* and *b* respectively, and of which *a* (shown in outlines) refers to the regular yarn, as required for the plain ribbed structure, and *b* (shown in full lines) to the additional strand of the compound thread, either thread (*a* and *b*) being controlled by independent yarn guides or one guide with two feed holes, so that one strand can be acted upon independently of the other.

With reference to the first course of loop formation shown in the illustrations (see 1 in Fig. 1) the strand *b* is projected from the compound yarn where the same forms sinker-wales X so as to form loops *c*, which project outwardly beyond the ribs B in order that they can be readily napped during finishing the goods, and without injury to the knitting yarn constituting the said ribs, these loops being formed by applying the strand *b* of the knitting yarn to a projecting sinker in its course from the needle which produces the rib B, to the needle which produces the rib A.

In course 4 of the fabric structure shown in Fig. 1 the strand *b* of the knitting yarn is projected so as to form loops *d* on the opposite face of the fabric from that on which the loops *c* are formed, the operation being the same except that the sinkers draw the loop in the opposite direction from those which formed the loops *c*.

In course 6 of the fabric structure shown in Fig. 1 the formation of loops on both faces of the fabric is given, viz. *e* and *f* respectively.

In course 8, Fig. 1, the loops 9 as formed from the strands *b* of the knitting yarn do not form stitches in the ribs B of the fabric, the yarn guides in this case being so arranged that the guide which controls the strand *a* will feed the same to both sets of needles; but the guide which controls the strand *b* will feed the same only to the needles which produce the ribs A and to the sinkers, this strand passing behind or out of the path of the other set of needles, which produce the ribs B in the fabric.

In course 11 Fig. 1, the strand B of the knitting yarn forms loops *h* without forming stitches in the ribs A of the fabric. The yarn guide controlling strand *b* in this case feeds said yarn to the needles which form the ribs B in the fabric and to the sinkers, but lays said strand *b* behind or out of the path of the needles which form ribs A in the fabric.

A compound knitting yarn otherwise disposed, as in courses 8 or 11, as thus explained, may be caused to form loops on both faces of the fabric by subjecting its strand *b* to the action of sinkers disposed in every one of the spaces between the needles instead of only in every other space.

In course 1, Fig. 2, the loops *i* overlap ribs B instead of being drawn out between the ribs A and B.

In course 3, Fig. 2, is shown a similar fabric, in which, however, each compound yarn is composed of three minor strands *j*, *k*, *l* instead of two strands, the strand *l* being the one which forms the loops *m*.

With reference to illustrations given it will be readily understood that whatever pattern used (of those seven illustrated) in practice the compound knitting yarn will usually be employed in every course in order to produce a uniform fabric, the single diagrams being given for sake of clearness.

This mode of producing a suitable surface for an improved nap in the finishing to knit goods, and thus shown in connection with a plain ribbed fabric, is also applicable to knitted fabrics in tuck stitch, the location and disposition of the fleecing loops in the latter case not varying materially from those shown in connection with illustrations given. (Scott & Williams, Phila., Pa.)

THE SCOTT & WILLIAMS LOOPING AND SEAMING MACHINE.

This machine is made with or without the elastic stitch attachment, and is designed for the joining or seaming of knitted fabrics, like the toes of seamless hosiery, heels and toes of regular made hosiery, as well as rib cuffs and bottoms for Balbriggan underwear. The machine is also used for the seaming of sweaters, and attaching of sweater necks, etc., and is most simple in its construction and operation, it being similar to a chain stitch sewing with the addition of the points upon which the fabric to be joined is set, thereby insuring the proper fastening of each stitch. The seam made on this machine is very small and elastic.

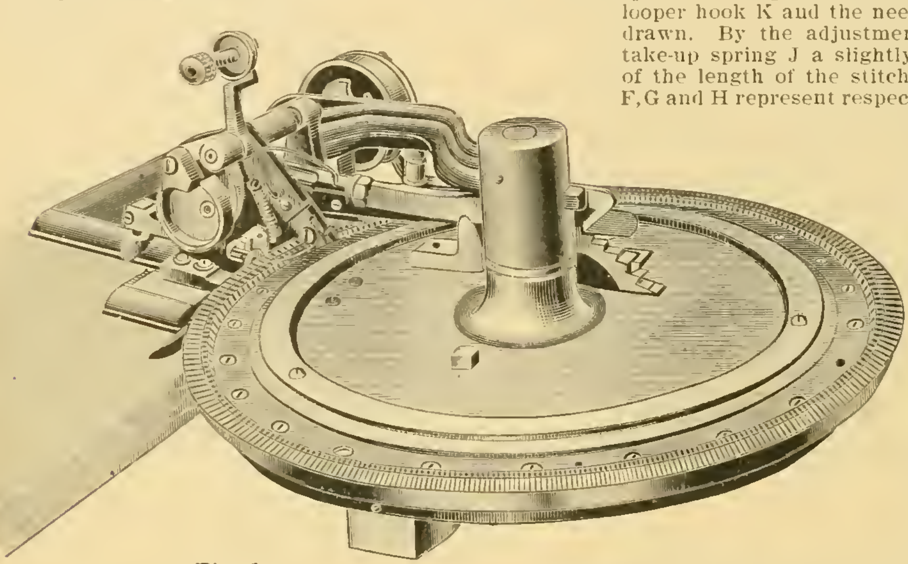


Fig. 1.

The construction and adjustment of the machines will be readily understood from the accompanying illustrations, of which Fig. 1 is a perspective view of this looper. Fig. 2 represents a sectional view of the bed plate and point ring. Fig. 3 represents a side elevation of all the working parts of the machine, and Fig. 4 a plan and side elevation (enlarged) of the points upon which the fabric is set for seaming.

In Fig. 2, A indicates the looping points, B the clamp plates, and C the clamp screws, for the replacing of broken or defective points. D represents a friction clamp, which is used to avoid the point ring from being easily moved out of alignment with the needle by the operator when putting the fabric on the points.

With reference to Fig. 3, E represents the sewing thread tension of the machine, and which should be always sufficiently tight to draw the loop tight enough to clear looper hook K after it has been cast off from it. The tension or take-up spring J draws the loop or stitch tight, after it has been cast off the looper hook K and the needle L has been withdrawn. By the adjustment of the tension or take-up spring J a slightly variable tightening of the length of the stitches may be obtained. F, G and H represent respectively the needle arm and its eccentric, also the cams and looper hook arm. All these parts are permanently adjusted on the machine before it leaves the works, hence no further reference to it is required. Looper hook K is adjustable, both in a horizontal and vertical position; the vertical position should be such as will permit the needle to enter the hook central between the tongues, whereas the horizontal position should be such as will permit the top tongue of the hook to take the thread from the needle about ¼ of an inch back of the eye, the needle L being adjustable for this purpose. I is a rack, having a suitable number of teeth to suit the gauge or number of points in the machine. It is adjustable on its shaft, so that the points can be set to index with the needle, a feature necessary with machines of this kind.

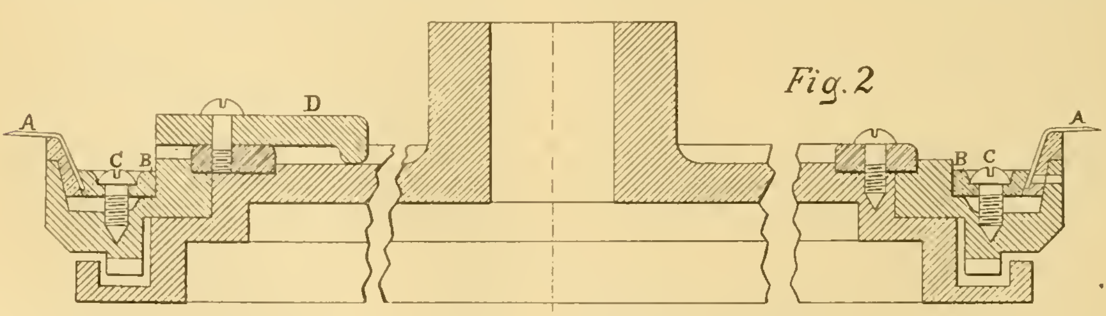
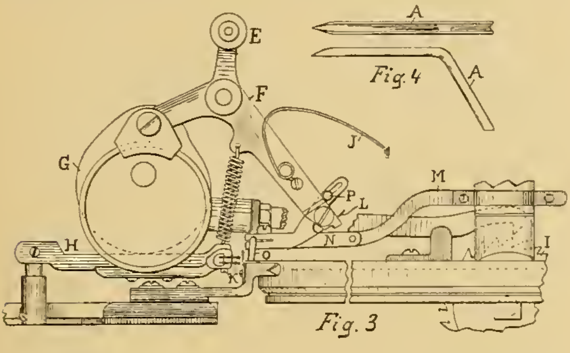


Fig. 2

M, N and O represent an elastic stitch attachment which can be applied to any make of machine, the



same consisting of a bracket M, which is clamped to the centre post of the machine. N is a pivoted lever, in which is set a stitch finger O, which being in the path of the thread, has the loop formed around it at the same time the stitch is through the loops. This finger remains in the loop until the needle arm F has nearly completed its movement, and when arm F comes in contact with stud P in arm N, it raises the finger O out of the old stitch prior to forming a new stitch.

Loopers are built in one size only, the number of points per inch varying to suit the gauge of the knitted fabrics to be looped or seamed. The following gauge and number of points will be found the most suitable for a general line of work:

16 to 20	needles per inch	=	20	point loops.
14 " 17	" " "	=	18	" "
11 " 15	" " "	=	17	" "
10 " 12	" " "	=	16	" "
8 " 10	" " "	=	14	" "
7 " 9	" " "	=	12	" "
6 " 8	" " "	=	10	" "
5 " 7	" " "	=	9	" "
4 " 6	" " "	=	7	" "

The speed of machine should be equal to the skill of the operator, the production varying according to the gauge, from 30 to 100 doz. per day. (Scott & Williams, Philadelphia, Pa.)

SCOTT & WILLIAMS' FINISHING MACHINE

For Automatically Festooning and Taping Ladies' Undergarments at the Necks and Arms.

Of the accompanying illustrations, Fig. 1 shows this machine in its perspective view, Fig. 2 a garment finished by the machine. Production of finished necks and arms in connection with this fabric is 35 doz. per day of 10 hours, whereas if dealing with fabrics requiring the finishing of necks only, 100 doz. per day of 10 hours can be produced.

The machine automatically inserts the tape as the bars are formed and attached to the garment. This finish has many advantages over the old method of sewing the previously made lace to the garment, both as to cost and durability, as well as the appearance of the garment when finished.

The construction of the machine and its operation are best described in connection with Fig. 1, which is a regular twin needle, zig zag upon which is placed the festooning and braid attachment, as shown in detail in Fig. 3. In the latter illustration, A represents the needle bar, with its head, having two needles fitted therein, which are threaded and tensioned in the usual manner. B represents the bar lever, which forms the bars through which the tape is threaded, this lever being threaded with a chained thread, made from the regular knitting yarn, or an extra heavy plain yarn as desired. C represents the festooning lever, threaded the same as lever B. This lever is arranged with two thread holes, so that various colors or threads can be used for tipping the festoon edges with silk, and various effects can be produced by the arrangements of the threads. All of the threads in levers B and C should be put under a slight tension by the attachment supplied to the machine for this purpose. Levers B and C are operated by grooved cams, which are pinned to their shafts, no changes or adjustments being necessary.

D indicates the braiding attachment for inserting the braid as the bars or lace are attached to the garment, the braid finger E receiving its braid from a spool mounted on a spindle under the machine table and should be slightly tensioned to avoid the sewing of the braid to the garments.

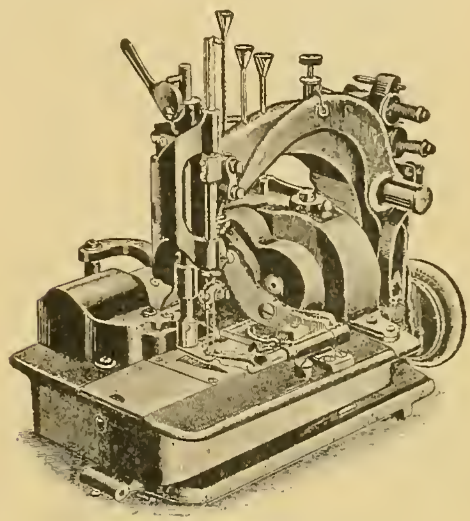


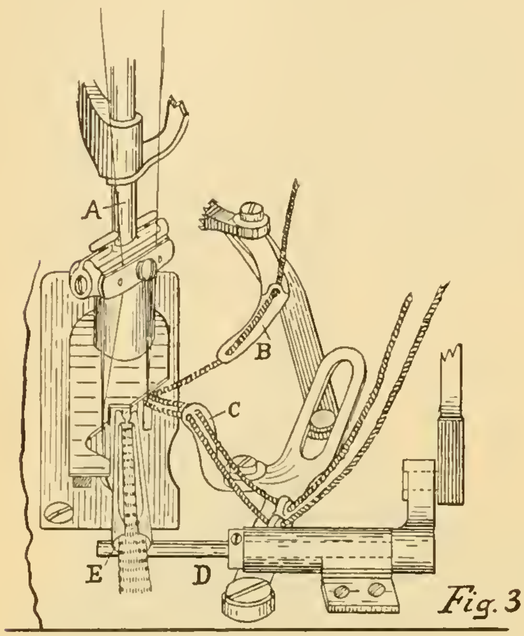
Fig. 1.

The operator feeds the garments to the machines in the usual manner, until the edging has been sewed

Fig. 2.

around the entire neck or arm hole, passing from under the presser foot of the machine at this point.

The operator then stops the machine and cuts the festoon apart, allowing the tape to be drawn through the machine sufficiently long to enable the operator



to tie the ends of the tape into bow knots at the top of the garment, in the arm holes, and the front of the garment at the neck.

The converting of the knitting threads into chain threads, for use on this machine, is done by an ordinary Chain Machine. (Scott & Williams, Philadelphia, Pa.)

SCOTT & WILLIAMS' NECK SEWING AND CUTTING ATTACHMENT.

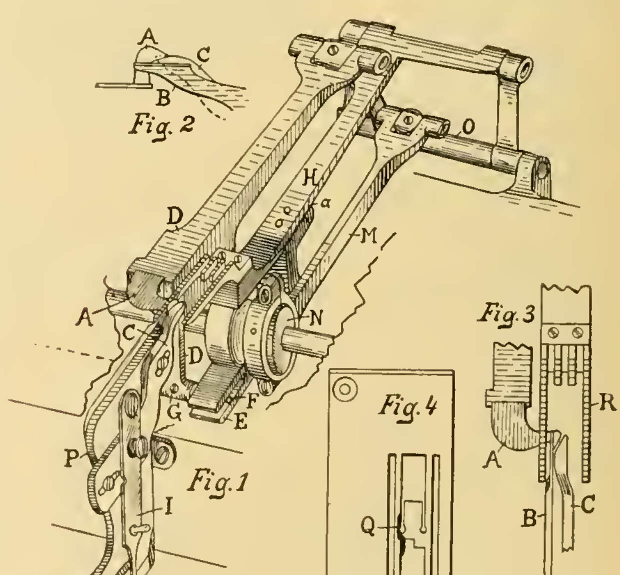
This attachment to sewing machines is designed for the automatic cutting and sewing of necks of knit underwear in one operation, thereby effecting, as will be readily understood, a considerable saving of labor, besides increasing the production. There is also less confusion in the new method of cutting and sewing the necks owing to the fact that two separate operations are dispensed with.

The machine is quite simple in its construction and operation, one operator being able to cut and sew from 125 to 150 doz. necks per day of 10 hours. The necks of the garments are marked in the usual way, some mills using for this work a power stamping machine, while others prefer the hand marking templet to mark the size and shape of the neck on the goods. Thereupon the goods are taken to the sewing machine, which completes the neck in one operation, thus saving the cost of the sewing by the single needle machine, and the cost of the cutting of the neck, which has always been a hard operation, requiring great skill. The new method also gives a neater finish owing to the fact, that it is impossible for an operator to fail to cover the raw edge when the cutting and sewing is done in one operation. The attachment can be applied to any twin needle flat bed machine of the Union Special Sewing Machine Company's type.

The adjustment of the attachment to suit the cloth to be operated upon is best described by means of quoting letters of reference in the accompanying illustrations, and of which Fig. 1 is a perspective view of the entire attachment, less the throat plate and presser foot. Fig. 2 is a side view of the upper and lower knives with fabric guard. Fig. 3 is a plan view of the knives and their relation to the feed dog. Fig. 4 is a plan view of the throat plate, showing the fabric diverter, for diverting the loose fabric from the path of the needle. Fig. 5 is a plan view of the knives and their lever. Fig. 6 is an end view of the fabric guard and its bracket, which is fastened to the front of the cloth plate.

Fig. 7 shows the completed shirt minus sleeves (more particularly given to show the completed neck), and Fig. 8 is a detail of the neck portion of this shirt (enlarged, compared to Fig. 7) showing the circular flap A as cut out (see B) of the material C sewed onto (*i. e.* reënforcing) the back portion of the shirt. Letters of reference *a* and *b* in Figs. 7 and 8 indicate corresponding portions in the shirt, *c*—*d* indicates the line on which the top of the shirt is sewed, the front portion of the shirt being shown turned back.

The top or movable knife A is shown in Fig. 2 at its highest position, prior to cutting the fabric. B represents the stationary or bottom knife, which should be set level with the top of the throat plate shown in Fig. 4. C represents the deflector, which is adjustable, as shown in Fig. 1, in combination with parts I and K, and of which I represents a lever, which through the deflector C can be adjusted to any one of three positions, it being understood that this member is employed to stop the cutting operation, and is also used as a gauge for the cutting of light Balbriggan fabrics. The deflector C is shown in all the illustrations as being set to its central position, suitable for light or Balbriggan fabrics, the forward throw of lever I, Figs. 1 and 6, raising the deflector C to such a position that all the fabric passes over the top of the knife A, thereby avoiding any cutting of the fabric. This is necessary, since an operator is sometimes called upon to re-sew a garment that has been previously cut around the neck by the machine,



or where the machine has been running with a broken sewing thread.

When the lever I is put back to the extreme outward position, by raising the lever I clear from the adjusting screw K in Figs. 1 and 6, the deflector C is at its lowest position, suitable for heavy fleece fabrics.

The adjusting screw K in Figs. 1 and 6 is used for setting the deflector C to a suitable position for light or thin fabrics, thus enabling the operator to finish any weight of garments at will; the best method of obtaining this adjustment being by sewing a small piece of waste fabric before commencing on a garment.

If the deflector C is too high, the knife will fail to cut; if too low, both layers of fabric will be cut.

The knife A is pointed, since it is necessary for it to pierce the fabric when a garment is first placed in the machine, the point of the knife A being somewhat lower than its back. When cutting one layer of fabric, the other will be entirely clear of the cutting point.

D in Fig. 1 represents the knife lever, upon which the movable knife A is mounted, this lever having both a vertical and a horizontal movement, giving the top knife A, a regular shearing motion. The vertical motion is obtained through the slotted bracket E, Fig. 1, mounted on the feed dog lever H at *a*, Fig. 1; the horizontal movement being obtained by the aid of the eccentric N and levers M and O, Fig. 1. The timing of the eccentric N should be opposite to that of the regular feed dog eccentric. Lever D, Fig. I, is connected to a bracket E by means of an eccentric stud F, held securely by a small screw G.

The bottom knife B is mounted to the deflector bracket P, as shown in Figs. 1 and 6, which in turn is securely mounted on the cloth plate of the machine, as shown at L in Fig. 6, in section.

Fig. 4 represents the throat plate of the machine, upon which is mounted a diverter Q for diverting one edge of the fabric out of the path of the needles, so that the backing of the neck of the garment only is sewed.

Fig. 3 shows the relative positions of the top and bottom knives A and B, with their cutting edges together, also the position of the deflector C, which should be as close to the knife A as possible, without actual contact. R represents the feed dog for feeding the fabric.

Review of general adjustment: See that all screws in the machine are secure, adjust the sewing in the usual way as the attachment requires no special

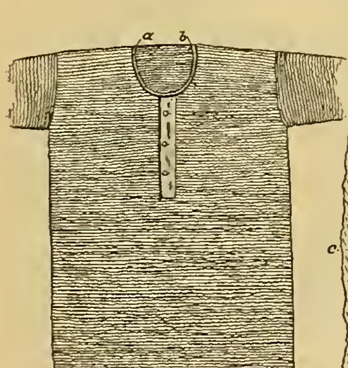


Fig. 7

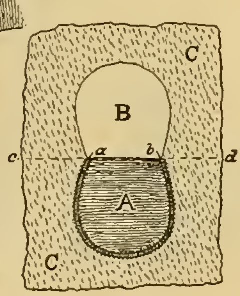


Fig. 8

adjustment in relation to the sewing parts. Set the knife A securely to lever D, set deflector C to its lowest position, try the cutting by using a heavy piece of fabric, two ply, in the same manner as a garment is sewed. If the knife is too high, both layers of fabric will be cut, if too low, neither layer will be cut; correct adjustments can be quickly made by turning the eccentric stud F in lever D (see Fig. 1.) See that the eccentric holding screw G in lever D is secured after each adjustment. After these adjustments are made, set the deflector C to

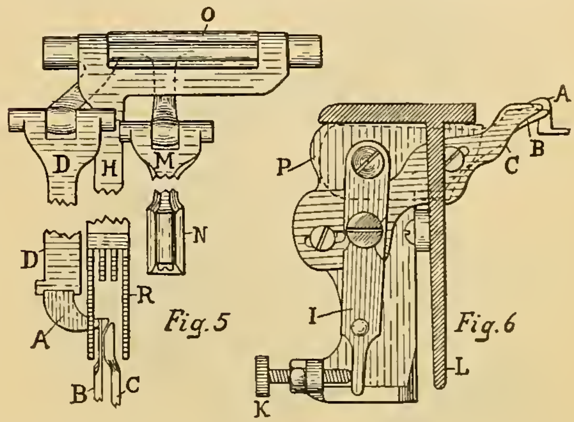


Fig. 5 *Fig. 6*

its central position, as shown in Figs. 1 and 6 by lever I. Then try the lighter fabric you wish to operate upon, adjust the screw K (Figs. 1 and 6) until one only of the two layers of fabric is cleanly cut, whereupon the machine is ready for use. (Scott & Williams, Philadelphia, Pa.)

THE MERROW SYSTEM OF ORNAMENTING FABRICS.

The Merrow System of Crocheting and Overseaming machinery and methods for finishing or ornamenting the raw or cut edges of textile fabrics has been in use for several years and includes many unique machines and results.

As the name implies, the finishes are after the order of those frequently made by hand crocheting and some of them are really the same as hand work, while others are similar but more elaborate.

The machines are in general much like sewing machines and the fabrics are handled by the operator in substantially the same manner as work is handled upon an ordinary sewing machine. All of the machines, however, are of special design and construction, adapted to their peculiar purposes and needs, and are built expressly for continuous operation at high speed in factories.

Single Thread Finish. Some of the finishes are made from a single thread which is carried through the fabric near the edge and interlooped along the edge alternately from either side of the fabric. This finish seems to be especially adapted to protecting and ornamenting heavy blankets and has been generally adopted for use upon the edges of horse blankets.

Fig. 1 is a perspective view of such a single thread crochet machine as made for this purpose, and which is usually provided with a hemmer which folds or doubles over the edge, and the crochet finish extends deep into the fabric including and covering the hem, making a heavy substantial edge with the minimum expenditure of covering material. These machines are built to run as rapidly as an expert operator can properly handle the blankets; therefore the production is very great, and the total cost of finishing is reduced to the minimum.

Two Thread Finish. Another class of the Merrow machines is especially designed for producing the two thread, double loop finish in which the needle thread is interlooped in double loops together with a supplemental thread along the edge of the fabric, producing a substantial and ornamental finish which

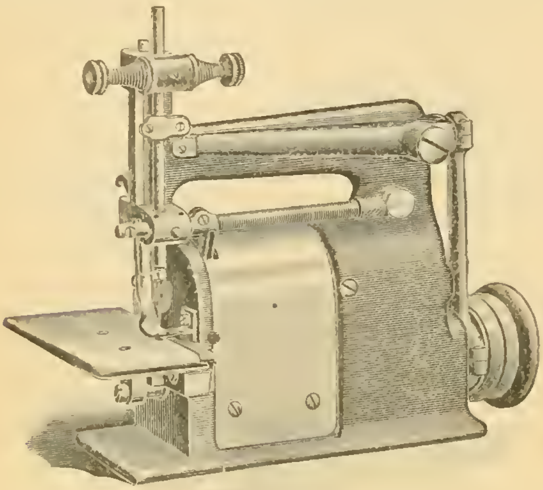


Fig. 1.

may be varied in elasticity to suit the work by varying the tension and size of the supplemental thread, and the appearance may further be varied by the use of a supplemental thread of contrasting shade or color. When desired the single thread finish can be made by the machines of this class by simply dispensing with the supplemental thread.

The machines of this class are made in two principal varieties, viz.: those making the plain finish where the work is fed intermittently at every stitch, and the other making the scallop or shell stitch finish, both of which resemble, but are improvements upon, hand crocheted finishes.

The Plain Crochet Machines are largely used in finishing the edges of the heavier grades of knit goods; tops of Lumbermen's socks; the bottoms of leggings; and all heavy ribbed fabric; the edges of wool blankets, light and heavy; the edges of cotton plush or napped blankets; the bottoms of flannel skirts, either cotton or wool; and very many other goods.

The machines are adapted to form a smooth, clean finish upon the roughest and most obstinate edges of any kind of fabric, and they are specially built for almost any purpose—some producing fine, narrow finishes; others very deep, very heavy borders, and others for the intermediate degrees of thickness of fabric and depth of finish.

The Scallop or Shell Stitch Machines are specially designed for producing the two thread scallop or shell stitch finish, which is an improvement upon the hand crocheted shell stitch in that the shell is reenforced with an extra thread interlooped along the edge, making it possible to produce effects not made by hand by introducing a supplemental thread of contrasting shade or color, and at the same time the shells are more substantial and retain their form in washing, and wear better than the handmade.

Fig. 2 shows in its perspective view one of these scallop or shell stitch machines, and which are very largely used in finishing the edges of knit underwear of all sorts, blankets, laprobes, horse covers, bottoms of skirts in cotton or wool flannel, and a large variety of other manufactured goods.

This finish on account of its low cost of production, its durability, and its beauty has come into general use. These machines are made in several varieties according to the width or depth of finish required.

The Overedging Machines produce a fine edge finish in buttonhole stitch with either three threads or two threads as wanted.

This stitch is made by locking a covering thread with the needle thread at or near the edge of the fabric and at the point of penetration of the needle, forming a purl with two threads or a "boxing" with three threads at the very edge.

Fig. 3 shows in its perspective view one of these overedging machines, and which is made in various modifications to produce a finish from the very narrowest stripe on a folded edge to a wide or deep finish on cut or selvage edges, and are very generally used in finishing the edges of knit underwear and for forming stripe effects in the body of fabrics by folding the fabric, then finishing the folded edge and afterwards flattening out the fabric. This variety of Merrow machines is built expressly for continuous running at very high speed in factories.

The Trimming and Overseaming Machines are in general appearance similar to the overedging machines previously referred to, only they are improved in many of their details and are provided with improved cutters which trim the edges of the fabric ahead of the needle and simultaneously with the sewing operation.

These machines are made for producing either the two or the three thread finish and some varieties of them are made so that they can be easily changed to produce the one or the other. They are in general use and their efficiency and durability, running continuously at three thousand or more stitches per minute, have been fully proved. These machines are usually provided with an edge controller designed to prevent the edge of the fabric from pouting or being stretched during the seaming operation.

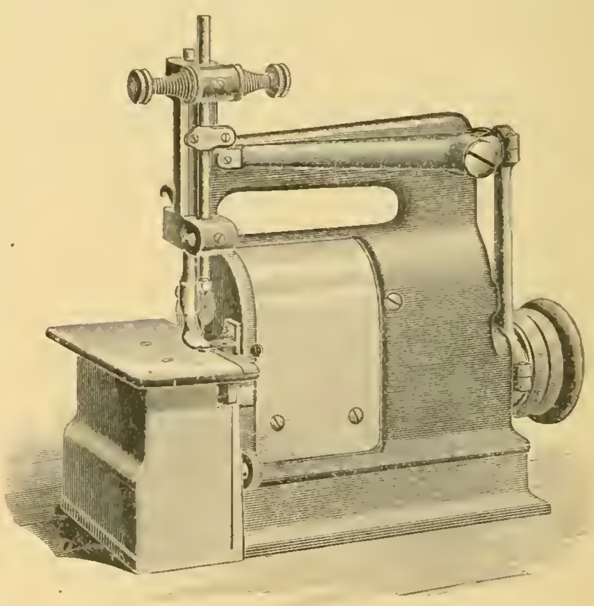


Fig. 2.

Many varieties of this type of machines are made, some of them being adapted to special purposes. Besides ordinary seaming and edge finishing, some are adapted to make a blind hem or concealed stitch very accurately by the use of special guides and appliances, and some are made for producing unusually

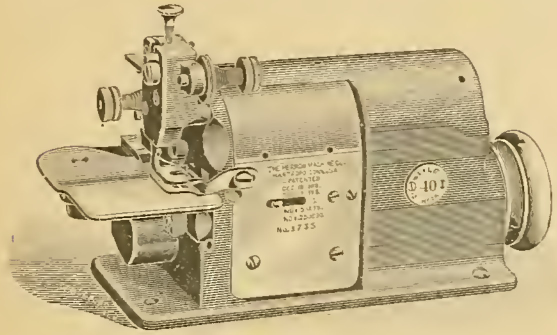


Fig. 3.

narrow or extra wide or deep seams or finishes. (The Merrow Machine Co., Hartford, Conn.)

TAYLOR'S BAND FOLDING AND CUTTING MACHINE.

The object of this machine is to automatically fold the edges and cut the cloth into the proper sizes or lengths required for trimming all kinds of knit fabrics and especially knit underwear, as for instance, the button stays, facings, waist bands, tapes, etc.

The machine is characterized by its simplicity, and consists principally of a folding piece for turning over the edges of the cloth which has been previously cut into the desired widths, a pair of feed rolls for passing the cloth through the machine, and a measuring and cutting arrangement for cutting the folded strip into the desired lengths according to the fabric on which it is to be used.

A point of interest in connection with the cutting arrangement is a device for stopping the delivery of the folded cloth while the cutting operation is going on, which prevents the material from choking the machine by accumulating behind the knife. The machine is very compactly made and occupies only a small space on a bench.

The accompanying illustrations will readily explain the details of the machine, Fig. 1 being a front elevation of the machine, and Fig. 2 a partial end view, showing the clutch mechanism for driving the machine.

Referring to the illustrations, 1 indicates the bed plate of the machine to which is secured two upright arms 2 and 3 which have bearings provided for the bottom feed roll 4 and also hold the movable bearings for the top roll 5. The shaft 6 of the bottom roll 4 extends across the length of the machine and has a clutch 7 secured to it at the left hand end, which when in clutch with the pulley 8, will drive the machine.

Secured to the front sides of the arms 2 and 3 is a work plate 9 which carries the folding piece 10 and through which the strip of cloth to have its edges folded first passes before being gripped and pressed by the feed rolls 4 and 5. This piece 10 is specially shaped at each side, *i. e.* with its edges turned over so that the cloth in passing through it will have its edges follow the curve of the edges of the piece 10 and thus be folded over by them. This piece 10 is easily removable and may be replaced by another size when it is necessary to fold different widths of strips.

Situated in back of the rolls 4 and 5 is a table on which the folded cloth passes, its outer edge being used as a cutting edge in connection with the cutting knife 11. This knife 11 is secured to a shaft 12, said shaft having a finger 13 which is actuated at the proper time to cause the knife 11 to descend and cut the cloth into lengths. The finger 13 is moved in an outward direction by means of raisers 14 on a chain 15, coming against it, which causes the knife to descend, a spring on the shaft 12 (not shown) also aiding in this movement, the knife being raised after the raiser passes the finger 13, by means of a spring 16 connected to the lower end of the finger 13 and to the work plate 9. The knife is prevented from raising too high by a stop piece 17 which is situated over its left hand end, and thus the finger 13 does not come in contact with the joints of the chain 15. The chain is positively driven from the front roll through bevel gears 18 and 19, the latter

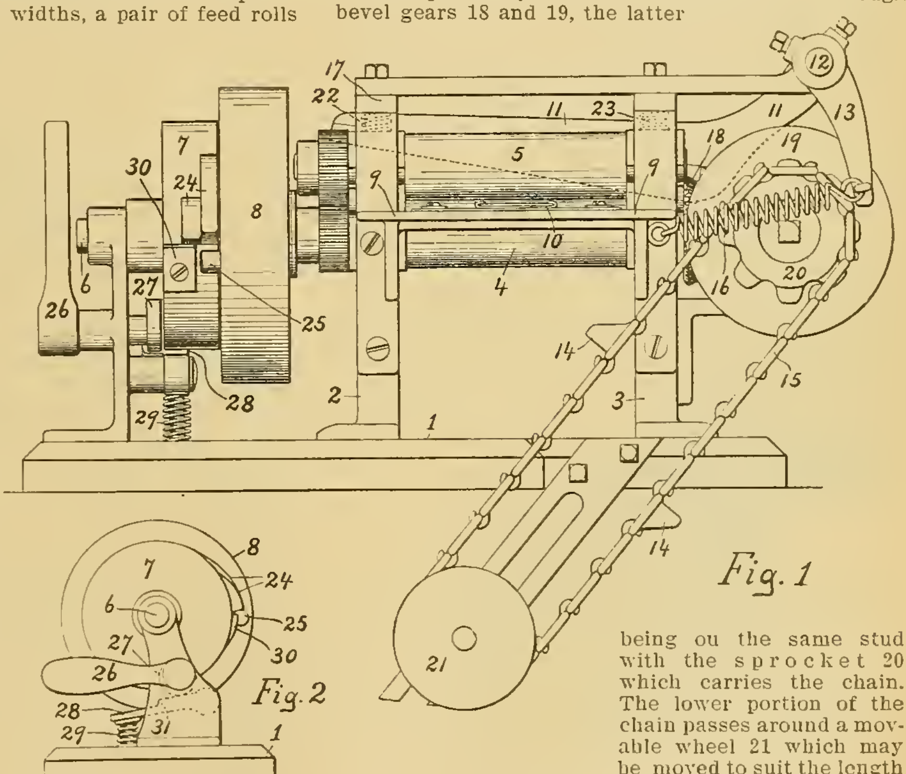


Fig. 1

Fig. 2

being on the same stud with the sprocket 20 which carries the chain. The lower portion of the chain passes around a movable wheel 21 which may be moved to suit the length of chain required. The distance between the raisers on the chain regulates the length to which the pieces of cloth are to be cut and thus by simply changing the position of the raisers on the chain, the lengths cut may be changed, and also the chain may be so built as to cut alternately different lengths.

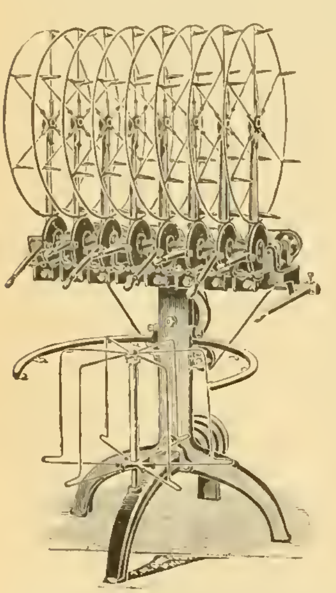
When the knife is cutting, the delivery of the material is stopped by raising the top roll 5 so that the rolls do not grip the material. The top roll 5 is raised by having a finger rest under each bearing of the roll, the other ends of the fingers being attached to a shaft which also has a backwardly projecting finger attached to it and situated under the right hand end of the knife, so that as the latter descends, a small piece attached to it presses on the finger and raises the other two fingers which in turn raise the roll. Springs 22 and 23 press the roll down again after the cutting is completed.

The clutch mechanism is shown in front elevation in Fig. 1 and in side elevation in Fig. 2. As was mentioned, the clutch 7 is secured to the shaft 6, and has a pivoted projection 24 in its perimeter, which is normally held in the position shown, by a spring on the inside of the clutch.

A pin 25, secured in the side of the pulley 8 comes in contact with this projection 24 and thus revolves the clutch and consequently the shaft 6. When it is desired to stop the machine, the lever 26 is raised by hand and the cam 27 allows the piece 28 to be raised by the spring 29, so that when the projection 24 comes around, it is pushed inwardly by the piece 28, which liberates the pin 25 from engagement with said projection. The momentum of the clutch will take it around slightly until the stationary projection 30 on the clutch comes in contact with the shoulder 31 on the piece 28, which immediately stops it. To start the machine again, the lever 26 is lowered, and which causes the cam 27 to press the piece 28 out of the path of the projection 24, so that when the pin 25 comes around, it will come in contact with said projection and revolve it in the usual manner. (James Taylor, Philadelphia, Pa.)

TAYLOR'S BACK WINDING MACHINE FOR WASTE KNIT FABRICS.

The object of this machine is to unravel imperfect pieces of knitted fabrics and wind the yarn thus obtained into a convenient form for handling and reusing. It will back-wind cardigan, half cardigan or tuck stitch, plain ribbed or flat goods, plaited goods, in fact any fabric as knitted with eight feeds or less may be thus unraveled, and in cases where two yarns had been originally, when knitting the fabric, fed through one yarn carrier, they may be separated and wound on separate reels. The advantage of this machine is at once apparent, in cases where high price material has been used, since the same can then be used again, whereas without this arrangement, the imperfect fabrics could only be sold as seconds or waste.



A perspective view of the machine is shown in the accompanying illustration, from which it will be seen that the same consists principally of eight upright arms, being provided at their top ends with open bearings for their respective reels to fit into, which construction allows each reel to be easily lifted out separately of its bearing in order to enable the operator to doff as the reels become full.

Each reel consists of a wire hoop with six spokes on which short pieces are secured, near the rim, projecting horizontally from said spokes, and on which the yarn is wound.

The reels are driven by having each rim in frictional contact with a grooved plate, the latter being driven by friction from a small plate in contact with its side face, said small plate being horizontally movable on to large and small diameters of the groove plate, by means of levers shown at the front of the machine. This allows each reel to be driven at any speed required by the stitch of the fabric it is back winding the yarn from, as is the case, for example, in tuck stitches. Each shaft of the small plates is driven by the same belt from the main pulley by having said belt pass alternately over and under small pulleys on the ends of the shafts.

The fabric to be raveled is placed on a wire frame, shown near the bottom of the machine in the illustration, different size frames being provided for different size fabrics, the former being easily taken off to be replaced by the proper size frame. The ends of yarn after being found on the fabric, are passed separately up through thread guides near the levers and from there to the reels where they are wound into skeins. (James Taylor, Philadelphia, Pa.)

FULLING MILL FOR KNIT GOODS.

There are two general kinds of construction of fulling mills used in connection with knit goods as require fulling, viz.: the hammer mill and the pendulum mill.

In the *hammer mill*, two beaters, as hanging suspended from the frame work of the machine, are alternately raised and lowered vertically by means of a revolving roll having prominent projections on its surface, and which projections in turn engage respectively with one projection on each beater and thus raise them, said beaters dropping by their own weight onto the fabrics under operation as soon as the two projections, which raised them — separate, and when the procedure of raising the beaters in turn is repeated. There are two beaters used for each trough as holding the fabrics and which trough generally is zinc lined, the feet of said beaters being at their lower ends, which come in contact with the cloth to be fulled, step-shaped at an angle of about 45 degrees, and by means of which shape they impart to the fabric under operation a rolling motion, which continually will bring different fabrics or portions of one fabric, under the direct operation of the feet of the beaters. This vertical movement of the beaters, however may be obtained in another way, for example by means of crank and lever or disk and lever connections.

In the *pendulum mill*, the feet of the beaters are operated in a more or less horizontal direction, by means of suitable crank and lever connections. The accompanying two diagrams are given to illustrate the construction and operation of such a fulling mill, and of which Fig. 1 is a side elevation of the machine with a portion of one of the sides broken away to more clearly show the means for loading and unloading the machine, Fig. 2 being a view in detail. With reference to Fig. 1 it will be seen that the trough into which the goods to be fulled are placed is fixed at an inclination to the floor line.

This angle of inclination is of service when changing the position of the beater feet, since the path in which the driving shaft moves during alteration is practically concentric with an arc struck from the line shaft and from which the beater is driven. The beater feet are suspended from a fixed centre and fall diagonally, making 180 strokes per minute or 90 each foot or pendulum. The beater feet being worked by an eccentric on the driving shaft, and the driving shaft being movable to the extent of 13 inches, the position of the feet may thus be varied to the same extent, in turn enabling the pressure on the cloth

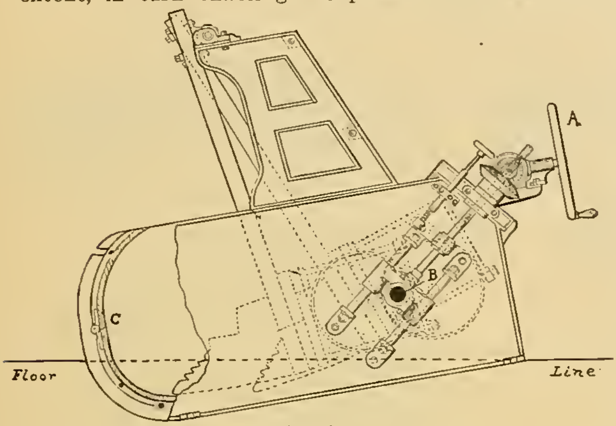


Fig. 1.

to be varied at pleasure. Diagram Fig. 2 shows the extent to which the alteration can be made. When the centre of the driving shaft is at F, that is, as forward as it can be, the position of the beater feet is shown at D, and when the shaft B is wound back by the hand wheel A and bevel wheels shown (see Fig. 1), as far as it will go, that is to G (see Fig. 2 again), the position of the beater feet is as shown by E, which is 13 inches farther back than D. It may

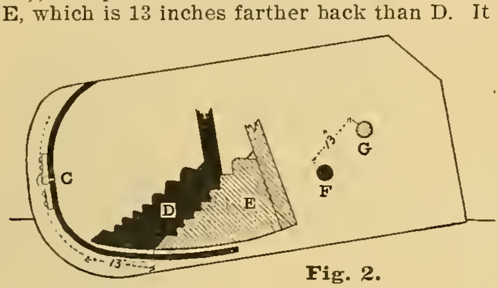


Fig. 2.

be said that when the feet are at E, the fulling mill has half as much more space for being loaded with goods to be fulled than when at D. From this it will be obvious that the same machine may be conveniently used for handling knit goods, or any other fabrics, in varying quantities. The front portion C of the fulling mill is hinged so that it can fall back and allow of the piece being quickly changed. Besides being used for a fulling mill the same machine can be also used for cleansing purposes after fulling or as the case may require.

JONES' NAPPER FOR FLEECED HOSIERY AND UNDERWEAR.

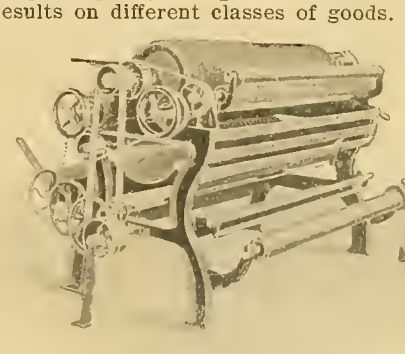
The same is a very simple and inexpensive machine for this purpose. In this machine the goods are fed between two corrugated rolls which revolve slowly, and pass the goods between two rapidly revolving rolls, covered with card clothing, which brush against the cloth and thus produce the required nap on the fabric. Revolving fans or paddles are placed close to the rolls, near the point where the goods leave, to prevent them from winding on the rolls.

A very long heavy nap can thus be produced by this machine. It is an invaluable machine for some lines of fabrics, since very short pieces can be napped by it, other styles of these machines for this purpose requiring an "endless" fabric to work upon.

Previous to submitting the fabric to the machine, see that all raveled ends are trimmed off, so as to avoid their catching in the card clothing. Run the revolving fans or paddles close to the card clothing, but without touching, since otherwise the latter will be dulled. Do not let the card clothing on top and bottom rolls touch. To sharpen the card clothing, cross the belts (thus running the machine back), and hold a strickle against the card clothing for about five minutes. Always sharpen ends the most to avoid making centre hollow. Hand screws are placed on front of the machine for regulating the pressure on the goods. Tighten the set screws when the proper adjustment is obtained. For satisfactory work in connection with hosiery, run Napping rolls 1200 r. p. m., countershaft as carrying tight and loose pulleys 600 r. p. m.; six inch pulleys on both. For underwear increase speed to 1500 r. p. m. (Lewis Jones, West Philadelphia, Pa.)

CURTIS & MARBLE KNIT GOODS NAPPER.

The accompanying illustration shows this napper in its perspective view, the same being designed for napping knit goods, such as fleecings, linings, stockinets, eiderdowns, etc., where a very thick and even nap is desired. The napping is done in the web or piece, one run of the fabric through the machine being in most instances all the napping required. The goods may be wound on the lower roll in front, or run from the fold and after passing through the machine are rolled up in the brackets at the back. Revolving spiral spreader rolls keep the goods out to their full width, and at the same time prevent their edges from curling over. The feed rolls, covered with card clothing, are placed close to the points of contact with the napping cylinder, to avoid any stretch of the goods, and insure even work. The napping cylinder, clothed with tempered steel clothing, is of large size, and acts upon the goods twice in their passage through the machine, napping them as they pass over the sharp edges of the cloth rests, which may be readily thrown away from the cylinder to allow a seam to pass, and be returned to the same position by means of levers. The amount of contact on the goods is easily regulated by hand wheels, and either light or heavy goods may be napped without delay in adjusting. An arrangement of hand wheels and ratchets is provided for convenience in threading the goods in the machine, and the feed of the cloth may be stopped and started while the cylinder is in motion. The speed of the cloth can be altered by change of pulleys or gears, so as to obtain the best results on different classes of goods. Brackets



are placed on the machine, for holding a traverse grinder for grinding the cylinder when required. The machine is built in different widths, for 40 inch, 60 inch, 74 inch, or 90 inch goods; its usual speed being 300 r. p. m. (Curtis & Marble Machine Co., Worcester, Mass.)

J. H. A. KLAUDER, Pres. and Gen'l Manager.
HENRY HIGGS, Superintendent.

J. H. GILES, Treasurer.
E. HEPPENSTALL, Huddersfield, England.

THE KLAUDER-WELDON
DYEING MACHINE COMPANY
AMSTERDAM, NEW YORK, U. S. A.

BUILDERS OF MACHINES FOR

DYEING
RAW WOOL,
RAW COTTON,
WASTE,
RAGS,
KNIT CLOTH,
SHIRTS,
DRAWERS,
HOSIERY,
HATS, CAPS,

DYEING
COTTON SKEINS,
WOOLEN SKEINS,
SLUBBING,
WORSTED SKEINS,
SILK SKEINS.

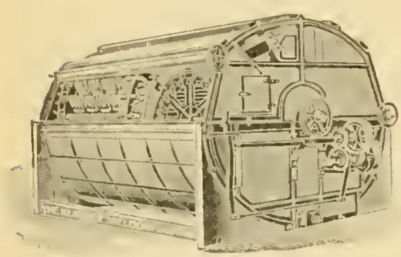
DYEING
SULPHUR COLORS
RAW COTTON,
HOSIERY,
SKEINS.

BLEACHING
RAW COTTON,
SKEIN.

SCOURING
YARNS.

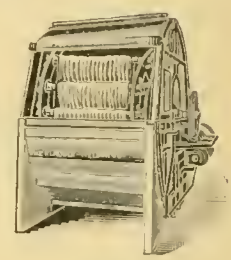
MERCERIZING MACHINES, FOR WARPS AND SKEIN.

SKEIN AND SLUBBING DYEING MACHINES.



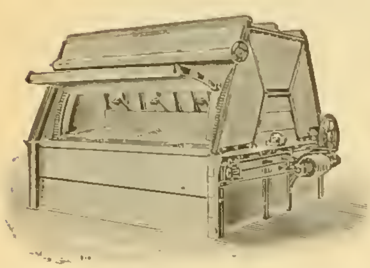
SAVES
75 per cent. in Labor.
30 per cent. in Winding.
Steam and Dye Stuffs.
Perfectly Even Dyeing.

CAPACITY:
50 to 700 pounds per batch.



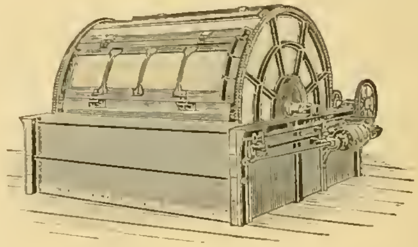
No Friction on the Skeins. No Matting or Tangling of the Yarn.
Universally Used.

RAW WOOL AND COTTON DYEING MACHINES.



SAVES
50 per cent. in Labor
besides Steam and Dye Stuffs.
Practically Indestructible.

CAPACITY:
200 to 1000 pounds per batch.



Leaves Stock in Perfect Condition. Does not Mat or Tangle the Fibre.
A Perfect Machine.

DYEING, BLEACHING, MERCERIZING, ETC., MACHINERY, DYESTUFFS, CHEMICALS.

THE KLAUDER-WELDON RAW STOCK DYEING MACHINE.

The object of this machine is to dye raw cotton or wool with an even and uniform color throughout the

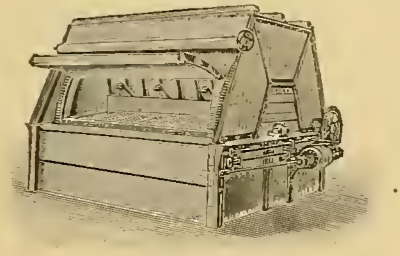


Fig. 1.

entire batch. and this without matting or massing the fibres into a big lump during the operation.

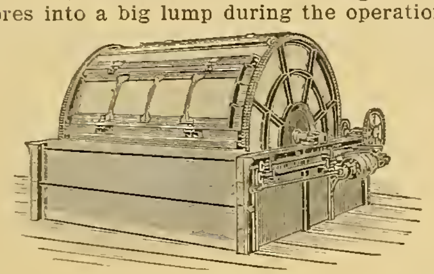


Fig. 2.

The machine is of the revolving type and consists principally of a hollow metal cylinder made into compartments for holding the stock to be dyed, a wooden tank containing the dye-liquor and in which the lower half of the metal cylinder revolves, and a wooden covering to enclose the cylinder and tank.

The details of the arrangement and the method of operation of the machine are given in the accompanying illustrations, of which Fig. 1 is a perspective view from the front of the stock dyeing machine; Fig. 2 a similar view, with the top cover removed, and Fig. 3 a section view through the machine, showing the arrangement of the compartments, method of driving the cylinder, etc.

Referring to the latter illustration, 1 indicates the wooden tank for holding the dye-liquor, said tank being made very thick to insure its durability. Heavy cast iron frames are attached to the sides of the tank to strengthen it. When installed in a plant, the tank is placed from 12 to 24 inches below the floor level, according to the capacity of the machine, in order to bring the doors of the cylinder conveniently low, so that the material to be dyed can be loaded and unloaded quickly and economically.

The cylinder is indicated by 2, and is constructed of heavy iron and bronze side castings and cross pieces fastened with large copper rivets and bolts. In the illustration, the cylinder is shown divided into four compartments, which is the arrangement used for cotton and coarse wool, while for fine wools six compartment machines are used.

It will be seen that the partitions 3 forming the compartments are not set radially from the centre of the cylinder but at an angle, the object in thus dividing the cylinder into compartments being to divide the material to be dyed into different batches in order to insure the thorough penetration of the dye-liquor and to prevent the material from matting and tangling during the process.

Outwardly projecting pieces 4 are also placed in each compartment of the cylinder in order to aid in keeping the material in a loosened condition.

To obtain a perfect circulation of the dye-liquor through the material while the cylinder is passing through the bath, the copper sheets, with which the compartments, cylinder heads, and partitions are lined, are perforated. Each compartment has a door 5, extending the full length of the cylinder, which when opened, allows the material to be loaded into or unloaded from its respective compartment.

The material is loaded into each compartment separately from the back of the machine, whereas the unloading is done at the front of the machine, the bottom partition of each compartment forming a table from which the stock is pulled with rakes into trucks or boxes. During the dyeing process the

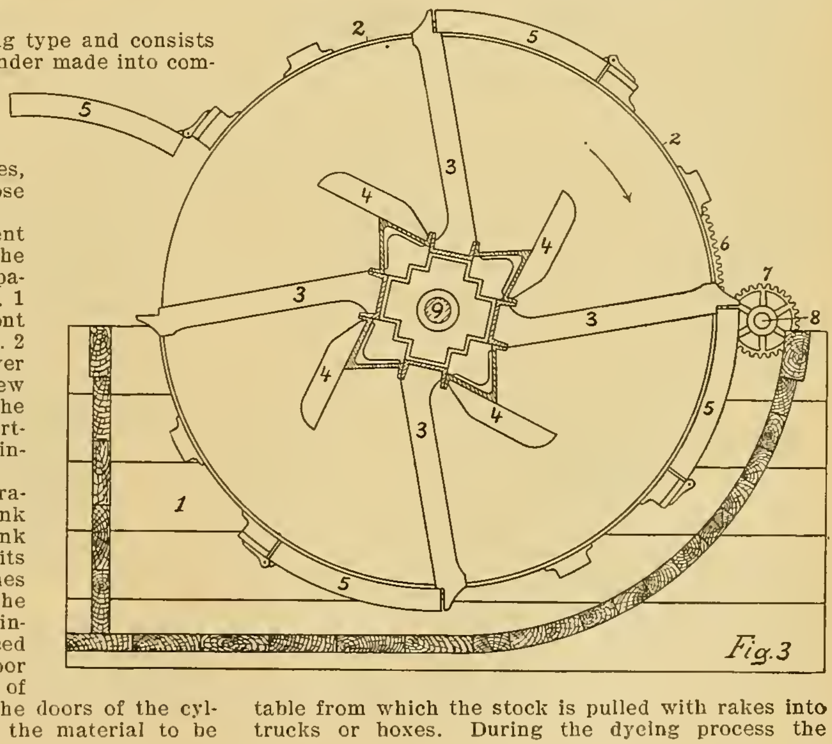


Fig.3

doors 5 are fastened securely to the cylinder by heavy bronze screws.

Attached to the periphery of each cylinder head are heavy bronze gear racks 6 into which mesh pinion gears 7 attached to a shaft 8, placed across the back end of the tank, said shaft being driven through gears from a belt and pulley. The cylinder is rotated slowly in the direction of the arrow on the centre shaft 9, thus carrying the material being dyed down into and through the dye-bath.

The compartments of the cylinder are so constructed that material in them is turned over at every revolution of the cylinder without any rolling motion, thereby preventing the stock from forming a mass or ball, and at the same time allowing all parts of the batch to be thoroughly penetrated by the liquor.

It has been demonstrated time and time again by practical experiments, that raw cotton or wool cannot be dyed in a cylinder that is not divided into compartments, for the reason that the material being dyed becomes matted and massed, thereby preventing a thorough and even penetration of the dye-liquor, and also leaving the stock in a very poor condition for after the operations.

The outside wooden cover of the machine has cast iron frames attached to each end, and to insure strength and rigidity, these are coupled together by rods extending from one side frame to the other.

The openings in each slide of the cover, where the machine is loaded and unloaded, are covered with canvas curtains when the machine is in operation. These roll up and leave the openings clear when the machine is being loaded or unloaded, as seen in Fig. 1.

This cover is used on the machine to confine the steam, thereby keeping the bath at an even temperature with less steam than it would be possible to do if the cylinder was exposed; also keeping the dye house free from steam which would be impossible if the covering was not used.

The machine is equipped for fast and slow speed, and the cylinder can also be reversed if desired. The method of driving the cylinder from a shaft extending across the back of the machine, and to which two pinion gears are attached that mesh with the racks fastened to the periphery of each cylinder head, is used on account of the enormous weight of the soaked material being dyed.

All the strain is thus taken from the main shaft, and at the same time insures a steady, even, driving motion which prevents the cylinder from being racked and strained by the irregular movement of the material being dyed.

The dye-liquor is heated by steam from perforated steam pipes which are located in the bottom of the tank. These are entered from both sides of the tank and run to the centre to insure an even boiling of the bath.

The capacity of the machine varies from 200 pounds to 1000 pounds per batch, depending on the size of the machine, and requiring from $1\frac{1}{2}$ H.P. for the smallest machine, to 3 H.P. for the largest machine.

Bleaching Raw Cotton. The machine as just explained for dyeing raw stock may also be used for bleaching raw cotton, but in which case it is necessary to have special linings for the tank, etc., and for economical reasons, it is best to have in addition to the machine, a separate tank to hold the bleach liquor when it is not being used, and a pump for pumping the bleach liquor from this tank to the machine, when required. Previously to bleaching, the cotton is wetted out with hot water in the machine.

In the machine, the raw cotton is thus successively wetted out, bleached, scoured, washed, tinted, and if desired, dyed without being handled or removed from the machine, the only thing necessary being to change the baths for the different processes. This makes the complete process practically a continuous one and by which the most economical results can be obtained, siuce one man can attend to the machine while in operation and thus the cost of labor is reduced to a minimum.

The tank of the machine is lined with heavy sheet copper, which allows the machine to be thoroughly and quickly cleaned after the different processes, and also prevents the wood work from being attacked by the bleaching liquor.

The cylinder is made entirely of bronze and perforated sheet copper, since it is absolutely essential that no iron shall enter into the construction of a bleaching apparatus, in order to guard against any possibility of rust spots, which would stain the cotton and thus be the cause of unsatisfactory work.

By having the cylinder enclosed, besides confining the steam, it also prevents the water, bleach liquor, etc., from splashing out, and on to the bleach house floor. The tank for holding the bleach liquor, when not in use, is preferably located below the level of the machine tank and under the floor. When the bleaching process is finished, the liquor is run out into this tank, and pumped back again when required. If circumstances do not allow the tank being placed below the floor, it could, of course, be located above the machine, and in which instance the pump would be used to take the liquor to this storing tank; however the location of the tank below the floor is preferable in all cases where possible to do so.

The machine is practically devoid of intricate or delicate parts, and consequently the expense and annoyance of break downs are almost nothing.

When not required for bleaching, the machine, of course, can be used as a dyeing machine, as previously explained. (Klauder-Weldon Dyeing Machine Co., Amsterdam, N. Y.)

THE KLAUDER-WELDON SKEIN DYEING MACHINE.

This machine is used for dyeing wool, worsted, cotton or silk, which has reached the stage of its manufacture where it has been reeled and made into skeins, so that the machine can operate on it in this form. It may be slubbing to be dyed, and which afterwards has to be twisted with some other yarn to make the completed product, or it may be the completed yarn, either single or ply yarn as the case may be, but in any case it must come to the dye house in the form of skeins.

The machine for dyeing the skeins is of the revolving type, and consists of a wooden tank, in which

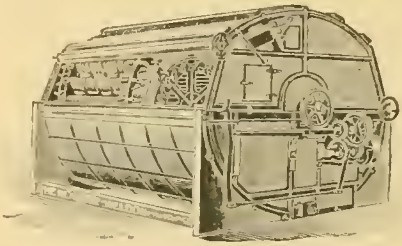


Fig. 1.

the dye-liquor is put and through which the skeins are passed, a metal reel, specially constructed for holding the skeins of yarn, and a wooden covering for enclosing the tank and reel.

The details of the machine and its method of operation are best shown by means of the accompanying illustrations, of which Fig. 1 is a perspective view of a double width machine, Fig. 2 a perspective view of a single width machine, Fig. 3 a cross sectional view of the machine, showing the centre spider which is the main portion of the reel, Fig. 4 is a detached holder from the outer series of holders on an outside spider, and Fig. 5 a detail view of a special inside holder for the dye sticks, taken from a centre spider, shown enlarged compared to Figs. 3 and 4.

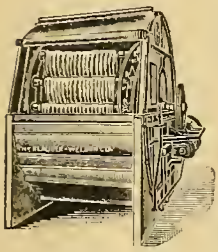


Fig. 2.

Referring to Fig. 3, numeral of reference 1 indicates the tank for holding the dye-liquor, in which a partition or false back 2 is placed at one end of said tank, and under which the steam pipes 3 are placed, the tank, when positioned in a dye house, being placed from 12 to 24 inches below the floor level, according to the capacity of the machine, to allow the operator to load and unload the machine handily, quickly and economically.

The reel 4, for holding the dye sticks on which the skeins to be dyed are placed, consists of three metal spiders in this machine, and of two spiders in a single width machine. These spiders are constructed of heavy iron and bronze castings, except when used for acid dyeing, when the whole construction is of bronze. They consist of skeleton frames, to which are fitted two series of attachments 5 and 6, for holding the ends of the square and round dye sticks on which the skeins 7 are placed, there being only two sections of the spider shown fitted with these attachments, but in the machine the other five sections are similarly fitted up.

Two styles of dye sticks are used in the machine, square sticks being used to rest in the outer holders of the spiders, and round ones are used to rest in the inner holders. The square sticks are left square at one end and made round at the other, the square end of each stick of the two series fitting into an outer holder, as shown in Fig. 4, as located on the outside spiders, while the round end of each stick fits into the holder 5 on the centre spider. This arrangement of having one end square is to allow the stick to be turned on its axis and consequently also the skeins of yarn, the method of doing this being to have the holder made rotary, and having projections 8 on all four sides, so that one always projects outwardly, and as the reel revolves, this projection comes into contact with a tripping arrangement and the holder and stick are turned one-quarter of a revolution on their axes. A ratchet 9 and pawl 10 are used to hold the stick after it is turned.

The round end of the stick is held by a corresponding outer holder 5 on the centre spider, and which consists of a semi-circular piece 11 in which the end of the stick is placed, and a latch 12 which secures said stick in its place, said latch being held in place by a spring 13.

To place a stick in the holder, or take one out, it is only necessary to press on the outer end of the latch in the direction of the arrow, which causes the latch to be moved on its pivot 14 and thus leaves the piece 11 open for the stick to be placed in it or taken out, as the case may be.

The round dye sticks are made round at both ends, one end fitting into the inner series of holders 6 on the centre spider, which operate similarly to those at 5, the other end fitting into a corresponding round hole on the outside spiders. These sticks do not require to be automatically driven, since the friction of the yarn will rotate them.

Another style of these holders, used as an inner series, on a centre spider is shown in Fig. 5. They are used where different length skeins are to be dyed in one machine, and where the stick may be placed in either hole 15 or 16, according to the length of the skein. The stick is held in by latches 17 and 18 respectively, said latches being pivoted at 19 and 20 and connected to an elbow lever 21, so that both are actuated by the lever 22. A spring 23, connected to one end of the elbow lever 21, keeps the latches always in position over the holes in which a stick is held.

When loading the machine for dyeing, each set of skeins is hung over one square and one round stick. The square stick is first placed in the machine; then the round stick. When unloading, the round stick is first removed from its bearings; then the square stick, and both sticks and yarn are then carried from the machine.

After placing the skeins in the machine, they are tightened by a lever 24 which is connected to the movable ring 25 on which the holders 6 are secured.

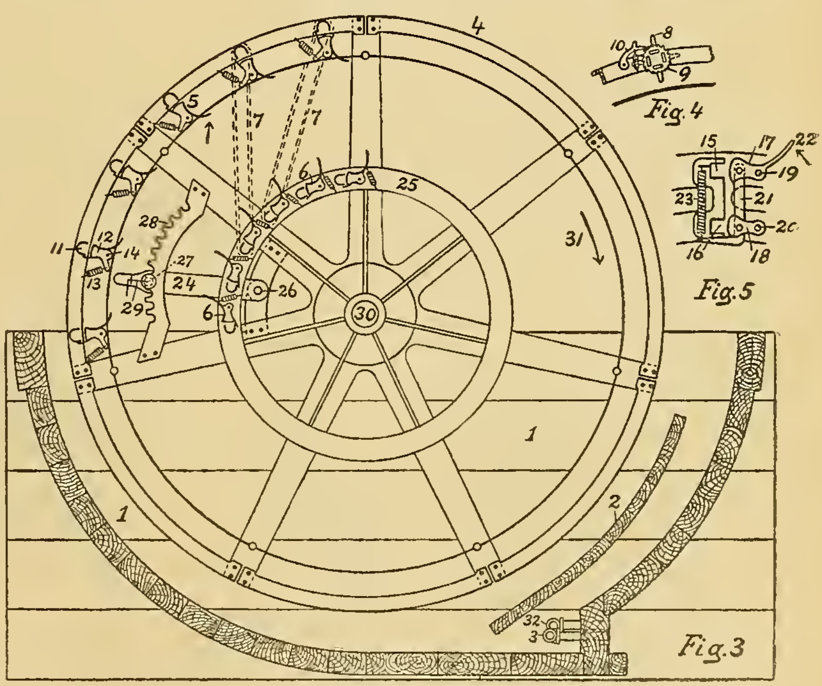


Fig. 4

Fig. 5

Fig. 3

This lever 24 is pivoted at 26, and after pulling the skeins as tight as required, said lever is secured in that position by letting a pin 27 into a groove 28 directly under it by means of a small rod 29.

The spiders composing the reel are attached to the shaft 30, and to the end of this shaft is fastened a driving worm gear, which, when the machine is in operation, causes the reel to rotate slowly in the dye-liquor, in the direction of the arrow 31.

The turning of the dye sticks by the means previously explained, causes the skeins to slowly change their positions on the sticks, thus insuring perfectly even dyeing, since all parts of the skeins will then be exposed to the dye-liquor uniformly, at the same time preventing any tangling of the yarn.

The machine is furnished with two sets of sticks for each compartment, so that while one batch is being dyed, the other set of sticks is loaded with another batch of skeins, and in this manner prevents delay between dyeing the batches. The steam pipes for the steam are entered into the bottom of the tank from the side and placed under the partition or false back 2, this arrangement being necessary, since these pipes are perforated, and the false back has to be used to prevent the jets of steam from striking the yarn.

The dyestuff is poured into a bronze kettle, attached to the outside of the machine, and is accurately fed to the bath, without any danger of spilling, being carried and discharged into the tank by means of perforated copper pipes 32.

The wooden cover for the machine has cast iron frames attached to each end, and to insure strength and rigidity, these are coupled together by rods extending from one side frame to the other.

The openings on each side of the machine, where the reel is loaded and unloaded, are covered with canvas curtains when the machine is in operation. These curtains roll up and leave the openings clear when the machine is being loaded or unloaded. This cover is used on the machine to confine the steam, thereby keeping the bath at an even temperature with less steam than it would be possible to do if reel was exposed; also keeping the dye house free from steam which would be impossible if the covering was not used.

The machine is equipped with fast and slow speed, and the direction of rotation of the reel can be reversed if so desired.

An outlet valve is placed on the side of the tank at the bottom and is of sufficient size to carry away the dye-liquor quickly after being used.

An alarm bell is attached to the machine, so that should any of the skeins become tangled, or a breakage of the sticks occur, the dyer is immediately notified by the bell.

With reference to silk dyeing, single and double width machines are built, to color from 5 to 200 lbs. of silk in the gum, said machines being designed so that the reel may be hoisted out of the bath, so as to facilitate sampling, and to allow any manipulation or changing of the bath that might be necessary. The tanks are also copper lined, and on account of this lining can be quickly and thoroughly cleaned with very little trouble between dyeing different colors.

For dyeing sulphur colors, the tank and cover are constructed entirely of iron and the latter is water tight, thus allowing the skeins to be completely submerged in the dye-liquor during the dyeing. All other parts of this machine are also made of iron.

When used for bleaching purposes, the spiders and fittings are made entirely of bronze, and the tank is copper lined, while if to be used for scouring, the machines have iron spiders and fittings.

Among the advantages of the machine are that, being automatic, it therefore produces an evenness of dyeing that cannot be obtained by hand. The machines are under control at all times and the skeins treated with a uniformity that insures a perfect production.

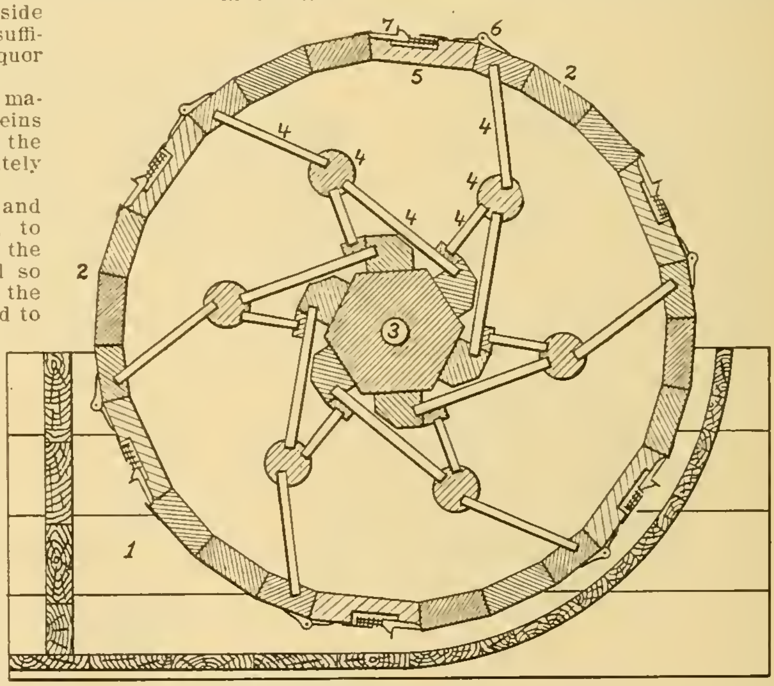
The dyer is relieved from the supervision of a large number of men and necessarily saved an amount of worry and annoyance.

One of the largest items in its favor is the saving in labor, since after the machine is loaded and started, it requires, comparatively speaking, no attention until the process is finished. Other items are, a saving in floor space, less steam required, economical use of dyestuffs, more accurate dyeing, a careful and gentle manipulation of the material during the process of dyeing and consequently a saving in labor and material in rewinding the material in the mill. (Klauder-Weldon Dyeing Machine Co., Amsterdam, N. Y.)

THE KLAUDER-WELDON KNIT GOODS DYEING MACHINE.

This machine is used for dyeing hosiery, underwear, caps, etc., which come to the dye house in an unfinished condition, that is with reference to the underwear, made up into unfinished garments. After coming to the dye house, the fabrics to be dyed are first boiled out, in the same machine as afterwards used for dyeing, and which consists of a tank for holding the dye-liquor and through which the goods are passed, a wooden cylinder divided into compartments, which holds the goods to be dyed, and which revolves with its lower half submerged in the dye-liquor, and a wooden cover which may either cover both the tank and cylinder or only the tank.

The details of the construction and operation of the machine are best shown by means of the accompanying illustration, which is a cross sectional view of the machine.



Referring to the illustration, 1 indicates the wooden tank made with heavy cast iron frames on each end of the tank, and to which the gearing is attached.

The cylinder, indicated by 2, is made almost entirely of white pine and cypress, each end head being supported by a bronze casting, the hub of which is keyed to a shaft 3. The cylinder is divided into six compartments by the partitions 4, which are so shaped as to prevent the goods being matted together by the revolution of the cylinder during the dyeing process, thus enabling the goods to be more evenly and thoroughly dyed.

The partitions of the compartments consist either of perforated boards or series of round pins, so placed that a perfect circulation of the dye-liquor is obtained. The steel shaft 3 extends through the centre of the cylinder and rests in bearings on the sides of the tank. This shaft is covered with wood on the inside of the cylinder to prevent the goods from coming in contact with the steel, the object of this being to prevent rust spots on the goods. Each compartment is provided with a door 5, and through which the goods are loaded and unloaded. The doors are perforated to allow the dye-liquor to circulate from the tank through the compartments, and are provided with heavy bronze hinges 6 and catches 7 to close and fasten said doors.

A steam pipe is entered in the side of the tank at the bottom and extends across said tank. The goods, being inside the cylinder, are thus not disturbed or injured by the steam.

An outlet valve for discharging the water, etc., is located on the side of the tank and is constructed of cast iron, bronze and rubber.

The top covering is supported on each end by cast iron frames and is well rodded. The openings at the back and front of the machine are covered by canvas curtains and which are rolled up during the loading and unloading process. The object of the top is to save steam, as it confines the heat; the volume of liquor is also reduced to a minimum, as compared with the amount of material being dyed, which results in using the dyestuff to the best advantage.

The cylinder is rotated by a driving arrangement, either from the side or from the back of the tank. When driven from the side, a worm gear is attached to the end of the main shaft 3, that runs through the centre of the cylinder, and this gear is driven from a worm located on the same shaft with the driving pulley. When driven from the back, a bronze rack is attached to the periphery of each end head of the cylinder, and the same driven from a shaft extending across the back of the tank on which are placed two pinion gears which mesh with the bronze rack. On the end of this back shaft is located a worm gear which is driven by a worm on the same shaft with the driving pulley. The back drive is preferable, for the reason that it relieves the main shaft of all strain, since the latter simply rests and rotates in the bearings on the sides of the tank.

A crank is furnished with each machine, so that should accidents occur, or power be cut off, the machine can be operated by hand, thus preventing the batch of goods being spoiled.

The goods to be dyed are first counted so that each compartment will have about an equal share of the batch. The doors are then closed and the goods boiled out, after which they are washed in running water in the machine, and when sufficiently washed, the water allowed to run off, and after which the dyeing process is begun, the material thus not being handled until the process is finished. The cylinder rotates slowly through the liquor and the machine requires no attention other than the regulating of steam and entering the dyestuff. The goods are thus alternately brought into the liquor and then carried around with the cylinder. During this passage, the goods in each compartment fall from one side to the other, and thus are always in a different position when entering the liquor from that during the preceding immersion. In this way all parts of the material are exposed to the action of the dye in the same degree.

Care must be taken not to run the machines at too great a speed and cause the goods to roll and knot up, as this will cause uneven dyeing. One man can attend three or four machines. From 150 to 400 pounds of goods per batch can be dyed in a machine, and from 5 to 10 batches per day, according to the material being dyed.

Among the advantages of the machine are the uniform application of the color, the large production, small amount of labor required, economy of steam and dyestuffs, and simplicity of construction.

The dyeing of knit goods requires care and experience. The dyes used are nearly all of the "direct" type, that is, colors which require no previous mordant. For light shades, the goods are generally boiled for one-half hour in the dye before adding salt or Glauber's salt and then the dyeing continued for one-half hour longer in order to complete the dyeing and thoroughly exhaust the dye-bath.

The dyes chosen for this work are those which are fast to washing and hot pressing and those which are easily soluble and go on evenly. For very light shades, the goods are bleached before dyeing, but in most cases this is omitted and the dyeing is done in the gray.

After being dyed, rinsed and extracted, the goods are sent to the boarding room to be shaped and dried. This is done by putting the garments on wooden forms called boards when they are wet, and drying them in this stretched condition. The garments are next removed from the boards to be finished, that is, to have the bands and buttons sewed on and to be pressed and boxed.

Roll Dyeing Machine. The system of dyeing knit goods before cutting up the roll into pieces, is now coming into general use and is carried out in a roll dyeing machine as follows: The goods are sent to the dye house in the form of rolls just as they come from the knitting machines. These goods are unrolled and usually boiled out in an open kier, then put through a washing machine, and in turn extracted. After extracting, they are dyed in kettles provided with a roll over which several pieces are passed side by side, the ends of each piece being sewed together to make it endless, so that they are continually passing through the liquor until the dyeing is complete. The length of these pieces should be as nearly equal as possible, so they will all get the same circulation in the same time. If one piece is, say 100 yards long and another 200 yards in length, both traveling at the same rate over the reel, one would pass out of the liquor twice as many times as the other, and what is likely to cause different shades in the same dyeing. (Klauder-Weldon Dyeing Machine Co., Amsterdam, N. Y.)

THE COHNEN CENTRIFUGAL DYEING MACHINE.*

The chief advantage of this machine is that it has successfully solved the problem of dyeing sulphur colors.

Two difficulties in the dyeing of sulphur colors have prevented the extended use of these valuable dyes.

1. Bronziness, streaks and irregularity of shade.
2. Harshness of the material dyed.

The first of these difficulties is due to the improper,

*Manufacturers desiring to see the machine in operation, with a view to purchases, may do so at any time, and on their own material, if they will forward the same to our Providence Office, 13 Matthewson Street. A. Klipstein & Company, 122 Pearl Street, New York City.

untimely and irregular oxidation of the dye in the material treated.

The second, to the oxidation of the dye in the liquor and its deposition on the outside of the material, producing in raw cotton a peculiar harshness that seriously interferes with its spinning, and in yarns in a similar way with weaving and knitting.

The cause of both difficulties must be sought in the nature of the sulphur dyes themselves, as well as their treatment during the operation of dyeing.

The Nature of Sulphur Colors. The sulphur colors have two striking peculiarities.

First.—They can only be dissolved in water by the addition of strong alkalies, which not only dissolve them, but at the same time reduce them to a colorless condition.

Secondly.—On exposure to air they absorb oxygen (oxidize) which at once develops the color and renders it insoluble in water or "fast." This oxidation takes place whether the color is in an alkaline solution or in the fibre of the material to be dyed. It is absolutely necessary in order to get a color at all, but if it is untimely, that is to say, if it takes place during the dyeing operations, it results in bronziness, streaks and unevenness; while if it takes place in the dye-liquor, the insoluble oxidized dye is deposited on the outside of the fibre and causes harshness and at the same time a total loss of the dyestuff so oxidized.

With reference to these sulphur colors, the Cohnen Centrifugal Dyeing Machine is a successful attempt to solve the dyeing of cotton, etc., in every stage of manufacture, raw stock, slubbing, yarns (cops, hanks, cones, warps, etc.), hosiery, etc. The machine itself is a combination of a pack or pump machine with a centrifugal machine, having the advantage over the former of providing for scientific packing to prevent "channeling" and irregular results; and over the latter of avoiding the loss of time, disagreeable work and untimely oxidation involved in changing the boxes. It does this by the attendant simply reversing the pumps, forcing the dye-liquor first from within outwards, then from without inwards. Its distinguishing characteristic is the combination of this reversible pump with perforated metal boxes placed in a closed, unperforated centrifugal drum, fitted with two sets of valves; one air tight for producing a vacuum, the other non air tight for ordinary hydroextraction.

It is this combination which solves the problem of dyeing sulphur colors without bronzing or streaks and with a saving of at least 20% of the dyestuff formerly used.

The Process of Dyeing is as follows:

1st. Packing. The material to be dyed is packed into suitable perforated metal boxes with exact allowance for the shrinkage that results from wetting. This packing prevents uneven pressure and therefore "channeling" and results in such uniform results that "cops" may be dyed with perfect evenness.

2nd. After packing, the boxes are placed in the closed centrifugal drum which is then connected with the reversible pump. The pump is put into action, and in thirty minutes has completed the dyeing operation, having forced the dye-liquor through the fabric at the rate of 600 gallons per minute.

3rd. On completion of the dyeing, the pump is detached, the air tight valves opened and the centrifugal machine set in motion to extract in vacuum. This operation drives all the surplus dye-liquor out of the cotton just as an ordinary centrifugal dyeing machine would do with the great difference that no air is admitted, and no untimely oxidation takes place.

4th. This operation completed, a fan is attached to the centrifugal drum which forces a current of air through the dyed material freed from the surplus dye-liquor until complete and uniform oxidation has been effected.

5th. After oxidation, the closed centrifugal drum is again connected with the reversible pump and the dyed material is thoroughly washed, although if the oxidation has been complete, washing is hardly necessary because even the first wash water is practically colorless, thus showing that absolutely no dyestuff is lost.

6th. Finally, after washing, the pump is again disconnected, the regular non air tight valves opened and the centrifugal drum run as an ordinary hydroextractor, leaving the material ready for the drying rooms.

All the changes thus described are made in a few seconds, and during the dyeing operation a second set of boxes is packed. The removal of the boxes containing the dyed material and the insertion of the freshly packed boxes requires at the outside ten minutes, thus avoiding all loss of time in loading and discharging and rendering the operation of the machine practically continuous during the working hours of the day.

Summarized, the Cohnen Centrifugal Dyeing Machine has the following points of advantage:

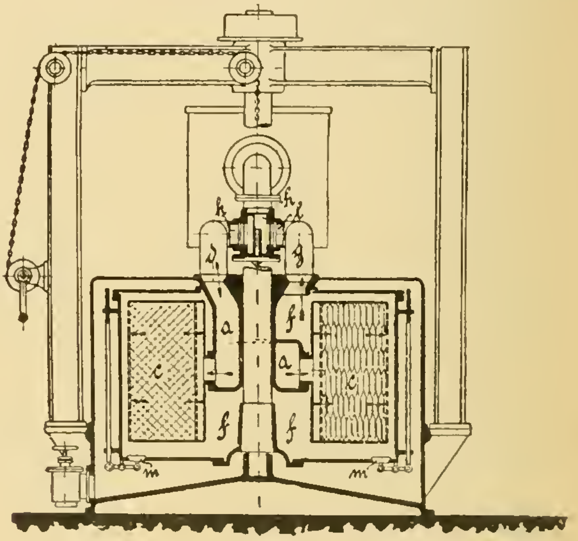


Fig. 1.

1st. Scientific packing to insure uniform dyeing.

2nd. Hydroextraction in vacuum before washing to prevent untimely oxidation of color on the fibre and all oxidation of color in the dye-liquor, thus saving 20% of dyestuff.

3rd. Perfect oxidation.

4th. Delivery of the dyed material ready for the drying room.

5th. Saving of time and labor in loading and discharging.

6th. Perfect dyeing.

7th. Saving in steam of 60 to 75% as compared with a Cylinder Machine.

It may be added that the size of the boxes permits of handling by one man with the greatest ease. That at the end of the operation both the machine and the dyed material are cold, and therefore in condition for easy handling. In dyeing sulphur colors, the time required is something over one hour, so that seven operations may be made in ten hours. Direct colors may be dyed in thirty minutes, including the changing of the boxes.

One practical form of the machine is best explained in connection with the accompanying illustrations, of which Fig. 1 is a sectional elevation of the machine proper; Fig. 2 is a side elevation, drawn on a smaller scale than Fig. 1, being given more particularly to show position of reservoir, working tank, pump, and pipe connections, also showing in dotted lines the working boxes (containing the material to be treated) raised by overhead pulleys and chains out of the centrifugal dyeing machine; Figs. 3 and 4 are detail sectional views of the dyeing machine, showing six boxes *c*, for holding the material to be dyed, in connection with the passageways for liquid (dye-liquor, water, etc., as the case may be) to enter and leave said boxes, *i. e.* material.

Inside the plain, unperforated centrifugal drum, is an inner chamber *a*, into which the dye-liquor is forced by means of a centrifugal pump *b*, through either the pipe *d* or *g* (see Fig. 1). This inner chamber is in direct communication with a set of partially perforated boxes *c* (which will be more fully described later), into which the material to be dyed is packed. After the liquid has entered by, say, the pipe *d*, it passes from the inner chamber *a* into the boxes, saturates the material, flows into and fills the collecting chamber *f*, then leaves the machine by the pipe *g*, returning thence to the pump to circulate again in the manner described. The conduit pipes *d*

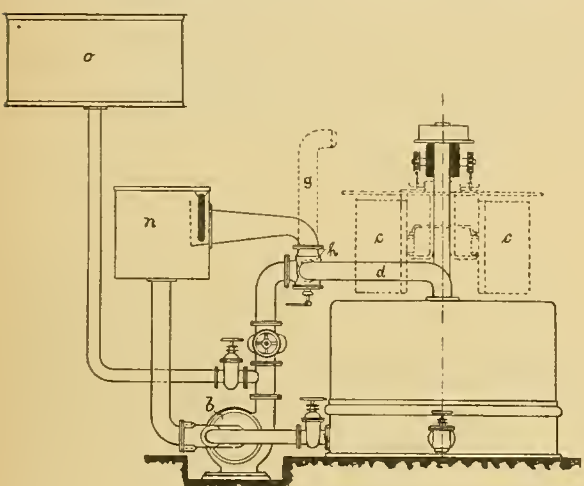


Fig. 2.

and *g* are so constructed that they can be easily disconnected from the drum, in which case they are swung up into the position indicated by the dotted lines in connection with pipe *g* in Fig. 2, after the dyeing, etc. operations have been completed, leaving the hydroextractor principle of construction of the machine to be then brought into operation.

These two pipes *d*, *g*, are connected by a three-way cock *h*, which controls the direction of flow of the dye-liquor, and can be regulated at will—that is to say (see Fig. 1) the liquid entering first at *k* and leaving at *l*, can, by simply turning this cock, have its flow reversed, entering at *l* and leaving at *k*. The liquid then flows through the material from the outside, inwards, and not as at first, from the inside, outwards. By this twofold direction of flow more uniform results in the dyeing are obtained, because it prevents "channeling," and during the whole of the time the liquid is being circulated, the centrifugal drum remains hermetically closed and at rest. The dyeing being completed, the outlet valves *m* are opened and the hydroextracting carried out in the usual manner.

The dye-liquor that is in the tank *n*—to which allusion will be made again—in the conduit pipes, and the collecting chamber *f*, as well as the extracted liquor from the goods, can either be pumped into the reservoir *o*, if required for further use, or be allowed to run off.

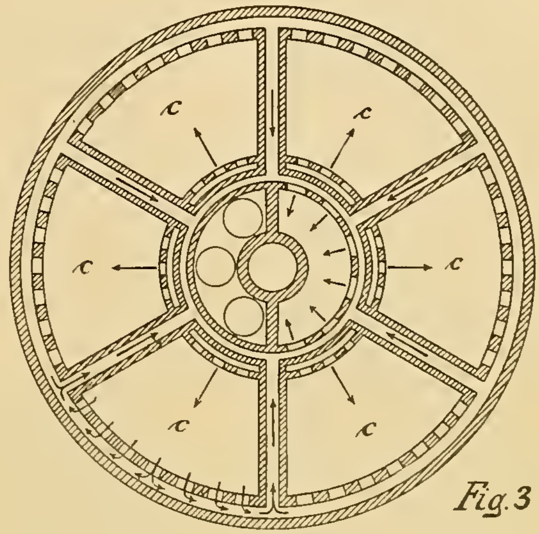


Fig. 3

The entire operation being complete, the lid of the drum is unscrewed and wound up by suitable means, carrying with it the centre casing and the boxes filled with material (see dotted lines, Fig. 2). These boxes are connected with the casing in such a manner that they can be easily taken off and replaced by others.

Spare boxes are provided with each machine, and as these will have been filled during the dyeing of the previous set, a very few minutes suffice for the exchange, after which the machine is again ready for work. These boxes are of somewhat peculiar shape, roughly resembling an old-fashioned wooden cradle with the addition of a lid, each box having eight

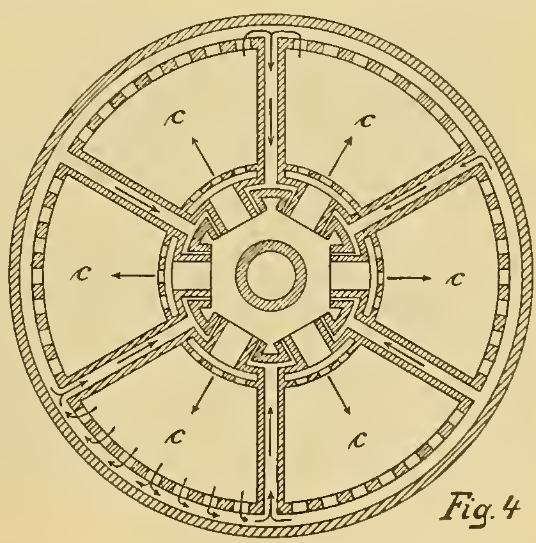


Fig. 4

sides, including the top and bottom. The back and front sides are parallel to each other, but unequal in breadth, so that while the two sides at right angles to the front are equal and parallel to each other, the remaining two sides taper down to the width of the back. The front wall of the box is perforated and removable, being in reality a lid, while the back has a round aperture in the centre onto which a short branch pipe or neck is fixed, and which serves as an inlet and outlet for the dye-liquor. This neck fits into an aperture of corresponding shape in the centre casing, which, with the addition of a simple but strong locking device that can be quickly operated, forms an absolutely tight connection. Inside the tapered part a perforated plate is fitted, and upon this the material to be dyed is piled above the level of the box; the lid is then placed on the top and forced into position by means of a strong screw press worked by hand, and firmly secured by winged nuts. The material being thus tightly packed within the confines of the box, the dye-liquor in penetrating it encounters a uniform resistance. If working only with two, three, or four boxes in connection with a six compartment machine, the remaining apertures in the centre casing are then tightly closed.

A notable feature is the working tank *n*, one function of which is to provide space for the increase in volume of the dye-liquor resulting from the condensation of steam used for boiling. It is here, too, that the dye-liquor is strengthened, tests made, and the liquid kept under observation generally during progress of the work. The height at which this tank is placed allows the liquor to flow down into the machine, and, filling it, simultaneously forces out the air—a consideration of the utmost importance when dyeing with sulphur dyes. Overhead driving has been adopted in the machine to avoid the danger of the strap becoming saturated, and the machine itself is driven by friction. (A. Klipstein & Co., New York, N. Y., American Agents for the machine.)

THE VACUUM DYEING MACHINE.

This machine operates by circulating the dye-liquor through the material, vice versa to some of the other dyeing machinery, which are operated on the principle of circulating the material in the dye-liquor, and can be used for dyeing Raw Stock, Yarns, Hosiery, Shoddy, etc., and is built in four different

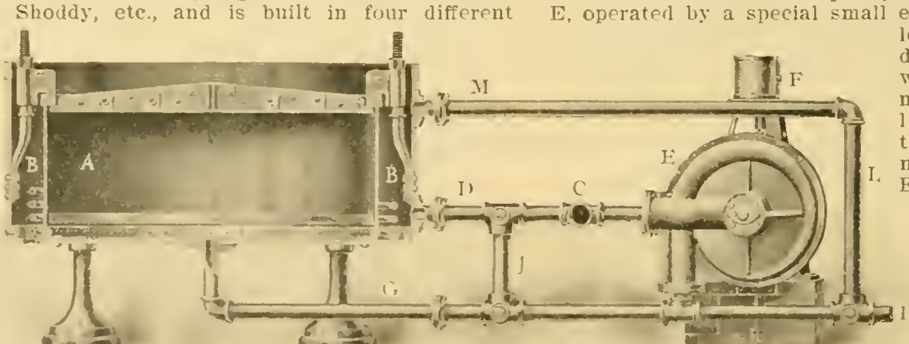


Fig. 1.

standard sizes to suit the varying requirements of a mill or job dye house, viz.:

48 inches	machines	requiring	5′ × 8′ floor space,
60 "	"	"	6′ × 9′ " "
66 "	"	"	6′ × 10′ " "
98 "	"	"	8′ × 16′ " "

and will handle from one hundred pounds of material like for example yarn or hosiery, to one bale of cotton (= about 500 pounds) at one operation. In the latter instance no special handling of the bale of cotton is required, the complete contents of the bale minus the bagging, without being compelled to open out the more or less matted cotton as caused by the heavy compressing at the ginnery, being placed direct in the dyeing machine, it being the purpose of the machine to dye most any textile material, or any soft kind of fabric like hosiery, no matter how much compressed when inserted, under the action of the circulating dye-liquor.

In order to explain the construction and operation of the machine, the accompanying three illustrations are given and of which Fig. 1 is a sectional elevation of the dyeing machine, showing pump, engine, supply pipes, etc., in perspective. This illustration shows a smaller size of machine, in which the dyeing reservoir is placed on stands, whereas in larger machines the latter are omitted, the casing of the machines being extended to rest on the floor as will be readily seen by consulting Figs. 2 and 3, and of which Fig. 2 shows such a large machine, its top covering being lifted by means of an overhead trolley and hoist arrangement. Fig. 3 is a perspective view of the machine, etc., with the top covering taken away, showing the contents of the dyeing machine—the material dyed—lifted bodily up and away from the machine by means of raising the perforated bottom of the dyeing reservoir, by means of the overhead trolley and hoist arrangement.

With reference to Fig. 1 more in detail, we see that the machine consists of two compartments, viz.: A the dyeing reservoir or chamber, and B the outer reservoir or tank. After the material to be dyed has been placed in the dyeing chamber A, the dye-liquor, having previously been prepared in a suitable tank (not shown), placed conveniently away from the machine and above its level, is then allowed by means of gravity, to enter through suitable piping at C and flow through pipe D into the outer tank or reservoir B. Steam is then turned on into the heating coil as situated in the lower portion of outer tank B, so as to bring the dye-liquor to a proper temperature. As soon as this tank B is pretty well filled, the pump E, operated by a special small engine F, is started, leaving the supply of dye-liquor on at C, which then, in connection with the liquor in tank B through pipe D, by means of the pump E, is forced through the bottom supply pipe G into the dyeing chamber A. Previously to entering the latter, the dye-liquor comes in contact with a "distributor" as is situated on the bottom of chamber A, and which distributor is shown in connection with Fig. 2, when examining said illustration more particularly. The purpose of this distributor is to distribute the dye-liquor upon entering the dyeing chamber A most uniformly all over the perforated bottom of said chamber, in order to act uniformly upon the material to be dyed. The dye-liquor thus introduced in chamber A, after passing through the material to be dyed, in turn overflows through the perforated top covering into the outer reservoir B, and from where, by means of pump E, it is circulated, *i. e.* drawn through pipe D to the pump E and from there forced back again through pipe G, into the dyeing chamber A, thus producing

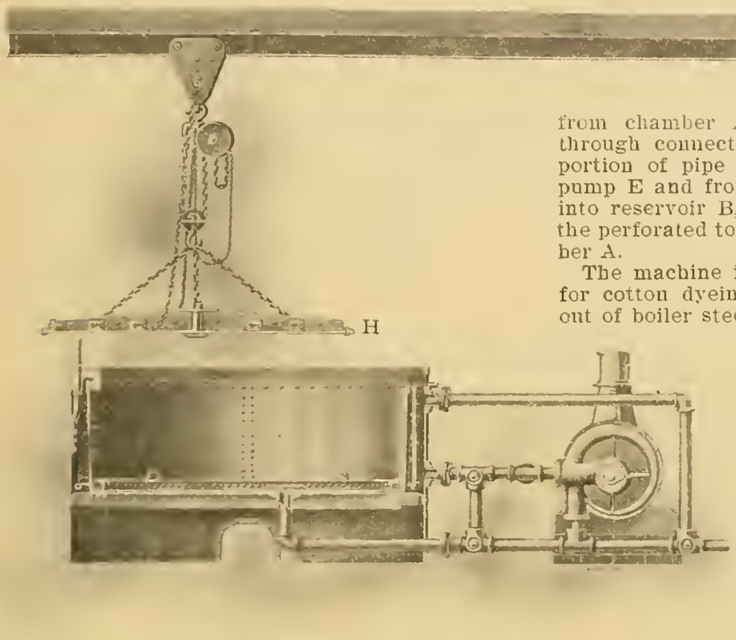


Fig. 2.

the characteristic circulation of the dye-liquor through the machine, *i. e.* the material to be dyed. After the machine has been filled with dye-liquor, stop the supply of dye-liquor at C from the outside tank (not shown).

The valve shown in connection with pipe D as well as the two valves shown in connection with pipe G are what is known as 3-way valves. The valve as situated at inlet C is also connected with a water supply pipe, and consequently after the machine has done dyeing, and the dye-liquor run off, water is introduced and the stock washed without having to be removed from the machine. The dye-liquor as withdrawn from the machine leaves the system of pipes at I, and from where it is guided back to the supply tank previously referred to, and from which it at the beginning was taken.

In unloading this machine, the top cover H is removed, as shown in Fig. 2. Then the hoist is brought again into position, and the entire load of dyed material, resting on the perforated inner bottom, is bodily raised, see Fig. 3, and shifted to one side of the machine and dumped. The perforated inner bottom plate is then replaced and when the machine is again ready for another dyeing.

If found advisable, the direction of circulating the dye-liquor through the machine, and thus also through the material, can be reversed by changing all 3-way valves previously referred to, circulating the dye-liquor then by drawing the same from chamber A through the bottom pipe G, up through connecting pipe J, through the right hand portion of pipe where inlet C is situated, into the pump E and from there through pipes K, L and M, into reservoir B, and by means of overflow through the perforated top cover H back into the dyeing chamber A.

The machine in its present state is more adapted for cotton dyeing, on account of being constructed out of boiler steel, which naturally would be affected by the acid, as used more or less in connection with wool dyeing; however, if dyeing wool where no acid is used, the machine can be used, for example: Wool waste, cotton and wool mixtures dyed in connection with salts black can be handled. The machine will also be found of advantage in dyeing cotton successfully in connection with those modern sulphur colors, at present coming so much in demand in connection with cotton manufacturing. These colors will oxidize on coming in contact with the air during the process of dyeing, and since the Vacuum Machine prevents this, by the dye-liquor covering the material completely on top during dyeing, the advantages of this machine will be quickly grasped.

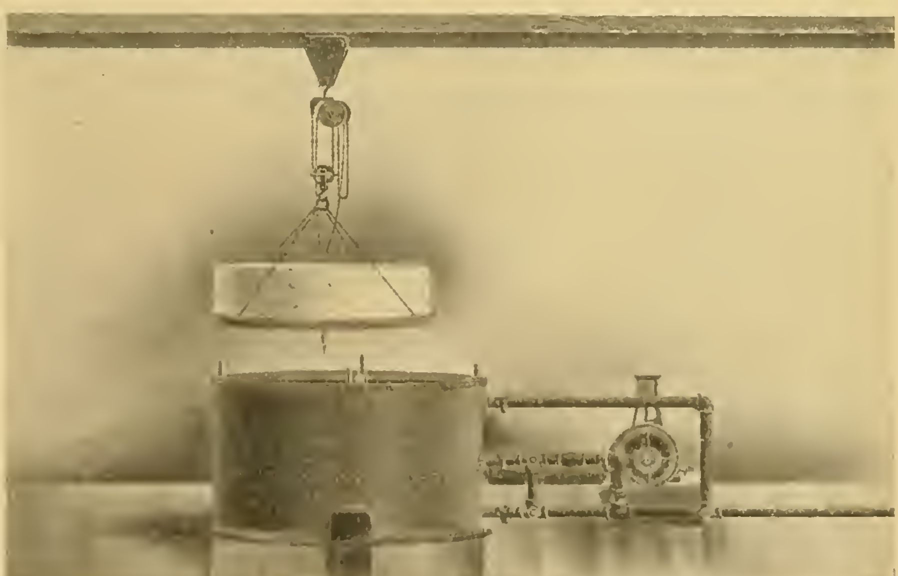


Fig. 3.

The Manufacturers of these machines are now building a Single Tank Machine, made of cast iron, or something similar in construction. This machine can be used for wool and bleaching purposes; the perforated top cover, as well as the perforated inner bottom plate being faced with copper and all supply pipes lead lined. The principle of operating the machine for bleaching being identical with that of dyeing; the bleaching-liquor being forced, *i. e.* circulated through the material to be bleached. (Vacuum Dyeing Machine Company, Chattanooga, Tenn.)

WARP DYEING.

There are two well known and distinct systems of dyeing cotton yarn in the warp, known respectively as the Long Chain or Scotch system, and the Short Chain or English system. On account of different impressions that may be conveyed by the use of the

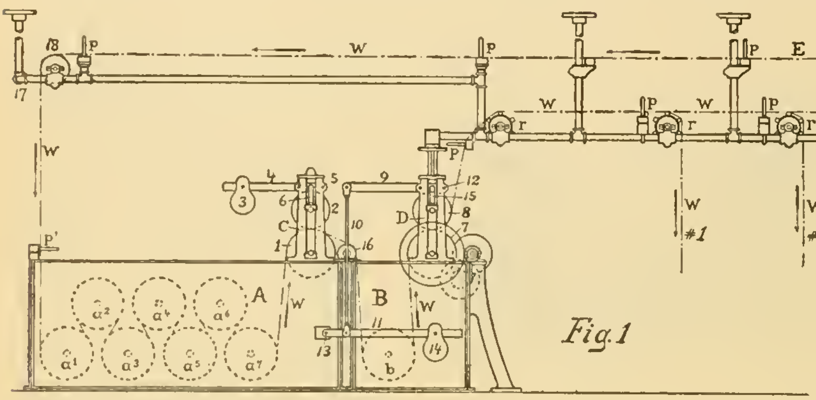


Fig.1

terms, Long Chain and Short Chain, it may be advisable to mention that by the Long Chain system of warps is understood the preparation of very long chains or warps which in turn are boiled, doubled, dyed, dried and split, and which may refer for either warp or filling purposes. Such as intended for warp purposes, after splitting, are then beamed and in turn slashed, whereas filling chains after splitting, are sized, dried and taken to a quiller for winding on bobbins (quills) ready for the shuttle. By the term Short Chain system of warps is understood the preparation of shorter chains or warps, to say from 1000 to 1500 yards, *i. e.* of such a length as will fill a loom beam; this system of handling chains usually referring to yarn for warp purposes. Such warps after reaching the dye house are in turn boiled, dyed, dried, and afterwards beamed and slashed. On account of the short lengths of these chains or warps, this system of handling yarn does not refer to such as destined for filling purposes, for the fact that the quiller would require too frequently threading up, on account of the short length of these chains, so that there would be no saving over skein quilling.

There is considerable difference of opinion as to the relative merits of these two systems with reference to handling warp yarn, but it depends more upon the quantity of yarn and the variety of shades to be dyed, which system should be used, than upon individual preference. Warp or chains dyed by the Long Chain system are usually from five to sixteen thousand yards long, each consisting of 275 to 500 ends, while those dyed by the Short Chain system are often warped the full number of ends, or else are dyed in lots of 2, 4 or 6 warps. For either system they are best brought to the dye house in "balls," but what in reality is not a ball in the ordinary sense of the word, said balls being made on a ball-warper by winding on a wooden cylinder a number of warp ends drawn together as one strand which is traversed back and forth along said cylinder, crossing and recrossing so as to prevent tangling.

Warp Boiling Out Machine. Whether the Long or Short Chain system is used, the first process in the dye house, and one of great importance is to thoroughly wet out and cleanse the yarn preparatory to dyeing, as otherwise it is impossible to get good results. This is done by running the warps through boiling water. Fig. 1 shows, in its side elevation, the machine especially designed and built for this work by the Textile Finishing Machinery Company of Providence, R. I., and which is the latest and most approved machine for this purpose. It has two iron tanks A and B, the one, A, for the boiling water (for loosening the dirt from the yarn), and the smaller one, B, for the cold water rinse. Each tank A and B is fitted with a draw-off plug for changing the water when the same becomes loaded with impurities removed by it from the warps under treatment. At the delivery end of each tank A and B, we find placed, on top of it, a set of nip stands C and D, each supporting in their housings a pair of squeeze rolls supplied with suitable pressure attachments for squeezing all superfluous water from the warps as they leave either tank. In this manner we find the nip stand C of the hot water tank A carrying the bed-roll 1, mounted upon which is the pressure-roll 2, and which receives additional pressure, besides its own weight, exerted on its shaft from weight 3, through lever arrangement 4, 5 and 6. It will be readily understood, that by moving the weight 3 in or out on lever 4, previously to tightening the former onto the latter, a varying degree of pressure of roll 2 upon

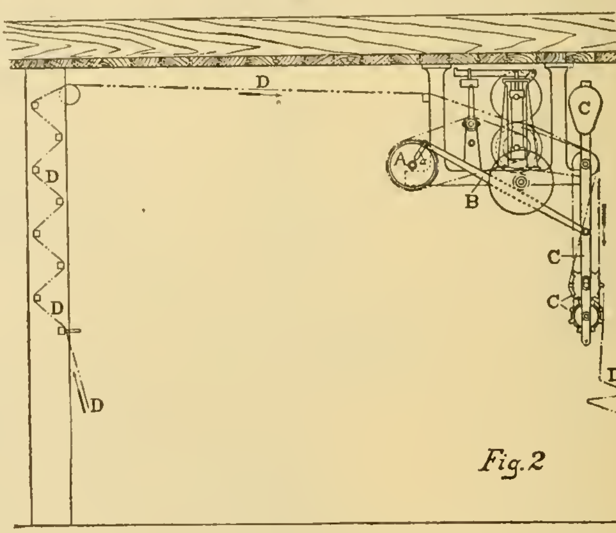


Fig.2

roll 1, *i. e.* upon the warps as passing between said rolls, is exerted; the amount of pressure required to be given, depending upon the amount of warp yarn treated in one run through the machine.

With reference to the squeeze rolls employed in connection with the cold water rinse tank B, we find in this instance a compound lever arrangement used, in order to be able to exert a heavier pressure, *i. e.*

free the warps treated more thoroughly from its water. D = nip-stand; 7 = bed-roll; 8 = pressure-roll; 9, 10, and 11 = compound levers, fulcrumed respectively at 12 and 13, and exerting pressure by means of weight 14 through lever 15 upon the shaft of the pressure roll 8, and thus upon the warp pass-

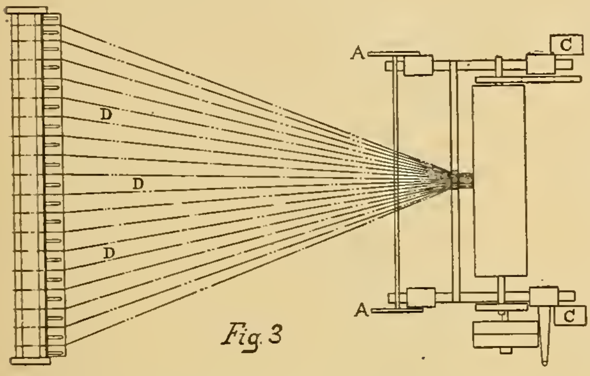


Fig. 3

ing between rolls 7 and 8, in turn delivering said warps from the machine in the proper condition as to moisture required for the next operation. It will be readily understood that in connection with either set of squeeze rolls 1, 2 and 7, 8 the water thus squeezed out of the warps is delivered back to its own tank.

a^1, a^2, a^3, a^4, a^5, a^6 and a^7 are seven cylinders arranged in tank A, for leading the warp through the boiling (boiling out dirt) process. Roll 16 guides the warps into the cold water rinse, and cylinder *b* leads them through this rinse.

The machine is driven by tight and loose pulley, and is fitted with a neat and light, but strong overhead rigging, supporting the necessary pin rails *p*, reels *r*, etc., for receiving and delivering the warps. Two deliveries, #1 and #2, are only shown in the illustration for the sake of bringing the latter within compass of the page; three deliveries as a rule being supplied by the builders of the machine, this third, or an additional delivery, being a duplicate of delivery #2, with reference to rigging, pin rail and reel, the only difference being in the entering arrangement of the rigging and where the hangers of said section #3 (not shown) carry no pin rail, the same being applied to the end (last) hanger of the rigging (not shown). The end-joining (not shown) of the rigging at section broken out (right hand side of illustration) is identical to the join made and shown at 17 at the left hand side of the illustration. 18 is a guide roller for guiding, *i. e.* entering the warps from the overhead entry by means of pin rail *p'* into the boiling tank A. The direction of the run of the warps, from their entry into the room at E, through the machine, to the deliveries #1, #2, etc., is clearly shown by means of arrows accompanying the line indicating the run of the warps.

The cold water compartment, or tank B, is frequently omitted, but is of great value for certain classes of work, as it leaves the yarn thoroughly rinsed and cool, and prevents it from drying up before it can be dyed, and from mildewing when allowed to lie for some time before further treatment, especially in warm or damp weather.

The width of the machine depends upon the number of warps it is desired to handle. The machine shown in the illustration (plus a delivery #3 not possible to be shown) is fitted to receive and deliver 20 warps or skeins at a time, each consisting of 275 to 500 ends; but these machines are built and fitted by The Textile Finishing Machinery Company, to run 12, 16, 20, 36 and sometimes up to 60 warps or sections of warps at a time. They also build smaller and consequently more simple machines, to handle four or more warps only.

The Long Chain System. By this system the warps as they leave the boiling-out machine previously described, are dropped into boxes or cans and are next taken to a warp doubling machine, where each is doubled a certain number of times and reduced in length to say 400 to 1000 yards.

Fig. 2 is an elevation, and Fig. 3 a plan view of the warp doubling machine as built by the Textile Finishing Machinery Co., the same being designed to hang from the ceiling, and when consequently by its use very little floor space is required for this process. At its delivery end is a traverse motion A, B, and folder C for plaiting down (D) the warps into trucks. The amount of the traverse motion given to the folder can be regulated by adjusting the end of lever B higher or lower in the slot *a* of the disk A.

The warps are now ready to be dyed, which is done in round or Scotch dye tubs. Fig. 4 shows such a dye tub in its elevation, the warps being run through the tub from four to seven times, depending on the shade to be dyed. The standard Scotch dye tub, as shown in the illustration, consists of a round wooden tub A, 55″ diameter at the bottom and 41″ deep, fitted with iron nip stands B, supporting two squeeze rolls C and D, with pressure attachments (lever E and weight F), so arranged that by means of the handle of the long lever G, the pressure as exerted both by roll D and weight F, can be very quickly

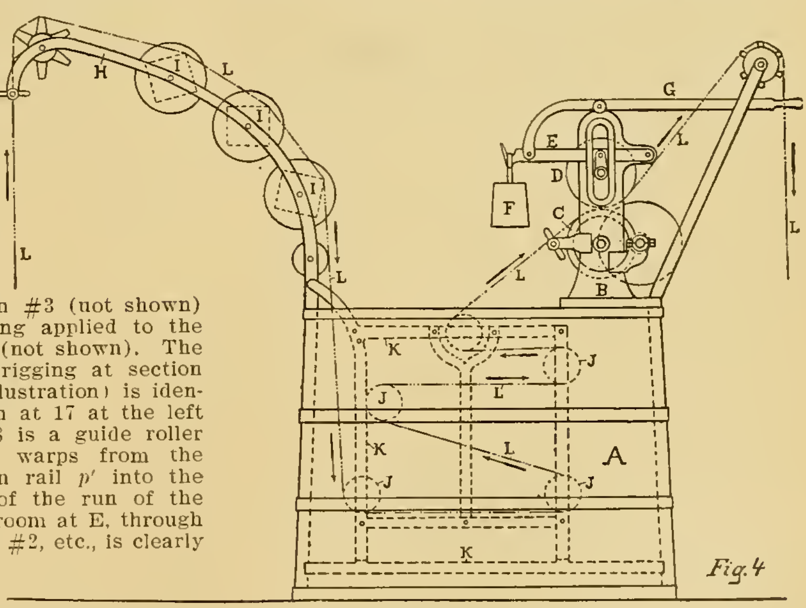


Fig. 4

removed while the ends of the warps are passing through the nip of rolls C and D, in order to avoid cutting the yarn.

On the entering side of the tub we find iron brackets H, with square beater or tension rolls I, and in the tub we find brass immersion rolls J, supported in brass frame K, for leading the warps through the dye-liquor. The run of the warps through the tub is shown by line L accompanied by arrows.

After being dyed, the warps are split out into their original length by a warp splitting machine, of which a plan view is given in Fig. 5. This machine consists of iron frames which support beaters, pin rail, etc. There are small iron frames to hang from the ceiling

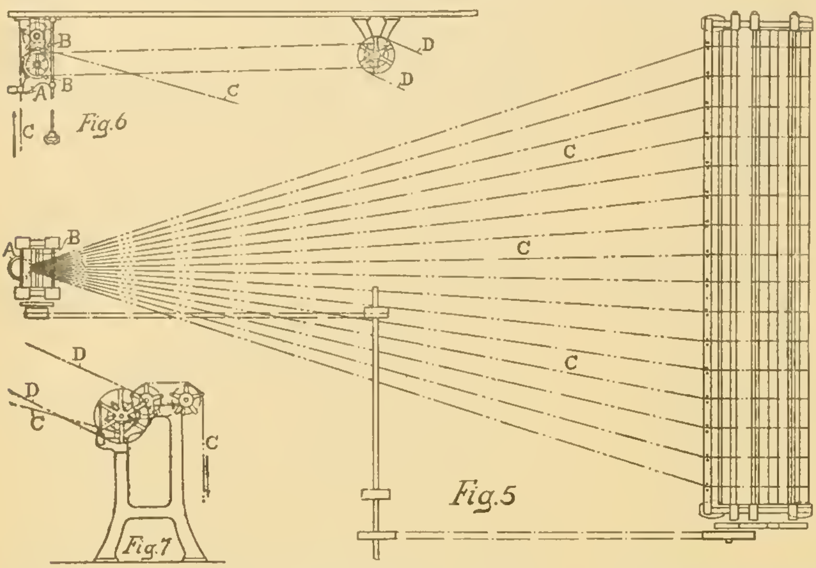


Fig. 6 Fig. 5 Fig. 7

to support pot eye A and small beaters B which draw the warps C up towards the ceiling from boxes or trucks placed on the floor. The driving of the machine is so arranged that the beaters on both frames or sections of the machine (receiving and delivery) start, stop and run in unison.

Fig. 6 is a detail illustration (elevation) of the receiving section of the machine, as is fastened to the ceiling, and Fig. 7 an elevation of the delivery section or frame of the machine. D in Figs. 6 and 7 = drive of delivery section from overhead frame.

The Short Chain System. By this system, the warps after being run through the boiling-out machine are taken direct to the dyeing machines, which are usually single compartment machines as shown in the accompanying illustration Fig. 8, which is an elevation of such a warp dyeing machine. However, in mills where large quantities of certain shades of yarn have to be dyed, two, three, four or even more compartment machines will be found advisable to be used.

Where the single compartment machine is used, the yarn is run through the same machine a number of times, depending upon the shade required, or it may be taken from one machine to another. The machine shown, consists of a wooden tub A, supported in iron frames B, to which are bolted the nip stands C, supporting two iron squeeze rolls D and E, which in the best machines, are covered with rubber and have attachments (levers F, G and weight H) for applying pressure. I, are immersion rolls for leading the warps through the dye-liquor. These warp dyeing machines are usually provided with a light but strong pipe overhead rigging, supporting the necessary pin rails J, bars K, and reels L, for receiving, running through and delivering side by side, four, six or eight warps, at a time, depending upon the width of the machine. The arrows in connection with line M indicate the run of the warp through the machine. When dealing with two or more compartment machines it will be readily understood that each compartment i. e. tub, is correspondingly provided with its own set of nip stands, squeeze rolls, immersion rolls, etc.

Indigo Dyeing Machine. It is of great importance that warps to be dyed with indigo should be properly prepared. This is best done on the complete warp boiling-out machine with the cold water rinse compartment shown and explained in connection with Fig. 1, as by the use of this machine, the yarn is left in the best possible condition to take the indigo.

There are many different arrangements of tanks and fittings for dyeing warps with indigo, but the arrangement shown in a general way in Fig. 9, and which is built by the Textile Finishing Machinery Company, is very largely used, is very convenient, economical and gives the best of results.

The vats are made up in sets of two, three, or sometimes four, with one overhead rigging for handling the warps for each set. These vats A, consist of cast iron plates, bolted together and are each 8′ long by 7′ deep by 30″ wide. For convenience in operating, they are sunk or let through the floor, so that the top is only a short distance above the floor.

The overhead rigging consists of a wooden frame B, which straddles the vats, and rolls (C) on a track so that it can be moved from vat to vat. This frame supports nip stands D, containing rubber covered squeeze rolls E, F, carrier rolls G, pin rail H, etc., and an immersion frame (shown in dotted lines) which by means of handle I through gears J and rope or chain connection K, can be raised from or

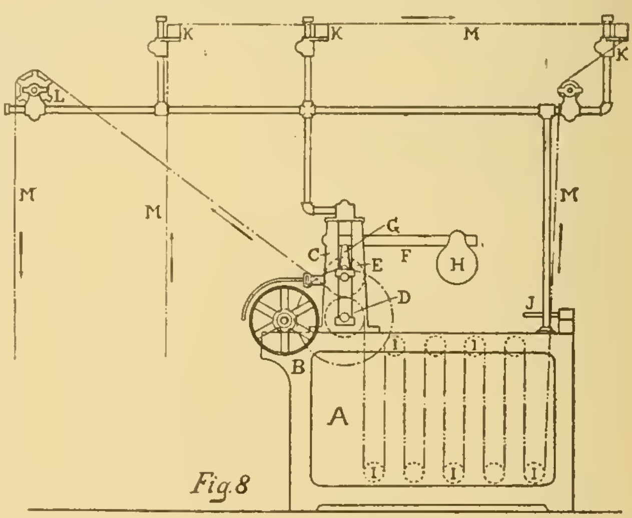


Fig. 8

lowered into the tanks A, and which supports the brass immersion rolls L, for leading the warps M through the dye-liquor. The warps to be dyed should be of such a length that they can be run through before it is necessary to stop the machine for any reason, as at noon or the close of the working day, since otherwise uneven dyeing will result. From three to four runs are usually given to the warps, they being dropped at the delivery end of the machine into trucks and allowed to oxidize between each run.

After dyeing the warps are dried on a warp drying machine.

Warp Drying Machines. Warps after they have been dyed by either the long or short chain system,

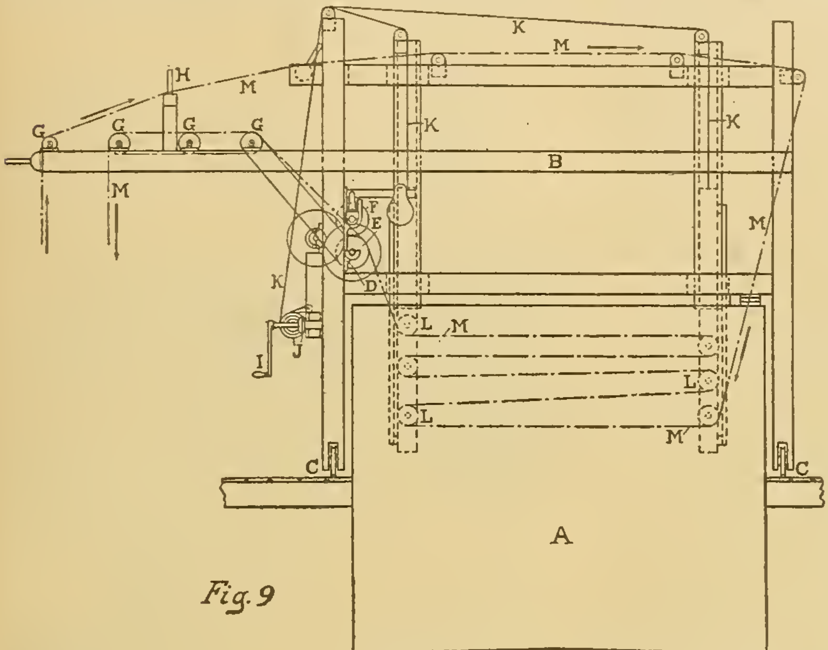


Fig. 9

and also warps which have been dyed in the indigo dyeing machine are then dried on a warp drying machine. While these machines vary considerably in size and capacity, what has come to be regarded as the standard machine for this work, consists of eighteen tinned iron cylinders arranged in two columns of nine cylinders each; each cylinder 144″ face × 23″ diameter. These upright drying machines, in mills where a large capacity is desired, sometimes have 22 cylinders arranged in two columns of 11 cylinders in each column, whereas for drying smaller quantities of yarn, drying machines with fourteen, nine, or even less cylinders are built.

Drying machines are also constructed of what is known as the horizontal type machine. Whichever style, these drying machines, as built by the Textile Finishing Machinery Co., are always very carefully constructed, with heavy iron frames, boxes and gears, and furnished with cylinders made from the best imported English tinned iron, having iron heads with vacuum valves and fitted with their patent spiral scoops (see special article on these spiral scoops in the Finishing chapter) for keeping the cylinders free of exhaust water. Usually these warp drying machines are fitted with pin rails, wooden drag rolls, etc., for handling two or four warps at a time, although sometimes cylinders are made 72″ face to run one or two warps only at a time.

Warp Sizing. After the warps have been dried on a warp drying machine, if for warp yarn, the same is run direct on a slasher beamer and then starched or sized on a cylinder slasher, built by the Textile Machinery Co., as is described on pages 186 and 187.

Filling yarn, while still in warps, however is sized on a sizing machine built especially for this purpose by the Textile Finishing Machinery Co. Such a machine is shown in its elevation Fig. 10, and consists of a wooden tub A, supported on iron legs B, fitted with iron nip stands or housings C, supporting nip or squeeze rolls D and E supplied with suitable pressure attachments (levers F, G and weight H), so that the warps will be thoroughly squeezed after being sized in the tub A, which for this purpose contains a brass immersion frame (not shown) which supports brass rolls. I and the necessary brass guides for leading the warps J through the size (see arrows for indicating the run of the warps through the machine). These machines are sometimes made with a single compartment, but usually two compartments side by side are the machines mostly in demand, and when one compartment is used to size yarn dyed in dark shades and the other for the sizing of light shades. These machines are fitted with light, but strong, pipe overhead rigging K, carrying pot eyes L, guide rolls M and reels N, to receive, size and deliver one warp in each compartment. After being sized,

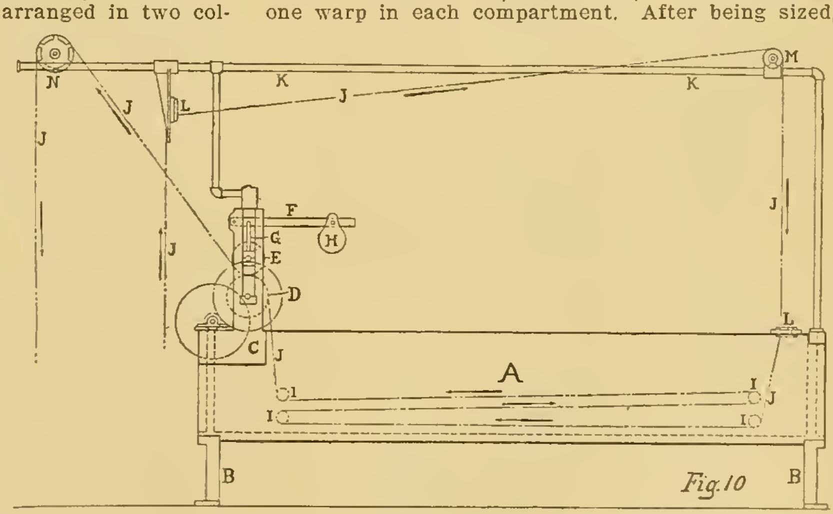


Fig. 10

the warps are again dried on a warp drying machine as used previously to this sizing process.

The warps are then taken to the quiller and wound on quills or filling bobbins. This process of preparing filling yarn for the loom is more economical if practised with the long chain system, the short chain system requiring too frequent threading up.

PREPARING WARPS FOR CHAIN DYEING.

All manufacturers of colored goods, the yarns for which are bleached or dyed before using, are only too familiar with the constant annoyance and expense caused by the snarling and breaking of the yarn in the various processes of the dye house. Since the introduction of chain quilling machines, by far the largest part of cotton yarns, both warp and filling, have been colored in the chain, which, notwithstanding all its drawbacks, has been found on the whole the most economical method.

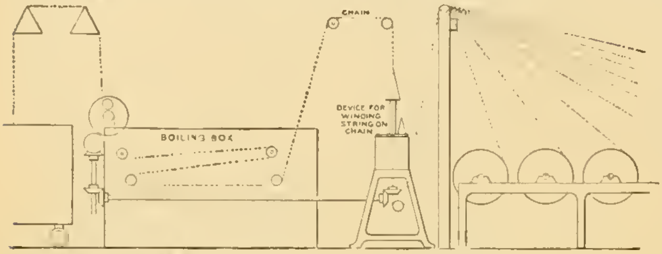


Diagram Showing the Winding-on Process.

The most difficult and unsatisfactory process in all manufacturing has hitherto been the rewinding or beaming of the colored or bleached chains after they are returned from the dye house. No one familiar with the manufacture of colored goods needs to be reminded of the endless number of broken and snarled chains, slack threads and twisted selvages, which are continually turning up in the beaming room, however carefully the dye house is managed.

There has long been an urgent need for some process or method by which the excessive damage done to chains in the dye house might be avoided, and the following processes of manufacture be thus rendered less difficult. This need has at length been supplied by the introduction of special machines and methods by the Draper Company, of Hopedale, Mass., by the use of which the snarling and breaking of chains in the dye house can be practically entirely prevented.

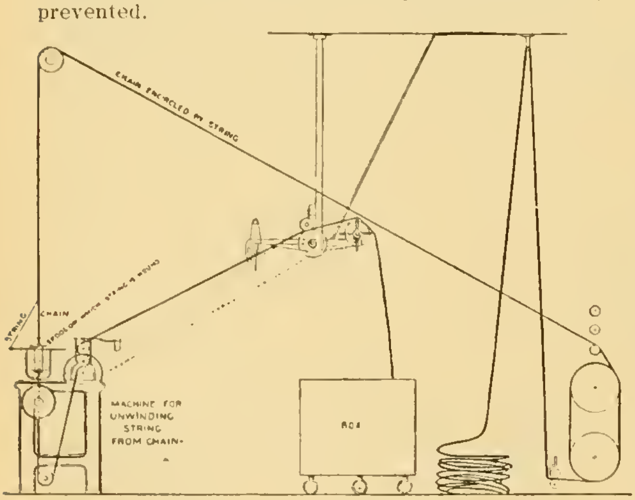


Diagram Showing the Unwinding Process.

The gist of the affair consists in winding or coiling around each chain from end to end a cord of suitable strength to hold the various threads together and prevent snarling and breaking in the dye house.

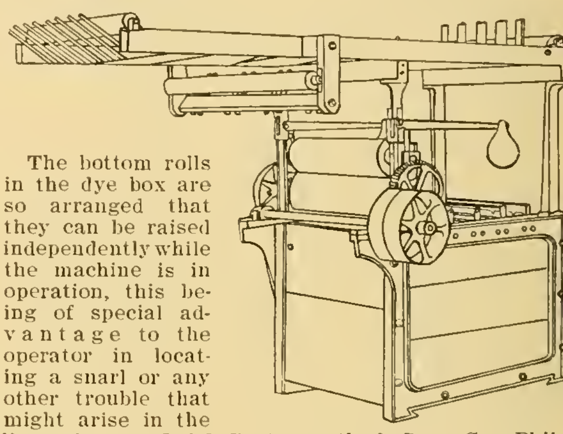
We believe we are well within bounds when we say that a net saving of at least one-half the whole cost of rebeaming may be readily made in the dressing room alone, and the gain in the weaving rooms, from the greatly improved preparation and the absence of knots and twists, should be nearly as much more.

This system of chain dyeing, including both the winding and unwinding process, is already in use by the principal mills that use colored warps, so that the field for further introduction is certainly somewhat limited.

The accompanying two illustrations, by means of their details given will at once convey to the reader a good idea of how said machines are used. We seldom have seen an idea introduced that won so prompt a recognition and gave so large a return on the capital invested. It certainly ranks with the most important of recent textile inventions. (Draper Co., Hopedale, Mass.)

BUTTERWORTH'S WARP DYEING MACHINE.

These machines are built of various sizes, for dyeing four to twelve cotton warps at one time, and are made complete with overhead frame, so the yarn can be fed and delivered from the same end.



The bottom rolls in the dye box are so arranged that they can be raised independently while the machine is in operation, this being of special advantage to the operator in locating a snarl or any other trouble that might arise in the liquor box. (H. W. Butterworth & Sons Co., Philadelphia, Pa.)

HUSSONG'S DYEING MACHINE.

The object of this machine is to dye the yarn in the shape of skeins, the construction and operation of it being readily seen by the accompanying illustrations, of which Fig. 1 is a longitudinal sectional view of a portion of this dyeing machine, and Figs. 2 and 3 detail illustrations (enlarged compared to Fig. 1).

A indicates the dye-vat, having an end compartment at *a* (but none at the other end of the machine), in which is a circulating wheel B, and under the compartment for the banks of yarn is a circulating chamber C, so that the dye-liquor is kept in constant circulation. The partition D is perforated. E is the carrying frame for the yarn, consisting of two side members, one on each side of the frame (only one F, being shown in the illustration). The side member F, as illustrated in detail illustration, Fig. 2, consists of two longitudinal bars *a*, secured together at intervals by bolts, while the side member (not shown) is a single frame. These two side members have each near their end, an extension G, coupled to longitudinal bar H, which is in turn attached to cross bar I. On these bars are eyes J, with which engage hooks K, carried by chains L, for raising the yarn-carrying frame E out of the dye-liquor when so required.

Extending from one side member F to the other (not shown), is a partition having a series of perforations therein, which allow the dye-liquor to pass onto the upper portions of the hanks of yarn. The two longitudinal bars *a*, are perforated at intervals, and form the bearings for the worm wheels N, which have extended hubs *b*, mounted in the bearings in the longitudinal bars *a*, the teeth of the worm wheels extending between the two bars, as are shown in

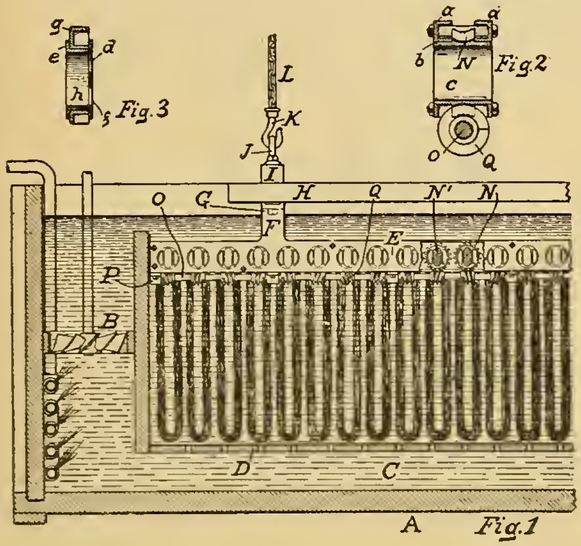


Fig. 2. Each worm wheel N is slotted at *c*, for the reception of the end of the dye sticks, on which the hanks of yarn are mounted. O is a longitudinal shaft running the full length of the carrying-frame E, being secured to the side member F by bearings P. On this shaft O, are worms Q, which mesh with the worm wheels N, as clearly illustrated in Fig. 1. One end (not shown) of the shaft O is shaped to fit a suitable handle, so that when the yarn frame is raised, this handle can be applied to turn the shaft O, which will, through the medium of the gearing thus described, turn the dye sticks (which are oblong in cross section, see N′ in Fig. 1), and thus will change the position of the hank of yarn on said dye sticks, allowing in turn an even dyeing of the hanks under operation.

The worms Q are alternately arranged right and left, so that every other dye stick, with its hank, will turn in one direction, while the others will turn in the opposite direction.

The other side member of the carrying-frame E, as cannot be shown in Fig. 1, is simply a single frame, and mounted in this frame, see Fig. 3, are disks *d*, each having a flange *e* at one side, and secured to the disk is a cap plate *f*, which holds the disk in position in the side member *g*, as illustrated in Fig. 3. The disks are slotted at *h*, to receive the ends of the dye sticks. This construction of a dyeing machine permits a ready removal of the dye sticks when it is desired to change a batch of yarn. The carrying-frame is comparatively light, and therefore can be readily raised and lowered by suitable arrangements. (J. Hussong, Camden, N. J.)

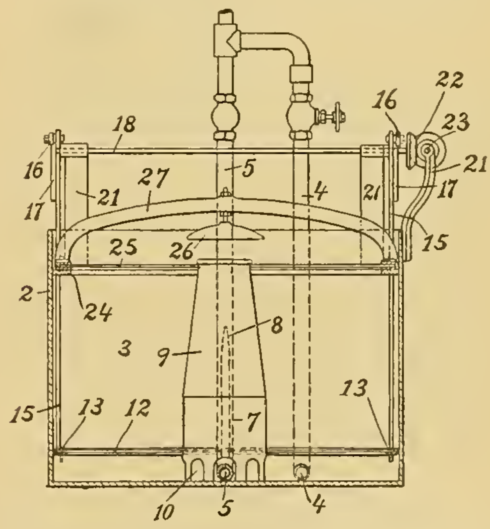
KERSHAW'S DYEING MACHINE,

for dyeing, mordanting, or similarly treating with liquids, wool, slubbing, yarn, and other fibrous material, is shown in the accompanying illustration in its section.

The vat 2 has an end partition 3 fitted at the end where the steam pipes 4 and 5 enter the machine, in order to keep the material from actual contact with the pipes. The pipe 4 runs along the bottom of the vat, and is perforated along the horizontal part, for heating the liquid in the bath by the emission of steam. The other pipe 5, runs along the centre of the bottom of the vat, and in an average size of machine has three vertical branches 7 terminating in nozzles 8. Only one of these branches 7 can be shown in the illustration, the others being duplicates, at proper distances apart, throughout the length of the machine. These branches 7, are surrounded by hollow cones 9, secured to the bottom of the vat, but having a number of openings 10 all round the bottom. A false bottom 12, of wirework or other reticulated material, is supported on the frame 13, fitting the bath above the pipes 4 and 5; and this frame is supported at each of the four corners of the machine, by vertical rods 15, extending above the bath, each having an anti-friction roller 16 at the top, each resting on an eccentric 17, carried by the two end shafts of the machine, one on each side of it.

The rods 15 have slots at the top, fitting the shafts 18, and are supported by bearing standards 21, being coupled together by the bevel wheels 22 at each end of the back shaft 23. When the shafts are put in motion, the eccentrics are rotated, thereby raising and lowering the rods 15, and with them the perforated false bottom 12. The shafts are driven by a worm wheel, together with a worm and driving pulley (all not shown in the illustration). Holes are made in the false bottom 12 to admit the bases of the cones 9, which latter are cylindrical to the height the bottom 12 rises.

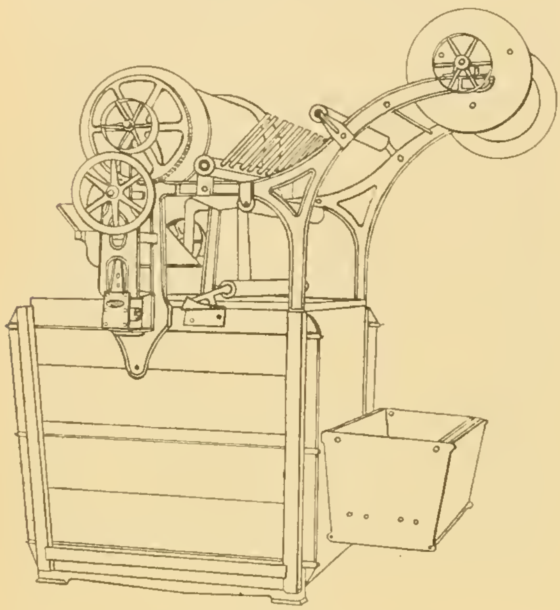
The material to be mordanted or dyed, is placed evenly in the vat 2 on the false bottom 12, and is packed more or less up to the internal flange 24, surrounding the vat, and a wirework cover 25 (made in two or more sections) is secured to the flange 24 by turn buttons, secured to the flange and turned across slots in the sides of the cover 25. Holes are formed in the cover for the tops of the cones 9.



When steam at a suitable pressure is turned onto the pipe 5, it is discharged at the nozzles 8 with sufficient force to carry a constant stream of liquid out of the tops of the cones, and such streams, meeting the concave deflectors or spreaders 26, are broken up into small jets or spray and evenly distributed over the cover and percolating through the material again enters the cones and is again distributed, thus maintaining a constant circulation. At the same time the false bottom 12 can be raised and lowered to alternately increase and relax the pressure on the material. The increase of the pressure and the relaxation thereof taking place from below, enables the material to readily open out or expand as the pressure is relaxed. The deflectors 26 are carried by bridge or span pieces 27, secured to the sides of the covers 25. (Joe Kershaw, Bradford, Eng.)

BUTTERWORTH'S PIECE DYEING MACHINE.

The accompanying illustration shows this machine, as used for the dyeing of worsteds, etc., in its perspective view, the same being a machine of unusually substantial construction. They are built usually in two sizes, for handling six and eight strings of cloth.



After dyeing, the cloth is passed through a cooling box, shown in front of the dyeing machine.

The driving can either be by engine as shown, or by friction clutch and chain wheel when driven by the power of the mill. (H. W. Butterworth & Sons Co., Philadelphia, Pa.)

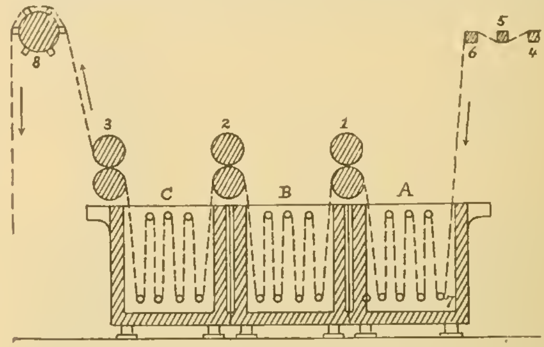
THE ARLINGTON BOX DYEING MACHINE

For the Continuous Dyeing of Cotton Fabrics.

Unlike the dye jig, as previously explained, and where the pieces enter the dye vessels perpendicularly, and return in same direction, the pieces in the box dyeing machine are made to travel over rollers fixed in cisterns beneath the surface of liquid, until delivered at the end of the course.

This machine is arranged to have one or more wood cisterns, three of which are shown in the accompanying illustration, representing a 3-box machine, in its section, each wood cistern or box A, B, C, laid in successive order, and having a series of seven small guide rollers, with a pair of nip or squeeze rollers 1, 2 and 3, placed over the joints of the various boxes for the purpose of drawing the cloth and squeezing the dye-liquor thoroughly into the pores of the fabric, and at the same time any surplus liquor back in its respective tank.

The pieces of cloth, after being sewn end to end, so as to form a continuous chain, are entered in the machine through overhead tension rails 4, 5, 6, and then under first guide roll 7 beneath the surface of liquor in first box A, and in turn circulated, as shown by dotted lines, throughout the whole length of the machine, *i. e.* as many boxes as there are used, and laid upon a truck on the floor of the dye house, by reel 8. One of the boxes shown or an additional box may be used for washing purposes, again the cloth when leaving reel 8 may be guided direct to a sepa



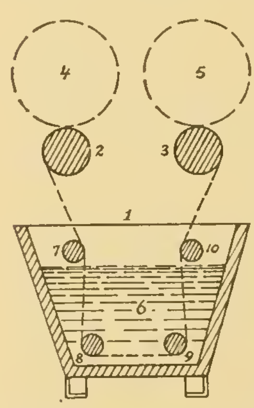
rate washer, in fact any arrangement of advantage to the mill may be used.

The housings of the squeeze rollers 1, 2 and 3 are mounted on specially designed side frames independent of wooden boxes, and are supplied each with top lever and weights for applying pressure to nip of rollers. Hand wheels and screws for lifting rollers are also provided. The whole arrangement is driven by side shaft and bevel gears through bottom roll. (Arlington Machine Works, Arlington Heights, Mass.)

THE ARLINGTON DYE JIG

For Dyeing Cotton Fabrics.

The accompanying illustration shows a section of the machine, the same consisting of a wooden tank 1 with cast iron side frames of suitable design, upon which are mounted two rolls 2 and 3, located sufficiently apart from each other to enable the operator to observe the correct routine of cloth, and to see that it undergoes an even and complete saturation in the dye-liquor.

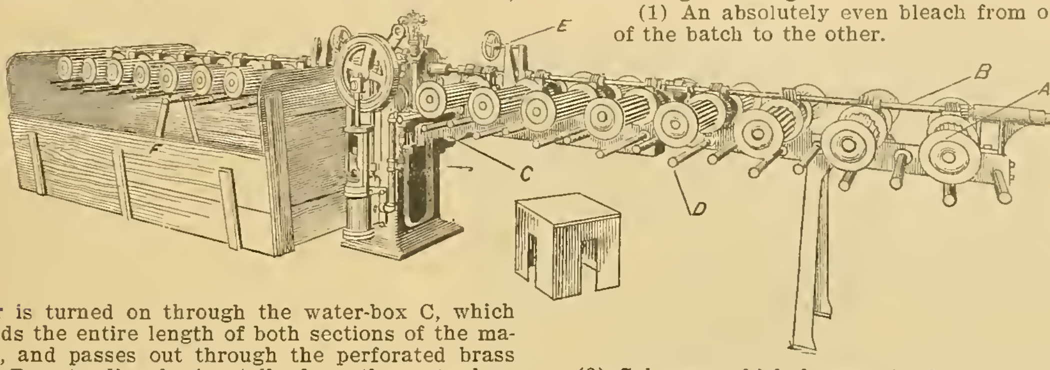


The reel of cloth 4 or 5 is placed on the surface of one of the rolls 2 or 3, and is thus made to revolve by frictional contact. The cloth (indicated by dotted line) is drawn by this method back and forth from roll to roll, guided in this travel through the dye-liquor 6 by small rolls 7, 8, 9 and 10, as often as may be required in establishing proper shade or color up to sample. The machine is driven by line shaft, mitre gear, and clutches. (Arlington Machine Works, Arlington Heights, Mass.)

THE WEBENDORFER SILK SKEIN WASHING MACHINE.

A most rapid and economical method of washing skein silk after dyeing, etc., is by means of the machine shown in the accompanying illustration; the operation of which is as follows:

The skeins to be washed are first hung loosely on the porcelain rollers A, the rollers on both sides of the machine being entirely filled with silk skeins before the machine is started up. The porcelain rollers are revolved through a worm and gear motion, said worms being on, and consequently operated by a shaft B running the entire length of each section of the machine. As soon as the rollers A are started,



water is turned on through the water-box C, which extends the entire length of both sections of the machine, and passes out through the perforated brass pipes D, extending horizontally from the water-box, and which are so located that each and every skein is deluged with water on both sides. This washing is continued as long as may be deemed necessary, in order to remove the surplus dye-liquor, etc., from the skeins, generally two or three minutes being necessary, and when one section of the machine is stopped by tightening the brake E, the silk is removed, and replaced by a fresh lot, and the operation is repeated.

During the washing of the silk, the porcelain rollers revolve, without interruption, in alternate directions, for short periods of time, first in one direction and then in the other, so that thorough washing of all parts of the silk is assured.

As will be seen from the illustration, the machine is built in two sections, precisely alike in construction, one to the right and the other to the left hand side of the engine for operating the machine. The machine thus operates continuously, one section washing, while the other is being loaded and unloaded with silk.

The rollers A are made of a highly glazed porcelain, and the water-pipes are of heavy brass, with brass caps.

In order to prevent water from running about over the floor, boxes F, open at the bottom, surround each section of the machine, only one being shown in the illustration in the left hand section of the machine, the other being taken away to show the construction of the machine more clearly. (Webendorfer Machine Co., Paterson, N. J.)

BUTTERWORTH'S BLEACHING MACH'Y

For Treating Textile Fabrics in the Open State.

In the bleaching of Heavy Sateens, Drills and similar goods, precaution and care have to be observed to obtain good results. The ordinary method of bleaching such goods—namely, running them through bleaching boxes in rope form—has many disadvantages. Probably the chief of the objections to this form of bleaching is that it is impossible to prevent the selvages curling. Another objection of only slightly less importance is that the face of the cloth is caused to break up or crack, producing a very undesirable effect. To obviate these defects, open bleaching had been instituted, it being performed by passing the cloth continuously, at its full width, through a number of ordinary cisterns; but the defect of this system is, that no pressure is brought to bear upon the cloth, and it is therefore, slow and laborious.

We illustrate herewith the modern, Jackson & Hunt's patent, open bleaching kier, as built by the H. W. Butterworth & Sons Co., Philadelphia, along with its necessary adjuncts, bleaching and souring machines and which by means of any number of machines at work, both here and abroad, has proven the following advantages:

(1) An absolutely even bleach from one end of the batch to the other.

(2) Selvages which have a tendency to curl are prevented from so doing, and after treatment in the kier will remain straight for subsequent processes.

(3) The face of the cloth is not broken.

(4) A better width is obtained than in rope bleaching.

(5) The cloth is "fuller" and less punished than in ordinary bleaching.

To take the machines in order, dealing with the first to operate upon the cloth, we find in Fig. 1 the preparing and batching machine, shown in its section, and in which machine the fabric is wound into a hard reel of cloth or batch. Examining this illustration we find the cloth fed in at the place indicated by arrow A, and from where it then passes under

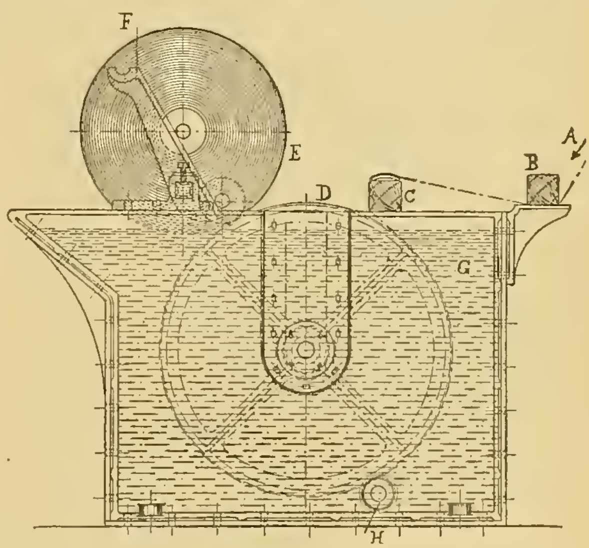


Fig. 1.

and over tension rolls B, C, and then around and under a metal drum D. It is then wound on a small metal drum or roller, which is arranged to slide up an incline F as it fills itself with the reel of cloth E.

The weight of the small drum keeps the growing reel of cloth or batch tight and in close contact with the large drum D, so that the cloth is wound in a regular and perfectly straight manner. The cistern G is made of cast iron and filled with caustic liquor which has previously been used in the kier. A perforated steam pipe H arranged along the bottom of the cistern G keeps the liquor at the required temperature, and also serves to drive it through the cloth as it is traveling around the drum D. One preparing and batching machine is sufficient to deal with the production of two or three kiers.

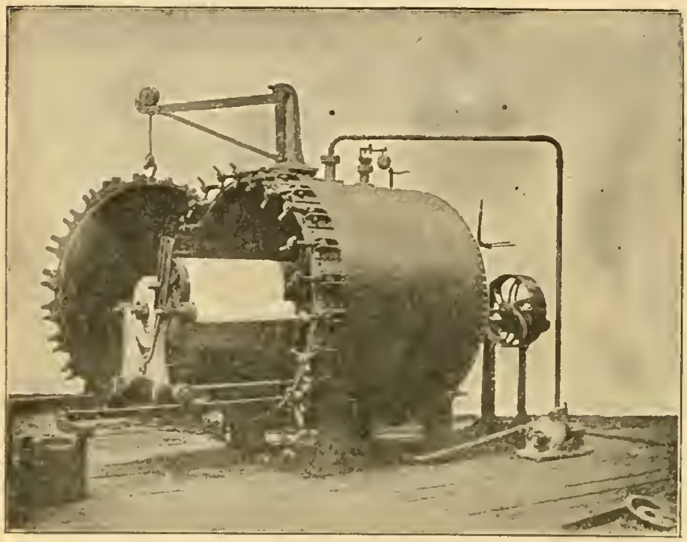


Fig. 2.

The prepared batch or reel of cloth with its metal roller, upon which it is wound, is then taken to the patent open bleach kier, shown in Fig. 2. As will be seen, the kier is fixed in a horizontal position, being made of steel plates, strong enough to stand

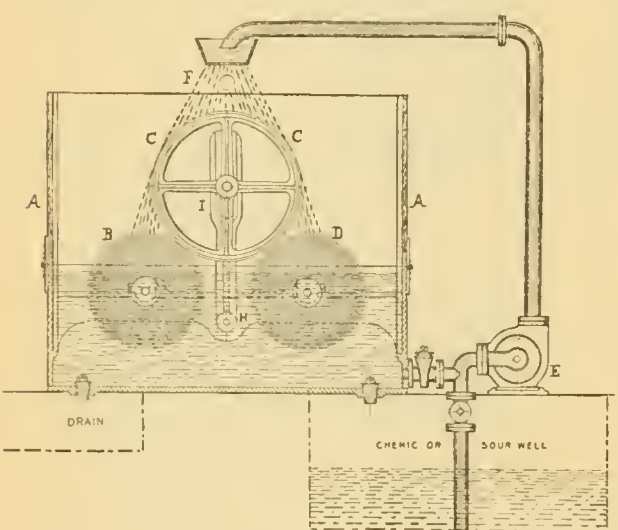


Fig. 3.

a working pressure of 60 lbs. to the square inch. A jib crane is employed to swing open the door, as required, it being so mounted that its attachment or detachment is easily accomplished. The cloth in the form of a batch is placed in position on a wagon, which, when run into the kier, automatically couples with the driving and reversing gear at the back. A drum is placed between the full and empty batch roller, remaining in contact with both, all the time winding is going on. Upon the door of the kier being closed, caustic liquor is run into the kier by means of a centrifugal pump, and steam pressure is applied until a pressure of 40 lbs. is obtained. The cloth is wound from one batch roller to the other, and vice versa, for a space of two hours. In the meantime a force pump is constantly circulating the liquor, drawing it from the bottom of the kier and delivering it in a shower on the top of the moving cloth.

Suitable mechanism is provided for automatically reversing the winding when the cloth on batch rollers is within a few yards of the end. At the end of this time, steam is turned off and the liquor drained out, when the door can be removed and the batch taken out and carried to the chemicing and souring machine. In the meantime another batch is placed in the kier, and the process progresses as explained before.

Some cloths, for example, plain blacks, require nothing but a washing after leaving the kier, but for chemicing and souring goods, the machine shown in Fig. 3 is used. The mechanical arrangements are identical with those in the interior of the kier, only the process is, of course, in this case carried out without pressure. A is a cistern into which the reel or batch of cloth is placed. B and D show this batch about one-half wound and unwound, respectively, the cloth continually being wound from one small wood roll to the other, *i. e.* within the last few yards at either end. During this winding process the cloth is made to pass over the wood lagged drum C, as carried by oscillating levers or arms I, which are free to move from side to side, being pivoted at H. As the arms have an open jaw at the top, the drum C adjusts itself to the increasing and decreasing sizes of the batches as the cloth is wound on and off. The object sought by this arrangement is that of keeping the cloth always at the same tension and free from the creases. It also brings pressure to bear upon the cloth, squeezing the liquor through it. In order to facilitate the removal of the batches from the cistern, the sides are provided with hinged doors. E is the pump and F the spurt pipe, as used for washing the cloth when the acid, or other liquor, is removed from the cistern. (H. W. Butterworth & Sons Co., Philadelphia, Pa.)

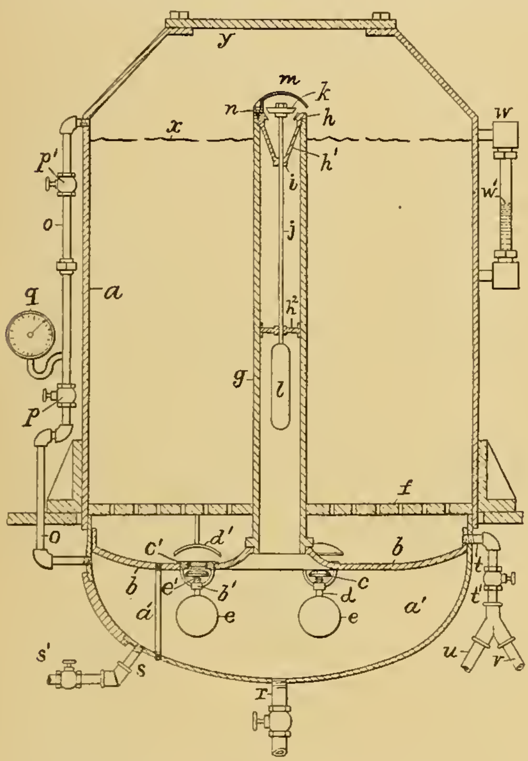
TYMS' BLEACHING KIER.

In this kier the liquor is discharged from a chamber in the bottom of the tank through a stand pipe to the upper part of the tank and thereafter circulated downward through the goods and upward through the stand pipe by variations of pressure arising within the tank and chamber.

Examining illustration given, which is a vertical section upon the centre line (where hatched) of the bleaching kier, we find a tank *a* provided near the bottom with partition *b*, having apertures in which valve seats c^1 are secured. Each seat is provided with arms to sustain a guide b^1 for the stem *d* of the valve *c*, which is supported upon the guide by spiral (cushions) spring e^1 when not pressed upwardly against the seat by a float *e*, attached to the valve stem. A grating *f* is fixed in the tank for supporting the goods to be bleached. Each of the valve seats c^1 is protected by a guard plate d^1, which is suspended from the grating and serves to prevent lint and other particles, which work down through the grating *f*, from falling directly upon the valve.

A stand pipe *g* is fixed in the middle of the partition and has a valve seat *h* secured within its top, being provided with downwardly extending arms h^1, having a guide *i* for a valve stem *j*. The top of the stem is provided with the valve *k*, which opens upwardly from the seat *h*, and the bottom of the stem is provided with a float *l*, which is suspended below the middle of the stand pipe. A guide h^2 is fixed in the stand pipe and fitted to the stem *j* just above the float. Guard *m* is fixed above the valve seat *h*, being sustained upon three studs *n*, through which screws are passed into the valve seat to support the guard with its edge above the seat to permit the escape of the liquor. A glass water gauge *w* is connected with the side of the tank near the upper part, and a pipe *o* connects the upper part of the tank with the chamber a^1 and with a pressure gauge *q*.

Cocks *p* and p^1 are placed above and below the pressure gauge, and the opening of each in turn serves to indicate the pressure in the part of the



kier with which such cock is connected. *r* is a waste pipe connected to the bottom of the chamber a^1. A steam pipe *s*, with cock s^1, is also connected to the chamber, and the tank next above the partition *b* is connected with a pipe *t*, having cock t^1 and branches *u* and *v* for supplying water or liquor, as may be desired, to the kier.

The operation of the kier is as follows: The goods to be bleached are placed in the tank *a*, which may be filled to the level indicated by broken line *x*, and the cover *y* of the tank is then tightly closed. Before any liquor is introduced the check valves *c* are held open by their weight and that of the float *c* as shown in the illustration, but the valve *k* upon the stand pipe is closed by its weight and that of its float. Liquor is then introduced through the pipe *t* above the partition *b* and flows through the open valves *c* into the chamber a^1, until the liquor raises the floats and closes the valves *c*, after which the liquor is supplied to the tank above the partition until it reaches a level somewhat below the top of the goods, as indicated by the line w^1 in the water gauge *w*. The cock t^1 being closed, the cock s^1 is opened, and the steam admitted to the chamber a^1 being confined therein by the closed valves *c*, rises in the stand pipe *g* and opens the valve *k*. The upward movement of the steam carries more or less of the liquor therewith and produces a constantly increasing pressure in the upper part of the tank. The liquor is not raised by the steam until it is thoroughly heated and boiled, so that the ebullition raises it to the bottom of the stand pipe, and it is then carried upward by the steam, raising the valve *k* in its passage, which promotes the upward flow of the fluids, as the upper part of the kier is at much lower pressure than the chamber a^1.

When the level of the liquor is lowered sufficiently by its upward discharge, the floats *c* drop and the valves *c* open, and as the pressure becomes equalized in the upper and lower parts of the kier the valve *k* closes. The liquor which is thus raised from the chamber a^1 above the goods, percolates gradually downward through the same and through grating *f*, and descends through the valve seats e^1 into the chamber a^1. When the liquor accumulates sufficiently to close the valve *c*, the pressure rises in the chamber a^1, as before, and drives the liquor from the chamber upward again through the stand pipe, opening the valve *k* and discharging the liquor upon the top of the goods, after which the intermittent movement of the liquor is continued, first upwardly through the stand pipe, and then downwardly by percolating through the goods until the valves *c* are closed. (John C. Tyms, Garfield, N. J.)

ALLEN'S BOILING AND BLEACHING KIER.

This improved kier, as it exists to-day, is not the design of a moment, but the combination of a practical knowledge of boiler making, guided for years by suggestions of operators of the leading bleaching plants all over New England.

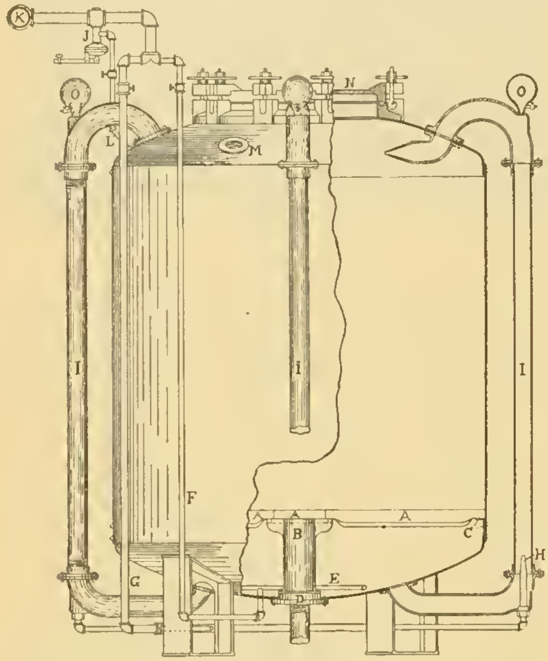
The bleaching of goods depends principally upon (1) the rapidity of circulation of the liquor through the goods, (2) the even distribution of this liquor during its circulation, (3) the temperature of the liquor, and (4) the strength of solution.

(1) Rapidity of Circulation. In the Allen Kier, the circulation is caused by the condensation of the steam as it leaves the projector points, causing a decrease of pressure in the vomit pipes, drawing the liquor from the basin to this point where the velocity of the issuing steam forces upward the liquor already in the pipes. Both of these actions are positive, and do not depend upon the working of any valve or part, nor upon the natural ebullition of the liquor. The liquor is forced through the pipe on to the top of the goods by a positive action, which can in no way fail to work, and is *independent of the working pressure* of the kier.

(2) Even Distribution of this Liquor During its Circulation. If the circulation of the liquor through the goods is uneven, that is, if more liquor passes through the goods at one point than at another, that point receiving the greater amount of circulation and having the greater chemical action will have the better boil. In order to obtain an even distribution of this liquor, it is essential that there should be sufficient liquor at all times on top of the goods to cover them, and deep enough to supply the downward trend of the liquor, without interruption at any point.

This quantity of liquor on top of the goods is easily maintained in the Allen Kier, by the positive and rapid flow of liquor in the outside vomit pipes, as previously described. It is absolutely essential for the even circulation of the liquor to have the kier evenly loaded and uniformly packed, for which one point should be as accessible as another, and there should be no chance to form channels down through the goods.

In the Allen Kier, the entire interior is free and clear, giving ample opportunity to spread the goods evenly, and pack with equal pressure, a feature not possible in connection with other styles of kiers where a centre vomit pipe is used, or any form of a kier having pipes or other parts passing up through the goods, since such pipes or parts form a natural channel down through the goods, for the liquor to flow more freely than in other parts of the kier. Having the entire interior in the Allen Kier free and clear, naturally there is nothing to interfere with the treading down of the goods, and the packer will be able to walk all around and all over the cloth, in turn giving a uniform density throughout the thus packed cloth. This is impossible to be done in other makes of kiers where there is a pipe passing up through the goods, and where there is a tendency for the packer to always walk more or less in a ring



around this pipe, leaving a space close to it which has not been thoroughly trodden by him, and which means a less density of cloth in such places, giving in turn a chance for the liquor to flow in such places more freely, and which consequently will result in an uneven boil. Again the advantage, *i. e.* convenience, of having a perfectly clear space inside the kier for loading and unloading the cloth will be readily understood.

(3) **The Temperature of the Liquor.** With wooden or iron open kiers, it is impossible to boil at more than atmospheric pressure, which means a temperature of the liquor of 212° F., whereas with the Allen Boiling and Bleaching Kier, which is operated under pressure, the boil can be run at 15 to 20 pounds pressure, which means a temperature of 250 to 275° F.; however, since these kiers are constructed to withstand a working pressure of from 60 to 80 pounds, if so desired, they will permit the temperature to be raised to 300 or 325° F., a feature which in connection with some classes of fabrics is of great benefit, besides the extra thickness of the material adds greatly to the life of the kier. In kiers, as previously referred to, having internal vomit pipes, the temperature throughout the goods cannot be kept even, since the upward flow of liquor is considerably hotter than that which has been distributed and is coming down, for which reason the goods in the immediate vicinity of this pipe will be several degrees hotter than at any other point, a feature which again will produce an uneven boil.

(4) **Strength of Solution.** The thorough and rapid circulation in the Allen Kier, makes it possible to use in connection with this kier, with equal results, a much weaker solution than could be used in other kiers not having this rapid and even circulation of the liquor, and since a weaker solution means less chemicals required for treating a given amount of goods, besides retaining more of the natural strength of the goods. Mills using this kier report a saving of about 75% in the amount of chemicals required for the boil, as compared to those styles of kiers where a centre vomit pipe is used, and from 10% to 20% in comparison with other makes of kiers. It might be well here to also mention the fact that on account of the rapid circulation of the weaker solution permissible to use, and the superior construction of this kier, only from 50% to 75% of the time as that necessary in connection with other types of kiers is required for the procedure.

A Description of the Construction of this Kier is best given by quoting letters of reference accompanying the illustration, showing this kier in its side elevation, partly in section, and with a portion of the shell removed to show its interior construction. In this illustration A indicates the grate, or false bottom, supported in its centre on a cast iron stand B, and at its circumference on an angle iron C, riveted to the shell of the kier at the outside. D is a bottom flange, tapped for 4″ pipe connections for blow off; however, when so desired, connection can also be made to this flange for filling the kier. E is the boiling pipe, being a circular pipe, perforated with ¼″ holes, and F is its supply pipe, supplying steam to the boiling system. G is a circulation supply pipe, which supplies steam to the projector nozzles H, whose peculiar construction and formation cause the rapid circulation of liquor in this kier. I are the outside vomit pipes and J the reducing valve, which reduces the pressure on the main steam line to that desired in the kier. K indicates the main steam supply pipe for the bleach house, L the low pressure connection, for pressure regulator, M the safety valve flange, N the manhole, and O the air chambers.

The shell of the kier is made of tank steel, of 60,000 lbs. tensile strength, with flanged steel heads of 55,000 lbs. tensile strength. The castings are all heavy, and made of best grey cast iron. The shell seams of the kier are of the double riveted butt joint type, with outside covering straps. As the rivets are countersunk on the inside, there is consequently a perfectly smooth surface where the goods come in contact with the kier.

The Operation of the Kier is very simple: In starting, open the valves on pipes F and G, which will cause the kier to boil quickly. The lever of a safety valve (not shown) connected to flange M, must be left up, so that the air pressure on top of the goods can escape as the boiling commences. When steam escapes from the safety valve, drop the lever, thus closing the safety valve, and then partly close off the valve on the pipe F, leaving the projector pipes wide open. Leave them in this position until the steam gauge begins to register, then partly shut off the supply for the projector nozzles H. The final adjustment of the valves on pipes F and G can only be determined by experiment, permitting in some instances the pipe F to be shut off entirely, the steam necessary to run the projector nozzles being in this instance sufficient to keep the kier boiling, however in most instances, this valve must be left open a very little. The valve on pipe G, and which governs the projector nozzles, should be shut off until the nozzles throw the liquor up through the pipes in a continuous stream, which is determined by opening the pet cock in the air chamber, and provided the valve on pipe G is open too far, there will be sputterings of steam and liquor from the pet cock, on the other hand, if it is closed down too far, nothing but steam or air will appear; again when the valve is closed to its proper point, nothing but liquor will appear at the pet cock. This point when once determined by the operator is always the same. The safety valve should be set to blow at the desired working pressure, and in case the pressure should get beyond this point, and blow too freely through the safety valve, then close down the boiling pipe F.

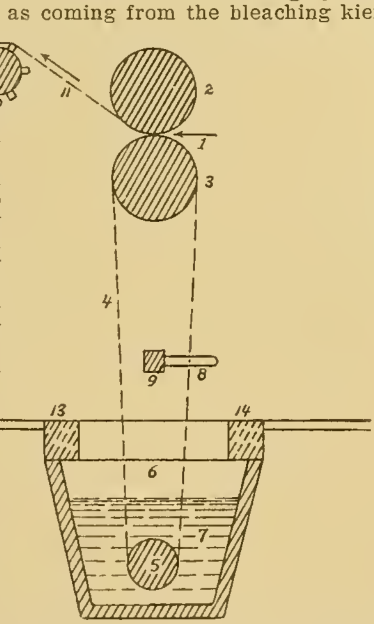
When working properly, the safety valve should not remain perfectly tight, but when up to its proper pressure should shake slightly and blow steam at short intervals, until the boil is finished.

In a great many bleach houses, it is customary on cotton goods to have the water valve connected to the tee on the under side of the safety valve. This pipe is used for washing out the goods after they have finished boiling, and also to cool the kier down as quickly as possible. When boiling under 15 pounds or over, there is a liability, if blown clear off and not cooled down, of stains showing in the goods when finished, due to the high temperature.

In regard to the time of boiling and the strength of the solution, these are questions which each bleacher has to decide for himself, as they vary on different goods. The common way is to boil with the strength to which they have been accustomed for the first two or three boilings, and to reduce the strength and time of boiling gradually, to the point at which the desired results are obtained. (Wm. Allen Sons Co., Worcester, Mass.)

THE ARLINGTON BLEACH HOUSE WASHER.

The object of this machine is to thoroughly wash the cotton cloth as coming from the bleaching kiers,



in the rope state, so that all acids and lime salts, etc., adhering to it, are properly removed from the goods, using in connection with the machine a running water, clear and free from dissolved organic matter and iron.

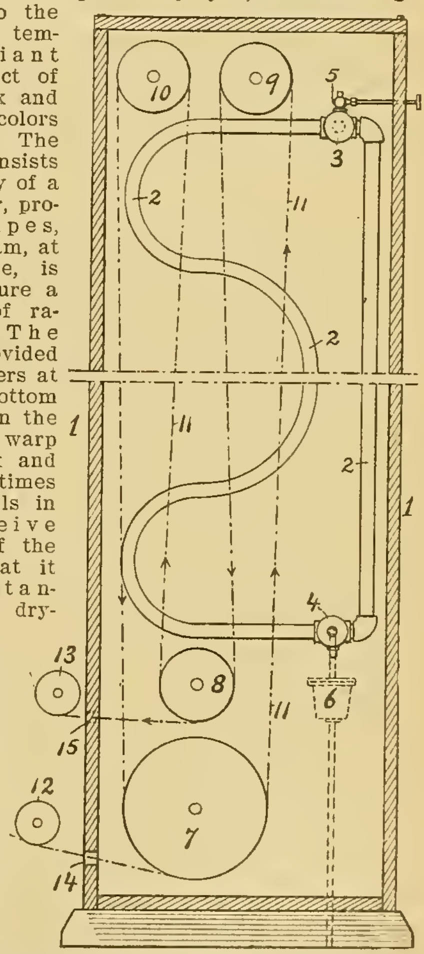
The accompanying illustration is a transverse section of the machine, showing the routine of cloth through the machine, and thus the principle of complete saturation with water and alternate squeezing by the upper rolls.

The cloth is drawn from the kiers through pot eyes (see arrow 1) by the nip of the two upper rolls 2 and 3 and then in a downward course (4) underneath a roll 5, deeply immersed in the box 6 containing the water 7; the cloth then is drawn upwards, and guided to its proper position on upper squeeze rolls 2 and 3 by wood pegs 8, a series of which is pitched out side by side from peg rail 9, so as to allow free passage for cloth. This operation of running the cloth around rolls 3 and 5 is repeated up and down, first in water, and then squeezed, until the whole width of the machine has thus been threaded by the cloth, and when after passing upwards between the last two pegs of the series, the cloth is carried away by reel 10, see dotted line 11, and conveyed to squeezers. 12 indicates the floor line, and 13, 14 the foundation beams.

The altitude at which the upper rolls are placed, allows a downward current of the water coming from nip of rollers to add materially to a thorough wash. (Arlington Machine Works, Arlington Heights, Mass.)

OXIDIZING AND DRYING MACHINE.

The object of this machine is to provide a drying apparatus which will simultaneously subject the material, which has been previously dyed, to a steaming process and to the action of high temperature radiant heat, the object of which is to fix and brighten the colors on the material. The machine consists principally of a closed chamber, provided with pipes, into which steam, at high pressure, is passed, to secure a high degree of radiant heat. The chamber is provided with guide rollers at the top and bottom and the yarn in the form of a chain warp is passed back and forth several times around the rolls in order to receive more action of the process, so that it becomes substantially dry, said drying process being carried on in a bath of steam which fills the chamber. The dyed yarn is passed through an atmosphere of steam, while being subjected to a high temperature of radiant heat, which has the effect of expelling the excess of moisture in the dye on the material under treatment, in turn developing, brightening and fixing the color.



The compartment in which this process is carried on is kept supplied with steam, provided by vaporizing the moisture carried in with the yarn, consequently, after once filling the chamber with steam, no further supply from the outside is necessary.

A diagram of the machine, showing the arrangement of the pipes and the passage of the yarn, is given in the accompanying illustration, which is a sectional side elevation of the machine.

Referring to the illustration, 1 indicates the closed chamber, having the steam pipes 2 of which there is a series in the machine, all being connected at the top and bottom to manifolds 3 and 4 respectively. Steam is admitted through a valve 5 and a trap for condensed steam is provided at 6. Bottom guide rolls 7 and 8, and top guide rolls 9 and 10 extend across the machine and the yarn 11 is guided from a guide roll 12, under the roll 7, then up between two lines of pipes 2 to the upper roll 9, and from there down and under the other bottom roll 8, then up again to the other upper roll 10, from where it is guided again to the first bottom roll 7 and over the same rolls, as explained, until the whole length of the rolls is covered, the yarn passing up between different lines of pipes 2 and at last passing out of the chamber, from the roll 8, to a guide roll 13. Guide rolls 12 and 13 are used to prevent the yarn from coming in contact with the sides of the openings 14, and 15 respectively, of the chamber.

The yarn in this manner comes from the machine in a dry condition, that is, not absolutely dry, but in such a condition that the moisture left in it is only that due to the action of the steam at high temperature. The guide rolls 7, 8, 9 and 10 are all driven at the same surface speed through proper gearing connecting them. (John W. Fries, Winston-Salem, N. C.)

MERCERIZING.

Considerable interest has during late years been taken in mercerizing cotton, chiefly for producing a silky effect on cotton yarns and fabrics. The process itself, originally, was discovered by John Mercer, a prominent calico printer in Lancashire, England, and was patented by him in 1850; however Mercer missed to discover the proper application of the material under treatment, as practiced so extensively at the present day. Mercer was born at Great Harwood, near Blackburn, England, Feb. 21st, 1791, and died Nov. 30th, 1866.

Before going more in detail in explaining the subject of mercerizing, it may be interesting to mention here that dilute solutions of caustic soda (or caustic potash) of from 2 to 7% strength, have no action on cotton, in the cold, even at a prolonged immersion of the fibre with the alkaline solution. Solutions of from 1 to 2% strength have little if any action upon the cotton, no matter how high a temperature and pressure used (a feature of great importance to bleachers). Solutions of caustic soda of greater strength than 3%, when boiled under pressure, convert cotton fibres into soluble bodies, dissolving as much as 20 per cent. of it under such a treatment. However the action of strong solutions of caustic soda or caustic potash upon cotton is different, and is the cause of its mercerization.

Mercer's original patent, gives a very complete account of the process as practiced now, some fifty years after its invention, since all he missed to discover was to apply the yarn or fabric to his process under tension; in turn losing one of his claims, one which never proved of any great value, viz., shrinkage of the cotton fibre in its length and thus increase in strength, but on the other hand would have gained a far superior point, viz., a silky lustre to cotton yarns and fabrics thus treated (the present day mercerizing) by his process. However his patent otherwise covers mercerizing as practiced now completely, and is thus quoted:

My invention consists in subjecting vegetable fabrics and fibrous materials—cotton, flax, etc.—either in the raw or manufactured state, to the action of caustic soda or caustic potash, dilute sulphuric acid or chloride of zinc, of a strength and temperature sufficient to produce the new effects and to give the new properties to them which I have hereinafter described.

The mode I adopt of carrying into operation my invention to cloth made wholly or partially from any vegetable fibres, and bleached, is as follows: I pass the cloth through a padding machine charged with caustic soda or caustic potash of sp. gr., say, 60° to 70° Tw., at the common temperature, say, 60° F. or under, and without drying the cloth wash it in water, then pass it through dilute sulphuric acid and wash again; or I run the cloth over and under a series of rollers in a cistern with caustic potash or soda of sp. gr. from 40° to 50° Tw., at the common atmospheric temperature, the last two rollers being so set as to squeeze the excess of potash or soda back into the cisterns; the cloth then passes over and under rollers placed in a series of cisterns charged at the commencement of the operation with water only, so that at the last cistern the alkali has been nearly all washed out of the cloth; when the cloth has either gone through the padding machine or through the cisterns above described, I wash the cloth in water, pass it through dilute sulphuric acid, and wash again in water.

When I adapt the invention to grey or unbleached cloth made from vegetable fibrous material, I first boil or steep the cloth in water, so as to have it thoroughly wet, and remove most of the water by the squeezer or hydroextractor, and then pass the cloth through the soda or potash solution, etc., and proceed as before described.

I apply my invention in the same way to warps, either bleached or unbleached, but after passing through the cistern containing the alkali, the warps are either passed through squeezers or through a hole in a metallic plate to remove the alkali, and washed as before described. When thread or hank yarn is operated on, I immerse the thread or yarn in the alkali and then wring out, as is usually done in sizing or dyeing them, and afterwards wash, sour, and wash in water as before described.

When I apply my invention to any fibre in the raw state, or before it is manufactured, I first boil it in water and then free it from most of the water by the hydroextractor or a press. I then immerse it in the alkaline solution, and then remove the alkali by the hydroextractor, or I press the alkali out with a press and then wash in water, sour in dilute sulphuric acid, wash again, and then remove the water by a press or hydroextractor.

When cloth, made from vegetable fibre, cotton, flax, etc., has been subjected to the action of caustic soda or potash, as before described, by padding, immersion, or any other way, and then freed from alkali by scouring and washing according to my said invention, the cloth will be found to have acquired certain new and valuable properties, the more remarkable of which I here describe. It will have shrunk in its length and breadth, or have become less in its external dimensions, but thicker and closer, so that by the chemical action of caustic soda or potash I produce on cotton and other vegetable fabrics and fibres effects somewhat analogous to that which is produced on woolens by the process of fulling or milling.

It will have acquired greater strength and firmness, each fibre requiring greater force to break it. It will also have become heavier than it was before it was acted on by the alkali, if in both cases it be weighed at the temperature of 60° F. or under.

It will have acquired greatly augmented and improved powers of receiving colors in printing and dyeing. The effects of the application of my invention to the vegetable fibre in any of its various stages before it is manufactured into cloth will be readily understood by reference to its effects upon cloth composed of such fibres.

Secondly, I employ sulphuric acid diluted to 105° Tw., and at 60 F. or under; I use this acid instead of soda or potash, and operate in all respects the same as when I use soda or potash, except the last scouring, which is here unnecessary.

Thirdly, when I employ solution of chloride of zinc, instead of soda or potash, I use the solution of sp. gr. 145° Tw., and at 150° to 160° F., and operate the same in all respects as when I use soda or potash. When I operate on mixed fabrics, partly of vegetable and partly of silk, wool, or other animal fibres, such as delaines or jeans, etc., I prefer the strength of the alkali not to be over 40° Tw., and the heat not above 50° F., lest the animal fibres should be injured.

I may, in conclusion, remark that the construction of the apparatus or machinery and the strength and temperature of the soda or potash, sulphuric acid or chloride of zinc solution, may be varied to a considerable extent, and will produce proportionate effects without at all deviating from my invention. For instance, caustic potash or soda may be used even as low as 20° Tw., and still give improved properties to cotton, etc., in receiving colors in printing and dyeing, particularly if the temperature be low, for the lower the temperature the more effectively the soda or potash acts on the fibrous material. I do not, therefore, confine myself to any particular strength or temperature of the substances I employ, but the particular strengths and temperatures here described are those which I have found best and prefer.

And I claim, as of my invention, the subjection of cotton, linen and other vegetable fibrous material, either in the fibre or any stage of its manufacture, either alone or mixed with silk, woolen or other animal fibrous material, to the action of caustic soda or caustic potash, dilute sulphuric acid, or solution of chloride of zinc of a temperature and strength sufficient to produce the new effects, and give to them the new properties before described, either by padding, printing or steeping, immersion, or any other mode of application.

By this process as then invented and practiced by Mercer, there were produced on cotton fibres, in yarns and fabrics, effects somewhat similar to those which are produced on woolens by the process of fulling; the fibres shrinking about 20% of their length, at the same time acquiring greater strength and an increase in their diameter, *i. e.* they became heavier than before being acted on by the alkali, provided in both cases they were weighed at the temperature of 60° F. or under. We also notice from the patent quoted, that Mercer discovered that cotton treated by his process acquires a very considerable affinity for dyestuffs, taking them up much more readily from dye baths, than cotton not mercerized, and that mercerized cotton can be dyed in very brilliant shades. Mercer however never realized any value from his invention, for the contractions of the yarn and cloth (about 20%) after passing through this process made them more expensive, and the advantages gained (strength and affinity for dyestuffs) were more than overcome by their increased cost of production, so that the process was for years practically forgotten, for the fact that it must be remembered that Mercer never discovered the actual advantages of his process as practiced at the present day, that is—if properly handled during his process, the cotton fibre will obtain a silky lustre.

The next application of Mercer's process was in the manufacture of silk and of worsted crepons, a light dress fabric, a distinctive feature of which was its crepe or crinkly effect produced in weaving, and which were very popular and the height of fashion for ladies' wear some ten to fifteen years ago. Goods of this description were made to be washable, so that they would not lose their crepiness through washing, and as a rule were commonly dyed in plain colors. They were woven with two warps, a back and a face; the back warp being woven tight, *i. e.* under a severe tension, whereas the face warp was let off loose. This feature of two kinds of let offs for the warp coupled with peculiar weaves for each system of warp, produced the crinkly or crepe effect, previously referred to, to the fabrics. Soon goods were brought into the market (from Germany) that had this peculiar crepe effect exaggerated into large puffs, which then at once took the popular fancy and were extensively imported, and naturally drove their more modest predecessor out of the market. Examination of the latter styles showed that the back warp was of cotton sparsely scattered across the width of the goods and that filling threads were also thrown on the back in regular or irregular patterns as desired, and that the much sought after effect had been produced by passing the goods with their cotton back and worsted or silk face through the original mercerizing process, shrinking the cotton in all directions of from 20 to 25 per cent, and throwing the face (worsted or silk), which was unaffected by the cold caustic alkali, into great puffs and blotches.

Later, a firm of German dyers, experimenting on some half-silk and cotton goods which they desired to piece dye, found that the cotton did not take the dye with the same intensity as the silk, and to help themselves over the trouble, they concluded to mercerize the fabrics, and when, to prevent the loss in the cotton by shrinkage, put it through the concentrated solution of caustic soda in a strongly stretched condition. This experiment was a perfect success. They not only found that they had achieved all they desired, but to their astonishment, also *that the cotton had assumed a lustre* equal to that of silk. They developed this discovery into a process to produce the silk lustre upon cotton now known as mercerized cotton, silkoline, sub-silk, silk-lustre, etc., *i. e.* the process known at present as mercerizing.

To obtain this silk lustre, the general method to be pursued is as follows: Skeins, yarns, warps, or piece goods in a stretched condition are immersed in a solution of caustic soda for about fifteen minutes in a strength of bath about 30° B. The goods are then lifted, and the surplus liquor is removed either by squeezing the goods through rolls, or putting them through the hydroextractor. They are then thoroughly washed with clear water. A second bath of diluted sulphuric acid neutralizes all remaining alkali, when a final rinsing leaves the goods in condition for either bleaching or dyeing.

The quality and degree of lustre and silk-like appearance is largely dependent upon the quality of the cotton used, long stapled Sea Island and Egyptian cotton (combed), giving the best results. If the yarn is gassed, and thus the ends of the fibres removed, the result is still further improved. Ordinary mule yarns, and ordinary calico made of short stapled cotton, only receive a slight lustre. Loosely spun cotton yarns slip in mercerization under tension, but in hard twisted yarns most of the fibres get really stretched; hence a perfect silky lustre can only be produced when the twist is sufficient to prevent many threads from escaping the tension. Cotton mercerized loose (*i. e.* Mercer's original invention) has a leathery appearance, and the fibres are shortened and thickened, whereas stretching makes them thinner and more shiny. The greatest lustre to the fibres is obtained when the thread has reached its elastic limit, *i. e.*, just before it breaks. The more the lye soaked cotton is stretched, the greater the lustre, and consequently a scale of lustres with their corresponding tensions, can be readily constructed in any mill or mercerizing establishment. The intensity of the dyeing stands in the closest connection with this scale. Loose mercerized cotton dyes the darkest, whereas the more the mercerized cotton has been stretched, the lighter the color; that is, the most lustred cotton takes the lightest shade, but even this is distinctly darker than it would have been on unmercerized materials. This silky lustre on cotton is very durable, and resists bleaching, washing and dyeing; only color lakes, thick precipitates on the fibre such as Turkey red can hide it. That a chemical change has taken place in the cotton fibre after mercerizing is at once apparent; it will be found that the sulphur dyestuffs will dye in many instances from a cold bath, in from one-quarter to one-half the time usually required for dyeing in connection with cotton not mercerized, a feature which has given many a dyer trouble to produce even shades. The action of many azo colors, as used for wool dyeing, will be also worth notice. They do not stain unmercerized cotton, a feature made use of by manufacturers in certain lines of mixed goods; but when mercerized cotton threads are substituted, it will be found that they are stained to such an extent as to preclude their use. That the mercerizing process is actually a chemical one is clearly demonstrated by the action of pure tannin solutions upon both, ordinary and mercerized cotton, since cotton not mercerized has the property of taking up in a given time, and under the same conditions, a greater amount of tannin than mercerized cotton, thus indicating that the tannin absorbing factor for cotton is reduced by means of mercerizing.

On account of the speed with which mercerized goods take up dye, as previously mentioned, they are liable to do so with want of uniformity, and consequently retarders, such as Glauber's salt and phosphate of soda have to be used. Turkey red oil is also very good for this purpose. To get the lively colors so much in demand for mercerized articles, the direct dyes are usually topped with basic dyes, and which go on very fast, and consequently care and speed must be exercised during the process, which should be carried out in the cold, in presence of acetic acid. In using adjective dyes it must be remembered that mercerization increases the affinity of cotton for mordants as well as for dyes, and that consequently less of the former than of the latter must be used. Baths of tartar emetic should be about 30% weaker. To prevent too rapid dyeing, the bath should be cold, and acidified with acetic acid. The dye should be added gradually, and the goods carefully worked. If the bath is not exhausted enough with deep shades, heat to about 130° F. for a quarter of an hour.

When it is desired that mercerized cotton should rustle similarly to silk, besides having the silky lustre, this is facilitated by bleaching the mercerized material.

Bleached yarns, after dyeing and rinsing, are passed through a cold neutral soap bath, rinsed and soured with acetic, or better with tartaric acid. Yarn so treated has a very persistent rustle. Unbleached yarns, after dyeing, are passed first through a 1.5% bath of commercial acetate of lime for about a quarter of an hour, then through a lukewarm 1% bath of Marseilles soap for a quarter of an hour, and finally for a third quarter through a cold 2.5% bath of acetate acid, and in turn extracted and dried, without rinsing. All these baths can be used again, the first changing very slowly in strength. For dark shades and black, pyrolignate of lime, which is cheaper than the acetate, can be used instead of it. The soap bath must lather continually while in use, and must be kept frothing by adding more soap from time to time. The last bath must be distinctly acid all the while it is in use, and as the acetate is neutralized by the lime more of it must be added.

Practically no success has attended the numerous attempts which have been made to dye goods before mercerizing it; since even those dyes which stand the action of caustic soda best undergo a perceptible change of shade when subjected to it, and the others will bleed.

We might ask the question, how does mercerized cotton acquire its high lustre? The best and most readily understood reply is that the cotton, through the action of the caustic soda, is brought to a gelatinous or parchment-like condition; the extreme tension rounding and concentrating the fibres so that the rays of light as they fall upon them are reflected instead of being absorbed.

In mercerizing, to save expense, the first rinsings, which are caustic soda lye of 15 to 20° B., are collected and used for diluting stronger lyes, or for dissolving the solid caustic. In some instances it has been suggested that the lye is cooled during use by means of ice. This process however has lost ground, on account of the heavy expenses connected with thus cooling the liquor, it being cheaper to use a stronger lye at an ordinary temperature, especially when dealing with cotton containing little or no size. In mercerizing at ordinary temperatures, about 65° F., the lye should be about 30° B., whereas at about 36° F., a lye of 18 to 22° B., could be used to get the same results. To get the greatest possible lustre, the lye must be strong enough to produce the maximum amount of contraction in loose cotton. The time of exposure to the lye is not of much consequence; ten to fifteen minutes is enough. So long as the goods get thoroughly penetrated by the caustic alkali, it is immaterial whether they are entered wet or dry. In the latter case more care is naturally necessary to see that they do get perfectly soaked. Enough lye must be washed out of the mercerized goods to prevent them from again shrinking before the tension is relaxed, but if the water in the washing compartment brings the lye in the fibres below 10° B. no further shrinkage will take place.

The peculiar feature of the process, *i. e.* that the intensity of the action lessens, with the rise of temperature; or, in other words, the higher the temperature the stronger the lye required in order to produce any given effect, has thus far not yet been satisfactorily explained. At ordinary temperatures, the action begins when the lye contains 10% of NaHO, which corresponds to a specific gravity of 1.115. The effect increases, the temperature remaining constant, until the specific gravity of the lye reaches 1.34, and when it contains 31% of NaHO. The temperature must however not exceed 70° F. at the most. Lyes varying in strength between 20 and 25% of NaHO, *i. e.* between 1.225 and 1.275 S. G., act well and quickly at from 50-65° F., but if the concentration falls below 10% of NaHO, the lye will not mercerize except brought to an extremely low temperature. Naturally, it is impossible to make a very weak lye mercerize at any temperature. It is a remarkable fact, however, that the presence of zinc, in some unexplained manner, assists the mercerizing action of caustic soda. A lye of that substance of 1.1 specific gravity, which has no action on cotton, will act on it energetically if zinc oxide is dissolved in it in the proportion of two molecules of zinc oxide to one of sodium monoxide ($2ZnO$ to Na_2O).

As mentioned before, mercerizing increases the strength of the cotton fibre in all cases, whether mercerized under tension or not, however the fact is, that cotton mercerized under no tension will obtain considerably more strength compared to its condition before mercerizing, whereas cotton mercerized under tension will only gain about one-half of this additional strength, than when not mercerized; this result showing that the full strengthening of the fibre is only obtained when the same is permitted to shrink by the process, *i. e.* mercerized without tension. This feature however is of less importance to the manufacturer and only quoted for a fact; the increase in lustre as obtained by mercerizing under tension being the important point for him. Another interesting difference between mercerizing with or without tension is that in the first instance the lye does not affect the original elasticity of the cotton, while in the latter case the elasticity of the yarn is increased about one-third.

In order to obtain a perfect mercerizing (evenness of lustre) the yarns or fabrics as the case may be, must be thoroughly scoured and extracted before passing to the lye-bath. It will be readily understood, that the less yarn is handled after being mercerized, the better its lustre, and nothing will hurt the lustre so much as handling and treating with chemical liquors; and if the yarn is to be bleached after being mercerized, it will have to undergo several handlings and treatments to bleach it, and consequently there will be a risk of loss of lustre, to avoid which it seems advisable to bleach previous to mercerizing; however, the general run of opinion is that bleaching should follow mercerizing, possibly that in this way a washing, a scouring and a drying are saved, and besides a perfect white the result. With reference to piece goods they should be subjected to crabbing before mercerizing, and the preliminary boiling and wetting out done thoroughly. With reference to yarns, as already mentioned, the same should be previous to the process gassed, since otherwise the hairy fibres remain loose, are not stretched, and consequently shrink, remain without lustre, and in turn to a certain extent hide the otherwise lustred surface of the yarn.

Regarding the cross section of the cotton fibre after mercerizing loose and in the form of yarn under tension, the former is in nearly every instance circular and with the central lumen very much smaller, and frequently of irregular shape, whereas on the other hand, cross section of the fibres from yarn mercerized under tension, appear polygonal, especially those fibres composing the core of the thread, due to the pressure of each fibre against its neighbors in the thread, while the fibres as situated on the outside of the thread only show this pressing on the sides towards the centre of the thread. The characteristic of the central hole or lumen is, in many cases, quite distorted, thus indicating an expansion of fibre substance in two directions, towards the centre, and towards the circumference.

Besides caustic soda, both nitric acid and sulphuric acid have been proposed for mercerization. Diluted nitric acid gives no results worth having, and no lustre under tension is got with strength below 38 to 43° B. Practically therefore, caustic soda is the everyday mercerizing agent, the lye bath to be used at a strength of about 30° B., or practically the same strength as originally suggested by Mercer.

To distinguish mercerized from unmercerized cotton, the microscopic test can be employed, also a dyeing test, which is as follows: 5 oz. of potassium iodide are dissolved in from 12 to 24 of water, 1 to 2 oz. of iodine added, and these mixed with a solution of 30 oz. of zinc chloride in 12 of water. The cotton is soaked in water and then immersed in this solution for about three minutes; then rinsed with water. If the cotton is unmercerized, it will quickly lose its color, while mercerized cotton keeps its blue color much more obstinately. This reaction can be used even with dyed cotton. If, for example, it is desired to know whether some dyed cotton has been mercerized, some mercerized and some unmercerized cotton is dyed the same color, and then all three cottons tried with the above solution. Mercerized cotton will show darker after rinsing. To test for mercerization in dark dyed goods, the color should first be discharged with bleaching powder, acetate of tin, etc. For bleached or lightly dyed goods it is often enough to compare the cotton after the above iodine treatment with another sample which has been soaked with water only.

The Application of Mercerized Cotton for Textiles. The discovery of the fact that by mercerizing cotton under tension, the same acquires a permanent silky lustre, has in late years led to some considerable changes in the production of textile fabrics. The part that mercerized cotton is taking in this direction is continually growing, and it is now utilized along with silk and wool for the production of novel and artistic effects in all kinds of textiles that were formerly undreamt of. In many classes of mohair and alpaca goods, it has made its appearance with pleasing results, again for making certain kinds of lustre fabrics it is now much used. For the production of satins (silk cotton goods) it results in a fabric more closely resembling silk than was formerly attainable. It also has found a prominent place in the manufacture of woolen and worsted figured dress goods. It is now also extensively used in the manufacture of worsteds for men's wear, for special effects formerly produced by silk only. In the figured damask table cloth trade it has also been found of service. In connection with upholstery goods, draperies, curtains, coverings, it has simply revolutionized the construction and design of these fabrics. In fact there would seem to be no end to the variety of goods and the variety of effects which can be obtained from the use of mercerized cotton. Among the changes of a chemical character which occur, there is one that must not be overlooked, for it is one which in the hands of a dyer constitutes one means of increasing the novelty of effects in fabrics obtained by the combination of mercerized cotton with other fibres, based upon the marked increase in the affinity of mercerized cotton over ordinary cotton for dyes. For instance, if a piece of cotton cloth woven partly from ordinary cotton and partly from mercerized cotton be dyed, then the latter takes a much deeper color than the former, a feature which can be used for producing novelties, the design being thrown up and brought into more prominence as a dark shade on a light ground, or vice versa.

THE KLAUDER-WELDON WARP MERCERIZING MACHINE.

As we have seen from the previous article, one of the great disadvantages inherent in the process of mercerizing is that the warp tends to shrink very decidedly under the influence of the caustic bath, thereby decreasing in length and thus, more or less, depreciating in value. Various methods have been devised by which to overcome this disadvantage of shrinking, such as by stretching the material before and after subjecting it to the influence of the caustic bath, or by a positive stretching of the material while it is subjected to the action of the caustic, this latter method being the one employed in the Klauder-Weldon machine, in which it is possible to feed the warp, in its open width, continuously through the caustic and other necessary baths, and at the same time exerting sufficient tension on said warp to prevent it from shrinking during the process, thus avoiding the disadvantage mentioned, and doing away with the necessity for any positive stretching of the warp, either before or after the process. In this manner, the machine provides for the continuous production of a properly mercerized warp which shall have the requisite lustre and strength, without having suffered in appreciable shrinking during its passage through the machine. By having the warp in the sheet form, insures the perfect treatment of every individual thread, since the tension on each thread is uniform and in a great measure regulates the evenness with which the operation is performed.

The warp mercerizing system, where advisable to be used, is generally preferred to skein mercerizing, for when the skein is put under tension during the

1	2	3	4	5	6	7	8	9	10
Wet	Boil	Cool	Mercerizing	Wash	Wash	Acid	Wash	Wash	Soap

Fig. 1.

process, the different threads, *i. e.*, different rounds of the same thread, will not receive the same amount of tension, owing to the shape of the skein which makes the outside layer longer than the inside layer, and consequently the mercerizing will be more or less uneven. Uneven mercerizing on yarn to be dyed, as explained in the article on Mercerizing, will naturally produce uneven dyeing during that process, because a mercerized yarn takes dyes better than an unmercerized yarn, and consequently the portions of the yarn which did not receive the full benefit of the mercerizing process will not dye as readily and bright as the fully mercerized portion.

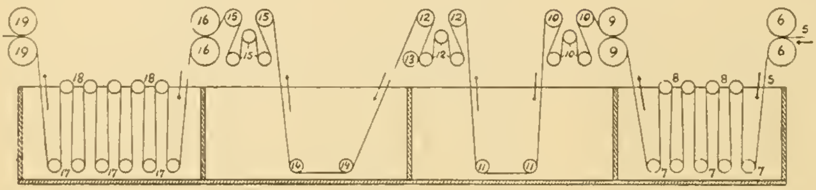


Fig. 2.

The arrangement of the different baths in the machine for the warp mercerizing, and the details of the construction and operation of said machine are best given by means of the accompanying illustrations, of which Fig. 1 is a diagram showing a plan of the baths, and Fig. 2 is a diagram given for the purpose of showing the arrangement of the different rolls as used in the various baths, and the methods of passage of the warp through the various baths.

Referring to Fig. 1 for an outline description of the process as carried on in this machine, 1 indicates the wetting out bath for the warp, the water for this purpose containing a small amount of caustic soda; 2 is the boiling water bath through which the warp passes after leaving bath No. 1; 3 is a cold water bath; 4 is the mercerizing bath and which is made up principally of a caustic soda solution; 5 is a rinsing bath, using cold water for this purpose; 6 is a similar rinsing bath to bath No. 5; 7 is the acid bath; 8 is a rinsing bath of cold water to wash the excess of acid from the goods; 9 is a similar rinsing bath to bath No. 8; 10 is the soaping bath, which of course, contains a soap solution. Two rinsing baths 8 and 9 respectively are used in order to free the material of any possible traces of acid previous to entering the soap bath, because if present the same would neutralize the soap. The method of passing the warp through the various baths, as mentioned before, is shown in Fig. 2.

The passage of the warp 5 through the different baths is very rapid, said warp passing through the machine in the direction of the arrows, entering the machine through a pair of feed rollers 6, then into the first bath by passing under and over guide rollers 7 and 8 respectively. After leaving the first bath, the warp passes similarly through two more baths (not shown) and after thus leaving the third bath, the warp passes between a pair of what might be termed delivery rolls 9 and from there, around the tension rolls 10, then down under the guide rolls 11 in the mercerizing bath. After leaving this bath, the warp passes around tension rolls 12, similar to those at 10, and a roll 13, being in contact with one of these rolls, acts with it as a delivery pair and also squeeze rolls for the purpose of saving the mercerizing liquor, and which thus runs back into its bath.

After leaving the top tension roll 12, the warp is passed successively into two rinsing baths (not shown), the passage being similar to the first bath explained, and after that passes down under the guide rolls 14 in the acid bath. From this bath, the warp passes around the tension rolls 15 and between the delivery rolls 16, and from there into two successive rinsing baths (not shown), the passage being similar to the first one explained. After having all traces of acid removed, the warp then passes under and over the rolls 17 and 18 in the soap bath, and from there passes from the machine through a pair of delivery rolls 19.

The object in having the warp pass around the different rolls is to keep it at all times under the proper tension, and in this manner avoid any shrinkage, as is its tendency to do. The arrangement of the sets of rolls for the other baths is similar to those explained, as will be seen from the illustration, with the same object in view of keeping the warp under tension in its passage through the machine.

After being delivered from the last pair of rolls of the machine, the warp is run into truck boxes and is either taken to the drying machine or to the dyeing machine, as the case may be. It is impracticable to have the drying and beaming apparatus continuous with this mercerizing machine, because of the greater speed of the passage of the warp through this mercerizing machine as compared to its speed through any make of drying and beaming machinery.

All of the rolls on the mercerizing machine are driven at the same surface speed, and thus hold the warp under tension without stretching. For the convenience of the operator in running the machine, shipper rods are placed on each side of the machine to enable him to stop the machine from practically any point. In some cases only one shipper is provided, if desired. (The Klauder-Weldon Dyeing Machine Co., Amsterdam, N. Y.)

PALMER'S SKEIN MERCERIZING APPARATUS.

The novelty of construction refers to the frame for stretching and moving yarn during its dipping process, and the means for supporting and conveying this stretching frame.

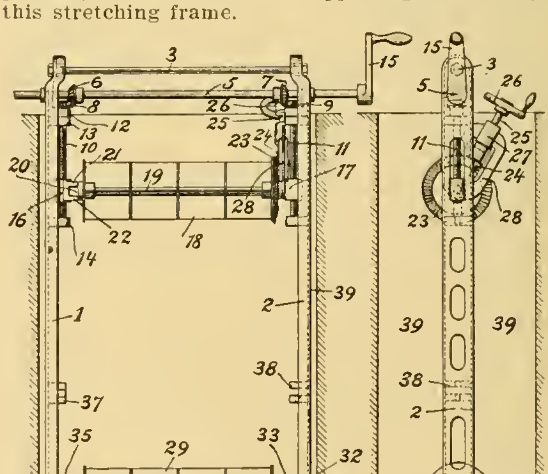


Fig. 1 *Fig. 2*

Fig. 1 is a view of the yarn stretching frame in side elevation, in the position which it assumes when inserted in a vat; the vat being indicated in section. Fig. 2 is an end view of the same.

The yarn frame consists of a pair of vertical side bars 1 and 2, set with their outer faces toward each other, and top and bottom bars 3, 4, for holding the side bars 1, 2. at the proper distance apart. A shaft 5 is journaled in the side bars near the upper ends of the same, and is provided with bevel gear pinions 6 and 7, which mesh with bevel gear pinions 8 and 9 on screws 10 and 11 respectively. The screws 10 and 11 are swiveled in lugs fast to the faces of the side bars 1 and 2, as follows: The larger part of the screw stem in proximity to the bevel gear 8, passes through a lug 12, and the stem of the screw is then reduced, forming a shoulder which rests on the lug 13, through which the stem passes, the lower end of the screw being reduced still further and working in a lug 14. In like manner the screw 11 is swiveled to the bar 2. The shaft 5 is provided with a crank 15 for rotating it, and thereby simultaneously rotating the screws 10 and 11. On the screw 10 there is a vertically traveling nut 16, and on the screw 11 there is a vertically traveling nut 17.

The upper reel 18 is mounted to rotate on a spindle 19, the latter being secured at one end to the nut 17 and at its opposite end being adapted to removably engage the nut 16, so that the end of the spindle 19 with the reel thereon, which is engaged with the nut 16, may be swung away from the nut on the screw 11 as a hinge, into a position to permit the removal of the skein of yarn already treated and place another skein or hank of yarn on to be treated. The end 20 of the shaft 19 is squared, permitting it to swing between a pair of jaws or lips 21, 22, on the nut 16, the face of the jaw 22 being slightly recessed to prevent the spindle from unintentional displacement. The end of the reel toward the nut 17 is provided with a bevel gear wheel 23, which is engaged by a pinion 24, carried by a shaft 25 provided with a hand wheel 26 for operating it and mounted in a sleeve 27, fixed to a bracket 28, carried by the nut 17.

The lower reel is denoted by 29, and is mounted to rotate on the spindle 30, hinged at one end by means of an eye 31 and pin 32 between a pair of lugs 33, 34, fixed to the face of the reel 2, and at its opposite end is adapted to enter between a pair of lugs 35, 36, one or both of them having their faces slightly recessed to prevent the unintentional removal of the spindle, while at the same time permitting it to be swung on its hinged connection outwardly into a position similar to that as previously explained in connection with reel 18. Additional sets of lugs 37, 38, are provided, to adapt the machine to varying sizes of skeins or hanks.

In operation, the reels 18 and 29 having been swung at one end outwardly, the skein is placed thereon, and then the reels swung back into the position shown in the illustration. The stretching of the skein or hank is then accomplished by turning the crank 15, which will simultaneously turn the screws 10, 11, and thereby cause the nuts 16, 17, to travel in a direction to move the reel 18 away from the reel 29, or, if it is desired to remove the skein, turning the crank in the reverse direction will cause the reel 18 to approach the reel 29, and permit the ready removal of the skein. While the frame is in the vat, the reels may be caused to travel with the yarn thereon by turning the wheel 26, which by the engagement of its pinion 24 with the bevel gear 28, will cause the reel 18 to rotate, and this will, through the yarn stretched thereon, cause the reel 29 to rotate.

For convenience in lowering the yarn frame, thus explained, into the vat 39, and removing it therefrom, said frame is supported by means of a rope, or chain, passing over a pulley, depending from a carriage, and being provided on its opposite end with a counterbalance weight, so that the frame can be handled with ease. For removing the frame from over the vat to recharge it, an endless curved track, for the carriage, previously referred to, to run on, is provided, so that the carriage may follow from a position over the vat around into position over the same vat without retracing its course.

Two platforms, conveniently located in the course of the track, are provided, for resting the frame either for purposes of draining or for recharging. For example, the frame as it comes directly from the vat may be left on the first platform to drain, while a previous frame may be receiving its charge of yarn on the other platform, to be moved along the track in position over the vat for immersing it, and the frame on the first platform may be subsequently moved to second platform for recharging, while the frame fresh from the vat may be moved into position for drainage on the first platform.

An Improved Reel for this Skein Mercerizing Apparatus has also been devised, the same having for its object to keep the individual strands or threads of yarn composing the skeins, during mercerizing under an even tension, in order to secure the proper working of the process, the object of the improvement being to provide a frame for holding the skeins in the bath with an even and uniform tension on all of the yarn, both on the inside as well as the outside of the skeins, and which tension has heretofore been more or less uneven, the outside of the skeins having been stretched to a greater degree than the inside, owing to the outside of the skeins being farther from the reel holding them, than the inside of the skein, said uneven stretching of the skeins resulting naturally in uneven mercerizing, and consequently uneven dyeing, provided if dealing with yarns to be dyed, all features previously explained in the article on Mercerizing.

The arrangement of the frame by which an even and uniform tension is given to the skeins is best shown by means of the accompanying illustration, Fig. 3, which is a diagram of the position of the reels in the frame for holding the skeins, showing a skein held by the reels, said skein, however, being exaggerated in order to show clearly the action of the reels on the tension of the entire skein.

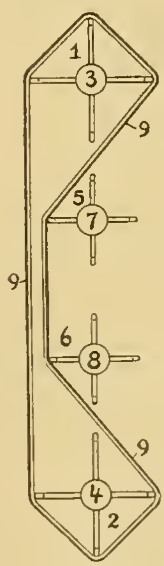


Fig. 3.

Referring to the illustration, 1 indicates the top reel over which the skeins to be mercerized are hung, and 2 is the bottom reel arouud which the lower portions of the skeins are placed.

The top reel is mounted to rotate on a shaft 3, one end of which is secured within a vertically traveling bar, and the other end is removably held by another vertically traveling bar, thus allowing said reel to be swung out horizontally when required. Each vertically moving bar is provided with a screw threaded lug, which are engaged on the screw threaded portions of two respective vertical shafts; and by means of handles secured to the top of both shafts the top reel may be raised or lowered to put tension on the skeins or take it off. The bottom reel 2 is loosely mounted on a stationary shaft 4, one end of which is hinged in a lug on the side of the frame, and the other end is temporarily held by a lug on the opposite frame, so that this reel can also be swung out when required, that is, when yarn is to be put in the machine on the reels, or taken out.

In order to prevent an uneven tension in the skeins on the reels, as previously pointed out, two smaller reels 5 and 6 are placed between the two main reels with their shafts 7 and 8 in the same vertical line with shafts 3 and 4, and thus force the skeins of yarn 9 out of a straight line, as shown. This action will cause a greater tension to be put on the inside of the skein as represented by the lighter line on that side of the two large reels, for the same reason that a greater tension is put on the outside of the skein as represented by a heavy line, by it passing around the two reels 1 and 2. Thus the extra tension given to the outside of the skein is counterbalanced by the extra tension given to the inside by the two reels 5 and 6, and the tension over the entire skein then becomes uniform.

In placing the skeins on the reels 1 and 2, the same are swung outwardly as explained, after the reels 5 and 6 have been swung away from the opposite side of the frame as a pivot. After placing the skeins on the reels, they are all swung back to the position shown, and the skeins put under tension by raising the top reel 1 through the mechanism previously explained. (Isaac E. Palmer, Middletown, Conn.)

DYESTUFFS AND CHEMICALS

SOCIETY OF CHEMICAL INDUSTRY, BASLE, SWITZERLAND.

The Society of Chemical Industry are the largest manufacturers of Coal Tar Dyes in Switzerland. Basle is a seat of this industry, and has six firms engaged in the business. Although there are no patent laws in Switzerland to encourage invention, yet the Society of Chemical Industry has become famous through the patented dyestuffs which it has put on the market. These patented dyestuffs are the following:

Auramine.	Acid Violets.
Victoria Blue.	Rhodamine B and G.
Violet Crystals 6B.	Rhodamine S.
Ethyl Purple.	Rhodamine 6G.
Tartrazine.	Anthracene Red.
Alkali Violet.	Patent Phosphine.
Direct Indigo Blue.	

Owing to the necessity of purchasing raw materials from the larger German works, the Society of Chemical Industry arranged for the manufacture of these patented products partly with the Badische Anilin & Soda Fabrik and partly with Fredk. Bayer now known as the Farbenfabriken of Elberfeld.

The latter patented articles, such as the Patent Phosphine and Direct Indigo Blue, are being worked direct, without sharing with the German manufacturers.

In addition to these patented colors the Society of Chemical Industry make the whole series of Direct Dyeing Cotton Colors, such as:

Carbide Black.	Direct Green.
Direct Blue.	Direct Yellow.
Direct Brown.	

They also manufacture the principal colors used for wool, such as Diamond Black, Naphtol Black, Naphtylamine Black, Fast Chrome Blacks, Blues, Browns and Yellow.

Within the past few years, recognizing the demand for colors fast to light, washing, and the ordinary processes of manufacture, and recognizing the value of direct application, they have studied out thoroughly the manufacture of so-called sulphur dyes, and to-day have not only the most extended line of *Sulphur Colors* on the market, but at the same time stand preëminent for the quality of the colors produced.

The *Pyrogen Indigo* made by them has no equal in Sulphur Blues. It combines all the valuable properties of a sulphur color with the brilliancy of the basic colors.

Pyrogen Blue R and 2R have been more extensively sold than any other Sulphur Blue made. The same is true of Pyrogen Browns manufactured by the Society.

In Blacks, which is one of the most largely used of all colors, the Thiophenol Black in its different shades, stands preëminent for strength, solubility and beauty of shade.

To these standard products have recently been added *Pyrogen Green* and *Pyrogen Yellow*, so that it is safe to say that in this entire class of dyestuffs the Society of Chemical Industry stand preëminent, not only as to the variety of colors they produce, but as to the ability to produce them cheap enough to meet the severe competition which prevails to-day in the coal tar industry.

On account of the great importance of the dyestuffs of the Society of Chemical Industry, we herewith quote a list of their various products, arranged according to their fastness and application with reference to textile manufacturing—Cotton, Wool, Silk and Jute.

DYESTUFFS FOR COTTON.

Dyestuffs for Apparatus Dyeing. Specially suitable for Cops.) Easily soluble and very level dyeing.

Chlorantine Yellow JJ, JG, T.
Cotton Yellow CH.
Fast Yellow R1209.
Chlorantine Orange TR, TRR.
Direct Orange R.
Chlorantine Brown R.
Direct Brown R1804.
Cupranil Brown R, G, B.
Direct Brown M617.
Chlorantine Red 4B, 8B.
Acid Congo R.
Direct Safranine G, B.
Direct Pink GN, BN.
Chlorantine Pink.
Cotton Red D.
Chlorantine Violet R, B.
Chlorantine Lilac B, BB, R.
Tolamine Violet 2422.
Direct Blue BX, 2B, 3B.
Acetylene Blue 3R, BX, 3B, 6B.
Acetylene Pure Blue.
Acetylene Sky Blue.
Direct Light Blue 550.
Direct Sky Blue, green shade.
Direct Indigo Blue A, BN, BNK.
Cotton Blue N, R.
Indigen Blue BB, B, R.
Direct Green BG95, G. (Dissolve without Soda.)
Indigen Black B.
Melantherine HW, BH, JH, BO, RO.
Carbide Black S, E.
Neropaline P.
Direct Black 1602, 1718.
The various Pyrogene Colors and Thiophenol Blacks.

Dyestuffs Rendered Fast to Water by aftertreatment with Aluminium Salts.

*Fast Yellow R1209.
Direct Yellow *1704, CR, 2192.
Direct Orange G.
Direct Brown *1655, JJ, P, 1659, R1804.
Chlorantine Brown R, B.

Cupranil Brown *R, G, B.
Direct Violet *CB, N582.
*Tolamine Violet 2422.
Chlorantine Violet *B, R.
*Chlorantine Lilac B, BB, R.
Cotton Red 12B, 11B, *10B, *6B.
*Cotton Red 5B, B.
Acid Congo R1573.
*Direct Safranine B, G.
Chlorantine Red 4B, 8B.
Chlorantine Bordeaux B.
Chlorantine Blue BB.
*Cotton Blue R.
*Direct Blue B, R.
Neropaline P.
*Opaline 2G.
Direct Green J, B695.
*Tolamine Green 2040.
Carbide Black *E, S.
Direct Black CR, 1602, 1718, 1632.
Direct Grey B, R.

*These colors bleed a little into white cotton when steeped in warm water.

Direct Dyestuffs for Cold Dyeing.

Fast Yellow R1209.
Cotton Yellow CH.
Direct Yellow T, TO.
Direct Orange G, R.
Direct Pink BN369, GN403.
Chlorantine Lilac B.
Chlorantine Brown R, B, BB. (Fairly good.)
Acetylene Blue 6B.
Acetylene Pure Blue.
Acetylene Blue 3R.
Direct Safranine B1687, G1688. (Up to 2%.)
Melantherine BH678, JH.

These are applied in cold or lukewarm bath, with the addition of 10-15 lbs. Glauber's salt, 1-1½ lbs. Soda per 100 gallons.

Dyestuffs Fast to Washing.

The following cotton dyestuffs do not bleed into white cotton on washing with neutral soap:

(1) The various basic dyestuffs, after-treated with tannic acid and tartar emetic.

The following bleed a little:

Rhodamine S, B, G.
Fast Green O, JJO.
Victoria Blue B.
Brilliant Victoria Blue RB.
New Victoria Blue GG.
Chrysoidine G, R.
Bismark Brown G, R.

(2) The various Pyrogene colors. (Fast to fulling.)
Rosanthrene O, R, A, B, CB. (Developed.)

(3) Melantherine BH, HW, JH. (Developed.)
Neropaline P. (Developed.)
Cupranil Brown B, G, R. (With copper.)
Direct Yellow CR. (With bichromate and copper sulphate.)
Direct Brown M, V. (Developed.)
Nitranil Brown various brands. (With p-nitraniline.)
Indigene Blue B, BB, R. (Developed.)
Direct Sky Blue, green shade. (With copper.)
Acetylene Sky Blue. (With copper.)

As comparatively fast may be mentioned:

Chlorantine Yellow JJ, JG.
Fast Yellow R1209.
Direct Yellow T.
Chlorantine Orange TR, TRR.
Chlorantine Pink.
Chlorantine Lilac B, BB, R.
Direct Blue 2B548.
Chlorantine Blue B, BB.
Direct Indigo Blue A.
Direct Brown J, JJ, 1655, 1804.
Cupranil Brown B.
Direct Black 1718.
Direct Grey G.

Dyestuffs Fast Towards Hot or Boiling Size.

BASIC DYESTUFFS.

*Auramine O, II.
Brilliant Phosphine G, 3G, 5G.
Patent Phosphine GG, G, M.
Safranine GOOO, BOOO.
*Rhodamine 6G, B, 3B.
*Violet 2B, 3B.
*Crystal Violet 5BO.
*Ethyl Violet.
Brilliant Violet 6B, 8B.
Methylene Blue G.
*New Blue RS.
Victoria Blue B.
*Fast Blue MD.
*Victoria Blue R, 4R.
*Brilliant Victoria Blue RB.
New Fast Green 2B, 3B.
Fast Green JJO, O.

The fastness to sizing of the above dyestuffs is considerably increased by after-treating with tannic acid and tartar emetic. Those colors marked * are particularly fast to sizing.

DIRECT AND PYROGENE DYESTUFFS.

The various Pyrogene colors and Thiophenol blacks.
Rosanthrene O, R, A, B, CB. (Developed.)
Direct Yellow CR. (With bichrome or chrome alum.)
Melantherine BH, HW, JH. (Developed.)
Neropaline P. (Developed.)
Cupranil Brown B, G, R. (With copper sulphate.)
Direct Sky Blue, green shade. (With copper.)
Acetylene Sky Blue. (With copper.)
Direct Brown M, V. (Developed.)
Direct Pink BN, GN. (For pale shades.)
Direct Green B695. (With chrome alum.)

Most direct dyestuffs, which are rendered fast to water by an aftertreatment with aluminium salts, also withstand the action of warm size (at 122-140° F.).

Dyestuffs Which Dye Cotton, but Leave Woolen Threads Untinted in Boiling Acid Bath.

Auramine II, O, G.
Pyrogene Yellow M. (Direct and treated with chlorine.)
Patent Phosphine M, G, GG, R.
Brilliant Phosphine 5G-G.
Rosanthrene CB. (Developed.)
Direct Brown M, V.
Pyrogene Brown G, 3G, 5G, B, D, M, R, V.
Pyrogene Cutch 2G.
Nitranil Brown. (Various brands.)
Safranine GOOO, BOOO.
Rhodamine 6G, B, 5G, 3B, S.
Methylene Blue G.
New Blue RS.
Pyrogene Blue R and RR.
Pyrogene Direct Blue, red shade and green shade.
Indigene Blue B, BB, R.
Victoria Blue. (Various brands.)
Melantherine HW, BH.
Neropaline P.
Indigene Black B, BB.
Pyrogene Black. (Various brands.)
Thiophenol Black. (Various brands.)
Fast Green O, JJO, I.
New Fast Green 2B, 3B.

The Direct Dyestuffs diazotized and developed (or after-treated with diazotized paranitaniline).

The Basic Dyestuffs after-treated with tannic acid and tartar emetic.

DYESTUFFS FOR WOOL.

Dyestuffs Which May be Dissolved in the Hot Acid Dye-bath.

Naphtol Yellow S.
Quinoline Yellow.
Tartrazine.
Orange II, R.
Paper Red PSN, PE.
Ponceau S for silk, 4161.
Kiton Red S.
Amaranth G and B.
Acid Violet 4R, 3BN, 6BN, 7B.
Kiton Blue.
Kiton Green B.
Benzyl Green B.
Anthracene Acid Green.
Navy Blue BW and HH.

Easy Leveling Dyestuffs.

Naphtol Yellow SS.
Azo Yellow O, I.
Orange II.
Rhodamine G, B.
Diamond Magenta.
Kiton Red S.
Violet 3R-4B.
Crystal Violet 5BO.
Kiton Blue B.
Wool Green S.
Alkali Blue 3R-6B.

As Sufficiently Level Dyeing for Ordinary Requirements the following may also be mentioned:

Quinoline Yellow.
Tartrazine.
Orange MNO, N, R.
Ponceau S for silk, 4161.
Benzyl Bordeaux B.
Acid Violet 7B-4R.
Benzyl Violet 10B, 6B, 4B. (Neutral, very good.)
Alkali Violet O.
Victoria Blue B. (Not in mixtures.)
Navy Blue BW and HH.
Acid Green O, yellow shade.
Acid Green O, blue shade.
Benzyl Green B. (Neutral, very good.)
Acid Black NX, 3X, D.
Chrome Fast Yellow G, GG.
Chrome Fast Brown G, R, B.
Chrome Fast Black F, BB, FW, R.

Dyestuffs Fast to Fulling.

ACID AND MORDANT (CHROME) DYESTUFFS.

*Quinoline Yellow.
Tartrazine.
Orange *N, R.
Ponceau S for silk, 4161.
Paper Red PSN, E.
Rocceline.
Benzyl Bordeaux B.
Acid Rhodamine R, RR, RRR.
Anthracene Red I.
Benzyl Violet 6B, 10B, 4B, 5B.
Induline.
Acid Violet 3BN, 4BN, 6BN, 7B.
Alkali Violet.
Fast Cloth Blue G, R, RRB.
Grey R, B, BB.
*Wool Green S.
Anthracene Acid Green.
Benzyl Green B.
Benzyl Blue B, S.
Chrome Fast Yellow GG, G.
Chrome Fast Brown R, G, B.
Chrome Fast Black F, BB, FW, R.
Acid Black NX, 3X, D.

*These colors stain white wool slightly.

BASIC DYESTUFFS.

Rhodamine G, B.	Victoria Blue B.
Diamond Magenta.	Ethyl Violet.
Violet 3R-4B.	Crystal Violet 5BO.

DIRECT DYESTUFFS.

Cotton Yellow CH.
Direct Yellow CR.
Direct Orauge G, R.
Acid Congo R.
Cotton Red 4B.
Direct Pink BN, GN.
Direct Safranine G, B.
Chlorantine Red 4B, 8B.
Acetylene Blue 3R. (Stands a light fulling.)
Direct Blue BX.
Acetylene Blue BX.
Direct Blue W104.
Direct Blue 3B, 2B. (As Acetylene Blue 3R.)
Acetylene Blue 3B. (As Acetylene Blue 3R.)
Acetylene Blue 6B.
Acetylene Pure Blue.
Direct Light Blue 550.
Direct Sky Blue, green shade.
Acetylene Sky Blue.
Direct Green B695.
Melantherine BH, HW.
Indigene Black 2980.
Direct Brown M.
Direct Brown R.
Cupranil Brown B, G, R.

The direct dyestuffs do not bleed into white wool duriug fulling, but white cotton becomes more or less stained.

Dyestuffs Fast to Finishing. (Steaming.)

ACID DYESTUFFS.

Quinoline Yellow.	Eosine.
Naphtol Yellow S.	Erythrosine.
Tartrazine.	Ponceau S for silk.
Orange II, R.	Ponceau 4161.

BASIC DYESTUFFS.

Rhodamine B, G.	Violet 4R-3B.
Diamond Magenta.	Crystal Violet 5BO.

In addition, those direct dyestuffs which are applicable to wool.

MORDANT DYESTUFFS.

Chrome Fast Yellow G, GG.
Chrome Fast Brown G, B, R.

Not quite so fast are:

Azo Yellow O, I.
Orange MNO.
Kiton Red S.
Rocceline.
Benzyl Bordeaux B.
Acid Violet 7B-4R.
Pure Blue ARI-BSI.
Alkali Blue 6B-3R.
Kiton Blue.
Alkali Violet O.
Benzyl Violet 10B-4B.
Navy Blue BW, HH.
Acid Green O, yellow shade.
Acid Green O, blue shade.
Wool Green S.
Anthracene Acid Green.
Kiton Green B.
Benzyl Green B.
Acid Black NX, 3X, D.
Chrome Fast Black BB, F, FW.
Grey B, BB, R.
Victoria Blue 4R, B.
Benzyl Black B, 4B.

Dyestuffs Fast to Stoving.

BASIC DYESTUFFS.

*Auramine G, O, II. Violet 3R-3B.
*Rhodamine B, G. Crystal Violet 5BO.
Diamond Magenta. *Night Blue.
*Victoria Blue 4R, B, R.

ACID DYESTUFFS.

*Quinoline Yellow.
*Naphtol Yellow S.
Azo Yellow O, I.
Orange MNO, II, R, N.
*Tartrazine.
*Ponceau S for silk, 4161.
*Kiton Red S.
Rocceline.
Benzyl Bordeaux B.
Benzyl Violet 4B-10B.
Amaranth G and B.
Anthracene Red.
Anthracene Acid Green.
*Wool Green S.
Benzyl Green S.
Acid Violet 4R-7B.
Benzyl Blue B, S.
Navy Blue BW, HH.
*Grey R, B, BB.
*Chrome Fast Yellow G, GG.
*Chrome Fast Brown B, R, G.
*Chrome Fast Black BB, R, FR, F, FW.
Benzyl Black B and 4B.

DIRECT DYESTUFFS.

*Cotton Yellow CH.
*Direct Yellow CR.
Direct Orange G, R.
Direct Violet C, CB, N.
Acid Congo R.
Chlorantine Red 4B, 8B.
Direct Safranine G, B.
*Direct Blue 2B, 3B.
Direct Blue BX, 3R, W104.
*Direct Sky Blue, green shade.
Acetylene Pure Blue.
Acetylene Sky Blue.
*Direct Light Blue 550.
Acetylene Blue *3B, 6B, BX, 3R.
Direct Green J, B695.
Direct Brown R, M.
Melantherine BH, HW, JH.

*These colors answer the highest requirements in this respect.

Dyestuffs Fast to Acids.

ACID DYESTUFFS.

†*Quinoline Yellow.
†*Naphtol Yellow S.
‡*Azo Yellow O, I.
†*Orange II, R.
†*Tartrazine.
‡*Orange MNO, N.
†*Acid Rhodamine R, RR, RRR.
†*Amaranth G, B.
Benzyl Bordeaux B.
†*Ponceau.
Paper Red PSN, PE, E.
‡*Rocceline.
†*Eosine.
†*Erythrosine.
†*Anthracene Red.
‡*Alkali Blue 6B-3R.
‡*Alkali Violet.
‡*Acid Violet 4R.
†*Acid Violet 3BN, 4BN, 6BN, 7B.
†*Benzyl Violet 4B-10B.
†*Acid Green O, yellow shade.
†*Acid Green O, blue shade.
Kiton Blue.
Navy Blue BW, HH.
†*Benzyl Blue B, S.
†*Induline.
†*Wool Green S.
Benzyl Green B.
Anthracene Acid Green.
Kiton Green B.
†*Acid Black 3X, NN, HA.
Benzyl Black B, 4B.

MORDANT DYESTUFFS.

†*Chrome Fast Yellow GG, G.
†*Chrome Fast Brown R, G, B.
†*Chrome Fast Black R.
Chrome Fast Black FW, BB, F.

BASIC DYESTUFFS.

Auramine II, O.
Patent Phosphine G, GG.
†*Rhodamine G, B.
Rhodamine 3B.
Diamond Magenta.
‡*Violet 2B, 3B.
‡*Crystal Violet 5BO.
Brilliant Violet 6B, 8B.
Victoria Blue 4R, B.
Brilliant Victoria Blue RB.

*These colors are fast to carbonizing, the rest are simply fast to perspiration. † Represents very good. ‡ Represents sufficient.

DIRECT DYESTUFFS.

All direct dyestuffs applicable to wool are sufficiently fast to perspiration. The fastness to carbonizing does not come into consideration, as the burrs are dyed by these colors, thus rendering the process of carbonizing unnecessary.

Dyestuffs for Carpet Yarn.

*Chrome Fast Yellow GG, G.
*Chrome Fast Brown G, R, B.
*Chrome Fast Black F, R, BB.
Anthracene Red I.
Quinoline Yellow.
Tartrazine.
Kiton Red.
Benzyl Bordeaux B.
Rocceline.
Paper Red PSN, PE.
Acid Violet 4R.
Induline.
Wool Green S.
Benzyl Green B.
Kiton Green.
Grey BB, R, B.
Benzyl Black B, 4B.

*These colors to be after-treated with 1.5% Bichrome.

Dyestuffs for Shoddy and Mungo.

Naphtol Yellow S.
Tartrazine.
Direct Yellow T.
Fast Yellow R1209.
Orange MNO, II.
Rhodamine B.
Direct Safranine G, B.
Anthracene Red.
Cotton Red 12B.
Diamond Magenta.
Benzyl Bordeaux B.
Cotton Red 11B1436.
Tolamine Violet N.
Direct Blue W104.
Benzyl Violet 4B, 6B, 10B.
Acid Violet 3BN, 4BN, 6BN, 7B.
Opaline 2G.
Alkali Violet O, I.
Violet 3R-4B.
Crystal Violet 5BO.
Pure Blue. (All brands.)

Brilliant Violet 6B and 8B.
Victoria Blue B, R, 4R.
Benzyl Blue B and S.
Brilliant Victoria Blue RB.
Alkali Blue 3R-6B.
Direct Indigo Blue BN, BNK, A, BK.
Kiton Green B.
Tolamine Green B.
Wool Green S.
Benzyl Green B.
Fast Green O and JJO.
Cupranil Brown B, G, R.
Acid Black. (All brands.)
Carbide Black RI.
Direct Deep Black 171S.

Shoddy is dyed with direct dyestuffs in 10-15 times its weight of water, with addition of 40 lbs. Glauber's Salt per 100 gallons, for ½ hour boiling.

Direct dyestuffs are especially suitable for the dyeing of mungo or shoddy containing cotton, or such as are required fast to washing.

Basic dyestuffs are applied in neutral bath.

Acid dyestuffs and Victoria Blue R and 4R are dyed for one hour at the boil, with an addition 8% sulphuric acid.

Dyestuffs Fast to Water.

The dyestuffs in the following list do not bleed into either white wool or white cotton on steeping 3 days in cold water.

Chrome Fast Yellow G, GG.
Tartrazine.
Cotton Red D.
Acid Congo R1573.
Acid Rhodamine R, RR, RRR.
Anthracene Red.
Amaranth G, B.
Acid Violet 3BN, 6BN, 7B, 4BN.
Benzyl Violet 4B, 6B, 10B.
Alkali Violet.
Pure Blue B.
Water Blue CIII.
Victoria Blue 4R, R.
Alkali Blue 6B, BB, R, 3R.
Benzyl Blue S. B.
Navy Blue RIII.
Induline.
Benzyl Green B.
Kiton Green.
Chrome Fast Black F, R, B, FR, FW.
Grey R, B, BB.

DYESTUFFS FOR SILK.

Basic Dyestuffs.

Auramine *O, *II, †G.
*Patent Phosphine G, GG.
*Brilliant Phosphine 5G, 3G, G.
†Chrysoidine G, R.
†Bismark Brown G, R.
†Diamond Magenta.
*Rhodamine G, B, S, †6G, 3B.
†Safranine GOOO, BOOO.
†Cotton Scarlet G.
†Cardinal Red G.
*Violet B-4B.
†Violet. (Redder brands.)
*Crystal Violet 5BO.
*Ethyl Violet
*Brilliant Violet 6B, 8B.
*Methylene Blue G. (Mostly for topping purposes.)
*Victoria Blue 4R, R, B.
*Brilliant Victoria Blue RB.
*New Victoria Blue GG.
*Brilliant Glacier Blue.
*New Fast Green 2B, 3B.
*Fast Green JJO and O.
†Jute Black N, V, GN.

Mordant Dyestuffs.

‡*Chrome Fast Yellow G and GG. (Chromed.)
‡*Chrome Fast Black. (Chromed.)

Acid Dyestuffs.

*Tartrazine.
Quinoline Yellow.
†Naphtol Yellow S.
Yellow WR.
†Azo Yellow O, I.
Orange MNO, N, II.
†Paper Red PSN, PE.
Acid Rhodamine R-RRR.
Ponceau S for silk.
*Acid Violet 7B-3BO.
*Amaranth G, B.
*Kiton Red S.
Rocceline.
Benzyl Bordeaux B.
Alkali Violet I.
Alkali Blue 3R-6B.
Induline.
*Pure Blue B for silk.
*Navy Blue 5R, RIII, RSP.
Night Blue.
Blue Fluorescent.
Kiton Blue B.
*Acid Green O, yellow shade.
Acid Green O, blue shade.
Kiton Green.
†Wool Green S.
*Grey R, B, BB.
Benzyl Green B.
Acid Brown G, R, B.
Resorcine Brown.
Acid Black NN, HA.
Silk Acid Black.
Eosine JLI.
Erythrosine B.

Direct Dyestuffs.

‡Thiazol Yellow.
‡¶Direct Yellow CR, T.
§Cotton Yellow CH.
‡¶Chlorantine Yellow JJ.
§Chlorantine Yellow JG.
‡Fast Yellow R1209.
§¶Chlorantine Orange TR, TRR.
§Direct Orange G, R.
‡Cupranil Brown G, R.
Cupranil Brown B. (Coppered.)
‡¶Chlorantine Brown B.
Chlorantine Brown R, BB.
§Direct Brown ¶M, R.
‡Direct Brown V. (Developed.)
§Direct Safranine G, B.
Direct Pink GN, BN.
§Chlorantine Red 4B, 8B.
‡Chlorantine Lilac B, BB.
§Chlorantine Pink.
§Direct Violet N.
§Direct Blue 3B, 2B, BX, 3R.
§Acetylene Blue 3B, BX, 3R.
§Chlorantine Blue B, BB.
§Direct Light Blue 550.
‡Indigene Blue B, BB. (Developed.)
§¶Direct Sky Blue, green shade.
¶Acetylene Sky Blue.
‡Direct Green J.
Direct Green B695.
§Direct Grey.
‡Melantherine BH, HW, developed. (Direct dyeings bleed.)
‡Indigene Black B.
Indigene Black HS. (Developed.)

The dyeings obtained with the basic dyestuffs, and the majority of the acid and direct colors, gain considerably in fastness to washing by steeping for several hours in 3-6% tannic acid at 85-105° F. (All Direct Dyestuffs are fast to water.)

*These silk colors (Basic, Mordant, Acid, as well as all Direct Dyestuffs quoted) are fast to water.
†Fairly fast to water.
‡Fast to washing and fulling. (At 122° F. with 5 lbs. soap per 100 gallons.)
§Fast to washing and fulling, but bleed slightly into cotton.
¶Become faster to fulling and washing, if after-treated with 5-10% chrome alum at 194-212° F.

Dyestuffs Suitable for Dyeing Silk Yarn Intended to be Woven with Raw Silk, and "Boiled Off" in the Piece.

The series of Pyrogene colors. (Special treatment.)
Melantherine BH. (Developed with β naphtol or resorcine.)
Direct Blue 2B. (Developed with β naphtol.)

Dyestuffs for Heavily Weighted Silk. (Tin weighting.)

Azo Yellow I, O.
Citranine OOO.
Orange II, R.
Acid Rhodamine R, RR.
Acid Violet 4R, 3R.
Alkali Violet.
Brilliant Victoria Blue RB.
New Victoria Blue GG.
Victoria Blue 4R.
Brilliant Glacier Blue.
Acid Brown G.
Benzyl Green B.

DYESTUFFS FOR JUTE.

Auramine O, II, G.
Patent Phosphine G, GG, M.
Azo Yellow I, O.
Orange MNO, II, R.
Chrysoidine G, R.
Jute Scarlet B, 4R, G.
Rocceline.
Paper Red PSN, PE.
Russian Red, yellow shade.
Russian Red, blue shade.
Chlorantine Red 4B, 8B.
Rhodamine S.
Safranine GOOO, BOOO.
Diamond Magenta.
Violet 3R-3B.
Crystal Violet 5BO.
Brilliant Violet 6B, 8B.
New Blue RS.
Victoria Blue 4R, R, B.
Pure Blue AI, ARI, BSI.
Water Blue CIII.
Brilliant Victoria Blue RB.
New Victoria Blue GG.
Brilliant Glacier Blue.
Fast Green JJI, FII, I, BBI.
Chlorantine Brown R, B, BB.
Cupranil Brown G, R, B.
Jute Black N, GN, V5093.
Catechu Brown.

Full particulars regarding how to use the products of the Society of Chemical Industry may be found in a handbook which they publish, and which will be gladly furnished by their agents in the United States and Canada, A. Klipstein & Company, 122 Pearl St., New York.

COTTON DYEING.

Among the chief classes of dyestuffs used for cotton dyeing may be mentioned the Diamine Colors, Immedial Colors, Basic Colors, and Acid Colors as manufactured by the Cassella Color Co., of New York. They are used for dyeing cotton in practically all forms, that is, in the raw stock, sliver, roving, hank, cops, chain warps, and piece goods, as well as hanks and chain warps that have been mercerized previously. All of the classes mentioned will dye direct, that is, without a previous mordanting process, except some of the Basic colors which require the use of a mordant, although a few are suitable for direct dyeing.

DIAMINE COLORS.

Besides direct dyeing colors, there are some which require an aftertreatment either with metallic salts, or by means of diazotizing and developing or by coupling.

Diamine colors are very extensively used for dyeing loose cotton and their application for this purpose is continually increasing owing to the prominent advantages gained thereby, which are:

(1). Simplicity of working, one hour's dyeing being sufficient in most cases.

(2). The softness and spinning properties of the cotton are perfectly preserved, hence the dyed cotton may be spun to the same fineness as the raw cotton, without any appreciable waste being produced.

(3). The carding of the cotton is very much facilitated and consequently there is very little wear on the card clothing.

Most of the Diamine colors yield, by direct dyeing, dyes of good fastness to washing, which especially in pale shades satisfy most demands. The direct dyed dark shades are also satisfactory for many purposes, especially if the colors are not milled together with white cotton. If, however, the demands in regard to fastness to milling are more exacting, the colors must be fixed on the fibre to improve their fastness to washing, this being obtained either by metallic salts, or by diazotizing and developing, or by coupling.

The Diamine colors for direct dyeing are dyed at the boil with the addition of such neutral salts, as Glauber's salt or common salt, and with or without the addition of alkaline salts like soap or soda. The presence of alkaline salts retards the absorption of the coloring matter by the fibre, whereas neutral salts have the opposite effect; the more neutral salts the dye-liquor contains, the more rapidly the absorption.

These colors are usually dyed in a boiling bath or just below the boil, for about one hour. Very light shades require only about ½ hour at 105-120° F.

In the case of dark shades it is advantageous, after dyeing at the boil, to allow the cotton to feed in the cooling bath, *i. e.* to dye only about ¾ hour boiling and to allow about ¼ to ½ hour for feeding.

The Dye-bath for Direct Dyeing is prepared as follows:

For light shades 1% soda ash, 1-2% soap, and 3-5% sodium phosphate or (if preferred) Glauber's salt.

For medium shades—2% soda ash, 10% Glauber's salt (calc.).

For dark shades—2% soda ash, 20% Glauber's salt (calc.).

The soap used for light shades may be replaced by Turkey-red oil, and Glauber's salt in most cases by common salt, of which, however, 50% more have to be used, *e. g.*, for dark shades instead of 2% soda ash and 20% Glauber's salt use 2% soda ash and 30% common salt.

The dye-bath is best prepared by adding the constituents in the following order; first, the soda ash, then the color solution, and finally the Glauber's salt or common salt. In the case of shades of uneven dyeing tendency, the salt may be added in 2 or 3 portions after the dyeing has been progressing for some time.

The degree of concentration of the dye-liquor is an important factor when dyeing with the Diamine colors. The more dilute the bath, the more difficult it is to exhaust, whereas the more concentrated the solution, the more readily the coloring matter is absorbed by the cotton.

Aftertreatment with Metallic Salts. Owing to the fact that the resistance to light of direct dyeings produced with Diamine Colors may be considerably enhanced by a treatment with metallic salts and this process being exceedingly simple in its application, it has been steadily gaining in importance with the various industries.

The usual methods of aftertreatment are the following:

(1) Aftertreatment with cupric salts.

(2) Aftertreatment with bichromate of potash and sulphate of copper.

(3) Aftertreatment with bichromate of potash, chrome alum or chromium fluoride.

Aftertreatment with Cupric Salts. Sulphate of copper is the agent most generally utilized in this case. According to the depth of the shade required, 1-3% are used (reckoned on the weight of the goods), and added along with 1-3% acetic acid to the bath for aftertreatment.

The treatment with sulphate of copper in the first place increases the fastness to light and simultaneously improves the resistance to washing. The aftertreatment is generally carried out in a hot liquor; the latter may, however, equally well be merely lukewarm, or even cold, if it is to increase the fastness to light only.

Cupric Oxide of ammonia may replace sulphate of copper with advantage, it having the same effect, the application of sulphate of copper is however more convenient and cheaper. Of cupric oxide of ammonia, 1-2% should be taken, calculated on the weight of the cotton.

Aftertreatment with Bichromate of Potash and Sulphate of Copper. According to the depth of the shade 1-2% each of bichromate of potash, sulphate of copper and acetic acid should be taken. The effect of this aftertreatment with reference to resistance to light is the same as with sulphate of copper alone; with regard to fastness to washing, a combination of sulphate of copper and bichromate of potash has a more favorable effect. The aftertreatment is carried out in a boiling bath.

Aftertreatment with Bichromate of Potash, Chrome Alum or Chromium Fluoride. According to the depth of shade, 2-3% each of bichromate of potash, Chrome Alum or Chromium Fluoride, and acetic acid should be used. These salts are applied in a boiling bath and render some colors considerably faster to washing; the fastness to light is however not effected thereby. In place of bichromate of potash, bichromate of soda may be used.

Metallic salts do not interfere with the shading; goods after-treated with metallic salts may be shaded at will by first rinsing them thoroughly and topping with suitable Diamine Colors in a fresh bath containing 2-3% soda. It is in such a case unnecessary to repeat the aftertreatment.

Diazotized and Developed Dyeings. The fixing of Diamine Colors by diazotizing and developing, is, as is well known, one of the processes most frequently applied. This treatment increases on the one hand the intensity of the shades, rendering them in some cases twice as heavy, and on the other hand fixes the colors so well that the developed dyeings may be termed very fast to washing and milling.

The Diamine Colors which may be diazotized and developed are: Primuline; Diamine Cutch; Diamine Browns M, S, V; Cotton Browns A, N; Diamine Blues 2B, 3B; Diaminogene Blues BB, G, NB, NA, 3RN, Sky-blue N, Dark Blue; Diamine Azo Blues 6B, 2R, R; Diamine Heliotropes G, B, O; Diamine Blacks BH, RO, BO; Diamine Blue Black E, Diamine Azo Black B, Diamine Beta Blacks B, BB; Diaminogenes B, extra, BW, CCL.

The following three operations are necessary for producing diazotized and developed dyeings:

(1). Dyeing with one of the colors capable of being diazotized in the manner as will be explained, and rinsing in cold water (whizzing or wringing off after rinsing is hardly necessary).

(2). Diazotizing for 10 or 15 minutes in cold water containing nitrite of soda and hydrochloric acid, then rinsing in water containing a little hydrochloric acid.

(3). Developing for 10 or 15 minutes in cold water containing a developer, such as Beta Naphthol, Naphthylamine ether powder, Phenylene Diamine, Phenol, etc.

With regard to the dyeing process, nothing need be added to what has already been stated in connection with the production of direct shades. The diazotizing always takes place in a cold bath.

The Bath is made up as follows: 2½% nitrite of soda, 7½% hydrochloric acid 20° B., or 5 % sulphuric acid 66° B.; Reckoned on the weight of the goods, and calculated for very dark shades.

First, dissolve the nitrite of soda in some water and add the solution to the bath, then add the sulphuric or hydrochloric acid.

If the bath has been already used, add ⅓ of the above quantities for every 10 lbs. of cotton.

It is seldom necessary to prepare a stronger diazotizing bath than the above. In order to ascertain whether the bath is still active, dip into it a piece of paper impregnated with starch paste and potassium iodide, which should at once turn blue. Further, the presence of the necessary nitrous acid can be detected by its smell. If, however, the odor of the bath is too pungent, it is an indication that too much nitrite is present. An excess of nitrous acid in the diazotizing bath is not injurious, but ought to be avoided for economical reasons.

When light shades are to be developed, the quantities given may be still further reduced as follows: 1½% nitrite of soda, 5% hydrochloric acid 20° B., or, 3% sulphuric acid 66° B.; Reckoned on the weight of the goods.

For diazotizing in dyeing machines, or for diazotizing piece goods on the jigger, reduced quantities must also be taken.

The diazotizing is best conducted in wooden vessels. When dyeing in machines, the diazotizing and developing may also take place in copper vessels.

The diazotizing and developing operations are always conducted in a cold bath, and the developing bath is charged with the necessary developer, in solution; the goods are turned for a few minutes in this bath, lifted, and rinsed, or soaped as desired. The shade and fastness of the dyeings obtained differ according to the developer employed.

Coupled Dyeings. A certain number of Diamine Colors can be fixed with Nitrazol C or Paranitraniline, by the so-called Coupling Process, in a similar way as by diazotizing and developing. An advantage of this process is that it is carried out in one bath only. The shades produced by coupling are as fast to washing and milling as those obtained by developing, and they possess, besides, a prominent fastness to acids.

The Dyestuffs Suitable for Coupling are:

For black:—Diamine Nitrazol Black B, Oxy Diamine Blacks A. D, AM, JB, JEI, JW, UI.

For blue:—Diamine Blue NC.

For Brown:—Diamine Nitrazol Browns RD, BD, G, B, T, Oxy Diamine Orange G and R, Oxy Diamine Brown G, Cotton Browns A, N, Diamine Brown S.

For yellow and mode shades:—Primuline, Diamine Fast Yellow A, Diamine Bronze G, Diamine Grey G.

The coupling is effected by treating the dyed and rinsed cotton goods for ½ hour in one of the cold coupling baths charged as follows for 100 lbs. cotton:

Coupling with Nitrazol C.

For 1½-2% dyeings: 2 lbs. Nitrazol C pat., ½ lb. soda ash, 3¼ oz. acetate of soda.

For 3-4% dyeings: 3-4 lbs. Nitrazol C pat., ¾-1 lb. soda ash, 3-4 oz. acetate of soda.

To dissolve the Nitrazol C, it should be stirred up with a little cold water (68-77° F.). Any lumps that may have formed should be carefully broken up, and the Nitrazol should finally be brought into solution by pouring a sufficient quantity of cold water over it.

The coupling bath is charged by first adding the solution of Nitrazol, then the soda, and finally the acetate of soda.

The cotton is worked in this cold bath for ½ hour and rinsed as usual.

Coupling with Paranitraniline C.

For 1½-2% dyeings: 4½ gallons diazotized Paranitraniline C, ½ lb. soda ash, 3½ oz. acetate of soda.

For 3-4% dyeings: about 6¼-8¾ gallons diazotized Paranitraniline C, ¾-1 lb. soda ash, 4¼-6¼ oz. acetate of soda.

The diazotized Paranitraniline to use is prepared as follows: Dissolve 2 lbs. Paranitraniline C with 2 gallons boiling condensed water, stir well, and then add 5 pints hydrochloric acid 20° B.; after some stirring, complete solution will have set in; then add 4¼ gallons cold water, which precipitates the hydrochloride of Paranitraniline in the form of a yellow paste. This solution should always be prepared a few hours before it is used in order to give it time to cool down by standing. When quite cold, add 1½ lb. nitrite of soda dissolved in 7 pints cold water, whilst stirring. After about 20 minutes, a clear solution results, which is then brought up to 25 gallons with cold water.

The diazo solution will keep for some time if preserved in wooden or earthen vessels and protected from heat or sunlight.

IMMEDIAL COLORS.

The Immedial Colors yield dyes of eminent fastness to milling, acids and light and are exceedingly well adapted to the dyeing of loose cotton, sliver, and roving and hanks, etc., in dyeing machines. The process of dyeing is most simple and it must only be observed that the dye-liquor should not come into contact with copper.

The machines constructed of iron, or nickel and the nickel-plated iron machines have proved the best. Great care should be taken that the water be free from lime, this condition being essential for the machine-dyeing generally, whatever coloring matter may be used.

The Immedial colors are best dissolved in wooden vessels by pouring over them hot water containing part of the sodium sulphide required for the dyeing process. Vessels, pipes or fittings of copper or brass should also be avoided for dissolving the dye. The metallic parts necessary should be of either iron or lead.

Copper has an injurious effect on the liquor only; dyed cotton may after rinsing come into contact with any kind of metal without suffering in any way.

The dye-bath is charged with soda, sodium sulphide and common salt or Glauber's salt. The quantities of each required for the various colors vary for the different processes of dyeing.

Sodium sulphide fulfils the very important mission of keeping the color in solution during the dyeing process, and the aspect of the dye color is therefore a reliable guide as to the correctness of the addition made; a sufficiently large quantity of sodium sulphide keeps the bath absolutely clear, whereas an insufficient addition renders it turbid, and the liquor, if dropped on white blotting paper, shows a visible precipitation. In the latter case a further addition of sodium sulphide brings the bath up to the required condition. It is specially requisite to restore the bath in this way, either after prolonged disuse or after too severe boiling. Unnecessary and excessive boiling should therefore be avoided, because it favors oxidation of the sulphide too much. On the other hand, an excess of sulphide cannot be recommended, the dyeings thereby remaining thin.

Soda ash is added in order to preserve the alkalinity of the dye-bath and to increase the effect of the sodium sulphide. In some cases soda ash is substituted by caustic soda lye.

Common salt and Glauber's salt promote the exhaustion of the dye-baths in a similar manner as when employed in dyeing with Diamine Colors. For pale shades the quantities of common salt or Glauber's salt must be moderated, whilst dark shades require an increase of salts.

The first bath per 10 gallons of liquor is prepared with:

8 oz. soda ash, 18-20 oz. cryst. sodium sulphide, 2 lbs. cryst. Glauber's salt, 2-4 lbs. Immedial Black.

For subsequent lots (considering the weight of the cotton to be dyed) use 2% soda ash, 9-10% cryst. sodium sulphide, 12-13% Immedial Black, 5-10% cryst. Glauber's salt.

The dye-bath is first charged with soda, then with the dyestuffs previously dissolved with sodium sulphide, and finally with Glauber's salt.

The dye-bath having been boiled up with all the additions, the cotton is entered and dyed either at the simmer for one hour or at full boil for about ¼ hour, in which latter case the steam is shut off after that time and the hot liquor allowed to circulate.

Other additions are sometimes made, but only in special cases, as, for instance, dextrine or sodium chromite for the dyeing of black on piece goods, or Turkey-red oil for the dyeing of Immedial Sky Blue on hanks or loose cotton, or for Immedial Black on warps, etc., in order to facilitate penetration.

The dye-baths may be preserved for constant use without fear of deterioration. If the sodium sulphide contained in the liquor should become oxidized by prolonged contact with the air and the coloring matter be thereby precipitated, the dye-bath merely needs boiling up and the addition of some fresh sodium sulphide to be fit for use again.

The Immedial Colors are generally dyed by boiling up the dye-bath charged with all the ingredients, shutting off steam and entering the goods and dyeing to the finish at or near boiling temperature.

An exception is made with Immedial Skyblue, and the Immedial Indones, Maroon and Bordeaux G, Immedial Skyblue being always dyed at a low temperature, about 70-85° F., and the others at about 120-140° F.

At the conclusion of the dyeing process, the liquor is run off, and the liquid remaining in the material is rapidly drawn or pressed off. The cotton is then at once rinsed with cold water or lifted and placed in a second machine filled with cold water. In either case the goods are finally rinsed with lukewarm or hot water.

When there is no aftertreatment, the goods must be very thoroughly rinsed after dyeing.

Black dyeings, whether after-treated or not, should be treated with an addition to the last rinsing bath of 3-5 oz. acetate of soda per 10 gallons of water; having remained a short period in this bath they are dried without any further rinsing. This aftertreatment with acetate of soda should never be omitted, unless the cotton is to be soaped or otherwise softened after dyeing.

It is very important that the goods be squeezed as perfectly as possible, and rinsed immediately after dyeing. The more thoroughly and evenly the goods are squeezed and rinsed, the greater will be their resistance to rubbing and the more even the shade.

The first rinsing bath, which will contain a fair amount of dyestuff, may be added to the dye-bath again or serve for dissolving the next addition of coloring matter.

In dyeing Immedial Blue C and CR there is a deviation in the process in so far as the cotton must not be rinsed after dyeing, but only well squeezed or evenly wrung and steamed in this state.

In the same manner as some of the Diamine colors are improved by aftertreatment, so also are some of the Immedial colors improved by aftertreatment.

Five patented processes are as follows:—(1). Aftertreatment with chromium salts, (2). Aftertreatment with acetate of soda, (3). Steaming with admission of oxygen, (4). Treatment with the peroxides of hydrogen or of sodium and (5). Development of brown dyeings with Nitrazol.

Aftertreatment of Dyeings with Chromium Salts:—This is resorted to chiefly in the case of Immedial Black, whilst for Immedial Brown, bichromate of potash and sulphate of copper are to be preferred. The aftertreatment of Immedial Black chiefly serves the purpose of varying the shade according to requirements, whereas in the case of Immedial Brown it improves the fastness to light.

Aftertreatment with Acetate of Soda:—This aftertreatment is of especial importance for blacks produced with Immedial Black, and should be applied in every case unless the dyeings be subjected to one of the usual alkaline finishing operations, such as soaping, oiling, etc. For this purpose, 3-5 oz. of acetate of soda per 10 gallons of water are added to the last rinsing bath; the cotton is worked in this liquor for a few minutes and dried without being rinsed again.

If the yarns or pieces are subject to some finishing process, the acetate of soda may be added to the finish.

In the case of dyeings which are scrooped with acids, as is frequently done with yarns, the acetate of soda should be added direct to the scrooping bath.

The cotton hanks are then soaped as usual and passed through a bath containing, instead of acetic acid alone, 1 pint of acetic acid and ½-1 lb. of acetate of soda, per 10 gallons of liquor.

Developing Immedial Blue C and CR by Steaming. This operation may be very easily carried out in any box made either of wood, copper or iron, or equally well in an ordinary dye-vat.

It should in any case be observed that the cotton must not be rinsed after dyeing, but simply well hydro-extracted or otherwise freed from an excess of liquor before being subjected to the steaming process.

Yarns and pieces are suspended on laths in the steam-box so that the steam may penetrate the goods evenly, whereas loose cotton or warps should only be piled up in layers of reasonable height. The steam-box remains closed during the steaming operation. If the steam-box be constructed of wood, the lid should be covered with felt or woolen cloth in order to render it as tight as possible.

The steam is best introduced at the lower part of the box in order to allow the condensed water to run off freely, and altogether care must be taken to prevent any condensed liquid from spotting the goods.

Very wet steam may however be rendered more serviceable by placing along the bottom of the box a gilled steam pipe for heating the box previous to charging it with the goods.

The hotter and drier the steam, the more rapid is the developing and the brighter the shade of the blue.

Air is also introduced into the steam-box simultaneously with the steam. This is done by means of a small injector which is adjusted between the steam pipes by means of two flanges.

Similar to developing by steam is the developing of Immedial Blue by smothering the dyed, moist cotton (loose cotton, yarn or piece).

The method of working is as follows:—The dyed and hydro-extracted cotton, the heat of which must be retained as well as possible, is placed into skeps or wooden boxes, the inside of which is lined either with oiled brown paper or oil-cloth (American cloth); these receptacles are then covered up in order to prevent a cooling or drying of the contents, and placed for a few hours, or overnight, in the drying room. The developing of the blue in this manner is best carried out with the temperature of the drying room at 140-160° F.

For smothering piece goods and warps, the same may be placed in the ordinary dyer's barrows, but care must be taken to place them in such a way that they do not dry where they touch the sides and that they retain their heat for a few hours.

After lifting, the cotton is rinsed in hot water.

Immedial Blue can also be developed by topping with Indigo instead of being steamed, the reducing action of the Indigo vat also developing the blue shade of Immedial Blue.

Developing Immedial Blue with Sodium Peroxide or Hydrogen Peroxide. Immedial Blue can also be developed by the application of the peroxides of sodium or hydrogen: the fact however that steaming is a cheaper and less complicated process accounts for the diminishing employment of these chemicals.

Aftertreatment of Immedial Brown with Nitrazol. This aftertreatment, the so-called "coupling process," causes the shades to turn considerably yellower and very much deeper. This coupling process is carried out exactly as previously described.

BASIC COLORS.

The application of the basic dyestuffs is restricted to the production of those exceptionally bright shades which cannot be obtained with either Diamine Colors or Immedial Colors.

For most purposes, however, it is sufficient to use the basic dyestuffs for topping cotton which has been grounded with Diamine or Immedial Colors without any previous mordanting.

The method of dyeing most frequently employed is to mordant the cotton first with tannic acid, or other tannins, and to fix the tannin subsequently with tartar emetic. The cotton is then well rinsed and dyed with basic dyestuffs.

The water used for mordanting with tannic acid should be free from iron if possible, as cotton mordanted in water containing iron acquires a more or less grey appearance, which is particularly objectionable for pale shades. If water free from iron is not at hand, a few drops of hydrochloric acid should be added to the mordanting liquor, whilst calcareous water is best corrected with acetic acid.

The mordanting bath is prepared: for light shades with 1½-2% and for dark shades with 4-5% of tannic acid.

The mordanting bath is not kept in the case of light shades; for dark shades, however, the baths may be used continuously, in which case they are freshened up with 3-4% tannic acid.

The above quantities refer to a mordanting bath containing a volume of liquor not more than 15-16 times the weight of the cotton. When mordanting in more liquor, the quantity of tannin should be correspondingly increased.

The cotton, which has previously been well boiled off and rinsed, is brought into the hot tannin liquor, turned several times, and then left standing immersed in and fully covered by the liquor.

For pale shades, 1-2 hours' mordanting is sufficient; for dark shades the cotton generally remains in the liquor overnight.

Since the tannin is taken up best in a cooling bath, the mordanting bath for dark shades should be warm on entering, but only lukewarm or cold when the cotton is taken out.

After mordanting with tannin, the cotton is well wrung or hydro-extracted and then brought into an antimony bath without being rinsed.

After mordanting with tannin and tartar emetic, the cotton must always be well rinsed before it can be dyed. In order to fix the tannin, the mordanted cotton is worked for 20-30 minutes in a cold bath containing about ⅓ or ½ of tartar emetic of the weight of the tannin employed. After the fixation of the mordant, the cotton must be very thoroughly rinsed.

The cold dye-bath is charged first with 2-3% acetic acid or 2-3% alum; enter the cotton, give a few turns and lift; then add the well-dissolved dyestuff in two or three portions, through a sieve, and raise the temperature slowly to 140-160° F.; allow to cool in the bath for 15-20 minutes and rinse.

Instead of being dyed on a mordant of tannin and antimony, some of the basic dyestuffs may, similarly to the Diamine Colors, be dyed also in a salt bath, although the fastness to light and washing is considerably inferior. Naphtindone BB and Irisamine G are principally used in this manner.

According to the depth of shade to be dyed, the bath is prepared with 3-5 lbs. of salt per 10 gallons of liquor; the cotton is then entered at 105-120° F. and the bath brought slowly to the boil. Irisamine may be dyed at 105-120° F. without any further heating.

In machine-dyeing the basic dyestuffs are used chiefly for topping.

The dyestuffs principally used are: Indazine, Naphtindone, New Methylene Blue, Methyl Violet, Solid Green and Brilliant Green, Safranine, Paraphosphine, Thioflavine T.

The cotton which has been dyed with Diamine or Immedial Colors is rinsed and then topped in a cold bath with the afore named basis dyestuffs, with the addition of 3% acetic acid (or alum) calculated on the weight of the cotton.

ACID COLORS.

Acid dyestuffs are used on cotton principally for bright shades which are not required to be fast to washing, and are divided into Scarlets, Eosines and Soluble Blues.

Scarlets:—Brilliant Croceïne M, R, B to 9B, Scarlet FR, FRR, FRRR, and Croceïne AZ.

Amongst these the Croceïnes are especially important, as they yield brilliant scarlet shades of excellent fastness to light; their resistance to washing however is very poor.

At dyeing, the quantity of liquor should be as small as possible (not more than 10 parts of liquor to 1 part of yarn), the bath being prepared with the requisite quantity of coloring matter and about 5 oz. alum and 2 lbs. Glauber's salt, per 10 gallons of liquor.

The cotton is entered at 120°-140° F. and turned for half an hour, whilst the bath is cooling off. The cotton is then evenly wrung and, without rinsing, dried at a moderate temperature.

Eosines:—Eosine 3G, GGF, BN, Eosine Scarlet B, Erythrosine yellow shade, extra N, B, D, Phloxine (749), Rose Bengale extra N, Irisamine G, and Rhodamine B. These dyestuffs yield still more brilliant shades than the Croceïnes, but are inferior to them in fastness to light.

The cotton is dyed for half an hour in a concentrated bath at 85°-105° F. with addition of 4-5 lbs. of salt per 10 gallons of liquor, and then dried without rinsing. It is important that not more dye-liquor than necessary (at the utmost 10-12 gallons of water for 100 lbs. of cotton) is used.

Soluble Blues:—Water Blues B, RB, R, Pure Soluble Blue, Methyl Blue for Cotton, Blues JBP, JB, BS, FS, RS, RRS and Alkaline Blues RRR to 6B.

There are two general methods of dyeing these colors, viz:

1. Direct dyeing with alum and Glauber's salt.

These dyestuffs are dyed exactly as previously described for the Croceïnes, however, only half as much coloring matter being required. The quantities of alum and Glauber's salt used remain the same.

2. Dyeing on tannin mordants.

The dyestuffs are dyed on tannin mordants exactly as previously described for basic dyestuffs, and yield then very bright colors, which though *faster* to washing than those dyed by the first method, cannot even then be termed practically fast to washing. The Alkaline Blues especially are dyed according to this second method.

TOPPING DIAMINE AND IMMEDIAL COLORS WITH BASIC DYESTUFFS.

The dyed produced with Diamine colors either by direct dyeing or by developing, possess the property of taking up and fixing the basic dyestuffs. This property may be made use of for brightening or shading such dyes with suitable basic dyestuffs. In the same advantageous way basic dyestuffs may be fixed on dyeings produced with Immedial colors.

The topping is always effected in a fresh bath containing the solution of the basic dyestuff and an addition of 2-3% acetic acid or 2-3% alum (of the weight of the cotton). The dyeing is done cold or lukewarm, and in the case of such basic dyestuffs which have a great affinity to the cotton the precaution is taken to turn the material several times in the liquor, which has been previously charged with alum or acetic acid only, subsequently adding the color solution in two or three portions.

For piece goods the topping has the special advantage of better covering the impurities (such as fragments of straw, dead cotton, etc.) always present in a low class goods.

COMBINATION OF INDIGO WITH DIAMINE AND IMMEDIAL COLORS.

The Diamine colors are used both for bottoming and for topping vat blues, whereby very much indigo is economized and the material is better dyed through. Particularly linen yarns, linen pieces and other tightly woven materials are bottomed, as they are not satisfactorily penetrated by Indigo alone.

All black and dark blue Diamine colors may be used for bottoming. Most extensively employed are diamine Jet Black SS, Diamine Black RO and Diamine Black BH. In a few cases Diamine Brown V is also used for the production of coppery shades.

The goods are for example bottomed with: 1½% Diamine Black RO, ½% Diamine Brown V, with the addition of 2% soda ash, 5% Glauber's salt and then dyed in the Indigo vat.

For topping Indigo shades, principally blue and violet Diamine colors are used, especially Diamineral Blue R, Diamine Fast Blue C and Diamine Violet N, all of which possess very good fastness to light and washing.

With reference to Immedial colors, apart from Immedial Black, Immedial Blue C and CR as well as Immedial Direct Blue B have given the most satisfactory results for bottoming Indigoes.

The bottoming with Immedial Black is chiefly employed for dark shades, and is done by dyeing first with 2-5% Immedial Black, this color being subsequently topped in the Indigo vat.

In bottoming with Immedial Blue, Immedial Blue C is used for light shades and Immedial Blue CR for deeper and more violet shades.

As a rule Immedial Blues are not steamed when applied for such bottoming purposes, however, this depends in the first instance on the shade to be produced and on the kind of vat employed.

For topping in the hydrosulphite vat the previous steaming may be dispensed with, both for pale and for dark shades.

If the topping be done in the zinc dust lime vat, pale shades will come out brighter, if steamed before topping, whilst for medium and dark shades steaming is unnecessary.

If the color be topped in the copperas-lime vat, it is advisable to steam previously, as this process renders the colors much brighter.

It is of no consequence whether the goods be washed before the topping to be unwashed into the vat; it is, however, of great advantage to leave the goods unwashed for 2-3 hours after having been topped in the vat, and to sour them off and wash them subsequently.

After dyeing piece goods with Immedial Blue they are frequently left unwashed and well covered with felting for 12-24 hours and then dyed in the vat.

In many cases yarns are first dyed in the vat and subsequently topped with Immedial Blue. Dyeing and steaming of Immedial Blue is then done.

Immedial Direct Blue B may be applied in the same way as Immedial Blue for bottoming Indigo with the advantage that it can be used for all sorts of vats directly without developing by steaming. It is dyed to a depth of 2-5%, washed and then topped with Indigo.

The basic dyestuffs are used in combination with Indigo only for topping the same and serve principally for brightening. Frequently, however, their application is even necessary in order to better cover the burls of cotton piece goods which are not well enough dyed by Indigo.

For this purpose, especially the various brands of New Methylene Blue, such as N, R and 3R and also Indazine M and Naphtidone BB are used.

The dyeing is effected exactly as described for topping Diamine and Immedial colors. In few cases only the Indigo dyed goods are mordanted with tannin and tartar emetic before being dyed with basic dyestuffs, in order to obtain greater fastness; in the latter case they should be dyed according to the method described for basic dyestuffs.

TETRAZO, TETRANIL AND TETRAZODE COLORS

of the American Dyewood Co., are Substantive, or Direct-Dyeing Colors, which dye cotton from the neutral bath in one operation. These colors are made in a large variety of shades, and are used on cotton according to the regular substantive dyeing methods as follows:—

For light shades, make up the dye-bath with the color, with 1% to 2% soda, and 5% to 10% Glauber's salt or common salt. Dye the material just below the boil for 30 to 45 minutes.

For dark shades, make up the dye-bath with the color, with 1% to 2% soda and 15% to 25% common salt or Glauber's salt. Dye the material for one hour.

The goods thus dyed should also be steeped for about 15 minutes in the dye-bath after boiling, in which case the shades become brighter and fuller.

It is advisable, when dyeing heavy or dark shades, to restore the same bath, as subsequent operations in the same bath require only about ⅔ the amount of dyestuffs and ⅓ the amount of assistants to be added to it.

As examples of the ordinary substantive dyestuffs, may be mentioned Tetrazo Red B, Tetrazo Pink BU, Tetrazo Blue 4R, Tetrazo Yellow R, Tetrazo Black G, etc.

Tetrazo Chlorine Yellow, Tetrazo Chlorine Brown, Tetrazo Chlorine Blue 4B, etc., are characterized by their good resistance to washing, light, acids and alkalies. Tetrazo Chlorine Yellow is especially fast and may be used for shading purposes, in connection with diazotized and developed colors, maintaining its own shade throughout the different operations. Tetrazo Yellow R, Tetrazo Red B, Delta Purpurine 5B, and Tetrazo Black N are of interest as being quite fast to acid. Tetrazo Black N is of importance, giving shades which do not change on exposure to air, and which stand acid well. This black is also of value for dyeing cotton in the fulling mill. In union work, cotton is dyed heavier than the wool. Tetrazo Pink BU is worthy of notice as being among the fastest substantive colors and answers the requirements for clear shades of pink, of excellent fastness to light and washing. This color, with Tetrazo Red B, Tetrazo Chlorine Rose Conc., Tetrazo Chlorine Red SB and Tetrazo Chlorine Lilac B, forms part of a series that should commend themselves for light and delicate shades of uncommon fastness where ordinary colors fail.

Many of the Tetrazo colors may be utilized to good advantage for the dyeing of union goods in one-bath. Some color both fibres equally, while others dye the cotton heavier and still others have more affinity for the wool. Tetrazo Lemon Yellow, Tetrazo Blue 3G, Tetrazo Brilliant Blue BB, Tetrazo Azurine G, Tetrazo Reds, Tetrazo Blacks G and R, Tetrazo Greens, Tetrazo Orange TG, Tetrazo Chlorine Yellow GG, and Tetrazo Chlorine Lilac B, color both fibres to about the same depth.

Some of the Tetrazo colors, such as Tetrazo Yellow CH, Tetrazo Orange TG, Tetrazo Red B, Delta Purpurine 5B, Tetrazo Azurine G, and Tetrazo Brilliant Blue BB, may be used to advantage on wool, dyeing with the aid of acetic acid, the resultant shades being extremely fast to milling.

The Tetranil colors have the additional property of being capable of aftertreatment with metallic salts, such as bichrome and bluestone, which is carried out as follows:—

With Bluestone: Run the goods for 15 to 30 minutes at 175° F. through a fresh bath containing 2% to 4% bluestone.

With Bichrome: Run the goods for 15 minutes through a boiling bath containing 1% to 3% bichrome. Colors thus treated become very fast to light and washing.

Tetrazode colors may be used as direct colors, but are of greater importance when diazotized and developed. For the latter make up the dye-bath, with the color, 2% soda and 25% common salt or Glauber's salt. Dye at the boil for one hour.

The dyed and rinsed cotton is then worked for 15 minutes in a cold diazotizing bath containing 2½% to 3% nitrite of soda, 7½% to 12% muriatic acid 20° B. or 32° Tw., and afterwards rinsed in water, slightly acidulated with muriatic acid, and then entered immediately into the developing bath.

The cold developing bath is prepared with the necessary amount of developer, such as Developer D or Developer N, and the materials are worked for 15 minutes; then rinsed and soaped, if necessary.

TETRAZO SULPHUR COLORS.

This important class of cotton dyes is of comparatively recent development, the series including blacks, blues, browns, drabs, yellows, greens.

Sulphur dyes are extremely fast to all influences usually brought to bear on dyed material, such as light, acids, crabbing, fulling, alkalies, and the mercerizing process; thus are applicable in a great variety of cases, and consequently their use is extensive.

There are two types of sulphur colors, one requiring an aftertreatment with some oxidizing agent in order to develop and fix the color, while the other group produces the fully developed color direct.

In the ordinary method of application the dyestuff is used in conjunction with sulphide of soda, the function of which is to act as a solvent for the color as well as a reducing agent.

In addition to sulphide of soda, it is usual to add to the sulphur black bath considerable quantities of common salt or sodium sulphate, in order to make the reduced dye less soluble, and thus produce deeper colors from a given amount of dye.

Sulphur black dye-baths cannot be well exhausted, for which reason it is necessary to use a large amount of dye in the first instance, and to keep the bath as a "standing bath" for use over and over again after suitable replenishment. The sulphur blacks vary considerably in their properties; some may be dyed almost as easily as the direct cotton colors, while in other cases it is necessary to use great precautions in order to produce a successful result.

Tetrazo Sulphur Blacks of the American Dyewood Co. are examples of the first mentioned class of colors, being concentrated colors dyeing direct without aftertreatment, and of exceptional value where it is desired to obtain dyeings on cotton which are fast to light, washing, fulling and cross-dyeing.

The formula for applying these dyes for 100 pounds of cotton, is as follows:

Start the bath with about—

150 gals. water.

10 to 14 lbs. dyestuff.

13 to 18 lbs. Sulphide Soda Conc. (or twice as much Sulphide Soda Crys.).

8 lbs. Sal Soda.

50 lbs. Common Salt or

80 lbs. Calcined Glauber's Salt.

The Sulphide Soda and dyestuff are usually boiled together and added to the dye-bath, but they may be added directly to the dye-bath, first putting in the Sulphide Soda, and the bath boiled to thoroughly dissolve the dye.

Dye one hour at a boil; rinse quickly in cold water, and then thoroughly three times. Keep a standing bath.

For the second bath add 8 lbs. to 12 lbs. dyestuff.

For the third bath add 6 lbs. to 10 lbs. dyestuff.

For the fourth and following baths add 5 lbs. to 9 lbs. dyestuff and three-quarters to seven-eighths the amount of Sulphide Soda Conc. as of dyestuff, and as much Sal Soda and salt as corresponds to amount of water used (usually ⅕ to ⅙ amount of first bath).

After dyeing, soften the yarn in a bath at 210° F. with 1 qt. Olive Oil and 2 lbs. Chip Soap.

If the water contains lime, some Sal Soda or Wyandotte Textile Soda should be added. Turn 4 times (about 15 minutes).

The dyestuff must be perfectly dissolved, and must remain in solution throughout the dyeing operation, it being noted that the developed dyes themselves are insoluble in water, acids or alkalies. The dye must be converted into a reduced form, in order to be soluble in alkalies. The reducing agent used is sodium sulphide, which, being alkaline, acts also as a solvent for the reduced dye. Any deficiency of sodium sulphide results in the presence of undissolved color particles in the dye-bath, and these, becoming temporarily fixed on the cotton, cause the dyed material to rub off. Excess of sodium sulphide in the dye-bath tends to prevent the fixation of the dye, and thus to produce weak shades.

The sodium sulphide is gradually oxidized by the atmosphere to sulphite and finally to sulphate, in which condition its solvent and reducing properties are lost.

The presence of caustic soda in the dye-bath tends to prevent the precipitation of free sulphur from the sulphide. Provided the dye is sold in the completely reduced condition, alkali alone will be required, adding just sufficient sulphide to counteract the oxidizing action of the atmosphere or the air in the water.

The dye-bath must be very concentrated, since sulphur blacks are what might be termed weak dyes. The amount of dye which is necessary to fix on the material in order to produce a good black varies from about 4 per cent in the case of the most concentrated to about 20 per cent with weaker dyes. Under the most favorable conditions, it is impossible to fix, on the cotton, in any one operation more than about 20 per cent of the amount of dyestuff present in the dye-bath at the time. It is therefore necessary, in order to prevent great waste, that a standing bath should be kept and used with the proper replenishment between each dyeing operation. A dye-bath may be used for several months before requiring to be emptied and reset; but the amount of sediment present, the degree of alkalinity, the density of the bath, etc., must be carefully watched and controlled in order to ensure satisfactory results.

To assist still further in the fixation of the dye, it is best to add to the dye-bath a considerable amount of common salt or Glauber's salt, but in replenishing the bath, it is not necessary to add this in proportion to the additional amount of color added, since a comparatively small amount is removed from the dye-bath by a single dyeing operation.

It is always best to avoid, as much as possible, exposure of the material under operation to the atmosphere during the dyeing. If oxidation takes place irregularly or superficially, uneven or bronzy dyes will result. In the same way an even and thorough squeezing of the material as it leaves the dye-bath is essential, and this should be followed at once by a thorough rinsing, in order to remove any superficially fixed dye. The presence of any metallic copper or copper compounds in the dye-bath must be carefully excluded, since the sodium sulphide at once attacks any copper with which it comes into contact, and the dyestuff is rapidly precipitated in an insoluble condition, with resulting loss of dye, rapid destruction of the copper, and bronziness and rubbing off of the dye.

The soaping of the material after being dyed, has for its object the removal of all the loosely adhering dye, thus rendering said material clean and also removing any bronziness, and at the same time softening the fibre which has become more or less harsh during the dyeing operation. For this purpose a hot solution of olive oil soap or an emulsion of oil and soap is used, and after washing off the goods coming from the dyeing, they are worked in this solution.

Sulphur blacks are very commonly used in dyeing warps, which are afterwards used in connection with wool filling for union fabrics in which the wool is afterwards cross-dyed with acid colors. In order that these goods do not soil white cloth when rubbed on it, it is necessary to leave in the material a small amount of acid, which, during the subsequent finishing operations, will frequently involve singeing, thus causing the cotton fibre to become tender.

The sulphur blacks are very suitable for topping with aniline black by treating the sulphur dyed cotton in an aniline black dye-bath, and since the latter contains some oxidizing agent, the sulphur black is developed simultaneously with the production of the aniline black.

Sulphur blacks, as developed with potassium bichromate, may also be topped with alizarin dyes, in which instance the chrome acts as a mordant for both.

Although Basic colors may be used for topping, the bloom imparted is very fugitive.

Loose cotton is dyed either in open dye-vats, or in dyeing machines, in the former instance it being advisable to keep the vat covered, in order to diminish the access of air to the material, and also to retain the heat. When using dyeing machines, the cotton must be entirely covered by the dyeing liquor, since the cotton as well as the liquor must not be exposed to the air more than is absolutely necessary.

The cotton after being dyed, must be immediately well washed, and finally softened. The necessity for the complete avoidance of copper in any of the apparatus with which the dye-liquor comes into contact, is equally important for this kind of dyeing.

The formula for dyeing Tetrazo sulphur colors on raw cotton for 100 pound batches is as follows:

Start the bath with
5 to 15 lbs. dyestuff.
5 to 15 lbs. Sodium Sulphide Conc.
2 to 3 lbs. Sal Soda.
25 to 75 lbs. Common Salt.

The Sodium Sulphide and dyestuff, as stated for dyeing sulphur black, are usually boiled together and added to the dye-bath, but they may be added directly to the dye-bath, first putting in the Sodium Sulphide, and the bath boiled to thoroughly dissolve the dye. Dye one hour at a boil; rinse quickly in cold water and then thoroughly three times.

It is advisable to keep a standing bath, in which case only about ⅔ of the quantity of Sulphide and dyestuff is necessary for the standing bath, adding enough salt to keep the density up to the original strength. In dyeing Tetrazo Sulphur Indigo the cotton should be allowed to oxidize in the air for one hour before rinsing.

The dyeing of cotton cops can be satisfactorily carried on in suitable cop-dyeing machines, using iron skewers for supporting the cops, however, an important point in connection with this style of dyeing must be seen to, and that is that the dye used in the bath should be in perfect solution, and on this account a somewhat larger addition of sodium sulphide than is used for other methods of dyeing is advisable.

When dyeing cotton in the form of hanks, great care has to be taken in order to produce a perfectly uniform color even when using the most level dyeing colors, since the production of perfectly even shades on hanks by means of these dyes is a matter of some difficulty. In the same manner as when dyeing in any style with sulphur dyes, an immediate and thorough squeezing and washing of the hanks are necessary operations.

Warps are now dyed with sulphur colors for use in connection with union goods, which are afterwards cross-dyed as previously mentioned, using for this purpose an ordinary continuous warp-dyeing machine, slightly modified so that the upper set of rollers is below the surface of the dye liquor and thus keep the warp from being exposed to the air during the operation. Two or three dyeing boxes are provided, followed by rinsing boxes. The warp should travel during the operation at such a speed that any given portion of it passes through the machine in four or five minutes. By thus dyeing in so short a time, it is necessary to use a much stronger bath than is required for loose cotton or for yarn dyeing.

Piece goods dyeing with sulphur colors is also carried on, although it is a more or less difficult operation, owing to the trouble in the production of level shades of sufficient intensity, in many cases an irregular bronziness being produced, which is due to irregular exposure of the goods to the air, or, more frequently to uneven squeezing or drying. By having the goods kept beneath the surface of the liquor, these deficiencies are practically overcome.

For Dyeing Tetrazo Sulphur Blues, Browns, Greens, Yellows, etc., of which there are various shades of each color, such as Tetrazo Sulphur Blue B, Blue R, Brown P, Brown R, Brown 4R, Brown RG, Brown G, Brown M, Bronze, Green B, Yellow G, etc., the first dye-bath is made up as follows for 100 pounds of cotton:

150 gals. water.
1 to 10 lbs. dyestuff.
1½ to 8 lbs. Sulphide Soda Conc. (or twice as much Sulphide Soda Crys.).
1 to 3 lbs. Sal Soda.
10 to 80 lbs. Common Salt.

The Sulphide Soda and dyestuff are usually boiled together and added to the dye-bath, but they may be added directly to the dye-bath, first putting in the Sulphide Sodium, and the bath boiled to thoroughly dissolve the dye.

Dye one hour at a boil; rinse quickly in cold water and then thoroughly three times.

Tetrazo Sulphur Yellow G, is dyed similarly, except that more Sodium Sulphide Conc. (3 to 12 lbs.) is required. This product gives shades of extreme brilliancy, being almost equal to the brightest substantive colors.

Tetrazo Sulphur Indigo is a very useful color for dyeing brilliant indigo blue shades with greenish cast, and requires to be applied as follows:

For 100 pounds of cotton:
200 to 250 gals. water.
6 to 15 lbs. dyestuff.
6 to 15 lbs. Sodium Sulphide Conc.
10 to 15 lbs. Sal Soda.
25 to 50 lbs. Salt.
3 pints Mineral Oil.

Dissolve the dyestuff, Sodium Sulphide Conc. and oil together in boiling water and add to dye-bath. Dye for one hour just below the boil, keeping yarn under surface of the dye-bath. Squeeze off liquor and hang in air for one hour, turning yarn occasionally. Rinse well in cold water and then work in bath at 75° F., containing 1 to 2 lbs. Ammonia per 100 gals. water.

For a standing bath one-half the quantity dyestuff and Sulphide Sodium Conc. are sufficient and correspondingly reduced amounts of salt, soda and oil.

Besides dyeing with single sulphur colors, by the methods explained, mixed shades may also be obtained by using more than one color in the same bath, said colors being either of the same class or of different classes as the case may be. The simplest method is to use two sulphur dyes in the same bath, and is excellently adapted for dyeing pale shades and where the retention of the dye-bath is not important. The production of dark colors may be also economically obtained when large quantities of the same shade are required; but for small quantities of goods to be dyed the same shade, it is not advantageous, since the dye-bath cannot be well exhausted and consequently a great deal of dyestuff would be lost when the bath is emptied.

In pale shades the mixture of sulphur browns and blacks yields a great variety of drabs and greys, and in darker shades, the black increases the depth of shade. The blacks may also be used to darken the blues, or the blues and yellows to tone the blacks, etc.

The shades produced by the sulphur colors, may also be modified by direct cotton colors, especially for producing bright colors with the sulphur colors, the main condition being to select such direct cotton dyes as will dye in a bath containing sodium sulphide.

Mordant dyes may be used for topping sulphur colors, when the latter are *developed with metallic salts*, this being a useful method of producing rich, full shades. Colors produced in this manner are extremely fast to all processes except cross dyeing, but are apt to bleed somewhat if subjected to a treatment with boiling acid.

Basic dyes are well suited for topping sulphur colors, since the latter act the part of powerful mordants towards them. This process is largely resorted to for the purpose of "toning" and "blooming" the shades. The topping with Basic colors should be done in a fresh bath after the sulphur dyed material has been well washed, and usually a small addition of acetic acid to the topping bath is desirable. The temperature of this bath should not exceed 140° F., and since many of the basic dyes are taken up very rapidly by the dyed cotton, it is advisable to add the color solution to the bath in several portions.

With reference to the properties of the sulphur dyes, they must be considered as the fastest of any of the cotton colors. They are very fast to light, although some of the yellows, greens, and blues do not stand this action so well. After developing, the fastness to light is usually increased. Their fastness to washing is generally excellent, many of the colors being unaffected even by boiling with soap. Boiling with dilute acid does not affect the sulphur dyes, and which are very suitable for cross-dyeing. When properly dyed these dyes do not rub and are unchanged by hot pressing.

PYROGENE INDIGO.

This is a new Sulphur dyestuff, lately brought in the market by the Society of Chemical Industry, and which with reference to cotton dyeing is superior to Indigo as regards its properties of fastness. In addition to its beautiful shade, which excels that of Indigo in brilliancy, and its fine overhand appearance, which approaches that of the basic dyestuffs, its low price renders its use more economical than Indigo and all its substitutes to cotton manufacturers. Pyrogene Indigo also possesses great covering power, and is very easily applied, requiring no aftertreatment. As regards its fastness to washing, fulling, acids, boiling and light, it may be classed as excellent; however the same as with all Sulphur dyestuffs, its fastness to chlorine is poor, but at the same time it is worthy of note to mention that Pyrogene Indigo retains its fine greenish blue shade on washing, whereas many of the ordinary Sulphur Blues acquire an objectionable reddish tone on washing.

Pyrogene Indigo may be combined with the various brands of Pyrogene Direct Blue, green shade and red shade, in all proportions, and all the shades of Indigo in vogue can be obtained with the help of these products. Blue shades dyed in this way may be used for all the purposes for which Indigo dyed cotton is employed; they possess considerable importance for the production of colored woven goods, and for the dyeing of piece goods. Pyrogene Indigo can be discharged with aluminium chlorate in the same way as Pyrogene Direct Blue, green shade and red shade, and these products form an excellent substitute for Indigo in the production of blue and white discharge effects.

Dyeing Recipe for Pyrogene Indigo.

For 100 lbs. cotton yarn or loose cotton:

170 -200 gallons water,
1 - 12 lbs. Pyrogene Indigo,
2½- 30 lbs. Sodium Sulphide Cryst. (2½ times the weight of dyestuff),
2½- 3 lbs. Soda Calc. (1½ lb. per 100 gallons).

For pale shades—

8½-20 lbs. Glauber's Salt Cryst. (5-10 lbs. per 100 gallons).

For full shades—

34-60 lbs. Glauber's Salt Cryst. (20-30 lbs. per 100 gallons).

The goods are dyed under the surface of the dye liquor for one hour, just below the boil (194° F.), squeezed off, and allowed to hang for ½-¾ hour in the air without washing. They are then washed well.

In the case of dark shades (6-8% and upwards) it is advisable, after oxidizing and washing, to soap the goods at 122-140° F. They are then washed and dried at a gentle heat.

For a standing bath, ⅔ of the original quantity of Pyrogene Indigo and 1½ times this amount of sodium sulphide will be quite sufficient. The additions of soda and Glauber's salt vary according to the amount of water which must be added to bring up the bath to its original volume.

Mixtures of Pyrogene Indigo and Pyrogene Direct Blue are applied in the same way; but, in this case, the quantities of sodium sulphide and Glauber's salt should be slightly reduced.

When dyeing on the jigger with Pyrogene Indigo, the recipe given may be used, and, in addition, it is recommended to add to the bath 6-10 lbs. dextrine per 100 gallons. After dyeing, the goods are immediately squeezed off, allowed to lie ¼-½ hour, washed, and, in the case of dark shades, soaped. Goods intended for discharging do not require soaping at this stage, as they are soaped after the discharging operation.

We might remark that since preparing this article an improvement has been made in this Indigo as regards solubility—the new mark, A. F., being much more soluble than the original product, and is especially adapted to work on the Cohnen Dyeing Machine (see pages 249 to 252) in consequence. (A. Klipstein & Co., New York.)

SULPHUR COLORS ON HOSIERY.

The most satisfactory dyeing processes for hosiery are those based upon the use of sulphur colors. In the early stages of their introduction there was much diversity of opinion as to the permanence of the black and the strength of the dyed material, but recent results demonstrate conclusively that the sulphur blacks yield results that meet every technical and commercial requirement.

The sulphur blacks have marked affinity for cotton in any form, and when applied to the fibre in a boiling bath, in the presence of the suitable accessory chemicals or salts, the results are remarkable. The color is fast to all influences. When properly washed after dyeing, it does not crock, rub or smut, and when properly dyed with suitable quantities of ingredients in the bath, the color will not fade under any influence, and will resist continued washing to the limit of endurance of the stocking itself. As to the bleeding of the black into adjacent white material, like any other similar color, this is only likely to occur when the washing is not thorough enough.

As more fully described in connection with the article on "*Tetrazo Sulphur Colors,*" some sulphur blacks are dyed in one operation and all completed when lifted from the dye-bath, washed and dried. Others require to be fixed; that is, in order to fix the color on the fibres, it is necessary to subject the dyed materials to the action of certain metallic salts of an oxidizing tendency, the most important being copper sulphate and bichromate of potash. Some sulphur colors require special precautions for dyeing, such as guarding against the action of the atmosphere, by keeping the hosiery totally immersed during the dyeing. Some blacks require the addition of sodium sulphide to the bath; others do not. Again, a few cannot be dyed without the presence of caustic soda. These are mere details and have a chemical bearing upon the process only, while the results may be exactly the same. The one essential point for all sulphur blacks, irrespective of details of making up the baths, is the absolute necessity of boiling during the dyeing operation; unless this is done, the resulting black will not possess the good qualities hoped for.

Hosiery manufacturers, especially those who do not have dyeing plants, should look carefully into the possibility of dyeing their own output with the sulphur blacks, as they will thereby be enabled to materially economize and incidentally reduce the yield of seconds. Hosiery dyed with any of the commercial marks of sulphur blacks, each of which has its own peculiar shade of black, however, will be found to have many excellent qualities, and will be in a good condition to be finished in any way desired.

The wearing qualities of sulphur-black-dyed hosiery compare favorably with hosiery dyed by the aniline black process, in that heel and toe do not wear out as easily. There is no doubt that the sulphur blacks are the blacks for hosiery of the future. The cost of installing a dyeing plant is much less than for any other process, while the dyeing estimates for equal lots or outputs for a definite time will show a much lower figure, not including known savings on seconds.

For hosiery yarns, the same points hold good, and as yarn-dyed hosiery is usually of a much higher grade than web-dyed material, the saving will be at once apparent. Yarns dyed with the sulphur colors are, as a rule, much stronger than those dyed with aniline black and consequently the delays are less numerous at the knitting machines, a feature which effects a material saving in the general expense account of the mill.

UNION DYEING.

Since it has been found possible to dye wool and cotton to the same shade with certain direct cotton colors in neutral Glauber's salt bath, these dyestuffs have assumed a position of tremendous importance in the dyeing of half-wool goods.

By employing the "one-bath method," so called in contra-distinction to the older method of mordanting with sumac and iron, it is possible to obtain brilliant solid shades on union fabrics.

ONE-BATH METHOD FOR UNIONS.

As already stated, the goods are dyed in one-bath with addition of 10-20 lbs. Glauber's salt per 100 gallons; the bath should be kept as concentrated as possible, 15-20 times the weight of the goods, as in this way better results are obtained than in more dilute baths. Hard water should be corrected according to the degree of hardness with ½-1½ lbs. soda per 100 gallons, and in fact a slight excess of soda is not altogether a disadvantage.

It should be noted as an important rule, that the majority of the direct dyestuffs go more on to the wool, at the boil, than on to the cotton, whereas at lower temperatures the cotton takes up more dyestuff than the wool.

The method of procedure is as follows:

The goods are entered at 140-158° F., dyed for half an hour at this temperature, raised to boil during the next quarter of an hour, and boiled until the wool is sufficiently dyed, which may take from one-half to three-quarters of an hour boiling. Then the goods are sampled (bitted); if the cotton is too light then more dyestuff is added, and the goods are allowed to run for some time in the cooling bath.

Attention should naturally be paid to the nature of the goods being dyed; for instance, goods containing a large amount of cotton should be dyed at a lower temperature, say 140° F.

As already mentioned, a slight excess of soda (or other alkaline salt, such as borax, sodium phosphate, sodium silicate, etc.), has a beneficial effect, inasmuch as it prevents the dyestuff from going too much on to the wool; for this reason the presence of acid, which often occurs in goods containing shoddy, should be avoided. On the other hand, a large excess of soda should be avoided, as it impairs the strength and handle of the wool.

For this purpose direct dyestuffs are used, and chiefly those which have the property of dyeing the cotton the same shade or a deeper shade than the wool, and for the purpose of shading the wool, such acid dyestuffs are employed as have the property of dyeing the wool in neutral bath without dyeing the cotton. The various brands of Benzyl Blue and Benzyl Violet of the Society of Chemical Industry, have proved particularly useful in this respect, and find extensive application in union dyeing.

In the dyeing of blue shades Alkali Blue is often used for the purpose of shading the wool; in this case an addition of 2-4 lbs. borax or sodium phosphate per 100 gallons is made to the dye-bath, as well as the usual quantity of Glauber's salt, and the goods are soured after dyeing.

The dye-baths may be used for further operations, and are replenished with ⅕ of the original quantity of Glauber's salt, and ⅔-¾ of the original quantity of dyestuff.

By the same method, two colored effects (shots) can be obtained, by employing different dyestuffs for the wool and cotton, and in selecting the cotton dyestuffs, particular care should be taken to use only such coloring matters as dye the wool as little as possible; however, these goods are usually dyed by the two-bath method, which we shall now proceed to describe.

TWO-BATH METHOD FOR UNIONS.

This can be carried out in several different ways, as follows:

1. The cotton may be first dyed in a concentrated, weakly alkaline bath for one-half to three-quarters hour at 104-140° F. with suitable direct coloring matters, the wool being afterwards dyed in a fresh acid bath with acid dyestuffs either lukewarm or boiling.

2. The operations may be carried out in the reverse order, the wool being first dyed in boiling bath with acid dyestuffs, the cotton being afterwards dyed in a cold or lukewarm bath, with addition of ¼-½ lb. soda per 100 gallons.

3. An older method, which is still extensively employed, is as follows:

The wool is first dyed in a boiling bath with acid dyestuffs; after washing, the cotton is mordanted with tannic acid or sumac for two to three hours cold, fixed by passing through tartar emetic, and afterwards dyed cold or lukewarm with basic dyestuffs. This method is particularly suitable for the production of bright two-colored effects, but is also much used for solid shades.

BURR DYEING.

The property which the direct colors possess of dyeing the cotton only in alkaline bath is often made use of in the so-called process of burr dyeing; the necessary dyestuff is added to the fulling liquor during the fulling process. In this way any cotton bits (nops or burrs) occurring in the woolen goods, which would otherwise show up in the finished goods as white spots, are perfectly covered.

The burr dyeing, as is explained in the special article on Burr Dyeing in the "Finishing" chapter, can also be conveniently carried out in the washing machine in a warm, slightly alkaline bath, which should be as concentrated as possible.

Carbide Black SO and E, and Direct Deep Black 1718 of the Society of Chemical Industry are particularly suitable for burr dyeing.

DYESTUFFS OF THE SOCIETY OF CHEMICAL INDUSTRY FOR UNION DYEING.

Direct Dyestuffs Which Dye the Wool Darker Than the Cotton in a Neutral Boiling Glauber's Salt Bath.

Cotton Yellow CH.
Direct Yellow CR1746.
Acid Congo R.
Direct Pink GN, BN.
Direct Safranine G, B.
Cotton Red 4B, 6B, 10B, 11B, 12B.
Chlorantine Red 4B, 8B. (Wool rather yellower.)
Chlorantine Pink. (Wool rather yellower.)
Direct Violet C, CB.
Direct Blue R. (Wool redder.)
Acetylene Blue 3R. (Wool redder.)
Direct Blue W104.
Direct Brown R.

By a suitable reduction of the temperature and by using a larger quantity of Glauber's salt (and in some cases by addition of a trace of soda), the above dyestuffs may be employed for the production of solid shades on union goods.

Direct Dyestuffs Which Dye the Wool and Cotton Alike in Neutral Boiling Glauber's Salt Bath.

Thiazol Yellow 2192.
Direct Orange G, R.
*Tolamine Violet.
Direct Blue *B, BX.
Acetylene Blue BX.
*Direct Blue R.
Direct Sky Blue.
Union Blue WGI, WGII, WGIII, WGIV.
Direct Indigo Blue A, BK, BN, BNK. (Wool redder. With addition of acetic acid both fibres are dyed alike.)
*Direct Grey BR.
Direct Brown M, R.
Cupranil Brown *G, R.
Union Brown M.

*These colors dye wool redder.

S

Direct Green B695, Y.
Direct Black 1602, 1718.
Carbide Black S, E.
Union Black K, S2050.

Direct Dyestuffs Which Dye the Cotton More Than the Wool in a Neutral Boiling Glauber's Salt Bath.

Chlorantine Yellow JJ, JG.
Fast Yellow R1209.
Direct Yellow T.
Chlorantine Orange TR, TRR.
Direct Grey 1474, 1368. (Wool yellower.)
Cupranil Brown B. (Wool slightly redder.)
Chlorantine Brown R, B.
Chlorantine Brown BB.
Direct Brown V.
Direct Blue 2B, 3B.
Acetylene Sky Blue.
Acetylene Pure Blue.
Acetylene Blue 3B, 6B.
Direct Light Blue 550.
Direct Violet N.
Melantherine JH.

Acid Dyestuffs Which Dye Only the Wool in Neutral Boiling Bath, and Which Can Therefore be Used in the Same Bath with Direct Dyestuffs.

Yellow WR.
Citronine OOO.
Orange MNO, R.
Acid Rhodamine R-RRR.
Rocceline.
Benzyl Bordeaux B.
Anthracene Red.
Acid Brown G, B, V.
Acid Violet 4R, 3BN, 4BN, 6BN, 7B.
Benzyl Violet 4B, 6B, 10B.
Benzyl Blue B, S.
Alkali Violet O.
Alkali Blue 3R-6B. (Must be subsequently soured.)
Anthracene Acid Green.
Wool Green S.
Benzyl Green B.
Fast Cloth Blue R, G, B, RB.
Acid Black HA, 3X, NN.
Benzyl Black B, 4B.

Rhodamine B is also useful for the purpose of covering the wool.

Direct Dyestuffs Particularly Useful for Dyeing Union Skirt Bindings.

Direct Yellow CR1746, 2039, T.
Chlorantine Red 4B, 8B.
Direct Pink GN, BN.
A mixture of 50 parts Acetylene Blue 6B, 50 parts Direct Blue W104.
Chlorantine Lilac B, BB.
Direct Indigo Blue BN, BNK, A, BK.
Cupranil Brown G, B.
Union Brown M.
Direct Black 1602, 1718.
Carbide Black E.
Direct Green G1574.

Directions for Dyeing. The dyebath is prepared with the necessary dyestuff and 15-20% Glauber's salt. The goods are entered at 140° F., worked at this temperature for 30 minutes, and then boiled for 20 minutes; in the case of Direct Yellow CR only 5-10 minutes.

Direct Yellow 2039 and T are boiled 20 minutes, then 2% acetic acid is added, and the boiling continued for one-quarter hour.

In the same way, Direct Indigo Blue A, BN, BK are boiled 20 minutes, then 2½-3% acetic acid is added, and the boiling continued for one-half hour.

Dyestuffs for Union Felts.

Chlorantine Yellow JG, Cotton Yellow CH, together.
Direct Yellow T.
Direct Orange G, R.
Acid Congo R1573.
Cotton Red 11B, 1436.
Chlorantine Red 4B, 8B.
Direct Indigo Blue BN, BNK, A, BK.
Union Blue WGI, WGII, WGIII, WGIV.
Direct Blue W104. (For darkening the wool.)
Melantherine HW.
Direct Black 1602, 1718.
Union Black K old, S2050.
Direct Green B695.

Directions for Dyeing. The dye-bath is prepared with the necessary amount of coloring matter and 30 lbs. crystallized Glauber's salt per 100 gallons. The goods are entered at 140° F., worked one-quarter of an hour at this temperature, then boiled three-quarters to one hour, and afterwards washed.

The duration of the dyeing at 140° F., is regulated according to the quantity of cotton contained in the goods; the above directions refer to felt containing 40% cotton; felt containing a larger amount of cotton is dyed rather longer at the lower temperature.

The goods should be well scoured before dyeing. (A. Klipstein & Co., 122 Pearl St., New York.—Sole Agents for the products of the Society of Chemical Industry in the United States.)

DYEING OF WOOL-SILK FABRICS.

These goods may be dyed either on the wince dyebeck or on a jig dyeing machine. The latter ensures, perhaps, a more level dyeing and is, by the tension it exerts on the fabric, a great preventive of wrinkling, however many prefer for these goods the wince dye machine, taking due care to keep them as open as possible by means of suitable batching or guide rails.

In the dyeing of wool and silk fabrics, heat plays an important part in the fixation of the color on the fibre, and in the wince dyebeck the goods are more continuously in the hot liquor than in the case of the jig machine. It is important to keep the goods open full width, as that tends to promote levelness of dyeing and the prevention of wrinkling.

The means of heating the dyeing machines must be adequate and so arranged that the temperature can be carefully regulated, for changes of heat have some influence on the degree in which the two fibres take up the dye. These goods may be dyed either in one uniform color or in two colors, that is the silk in one and the wool in another color.

Dyeing Self Colors. Generally speaking, the easily leveling acid dyeing colors will be found to give the best results on wool-silk goods, there being added to the bath either Glauber's salt and sulphuric acid, or Glauber's salt and acetic acid, or bisulphate of soda in the usual proportions. It is not easy to lay down hard and fast rules as to the exact conditions of carrying out the work, so much depends upon the dyestuff or dyestuffs used; some can be dyed well on to both the silk and the wool at 180° to 190° F., and as far as possible, such dyes should be used; while others need to be first worked at about 180° F. and then given a short boil, in order to become fixed on the wool. A little practical experience and observation with the particular dyestuffs favored by the dyer will soon show him which way to work.

Among acid dyes which have been found to work well, the following may be named: Tropaeoline O, Indian Yellow, Orange Extra, Brilliant Croceïne M, Cyanole Extra, Thiocarmine R, Indigo Blue N, Fast Acid Green BN, Formyl Violets, Brilliant Orseille C, Acid Magenta, Alizarine Blacks, Anthracite Blacks, Gloria Blacks, Victoria Black B, Fast Red A, Mentanil Reds, Croceïne Orange G, Fast Light Yellow G, Brilliant Acid Green 6B, Fast Green Bluish, Fast Light Green, Wool Blues, Azo Acid Violet R, Fast Acid Violet 10B, Victoria Violet 4BS, Acid Violets.

Many of the direct dyes of the Benzo, Diamine, etc., series dye very good level shades on to wool-silk goods from dye-baths which contain Glauber's salt and a little acetic acid. Among such dyes may be named Diamine Rose BD, Diamine Scarlets B and 3B, Diamine Red 5B, Diamine Bordeaux S, Diamine Fast Yellow B, Thioflavine S, Diamine Browns 3G and M, Diamine Catechine G, Diamine Catechine B, Diamine Blues, Diamine Dark Green N, Union Black S, Oxy-Diamine Black N, Diaminogene Congo Orange R, Pluto Orange G, Chloramine Yellow, Chrysophenine, Brilliant Benzo Green N, Benzo Dark Blues, Sulfon Cyanines, Chloramine Violet R, Direct Deep Blacks, Benzo Chrome Browns, Benzo Fast Scarlets, Benzo Rhoduline Red, Deltapurpurine, Geranine.

Dyeing Two-Colored Effects. The dyeing of two-colored effects on wool-silk goods is certainly not so easy as dyeing of self colors. The operation depends upon the fact that under some conditions, certain dyes will dye the silk better than the wool, as, for instance, at low temperatures, basic colors will go on to the silk very well but not on to the wool, while there are some acid dyes which will dye the wool but not the silk. In some cases, a single-bath process may be used, while in others, a two-bath process is adopted, dyeing the wool first and the silk last.

The one-bath method consists in using a combination of acid and basic dyes in a single-bath, along with acetic acid, the basic dye going on mostly to the silk. The goods are entered into the bath at 100° to 110° F., worked for about one-half hour, then the heat is slowly raised to 160° F. to dye the silk; finally the heat is raised to the boil to dye the wool. If necessary, the silk may be topped with a basic dye to bring it up to shade; in this case, the bath must be allowed to cool down.

In the two-bath process, the wool is first dyed in an acetic acid bath at the boil, and the following dyes leave the silk white under these conditions: Azo Cochineal, Azo Fuchsine, Azo Crimson, Azo Phloxine 2G, Cochineal Scarlet PS, Fast Red NS, Fast Yellow Extra, Naphthol Yellow S, Alizarine Saphirol B, Lanafuchsine, Brilliant Cochineal, Alizarine Lanacyl Blue, Naphthol Black. After thus dyeing, the silk is dyed with basic colors in a bath at about 100° F. The wool may take up a little of the color. The following colors dye the silk at 80° to 100° F., without staining the wool very materially: Thioflavine T, Amaranth, Acid Green, Methyl Blue, Formyl Violet S4B, Milling Yellow, Brilliant Croceïne, Brilliant Cochineal, Alizarine Lanacyl Violet B.

SILK DYEING.

The Direct Cotton Dyestuffs.

Many direct cotton (substantive) dyestuffs give dyeings on silk which, like those obtained on wool, are remarkable for their excellent fastness to water and washing; they have, on this account, met with considerable application in the dyeing of silk.

They are particularly useful for the manufacture of embroidery silks fast to washing, and are also used in the dyeing of silk thread effects fast to milling, and in the dyeing of waste silk.

By diazotizing and developing, or by aftertreatment with metallic salts, shades are produced which answer the highest requirements as regards fastness to washing, and which withstand the severest possible treatment with alkalies to which they may be subsequently subjected.

The direct cotton colors are applied to silk either in weakly acid bath containing Glauber's salt, or in a "boiled off" liquor-bath acidified with acetic acid.

The method of working is as follows:

(a) Dyeing in Glauber's Salt Bath.

The dye-bath is prepared, according to the depth of the shade required, with 5-10% Glauber's salt, the goods are entered at 104-122° F., raised gradually to the boil, the acetic acid being added in small quantities from time to time. 1-10% acetic acid is required, according to the exhausting power of the dyestuff; for pale shades the acetic acid may be omitted, or the minimum quantity will be found to be quite sufficient.

If a further addition of dyestuffs is required for shading purposes, the bath should be cooled down somewhat.

(b) Dyeing with Direct Dyestuffs in a Bath containing "boiled off" liquor and acetic acid.

The silk is then dyed in a bath containing 15% (on the volume of the dye-bath) "boiled off" liquor, with addition of just sufficient acetic acid to render the bath neutral or slightly acid.

The addition of acetic acid varies according to the depth of shade required, and to the exhausting power, *i. e.*, the leveling properties of the dyestuff; rapidly exhausting coloring matters require less, dyestuffs which exhaust more slowly require more acetic acid; as much as 10 per cent. may be required.

After dyeing, the silk is brightened with sulphuric or acetic acid, in the usual manner.

Diazotizing and Developing may be applied to silk by dyeing with suitable direct cotton colors, and afterwards diazotizing and developing according to the directions given for cotton. The fastness of the developed colors so obtained is about the same as those of the developed dyeings on cotton. Silk yarn so dyed is suitable for weaving with silk which has not been "boiled off," the goods being subsequently "boiled off" in the piece.

Aftertreatment with Metallic Salts is carried out exactly in the same way as in the case of cotton, the same dyestuffs being used.

The dyeings after-treated with copper sulphate are worthy of note on account of their excellent fastness to light; those after-treated with chrome alum are remarkable for their good fastness to water.

ACID DYESTUFFS.

The acid dyestuffs are also usually applied to silk in a broken "boiled off" liquor-bath, and for this purpose sulphuric acid is generally added to the bath until it shows a distinctly acid reaction; the Eosines and similar dyestuffs are applied in "boiled off" liquor-bath acidified with acetic acid.

The goods are entered at 122° F., the dyestuff being added in several portions to the bath. The temperature of the bath is then brought to the boil and kept at that temperature for some time; if necessary a further addition of acid is made during the course of the dyeing operation. The silk is then washed and brightened with sulphuric or acetic acid.

Alkali Blue is dyed on silk according to the following recipe:

The silk is dyed with addition of 3-5 lbs. Marseilles soap per 100 gallons in a boiling bath. It is then rinsed and soured in a fresh bath at 140-180° F., with 1½-5% sulphuric acid 66° B. (D. O. V.)

In the souring bath the goods may be "topped" or shaded with other dyestuffs. In this case it is recommended to wash and brighten in a fresh cold sulphuric acid bath.

BASIC DYESTUFFS.

The basic dyestuffs are dyed similarly to the acid dyestuffs, but in a "boiled off" liquor-bath containing acetic acid, or in a neutral soap bath; just sufficient acetic acid should be added, in the former case, to render the bath slightly acid. The goods are entered at 105° F., and raised slowly to boil, the dyestuff being added in several portions during the operation. Dyestuffs which dye level at lower temperatures may be dyed at 140° F.

After dyeing, the silk is washed and brightened as usual. As already stated, Eosine and Rhodamine are applied in a similar manner.

DYESTUFFS SOLUBLE IN OIL AND SPIRIT.

Whereas the dyestuffs insoluble in water are scarcely ever applied to wool and cotton, they are of importance in silk dyeing in connection with the so-called "dry-dyeing" process. They are used principally in this branch of the industry, in the dyeing of very light silk fabrics, point lace, gauze, and similar materials, which would be damaged by treatment in an ordinary dye-bath. The process consists in treating the goods with a solution of the necessary dyestuff in alcohol or benzene. These solvents have no detrimental action on the structure of the fabrics, and quickly volatilize, leaving a thin layer of dyestuff on the goods.

Shades obtained in this way are by no means fast, but are generally sufficiently fast to fulfil the requirements of this class of goods.

THE DYEING OF WEIGHTED SILK.

Among the many dyestuffs now on the market, only a limited number are suitable, on account of their good exhausting and easy leveling properties, for dyeing silk which has been heavily weighted with tin salts.

The dyestuffs, and which are given in table on page 277, possess the useful property of dyeing perfectly level shades at a temperature of 120° F., so that the weighted silk suffers no loss in weight during the dyeing operation.

These dyestuffs, with the exception of Alkali Violet, are applied in "boiled off" liquor-bath, with addition of sulphuric acid. The goods are dyed at 120° F., washed and brightened with acetic acid; Alkali Violet is dyed in neutral soap bath at 120° F., washed and brightened with sulphuric acid.

The dyestuffs may be mixed for the purpose of producing compound shades. (A. Klipstein & Co., New York.)

DYES FAST TO WASHING ON WEIGHTED SILK.

The use of alizarine dyes for silk dyeing depends on their forming lakes on the fibre with the mordant. This method of dyeing, however, is impossible, with weighted silk. For example, if we try to get a fine red with alizarine, on a silk weighted with tin, the oxides of tin and sodium which are present, together with silicic and phosphoric acids, form ugly, dirty looking lakes with the alizarine. Similar effects occur in all other cases. We have, nevertheless, in the diamine colors, dyes which can be used on weighted silk.

If, for example, we have to dye a cardinal red which is not required to be very fast to washing, we can get fine full shades on weighted silk with Diamine Scarlet B or 3B. Diamine Fast Red F gives shades on it which are very much faster to washing and stand light splendidly if after-treated with chromium fluoride. If red shades absolutely fast to washing are desired on weighted silk, use Primuline by the diazotizing process. Dye with a water-bath, heat with a little acetic acid, rinse, diazotize with sodium nitrate and hydrochloric acid in the cold and develop according to shade with betanaphtol, or a mixture of that and phenol; betanaphtol alone is best for staring reds.

For darker red shades and Bordeaux, develop with alphanaphtol or Bordeaux developer, *i. e.*, a mixture of alpha and betanaphtol. For delicate yellow shades, use Thioflavine S or Diamine Yellow FF. For golden shades, dye with Primuline, diazotize and develop with soda or sodium-phenol. By mixing the latter with various amounts of resorcin, various shades up to a full golden brown can be obtained. All other diamines can be used with success on weighted silk, so long as they can be after-treated with chromium or sulphate of copper. There is hardly any shade which cannot be obtained on weighted silk by a proper choice of diamines; even fast blacks can thus be obtained.

Another class of dyes which will play their part in dyeing weighted silk in the future is the sulphur dyes, especially the Immedial dyes. A mixture of Immedial Black and Immedial Blue gives upon weighted silk, navy blue shades of great durability. The same effects can be produced with Immedial Indone R alone or with Immedial Direct Blue OD alone and are much more superior to those obtained on ordinary silk with Alizarine Blue, but the use of those two dyes presents at present yet some difficulties.

A NOVEL PROCESS OF PRINTING COTTON.

The new process consists in printing the fabric with a suitable resist, treating in turn said resist imprinted on the goods with a solution of a suitable alkali, then thoroughly drying the goods and dyeing the same in an alkaline bath.

The new process is carried on thus: The fabric is first printed by means of suitable rolls with a resist of the following composition: 20 kilograms of lead sulphate in paste form, 12½ kilograms of lead nitrate, 7½ kilograms of sugar of lead, 3 kilograms cupric sulphate, 6 liters cupric nitrate, 3 kilograms alum, 3 kilograms leiogomme, 4 kilograms lightly burned starch, 8 kilograms of a solution of suitable gum, and ½ kilogram tallow. The fabric is dried after printing and then saturated, as by spraying or splashing, with a concentrated aqueous solution of potash (specific gravity 1.54), then thoroughly dried and passed through a dye-bath, containing, per one hundred liters, 2 kilograms of "immedial blue CR," 1 kilogram sodium sulphite, ½ kilogram soda lye of 40° B., and 2 kilograms common salt. The fabric is then steamed, if necessary, washed, acidified, and dried.

If the fabrics are to be dyed also in indigo they are not required to be washed and acidified before dyeing with indigo, since the latter step can he accomplished directly in the usual hydrosulphite soda bath. After the indigo bath is applied to the fabrics they are acidified, washed and dried.

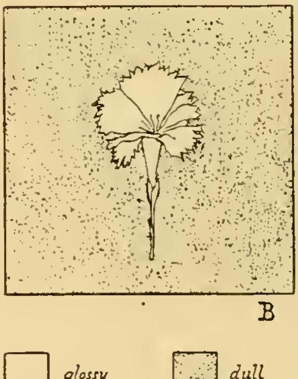
The process described produces a blue ground with white designs, the undyed portions as protected by the resist appearing in clear white, producing clear effects. If designs in other colors, such as yellow or orange, are desired, this effect is obtained by passing the fabric subsequently through a bath of bichromatic solution. (F. Schaab, Trier, Ger.)

A NEW PROCESS OF SILK PRINTING.

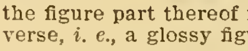
The object of the process is to change the effect (dull or lustre) between ground and figure in fabrics constructed of raw silk only, a feature otherwise obtained by using raw and degummed silk combined in the construction of the fabric, using in connection with a Jacquard loom one of the silks for warp and the other for filling. By the new process of printing no fancy loom or figured weaving is necessary, the result aimed at being obtained by printing the design (on a plain-woven fabric) by means of a paste containing a caustic alkali—for instance, caustic soda—and then subjecting the so-printed material to proper subsequent treatment. It must be mentioned here that unless great care be exercised in this process the action of the caustic alkali is very apt to go beyond the mere removal of the silk gum and thus attack the silk fibre itself, in turn reducing its strength. For this reason the action of the caustic alkali must be modified by the addition of grape sugar or glycerine, so that the gum only is removed and the strength of the silk fibre not affected.

If the fabric is dyed and the shade of the printed goods is to remain unimpaired, the coloring matter in the dyed fabric employed must be indifferent to the action of the degumming paste. The printing paste may also contain such colors or coloring matter as are not affected by the degumming paste and for which purpose indigo, anthraquinone black, oxamin red, etc., are suitable. Again, the designs can be produced by printing such reverses like chrome acetate on the fabric, which when dried or steamed are indifferent to the action of alkali, and by then passing the so-printed fabric through a bath containing caustic alkali, such as caustic soda, and a substance which will limit the action of the bath to the silk gum, such as grape sugar or glycerine.

A



B



The accompanying illustrations are given to explain the new process, showing in diagram A the ground part of the design executed in a glossy effect, while the figure part thereof is kept dull; B showing the reverse, *i. e.*, a glossy figure upon a dull ground.

The following examples illustrate the method of carrying the new process into effect. The parts are by weight:

Example 1. Printing a degumming paste containing caustic soda.—Make a paste of 200 parts of British gum and 400 parts of hot water. Cool and add 400 parts of caustic soda solution of 40° B. Print this paste upon dyed or undyed raw silk, dry at a moderate temperature, say 95° F., rinse, and, if desirable, pass through an acid bath. The so-prepared material can be dyed in the usual manner, if desired.

Example 2. Printing a degumming paste containing caustic soda and a limiting agent.—Introduce 100 parts of British gum in the usual manner into 700 parts of caustic soda solution of 40° B. Prepare also a mixture of 300 parts of grape sugar in 100 parts of water by heating on a water bath, stir until cool and pour into the British gum caustic soda paste and bring up to 1,200 parts by addition of water, if necessary. Print this paste and finish the material as in Example 1.

Example 3. Printing a degumming paste containing caustic soda, a limiting agent and a coloring matter.

(A) Make a paste of 10 parts of anthraquinone black and 40 parts of cold water; also, mix 60 parts of British gum with 700 parts of caustic soda solution of 40° B., and add to this 300 parts of grape sugar mixed with 90 parts of water. Mix all these and bring up to 1,200 parts by addition of water, if necessary. Print and finish as in Example 1.

(B) Introduce 60 parts of British gum into 700 parts of caustic soda solution of 40° B. Add 30 parts of indigo J. Prepare also a mixture of 300 parts of grape sugar and 100 parts of water by heating on a water bath. Stir until cool and pour into the British gum, indigo J and caustic soda paste, and bring up to 1,200 parts by addition of water, if necessary. Print this paste and finish the material as in Example 1.

Example 4. Printing a reserve and locally degumming by means of caustic soda and a limiting agent.—Mix 550 parts of hot water with 300 parts of British gum. Cool and add 150 parts of a solution of chrome acetate of 20° B. and make up to 1,000 parts by addition of water. Print this paste onto the material, dry, and then pass through a bath containing 300 parts of glycerine, 200 parts of water, 700 parts of caustic soda solution of 40° B., for from two to five minutes. Then rinse well in running water. (Badische Anilin & Soda Fabrik.)

BLEACHING WITH PEROXIDE OF SODIUM.

The rapid adoption of Peroxide of Sodium by textile mills of every kind, for bleaching all classes of fabrics, running from plain cotton, knit or woven, to all-wool fabrics, and including mixtures of cotton and wool or silk, has developed a set of helpful and still inexpensive machinery, with which to carry on the bleaching process. The type of machine to be used depends on the class of goods to be bleached and the method in which they have to be handled.

The pine vat with double bottom, under which a lead heating pipe is placed, forms the basis for all types of bleaching machinery, and is perfectly satisfactory for goods which are laid down in the bath or bleached in bundles, bags or nets. Broad goods are treated in the open width, being bleached on jigs, the quantity of liquor needed being only sufficient to cover the part of the goods below the inside rolls.

The endless chain method is employed for all piece goods which may run in rope form, the operation consisting in passing the goods over a large reel on top of the bleach tank or vat, the goods in turn dropping from the reel and falling against a slanting side of the bleach tank, collecting at the bottom in regular folds, and from where they are taken up on the other side of the tank by the rotation of the reel. A number of chains of cloth may pass through the bath at the same time and over the same reel by using wooden guide pins at the side of the tank to keep them separated. Yarns, formed into a loose chain, are bleached in the same manner.

The Peroxide of Sodium treatment has especially benefited the knit goods trade. It leaves cotton knits with their full strength, also preserving their elasticity and leaving no chemicals in the fibre; while for bleaching all classes of woolens, mixtures and unions, it has come to be regarded as one of the safest and most satisfactory methods. The reason for this is easily understood, if one comprehends the true significance of the Peroxide action. It is purely an oxidation process, and there never is in the bleach bath any deleterious combination of chemicals which might attack any fibre. The natural coloring matter in the fibre is oxidized to a colorless, soluble compound, which passes away in the after-washing and thus is entirely removed.

Mixtures of animal and vegetable fibres are treated in one-bath for two or three hours at a moderate heat, the bath still retaining a large part of its bleaching strength after the process. After restoration of the same, *i. e.* making it up again to the standard strength, which takes but a few moments, another batch of goods is entered, while a final lot is bleached over night, thus practically making a continuous and very economical method of running the bleach.

Mixtures, as well as all-wool, all-silk, or all-cotton goods, pass through the bleaching process without acquiring a foreign or disagreeable odor, while the white obtained is permanent and furnishes a magnificent basis for all the light shade dyes which go on evenly and do not tend to become streaked or faded.

White woolen blankets have been particularly improved by being bleached with Peroxide of Sodium, as they never yellow-up with age or washing, and any offensive odor is entirely eliminated. Curtains, laces and all fine cotton fabrics are left much more durable after passing through the process, as compared to some of the older methods, since the delicate peroxide action leaves the finest thread uninjured. The margin of safety in using the peroxide is large, that is, the process is not by any means a difficult one to prevent injury to the goods, as soon as it is properly understood.

Owing to the many advantages of peroxide of sodium as a bleaching agent, as already pointed out, we expect the same will continue to supersede the older processes in all branches of the industry. With reference to the details of the process, the reader is referred to Posselt's Textile Library, Vols. II and VIII.

WYANDOTTE TEXTILE SODA.

The same is used principally for scouring wool in any stage required during its manufacture, whether in the raw stock, yarns or fabrics. It is a mild form of carbonated alkali, free from caustic soda and other substances injurious to animal fibres. It is completely soluble in warm water to a clear solution, and owing to the process used in its manufacture, it is pure and uniform in strength. It can be used alone, but preferably in connection with any good soap, since the latter is one of the best scouring agents known. Wyandotte Textile Soda acts directly upon the wool grease and adhering dirt, loosening it, and facilitating its complete removal by rinsing. It does not act injuriously upon the finest wool fibres, a feature which is very important, as it obviates any possibility of complaints.

Wyandotte Textile Soda leaves wool stock, after being scoured, in a remarkably free and lofty condition, soft to the touch and without odor. It acts as an energetic assistant to the soap, in connection with scouring, almost instantly resolving the dried suint on the wool and rendering it extremely soluble.

When used in conjunction with soap for scouring yarns and fabrics, Wyandotte Textile Soda almost immediately emulsifies the wool oil, previously used in lubricating the stock, thereby leaving the yarns or fabrics, as the case may be, clean and in a most suitable condition ready for dyeing or finishing. Material after having been scoured with Wyandotte Textile Soda and rinsed, is ready for dyeing, which process in turn produces level shades, for the reason that the scoured wool is left almost as pure fibre.

Besides being used for wool, yarn or cloth scouring, Wyandotte Textile Soda is also a good softening agent for hard water. It also can be used in connection with soap for fulling, thus reducing the quantity of the latter which would otherwise be necessary for the process. It is also valuable as a boiler compound, since the lime in the water which causes the scales in the boiler is precipitated and on settling at the bottom can be readily blown off.

Wyandotte Textile Soda is also used to scour Tussah silk warps, in place of the more costly pearl ash, and this without leaving the threads harsh, thereby materially reducing the cost of this branch of silk mill work. It should, however, be used in connection with silk soaps, in order to secure the very best results.

Softening Water. In scouring wool it is necessary, from an economical standpoint, that the water used should be soft, in order not to destroy the scouring properties of the soap used. For hard water, therefore, use sufficient quantity of Wyandotte Textile Soda to make the water feel soft to the hand. If water contains iron or is yellow it is best to first heat it to about 120° F., then adding the Wyandotte Textile Soda and allow the precipitate to settle for an hour or more. All foreign matter is thus precipitated, and if the water is then drawn from a pipe a few inches above the bottom of the tanks, said water will be clear and sparkling.

For Scouring Fleece Wool with Alkali Alone. Where 100 lbs. pure alkali (soda ash) has been formerly used, it is necessary to use only 50 lbs. pure alkali (soda ash) and 20 lbs. Wyandotte Textile Soda, or if preferred, pure alkali (soda ash) may be used in the first bowl as formerly, and Wyandotte Textile Soda alone in the second bowl, using in this instance 25% less in weight than of pure alkali (soda ash) previously used. Also use a 3% solution of Wyandotte Textile Soda in the last bowl for rinsing, which will make the wool softer, loftier and of a better color. This process will retain the life of the wool and put it in a better working condition and eliminate entirely all possibility of burning the fibre of the wool during the process.

For Scouring Fleece Wool and Cloth with Textile Soda and Soap. Use ½ lb. soap and ½ lb. Wyandotte Textile Soda to each gallon of water. In making up your soap bath, run the water into a tank to about ⅓ the tank capacity, bring same to a boil, put in your soap, thoroughly dissolve same and when thoroughly dissolved and boiling, commence to fill the tank with water. Dissolve the Wyandotte Textile Soda in warm water, then add to the bath and stir well. When tank is full, shut off steam. *Do not boil soap after the Wyandotte Textile Soda has been added to the bath.*

Use this same solution for wool scouring, also in the cloth scouring department of the finishing room, using sufficient amount to thoroughly scour the wool or cloth as the case may be. The quantity of this soap solution to be used, depends upon the condition of the wool or cloth which you are scouring.

In connection with wool scouring use this same solution in the first and second bowl. Use a 3% solution of Wyandotte Textile Soda in the last rinse bowl. This will remove all soap and leave the wool soft, lofty and white. Owing to its efficient solvent action, it will be found in practice that wool scouring can be carried out at a lower temperature than formerly, thereby materially aiding in ensuring a high quality of scoured wool. The colors produced by dyeing on wool thus scoured will be brighter, more uniform and more lasting.

With reference to Cloth Scouring, use a sufficient quantity of Wyandotte Textile Soda solution in the first cold rinse after goods have been fulled, since this will remove all the soap and leave the cloth much softer. The quantity of Wyandotte Textile Soda to be used must be governed by the number of pieces you have been scouring and the condition of the water.

For Scouring Yarns. Wyandotte Textile Soda may be used alone in the box-machine, or in connection with soap in the second bowl, when it will leave the yarns in an excellent condition for being dyed fast and even shades.

Wyandotte Textile Soda as a Boiler Compound. Throw every day into the feed water of the boiler, 1½ lbs. of Wyandotte Textile Soda to each 100 gallons of water used. For ordinary hard water this is amply sufficient. For very hard water, 2 lbs. should be used to each 100 gallons of water. Use the blow-off tap freely. The detrimental effect of boiler scales is shown by the following: A scale of ⅛ of an inch in thickness causes 16% increase in the consumption of coal, ¼ of an inch thickness of scale an increase of 50%, and a scale of ½ inch in thickness increases the consumption of fuel 150%. The lime which causes the hardness of the water is precipitated as a muddy sediment by the Wyandotte Textile Soda, which is thus easily removed, instead of forming on the plates and tubes of the boiler as a scale. Wyandotte Textile Soda is absolutely harmless, and will not rust or pit the metal parts nor injure the fittings, and readily dissolves in cold or hot water. (The J. B. Ford Co., Wyandotte, Mich.)

IMPARTING TO COTTON STOCKINGS, ETC., A LISLE THREAD FINISH.

The gist of this new process, invented by A. N. Dubois, of Philadelphia, consists in saturating the goods to be treated with a mixture of chemicals having the property of changing the physical condition of cellulose fibre, removing the fluid by a hydroextractor, and then subjecting the goods to a drying action until the chemical impregnating them changes the character of the fuzz as adhering to the cotton thread, subjecting the goods at the same time to an energetic attrition, which breaks off the brittle fibre and imparts the lisle thread lustre and finish to the goods. The active chemicals are then neutralized or removed from the goods to prevent them from further acting on the body of the fabric. The new process may be used as a part of the dyeing operation or preparatory to dyeing or preparatory to bleaching.

The application of the new process is thus: Take four hundred pounds of cold water and add to it either four pounds of sulphuric acid of 66° Baumé or twelve pounds of hydrochloric acid of 22° Baumé or seven pounds of nitric acid of 36° Baumé or a mixture of these acids. In this solution immerse the cotton stockings, or other fabrics, in a "tomtom," for about thirty minutes. Then remove them and extract them in a hydroextractor, and in turn put them in an "oxidizing machine," in which the goods are thoroughly mixed up and tumbled about while exposed to a regulated heat. In this machine first dry the goods at a temperature of not over 92° F., and with the ventilator of the drying room open in full, and after the goods are sensibly dry, at from 90° to 120° F. maintain the tumbling and consequent attrition of the goods until the filamental fuzz is rendered brittle and broken off and the surface of the goods shows the desired lisle thread finish. Then remove the goods from the oxidizer and allow them to cool off, after which give them a cold alkaline bath of carbonate of sodium, carbonate of potassium, ammonia liquor, or the like in the proportion of about five pounds of the alkali to the hundred pounds of goods. This neutralizes the acid in the goods, which then wash, hydroextract and dye or bleach in any usual way.

When bleaching instead of dyeing the goods, first boil them before removing the filament, etc., with an alkali to free them from oil or dirt, and then proceed as before described.

When producing the lisle thread effect during dyeing, include in the dyeing solution some of the chemicals having the desired effect on cellulose fibre. Many dyes contain such chemicals in substantially the proper proportions, a feature especially true of all the aniline oxidized fast black dye-liquors. (A. N. Dubois, Philadelphia, Pa.)

COMPARATIVE TABLE OF HYDROMETER DEGREES BAUMÉ AND TWADDELL.

B.	Tw.	B.	Tw.
1	1.4	35	64.0
2	2.8	36	66.4
3	4.4	37	69.0
4	5.8	38	71.4
5	7.4	39	74.0
6	9.0	40	76.6
7	10.2	41	79.4
8	12.0	42	82.0
9	13.4	43	84.8
10	15.0	44	87.6
11	16.6	45	90.6
12	18.2	46	93.6
13	20.0	47	96.6
14	21.6	48	99.6
15	23.2	49	103.0
16	25.0	50	106.0
17	26.8	51	109.2
18	28.4	52	112.6
19	30.4	53	116.0
20	32.4	54	119.4
21	34.2	55	123.0
22	36.0	56	127.0
23	38.0	57	130.4
24	40.0	58	134.4
25	42.0	59	138.2
26	44.0	60	142.0
27	46.2	61	146.4
28	48.2	62	150.6
29	50.4	63	155.0
30	52.6	64	159.0
31	54.8	65	164.0
32	57.0	66	168.4
33	59.4	67	173.9
34	61.6	68	179.4

THERMOMETERS.

In ordinary thermometers two fixed points are taken, viz., those respectively at which water freezes and boils. In graduating an instrument, after exhausting the tube, filling with mercury and sealing, the height at which the column of mercury stands at these temperatures is determined by experiment. The space on the tube between these two fixed points is then divided into equal parts; the number of parts being 80, 100 or 180, according to the particular scale employed; and in order to extend the scale below the freezing point, and above the boiling point of water, the equal divisions are continued as far as necessary beyond the fixed points in both directions.

There are three thermometers in use, viz., Fahrenheit (F.), Reaumur (R.) and Celsius (C.), the relationship of which is as follows:

Freezing point or 32° F. = Zero in C. or R.
Boiling point or 212° F. = 100° C. or 80° R.

HOW TO CHANGE DEGREES OF CENTIGRADE OR REAUMUR INTO DEGREES FAHRENHEIT, AND VICE VERSA.

Centigrade into Fahrenheit.

$$F = \frac{9 \times {}^\circ C \text{ given}}{5} + 32$$

Example.—Find degrees F. for 40° C.
40 × 9 = 360 ÷ 5 = 72 + 32 = 104.
Answer.—40° C = 104° F.

Reaumur into Fahrenheit.

$$F = \frac{9 \times {}^\circ R \text{ given}}{4} + 32$$

Example.—Find degrees F. for 32° R.
32 · 9 = 288 ÷ 4 = 72 + 32 = 104.
Answer.—32° R = 104° F.

Fahrenheit into Celsius.

$$C = \frac{5 \times (\text{degrees F given} - 32)}{9}$$

Example.—Find degrees C. for 104 F.
5 × (104 − 32) 72 = 360 ÷ 9 = 40.
Answer.—104° F = 40° C.

Fahrenheit into Reaumur.

$$R = \frac{4 \times (\text{degrees F given} - 32)}{9}$$

Example.—Find degrees R. for 104° C.

$$\frac{4 \times (\text{degrees F given} - 32)}{9}$$

104 − 32 = 72 × 4 = 288 ÷ 9 = 32.
Answer.—104° C = 32° F.

Reaumur into Celsius.

$$C = \frac{5 \times \text{degrees R given}}{4}$$

Example.—Find degrees C. for 32° R.
5 × 32 = 160 ÷ 4 = 40.
Answer.—32° R = 40° C.

Celsius into Reaumur.

$$R = \frac{4 \times \text{degrees C given}}{5}$$

Example.—Find degrees R. for 40° C.
4 × 40 = 160 ÷ 5 = 32.
Answer.—40° C = 32° R.

I. CONVERSION OF CENTIGRADE INTO RÉAUMUR OR FAHRENHEIT.

C.	*R.*	*F.*	*C.*	*R.*	*F.*	*C.*	*R.*	*F.*
0°	0°	32°	**34°**	27.2°	93.2°	**68°**	54.4°	154.4°
1	0.8	33.8	**35**	28	95	**69**	55.2	156.2
2	1.6	35.6	**36**	28.8	96.8	**70**	56	158
3	2.4	37.4	**37**	29.6	98.6	**71**	56.8	159.8
4	3.2	39.2	**38**	30.4	100.4	**72**	57.6	161.6
5	4	41	**39**	31.2	102.2	**73**	58.4	163.4
6	4.8	42.8	**40**	32	104	**74**	59.2	165.2
7	5.6	44.6	**41**	32.8	105.8	**75**	60	167
8	6.4	46.4	**42**	33.6	107.6	**76**	60.8	168.8
9	7.2	48.2	**43**	34.4	109.4	**77**	61.6	170.6
10	8	50	**44**	35.2	111.2	**78**	62.4	172.4
11	8.8	51.8	**45**	36	113	**79**	63.2	174.2
12	9.6	53.6	**46**	36.8	114.8	**80**	64	176
13	10.4	55.4	**47**	37.6	116.6	**81**	64.8	177.8
14	11.2	57.2	**48**	38.4	118.4	**82**	65.6	179.6
15	12	59	**49**	39.2	120.2	**83**	66.4	181.4
16	12.8	60.8	**50**	40	122	**84**	67.2	183.2
17	13.6	62.6	**51**	40.8	123.8	**85**	68	185
18	14.4	64.4	**52**	41.6	125.6	**86**	68.8	186.8
19	15.2	66.2	**53**	42.4	127.4	**87**	69.6	188.6
20	16	68	**54**	43.2	129.2	**88**	70.4	190.4
21	16.8	69.8	**55**	44	131	**89**	71.2	192.2
22	17.6	71.6	**56**	44.8	132.8	**90**	72	194
23	18.4	73.4	**57**	45.6	134.6	**91**	72.8	195.8
24	19.2	75.2	**58**	46.4	136.4	**92**	73.6	197.6
25	20	77	**59**	47.2	138.2	**93**	74.4	199.4
26	20.8	78.8	**60**	48	140	**94**	75.2	201.2
27	21.6	80.6	**61**	48.8	141.8	**95**	76	203
28	22.4	82.4	**62**	49.6	143.6	**96**	76.8	204.8
29	23.2	84.2	**63**	50.4	145.4	**97**	77.6	206.6
30	24	86	**64**	51.2	147.2	**98**	78.4	208.4
31	24.8	87.8	**65**	52	149	**99**	79.2	210.2
32	25.6	89.6	**66**	52.8	150.8	**100**	80	212
33	26.4	91.4	**67**	53.6	152.6			

II. CONVERSION OF RÉAUMUR INTO CENTIGRADE OR FAHRENHEIT.

R.	*C.*	*F.*	*R.*	*C.*	*F.*	*R.*	*C.*	*F.*
0°	0°	32°	**27°**	33.75°	92.75°	**54°**	67.5°	153.5°
1	1.25	34.25	**28**	35	95	**55**	68.75	155.75
2	2.5	36.5	**29**	36.25	97.25	**56**	70	158
3	3.75	38.75	**30**	37.5	99.5	**57**	71.25	160.25
4	5	41	**31**	38.75	101.75	**58**	72.5	162.5
5	6.25	43.25	**32**	40	104	**59**	73.75	164.75
6	7.5	45.5	**33**	41.25	106.25	**60**	75	167
7	8.75	47.75	**34**	42.5	108.5	**61**	76.25	169.25
8	10	50	**35**	43.75	110.75	**62**	77.5	171.5
9	11.25	52.25	**36**	45	113	**63**	78.75	173.75
10	12.5	54.5	**37**	46.25	115.25	**64**	80	176
11	13.75	56.75	**38**	47.5	117.5	**65**	81.25	178.25
12	15	59	**39**	48.75	119.75	**66**	82.5	180.5
13	16.25	61.25	**40**	50	122	**67**	83.75	182.75
14	17.5	63.5	**41**	51.25	124.25	**68**	85	185
15	18.75	65.75	**42**	52.5	126.5	**69**	86.25	187.25
16	20	68.	**43**	53.75	128.75	**70**	87.5	189.5
17	21.25	70.25	**44**	55	131	**71**	88.75	191.75
18	22.05	72.5	**45**	56.25	133.25	**72**	90	194
19	23.75	74.75	**46**	57.5	135.5	**73**	91.25	196.25
20	25	77	**47**	58.75	137.75	**74**	92.5	198.5
21	26.25	79.25	**48**	60	140	**75**	93.75	200.75
22	27.5	81.5	**49**	61.25	142.25	**76**	95	203
23	28.75	83.75	**50**	62.5	144.5	**77**	96.25	205.25
24	30	86	**51**	63.75	146.75	**78**	97.5	207.5
25	31.25	88.25	**52**	65	149	**79**	98.75	209.75
26	32.5	90.5	**53**	66.25	151.25	**80**	100	212

III. CONVERSION OF FAHRENHEIT INTO CENTIGRADE OR RÉAUMUR.

F.	*C.*	*R.*	*F.*	*C.*	*R.*	*F.*	*C.*	*R.*
0°	—17.78°	—14.22°	71°	21.67°	17.33°	142°	61.11°	48.89°
1	17.22	13.78	72	22.22	17.78	143	61.67	49.33
2	16.67	13.33	73	22.78	18.22	144	62.22	49.78
3	16.11	12.89	74	23.33	18.67	145	62.78	50.22
4	15.55	12.44	75	23.89	19.11	146	63.33	50.67
5	15	12	76	24.44	19.56	147	63.89	51.11
6	14.44	11.56	77	25	20.	148	64.44	51.56
7	13.89	11.11	78	25.55	20.44	149	65	52
8	13.33	10.67	79	26.11	20.89	150	65.55	52.44
9	12.78	10.22	80	26.67	21.33	151	66.11	52.89
10	12.22	9.78	81	27.22	21.78	152	66.67	53.33
11	11.67	9.33	82	27.78	22.22	153	67.22	53.78
12	11.11	8.89	83	28.33	22.67	154	67.78	54.22
13	10.55	8.44	84	28.89	23.11	155	68.33	54.67
14	10	8	85	29.44	23.56	156	68.89	55.11
15	9.44	7.56	86	30	24	157	69.44	55.56
16	8.89	7.11	87	30.55	24.44	158	70	56
17	8.33	6.67	88	31.11	24.89	159	70.55	56.44
18	7.78	6.22	89	31.67	25.33	160	71.11	56.89
19	7.22	5.78	90	32.22	25.78	161	71.67	57.33
20	6.67	5.33	91	32.78	26.22	162	72.22	57.78
21	6.11	4.89	92	33.33	26.67	163	72.78	58.22
22	5.55	4.44	93	33.89	27.11	164	73.33	58.67
23	5	4	94	34.44	27.56	165	73.89	59.11
24	4.44	3.56	95	35	28	166	74.44	59.56
25	3.89	3.11	96	35.55	28.44	167	75	60
26	3.33	2.67	97	36.11	28.89	168	75.55	60.44
27	2.78	2.22	98	36.67	29.33	169	76.11	60.89
28	2.22	1.78	99	37.22	29.78	170	76.67	61.33
29	1.67	1.33	100	37.78	30.22	171	77.22	61.78
30	1.11	0.89	101	38.33	30.67	172	77.78	62.22
31	0.55	0.44	102	38.89	31.11	173	78.33	62.67
32	0	0	103	39.44	31.56	174	78.89	63.11
33	+0.55	+0.44	104	40	32	175	79.44	63.56
34	1.11	0.89	105	40.55	32.44	176	80	64
35	1.67	1.33	106	41.11	32.89	177	80.55	64.44
36	2.22	1.78	107	41.67	33.33	178	81.11	64.89
37	2.78	2.22	108	42.22	33.78	179	81.67	65.33
38	3.33	2.67	109	42.78	34.22	180	82.22	65.78
39	3.89	3.11	110	43.33	34.67	181	82.78	66.22
40	4.44	3.56	111	43.89	35.11	182	83.33	66.67
41	5	4	112	44.44	35.56	183	83.89	67.11
42	5.55	4.44	113	45	36	184	84.44	67.56
43	6.11	4.89	114	45.55	36.44	185	85	68
44	6.67	5.33	115	46.11	36.89	186	85.55	68.44
45	7.22	5.78	116	46.67	37.33	187	86.11	68.89
46	7.78	6.22	117	47.22	37.78	188	86.67	69.33
47	8.33	6.67	118	47.78	38.22	189	87.22	69.78
48	8.89	7.11	119	48.33	38.67	190	87.78	70.22
49	9.44	7.56	120	48.89	39.11	191	88.33	70.67
50	10	8	121	49.44	39.56	192	88.89	71.11
51	10.55	8.44	122	50	40	193	89.44	71.56
52	11.11	8.89	123	50.55	40.44	194	90	72
53	11.67	9.33	124	51.11	40.89	195	90.55	72.44
54	12.22	9.78	125	51.67	41.33	196	91.11	72.89
55	12.78	10.22	126	52.22	41.78	197	91.67	73.33
56	13.33	10.67	127	52.78	42.22	198	92.22	73.78
57	13.89	11.11	128	53.33	42.67	199	92.78	74.22
58	14.44	11.56	129	53.89	43.11	200	93.33	74.67
59	15	12	130	54.44	43.56	201	93.89	75.11
60	15.55	12.44	131	55	44	202	94.44	75.56
61	16.11	12.89	132	55.55	44.44	203	95	76
62	16.67	13.33	133	56.11	44.89	204	95.55	76.44
63	17.22	13.78	134	56.67	45.33	205	96.11	76.89
64	17.78	14.22	135	57.22	45.78	206	96.67	77.33
65	18.11	14.67	136	57.78	46.22	207	97.22	77.78
66	18.89	15.11	137	58.33	46.67	208	97.78	78.22
67	19.44	15.56	138	58.89	47.11	209	98.33	78.67
68	20	16	139	59.44	47.56	210	98.89	79.11
69	20.55	16.44	140	60	48.	211	99.44	79.56
70	21.11	16.89	141	60.55	48.44	212	100	80

HYDROMETERS AND SPECIFIC GRAVITY.

The concentration of a liquid such as sulphuric acid, or the amount of solid substance present in such a solution as nitrate of iron, may frequently be measured by a determination of the *density* or *specific gravity* of the solution. This is most accurately done by weighing a known volume of the liquid, since the specific gravity of any substance is represented by the weight of that substance compared with the weight of an equal volume of water, the latter being taken as unity.

Thus :— 50 cubic centimetres of water weigh 50 grammes.
50 cubic centimetres of sulphuric acid weigh 92 grammes.

Therefore the weight of sulphuric acid compared with water is as 92 : 50 and the specific gravity $= \frac{92}{50} \times 1 = 1.84$

The determination of specific gravity by this method necessitates the use of accurately gauged instruments, and requires considerable time and a certain degree of manipulative skill. For use in a dye-house, a simpler and more expeditious process is therefore desirable, and such is found in the use of the instruments known as *hydrometers* or *aereometers*, which, by simple immersion in the liquid, show directly on a scale the approximate specific gravity.

The instrument depends for its action upon the obvious fact that the denser (heavier) a liquid is the heavier the float which it will support. It takes the form of a weighted bulb supporting an upright graduated scale, a series of such instruments being so weighted that the stem of No 2 is almost entirely immersed in a liquid which floats No. 1—which is lighter—so high that the scale is nearly all above the surface of the liquid. No. 3 also is correspondingly heavier than No. 2 ; No. 4 than No. 3, etc.; one set of instruments, usually six in number, thus constituting a complete scale of sufficiently wide range to include all common liquids and solutions.

The method of graduating the scale varies in different instruments. One form is arranged to indicate directly the actual specific gravity, such being known as *specific gravity hydrometers*, but those most commonly in use are graduated with an empirical scale.

In England *Twaddell's scale* is commonly employed, and this bears a definite ratio to specific gravity ; but on the continent of Europe, and in America, *Baumé's hydrometer* is chiefly used, and the readings on this scale cannot be converted into specific gravity without the use of a complicated formula or reference to a table. A revised Baumé scale is now in limited use, and this, which is known as the *rational Baumé scale*, is directly convertible into specific gravity by means of a simple formula.

Other scales have been proposed and are met with occasionally, such as those of Beck, Cartier, Balling and Gay-Lussac. All these bear a definite relationship to specific gravity, and a table is given below by means of which any particular scale may be converted into specific gravity, or, indirectly, into another more convenient scale.

Hydrometer Scale.	*Formula for converting into Specific Gravity* (*Sp. gr.*).
1. Specific gravity hydrometer	Gives direct readings.
2. Twaddell's hydrometer	$\text{Sp. gr.} = \frac{0.5\,N + 100}{100}$
3. Rational Baumé	$\text{Sp. gr.} = \frac{146.3}{146.3 - N.}$
4. Beck's hydrometer	$\text{Sp. gr.} = \frac{170}{170 - N.}$
5. Cartier's hydrometer	$\text{Sp. gr.} = \frac{136.8}{136.8 - N.}$
6. Balling's hydrometer	$\text{Sp. gr.} = \frac{200}{200 - N.}$
7. Gay-Lussac's hydrometer	$\text{Sp. gr.} = \frac{100}{100 - N.}$

In the above formulæ, N = the particular degree which it is desired to convert. Thus, to change 168° Tw. in Sp. gr. :—

$$\frac{168 \times 0.5 + 100}{100} = 1.84 \text{ Sp. gr.}$$

$$25° \text{ Beck} = \frac{170}{170 - 25} = 1.172 \text{ Sp. gr.}$$

$$30° \text{ Rational Baumé} = \frac{146.3}{146.3 - 30} = 1.258 \text{ Sp. gr.}$$

In specific gravity determinations, two facts must be kept in view, viz., that the presence of a second substance in solution entirely vitiates any inference which may be drawn with regard to the amount of the principal ingredient ; and, secondly, that the specific gravity is greatly influenced by the temperature at which the experiment is made. Thus, if a sample of nitrate of iron is adulterated with sodium sulphate, it may show a high specific gravity and yet be weak in iron ; or, again, to illustrate the effect of temperature, aniline oil will sink in cold water, because it is heavier at low temperatures; but if the mixture is heated, the oil will rise to the surface and float, because, as it expands more quickly than water, it becomes lighter at high temperatures.

The determination of specific gravity should therefore always be made at as near 15° C. (60° F.) as possible ; this being taken as the standard temperature for such determinations.

COMPARISON BETWEEN SPECIFIC GRAVITY AND DEGREES.—Twaddell and Baumé.

Tw.	*B.*	*Sp. gr.*	*Tw.*	*B.*	*Sp. gr.*	*Tw.*	*B.*	*Sp. gr.*
1°	0.7°	1.005	59°	32.8°	1.295	117°	53.3°	1.585
2	1.4	1.010	60	33.3	1.300	118	53.6	1.590
3	2.1	1.015	61	33.7	1.305	119	53.9	1.595
4	2.7	1.020	62	34.2	1.310	120	54.1	1.600
5	3.4	1.025	63	34.6	1.315	121	54.4	1.605
6	4.1	1.030	64	35	1.320	122	54.7	1.610
7	4.7	1.035	65	35.4	1.325	123	55	1.615
8	5.4	1.040	66	35.8	1.330	124	55.2	1.620
9	6	1.045	67	36.2	1.335	125	55.5	1.625
10	6.7	1.050	68	36.6	1.340	126	55.8	1.630
11	7.4	1.055	69	37	1.345	127	56	1.635
12	8	1.060	70	37.4	1.350	128	56.3	1.640
13	8.7	1.065	71	37.8	1.355	129	56.6	1.645
14	9.4	1.070	72	38.2	1.360	130	56.9	1.650
15	10	1.075	73	38.6	1.365	131	57.1	1.655
16	10.6	1.080	74	39	1.370	132	57.4	1.660
17	11.2	1.085	75	39.4	1.375	133	57.7	1.665
18	11.9	1.090	76	39.8	1.380	134	57.9	1.670
19	12.4	1.095	77	40.1	1.385	135	58.2	1.675
20	13	1.100	78	40.5	1.390	136	58.4	1.680
21	13.6	1.105	79	40.8	1.395	137	58.7	1.685
22	14.2	1.110	80	41.2	1.400	138	58.9	1.690
23	14.9	1.115	81	41.6	1.405	139	59.2	1.695
24	15.4	1.120	82	42	1.410	140	59.5	1.700
25	16	1.125	83	42.3	1.415	141	59.7	1.705
26	16.5	1.130	84	42.7	1.420	142	60	1.710
27	17.1	1.135	85	43.1	1.425	143	60.2	1.715
28	17.7	1.140	86	43.4	1.430	144	60.4	1.720
29	18.3	1.145	87	43.8	1.435	145	60.6	1.725
30	18.8	1.150	88	44.1	1.440	146	60.9	1.730
31	19.3	1.155	89	44.4	1.445	147	61.1	1.735
32	19.8	1.160	90	44.8	1.450	148	61.4	1.740
33	20.3	1.165	91	45.1	1.455	149	61.6	1.745
34	20.9	1.170	92	45.4	1.460	150	61.8	1.750
35	21.4	1.175	93	45.8	1.465	151	62.1	1.755
36	22	1.180	94	46.1	1.470	152	62.3	1.760
37	22.5	1.185	95	46.4	1.475	153	62.5	1.765
38	23	1.190	96	46.8	1.480	154	62.8	1.770
39	23.5	1.195	97	47.1	1.485	155	63	1.775
40	24	1.200	98	47.4	1.490	156	63.2	1.780
41	24.5	1.205	99	47.8	1.495	157	63.5	1.785
42	25	1.210	100	48.1	1.500	158	63.7	1.790
43	25.5	1.215	101	48.4	1.505	159	64	1.795
44	26	1.220	102	48.7	1.510	160	64.2	1.800
45	26.4	1.225	103	49	1.515	161	64.4	1.805
46	26.9	1.230	104	49.4	1.520	162	64.6	1.810
47	27.4	1.235	105	49.7	1.525	163	64.8	1.815
48	27.9	1.240	106	50	1.530	164	65	1.820
49	28.4	1.245	107	50.3	1.535	165	65.2	1.825
50	28.9	1.250	108	50.6	1.540	166	65.5	1.830
51	29.3	1.255	109	50.9	1.545	167	65.7	1.835
52	29.7	1.260	110	51.2	1.550	168	65.9	1.840
53	30.2	1.265	111	51.5	1.555	169	66.1	1.845
54	30.6	1.270	112	51.8	1.560	170	66.3	1.850
55	31.1	1.275	113	52.1	1.565	171	66.5	1.855
56	31.5	1.280	114	52.4	1.570	172	66.7	1.860
57	32	1.285	115	52.7	1.575	173	67	1.865
58	32.4	1.290	116	53	1.580			

THE ELEMENTS WITH THEIR SYMBOLS AND ATOMIC WEIGHTS.

	Name.	Symbol.	Atomic Weight.		Name.	Symbol.	Atomic Weight.
1	**Aluminium**	**Al.**	**27.1**	36	Nickel	Ni.	58
2	**Antimony (Stibium)**	**Sb.**	**120**	37	Niobium	Nb.	94.2
3	Arsenic	As.	75	**38**	**Nitrogen**	**N.**	**14**
4	Barium	Ba.	137	39	Osmium	Os.	192
5	Berylium	Be.	9.1	**40**	**Oxygen**	**O.**	**16**
6	Bismuth	Bi.	208	41	Palladium	Pd.	106
7	Boron	B.	11	42	Phosphorous	P.	31
8	Bromine	Br.	80	43	Platinum	Pt.	194.8
9	Cadmium	Cd.	112.1	**44**	**Potassium (Kalium)**	**K.**	**39.1**
10	Cæsium	Cs.	132.9	45	Rhodium	Rh.	103
11	**Calcium**	**Ca.**	**40**	46	Rubidium	Rb.	85.4
12	**Carbon**	**C.**	**12**	47	Ruthenium	Ru.	103.8
13	Cerium	Ce.	140.2	48	Samarium	Sa.	150
14	**Chlorine**	**Cl.**	**35.5**	49	Scandium	Sc.	44.1
15	**Chromium**	**Cr.**	**52.3**	50	Selenium	Se.	79.1
16	Cobalt	Co.	59	51	Silicon	Si.	28.4
17	**Copper**	**Cu.**	**63.3**	52	Silver (Argentum)	Ag.	108
18	Didymium	Di.	147	**53**	**Sodium (Natrium)**	**Na.**	**23**
19	Erbium	Er.	166.3	54	Strontium	Sr.	87.5
20	Fluorine	F. or Fl.	19	**55**	**Sulphur**	**S.**	**32**
21	Gallium	G. or Ga.	69.9	56	Tantalum	Ta.	129
22	Germanium	Ge.	72.3	57	Tellurium	Te.	125
23	Gold (Aurum)	Au.	197.2	58	Thallium	Tl.	204.1
24	**Hydrogen**	**H.**	**1**	59	Thorium	Th.	232.4
25	Indium	In.	113.7	60	Thulium	Tu.	170.7
26	Iodine	I.	126.9	**61**	**Tin (Stannum)**	**Sn.**	**118.1**
27	Iridium	Ir.	193.2	62	Titanium	Ti.	48.1
28	**Iron (Ferrum)**	**Fe.**	**56**	63	**Tungsten (Wolfram)**	**W.**	184
29	Lanthanum	La.	138.5	64	Uranium	U.	239.4
30	Lead (Plumbum)	Pb.	206.9	65	Vanadium	V.	51.2
31	Lithium	Li.	7	66	Ytterbium	Yb.	173.2
32	Magnesium	Mg.	24	67	Yttrium	Y.	88.7
33	Manganese	Mn.	55	68	Zinc	Zn.	65
34	Mercury (Hydrargyrum)	Hg.	200.4	69	Zirconium	Zr.	90.7
35	Molybdenum	Mo.	95.9				

FINISHING PROCESSES AND MACHINERY.

FINISHING WOOLENS AND WORSTEDS.

The finishing of Woolens and Worsteds may conveniently be divided into Wet and Dry Finishing, and of which the first comprises all the processes from the loom to and including the dryer, the remaining processes belonging to the dry finishing department of the mill.

Wet Finishing comprises: Inspecting, Burling and Mending, Tacking, Fulling, Washing, Burr Dyeing, Carbonizing, Steaming and Stretching or Boiling and Stretching, Wet Gigging or Napping, Steam Lustring, Drying.

Dry Finishing comprises: Dry Gigging or Napping, Shearing or Singeing, Brushing, Polishing, Sanding, Steam Brushing, Spraying, Measuring, Doubling, Rolling and Weighing.

It must be understood however, that not every fabric is subjected to all the processes quoted, they simply being given as sub-divisions of finishing, to some of which a fabric in question may have to be subjected.

INSPECTING.

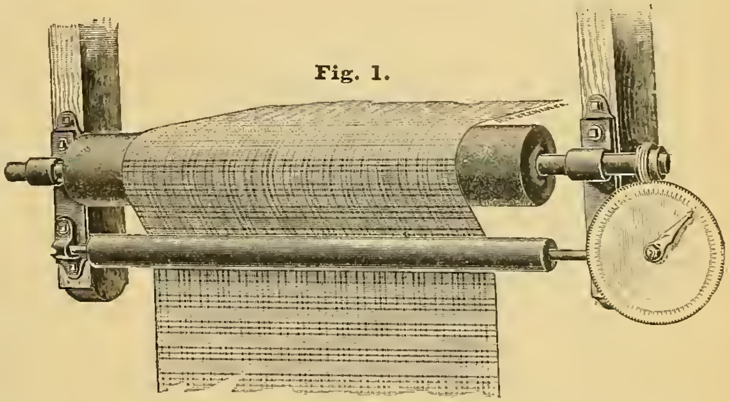
Although fabrics receive a perching, *i. e.* inspecting and measuring at the weave room, before they leave for the finishing room, yet said examination is, as a rule, not sufficiently reliable to have the finisher shoulder responsibilities, the same being more or less only performed for keeping the wage list of the weavers (find's) correct, or detect as quickly as possible imperfections in fabrics requiring at once prompt attention at the loom. In some mills a "sewing-in" department is connected with the weave room, whereas in others not, in the latter case the time required for correcting weavers' mistakes (find's) being then in turn charged by the finishing department against the fabric in question, *i. e.* the weave room and in turn against the weaver.

It will be advisable for every finisher to have each and every piece of fabric inspected by a responsible percher under his charge. As will be readily understood, a good light (a good N. E. light in connection with large, clean windows) is the most important requisite for the inspector to do this work, the other being a perch over which the fabrics are examined, and which consists of two rolls, usually attached to wooden hangers, fastened to the ceiling, or they may be put on posts in the room; in either case in such a manner as to bring the fabrics, when pulled over the perch, squarely in front of the window. In connection with 6/4 goods two persons as a rule attend to the perching, the inspector standing on one side and his assistant on the other side in front of the fabric to be examined, pulling the fabric slowly over the perch, both persons at the same time examining the fabric carefully as to imperfections. These may either be caused by carelessness of the weaver, imperfect running of the loom, poor yarn, etc.; however, no matter what was the cause, it is the work of the inspector to detect these mistakes which require later on fixing in the fabric, and when found, mark them prominently with chalk for the purpose of calling the attention of the sewing-in girls to such places, whose work it is to darn and fix up such places, giving to them also in connection with bad cases directions how to remedy them.

The aim of the inspector should be to bring the goods out as nearly perfect as possible, and at the same time to have as few allowances as can be had. When the face of a fabric has been examined, the same is done with its back. In some instances, in connection with light weight fabrics, the latter are examined from behind the goods, the inspector or more often his assistant, for this purpose changing his position by stepping in between the two runs of the cloth, which thus brings one of the runs of the fabric between him and the light, in turn enabling him to look through the fabric, and consequently readily detect any imperfection.

Fig. 1 shows in its perspective view such a cloth perch, having also a measuring dial attached, for registering the length of the fabric perched; the circumference of the large roller *i. e.* the measuring roller, being the ratio between the dial, worm gear and its circumference. The hand on the dial is held by a nut and spring and at the end of each piece of cloth perched, may be easily turned back to zero by the fingers, without changing any screw or nut. The dial which is nickel plated, and usually made to register sixty yards, is generally placed on the right hand side of the perch. It will be readily understood that the length of the rollers used, depends upon the

Fig. 1.



width of the cloth (from loom) made by the mill, the perch being built to suit. It also will be readily understood that in connection with narrow fabrics, *i. e.* 3/4 goods, one man alone can do the work.

When the inspector has thus carefully examined the fabric, and marked all imperfections, the piece is then rolled up and placed on a pile from which in time, it passes to the burling process.

BURLING.

The burlers, who are girls, and who usually work in connection with 6/4 goods, in pairs, together on a table, take the piece, and carrying it to their table, there unroll it and commence to examine the fabric, with its back up, for such imperfections as knots, bunches, runners, etc., using for this purpose both their eyes as well as their fingers, and in fact the latter more particularly.

The tables used for burling must be smooth, so that the burlers, when feeling for the knots or bunches, etc., will not come in contact with obstructions on the surface of the table, a feature which in turn would only create a loss of time, and in turn give rise to carelessness on the part of the girls by getting fooled.

The burling table should have its top fastened by hinges on one side to the framing, thus permitting the tipping of the top to any angle to suit the size of the girls; the top being held in this proper angle by suitable movable braces, placed on both sides of the table. This also permits the top to be let down level when the piece is finished, the girls then folding the fabric on the top of the table before taking it away. In some mills (although a question if advisable) the tops of the tables are covered with zinc so that a perfectly smooth surface is obtained. In this case however, care must be exercised that this covering, when wearing out, is promptly repaired, or the entire top re-covered to prevent damage to the cloth as thus burled over it.

The same as with any other hand operation, the use of the proper tool is of the greatest importance, and which tool in the present instance is the burling iron, which for this purpose should be ground flat on the sides and come to a sharp point, since if the sides are ground flat, the edges thus given the iron, will cut the threads easily and this with as little strain as possible on the threads; hence these irons should never be allowed to become worn on their edges, and neither as to point. Besides proper burling irons, a good pair of scissors are also needed by each girl, they to use them when cutting off knots, which never should be pulled off since by this procedure the respective threads in the fabric would become unduly tightened, and when released crawl back in the structure of the fabric, leaving an imperfection, *i. e.* a space without a thread, and consequently a chauce for an imperfection to show in the finished fabric.

All the knots which have been tied in the threads during winding, dressing, beaming, weaving, must be looked and felt for during burling, and carefully drawn by the girls to the surface and then clipped off, leaving the ends long enough so that no space without a thread will occur. Threads which are found loose on the face or back, caused by the weaver having tied in a broken end, should be cut off and not pulled off, especially so if the thread in question has been interlacing tightly; however, threads interlacing loosely should be pulled to their proper position first. A bunch must be drawn out a little at a time so as not to disturb or strain the thread to which it adhered, neither the surrounding threads. The same care must be exercised with runners, as caused by the filling having been drawn, for more or less space at the selvage, into the fabric.

After the back of the piece has thus been carefully burled, the face is next taken in hand by the burlers. Here the removal of knots is attended to with more danger than on the back, it being usually sufficient to draw the knots to the surface and leave them there for the shear to clip them off. Bunches in the yarn and runners of the filling will also require considerable attention on the part of the girls, in removing them carefully so no harm to the fabric is done. All places where runners have been taken out should be marked so that the sewing-in girl later on can examine such places to see if it has been done in such a manner as to cause no damage to the joining picks. In other words each knot or other imperfection is removed either from back or face, wherever most prominent or the easiest to get at it, when dealing with single cloth structures; whereas in connection with double cloth fabrics, the place, *i. e.* whether face or back, is properly defined by the ply of the fabric in which the imperfection is located, as will be readily understood from the construction of these fabrics. After the piece has been thus burled, the same is folded and placed on a pile in connection with other fabrics previously similarly burled, and from where, in time, it is then removed for the next operation of

DARNING OR MENDING,

or also called sewing-in, which as a rule is only done by experienced girls or women in that work, in fact the person must be, what we may consider, an expert with the needle, in order to do perfect work. The object of darning is to bring the goods up to perfection before they are allowed to undergo finishing. It is a good plan, where sufficient room is at disposal, to give each sewer-in the use of a perch for doing her work, since this will facilitate perfect work, again if the person knows weaving, such knowledge will also benefit her in her labor. On "fancy" work it is essential that the sewer-in should understand the colors as used for producing the various effects in the fabric and have a good eye for imitating the latter, taking adjoining patterns for reference, both as to the interlacing of the threads as well as the coloring, thereby making a nearly perfect affair of some of the most imperfect places, certainly work which requires experience as well as attention. On plain or mixes, the weave alone will only come under consideration, all kinds of sewing-in being then more or less regulated by the kind of final finish of the fabric; thus indicating that more exact work is required for a threadbare fancy fabric, requiring little, if any, finishing afterwards, than if dealing with a face finish fabric and where gigging, *i. e.* the nap thus raised on the face of the fabric, will cover many imperfections, never to be noticed in the finished fabric. The work however is tedious in the extreme and trying to the eyes, however experience comes to the aid of the person and after awhile imperfections are corrected to a nicety which formerly appeared hard or impossible to be remedied. It will be also a good plan for the overseer to regulate the work, giving the hardest styles to be mended to the most experienced hands.

With reference to some kinds of plain, face finished fabrics, the cutting out of good picks, in place of sewing-in a missed pick, is frequently resorted to, for the fact that the sewing-in of mispicks is generally found to be too tedious. To do this cutting out of a good pick in order to remedy a mispick requires a knowledge of cloth construction (weave formation) in order to know which picks have to be cut and which not, and unless this is well understood by the sewer-in, it is best not to attempt it, in fact it is no use for the sewer-in to attempt anything in the line of darning unless it can be made to look, in the finished fabric, sufficiently perfect that an allowance need not be made, otherwise the whole labor spent in mending the imperfection has been lost time, and consequent waste in money to the mill. Never attempt to do the impossible.

After the piece of cloth is mended, *i. e.* all mistakes possible to be corrected attended to, the same is folded and put on a pile with other fabrics previously treated in the same manner, to lie there until required for the fulling mill or washer as the case may be.

TACKING.

The Tacking of woolen fabrics for the fulling process means the stitching or tacking of the two selvages, face inside, either by hand or machine, and is practiced for two reasons:

First. It has been practiced since the last forty years with fabrics requiring flocking, in this manner keeping the flocks off from the face, most of which during the process of finishing the face would only be lost again; at the same time introducing flocks onto the face of the goods would vary the shade of the individual pieces, since the color of the flocks varies constantly, thus making it hard, if not impossible to match the goods for filling a case.

Second. Woolen manufacturers however have since then found by experience that in connection with fine face goods which have to run in the fulling mill for some time, tacking them, will protect the face of the goods from chafing during the fulling, the face is kept from being worn by contact with the heavy rolls, and anything that will protect the face of the fabric in this manner, cannot help but have a beneficial effect upon the general appearance of it in its final finished state. At the same time, the selvages are prevented from rolling or curling over, or from being caught and torn in the fulling mills, and light and delicate colors cannot be affected in exposed places by strong soaps; many stains, caused either by uneven distribution of soap, or such which would otherwise get on the goods during the fulling or washing, are avoided, and the goods are preserved in such good condition that it helps greatly in all the after-finishing processes. The matter of thus preventing the selvages from rolling or curling by means of tacking them, allows the combination of uneven weaves to be used more extensively in the construction of fabrics than would otherwise be practicable. If goods on which the filling is thrown more on the face than on the back, or vice versa, are not tacked, there is in most cases, more or less bother in fulling and the after-finishing processes. Another advantage of tacking is found in connection with piece dye fabrics, and there the tacking, besides being beneficial to fulling and scouring, at the same time is of immense advantage to get even dyeing, *i. e.* the goods taking the dye the same on the sides as in the middle of the fabric, and not to "shade-off," one of the hardest problems to overcome in connection with piece dyes. When woolens are run in the fulling mills or washers, after being tacked, the air inside the goods causes the folds to change position each time as they pass between the rolls, thus avoiding fixed creases or wrinkles and the consequent streaking of the goods. In addition to this, the goods will full much more evenly when tacked, than if not tacked, since when the goods are run in tubular form in the fulling mills, there is no opportunity for the sides to flop around loose in the mills and thus be more exposed to the air, receiving less pressure and heat than the middle, and in consequence not full as much as in the middle.

Tacking is also practiced in connection with worsteds, for washing, fulling or dyeing purposes, either one or all these processes being done more evenly if the goods are run in tubular form.

Tacking originally was done by hand, and in some mills this may yet be done, however, the proper way to do it, is by means of a sewing machine constructed especially for this work.

Tacking by hand has been and is generally done by boys, who, as will be readily understood, have to be watched closely in order that they do their work right. There are two ways of stitching the selvages, viz.: either take a stitch through the lists every three or four inches, using a continuous string of twine for this purpose, pieced out as the boy proceeds with his work, or run needle and thread simply through the two selvages and tie the string in a knot, cutting off the string and repeat the affair every three or four inches. By the latter method there will be less chance for the loops of the twine to catch in the fulling mill, besides quite a saving in twine will be made, while the work will be quite as effective, if not more so, than in the first mentioned case, for if the loops of the continuous end of twine should catch on a projection in the fulling mill, the twine will break and release quite a number of stitches, thus leaving the face of the fabric more or less exposed, the same as if the goods were not tacked at all.

The advantage of tacking by a sewing machine in place of tacking by hand, is that the stitches thus made are of uniform size, and at the same time small enough to answer the purpose excellently. A long chain stitch about ⅞″ long answers nicely for practically all classes of fabrics and it is not necessary to adjust the length of the stitch to each different fabric. The ordinary short stitches made on ordinary sewing machines which are not coarser than 4 or 5 to the inch, are not long enough for tacking goods which are fulled to any considerable extent. Short stitches of this kind will oftentimes cause the selvages to be severed from the body of the goods in the fulling process, or at best will felt in so tight that it will be impossible to pull the thread out. Short stitches will sometimes answer for worsted goods or some kinds of woolen goods which are fulled but little, but for the general purposes of tacking, a long chain stitch about ⅞″ long, has proved the best adapted of any stitches we know of. If any goods need to be stitched more open than this, the operator can easily leave open spaces at intervals by running the stitches outside the edge of the goods. This regular stitch prevents the thread from fulling in too tight; does not allow flocks to enter; allows enough air to escape to prevent the goods from ballooning up too much in fulling, but retains enough to cause the goods to change position each time they pass between the rolls.

There are two different types of sewing machines built for this purpose.

The one style of machine, and of which a perspective view is given in Fig. 2, showing the machine as built by the Curtis & Marble Machine Co., doubles

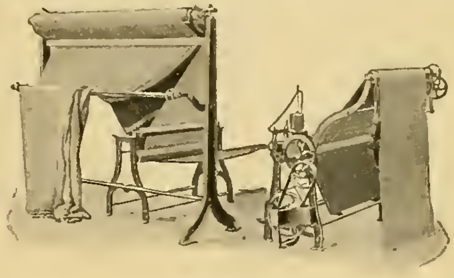


Fig. 2.

the fabric, and, after sewing the selvages together, folds the fabric in a pile, so that all the operative has to do, is to wrap the end around the piece, and place it in the pile with previously tacked pieces, ready for the fulling mill. The doubling in this machine is accomplished by pulling the fabric over a frame which stands upright about six feet, and has a roll at the top, over which the cloth is drawn. A friction attachment is supplied to this roll, in order to put tension onto the fabric and thus bring its two sides evenly together. An adjustable V-shaped or triangular frame runs slantingly from below this top roll to a point about 40 inches from this frame, and to about the same height from the floor as the sewing machine attachment. The end of the fabric is then pulled down and its two sides placed together below the triangular frame, previously referred to, and in turn brought forward, and into the action of a pair of feed rolls of the machine. The sewing is not started till about a yard of the fabric has been pulled through, and then the selvages are brought under the needle and stitched. The cloth then passes over a draft roll situated above the folder, and which takes the fabric from the sewing machine as fast as sewed and delivers it into the folder, which in turn folds it off nicely behind the sewing machine. An adjustable guide is provided to aid the operator in guiding the cloth under the needle straight and even, and this guide can be adjusted so as to stitch as close to, or as far away from, the outer edge of the goods as desired. Although, as a rule, the goods are tacked in a dry state, we may mention that if so required, the machine will stitch them when in a wet condition. After the fulling and washing are completed, by loosening one end of the thread the stitches may be drawn out. The doubling frame is readily adjusted for running different widths of goods, so as to always bring the selvages in line with the sewing mechanism. The operator controls the running of the machine by means of a foot treadle operating through a friction clutch. The standard sizes of these tacking machines are built for 72″, 80″, 90″ and 100″ wide fabrics from loom, wider or narrower machines however being built to order.

The other style of sewing machine previously referred to for automatically tacking, *i. e.* sewing the two selvages together is constructed minus the doubling and folding attachment for the fabric, but which machine, with a little care on the part of the operator, can be made also to do good work. Its principle of construction is identical to that of the common mill sewing machine, as used for sewing the ends of pieces together, when the fabric is threaded in a gig, napper, shear, etc., with the exception that the ring which acts as a feeder is extended into a drum, of the width of a doubled piece of cloth. This drum contains pins to hold the cloth in position and also a guide for the edge of the selvages, so that when the latter comes in contact with this guide, as the goods are fed to the drum and sewing machine, the sewing is sure to be done in the centre of the selvages. In order to operate this style of a sewing machine to its best advantage, be sure that the piece of cloth to be tacked is laid down back of the operator, in line with the needle bar of the machine, and this as far back as space will allow. This arrangement will bring the two selvages on a line and in turn save the operator much pulling, in fact, will permit him to double the fabric, ready for sewing, as fast as the machine can handle it.

After the fabric has been tacked, roll it into a compact bundle, and place it on the pile with other pieces, thus previously treated, until in its turn it is taken to the fulling mill.

FULLING.

The purpose of fulling is to obtain the shrinkage required for the proper length, width and weight of the fabric, at the same time putting the structure in such a condition as to permit the successively following finishing processes to be properly performed; it adds strength to the fabric; loosens any superfluous dyestuff matter adhering to the fibres, as well as all oil, grease, etc., added to the wool to permit carding and spinning, size added to the warp yarn for proper weaving, etc. This loss in weight of the fabric, as well as any further loss to the cloth during scouring, gigging, napping, shearing or any other finishing process, must be carefully taken in consideration by the finisher, with reference to shrinking length of fabric, in order to obtain proper final weight of cloth required.

Fulling is based upon the felting properties of the wool fibres, as explained on pages 31 and 32, a study of which will greatly assist in a clearer understanding of the principle underlying this process. The felting capacity of the wool fibre is, during fulling, called into action by bringing an alternating pressure to bear upon the moist fabric, *i. e.* wool fibres, in connection with a certain amount of heat. This alternating pressure is produced in the fulling mill by means of a set of rolls, between which the cloth is made to pass. These rolls vary in size in the various makes of fulling mills, however about 8″ face $\times$ 18″ dia. is a fair average of their dimensions. The face of the rolls is generally of wood or hard rubber, while the rest is of iron, very few all iron rolls being used. In most makes of fulling mills smooth face rolls are used, however in some makes the lower one of these rolls is supplied with flanges and the upper roll made to run inside of them, again in some foreign makes of machines, the shape of these rolls is changed (this subject is explained in a special article later on). As the weight of the top roll is insufficient to exert sufficient pressure upon the cloth under operation, elliptic springs are used to increase this pressure. The aim of the fuller should be to put as much cloth as possible between these rolls, since this will act as a cushion, and the pressure will thus be more effective. To keep the cloth running in the proper position in the mill, guide rolls and a guide frame are placed in the mill, the latter in some instances being made to act as a stop motion, provided the run of the cloth gets, for one reason or the other, snarled up at the bottom of the mill, and thus causes a knot to form, which on account of being too large to pass through its guide ring in the frame, will lift the whole frame and thus cause an outside arm, through proper lever connections to stop the machine, in turn preventing the cloth from being worn tender in places, or causing holes to be made, as would be the case if the run of the cloth was arrested, and the rolls keeping on turning, and consequently acting continually on one place of the fabric.

The pressure thus exerted by the rolls upon the fabric is, however, only in one direction, and which is laterally, for which reason the fabric if only exposed to this pressure, would shrink only widthways, the strain put upon the fabric while being pulled along by the rolls, through guide rings and from the bottom of the mill, having a tendency to rather stretch the fabric lengthways than shrink it. Thus means had to be provided in the construction of the fulling mill to counteract this tendency, and simultaneously exert sufficient pressure to cause the fabric to also shrink in its length when so required, and what is accomplished by providing a device known as the trap or clapper to the mill. This contrivance is placed directly back of the rolls, and in such a position that the fabric will have to pass through this box-like affair before allowed to drop to the bottom of the mill. These boxes vary in length in the different makes of fulling mills, however, they should not be allowed to fall below 18 inches in length. The top of the trap is firmly fastened to a shaft, which extends to the outside of the fulling mill, and is also supplied with an arm, which is fastened so as to stand in the same direction as the top of the box, which is fastened to the other end of this shaft. This cover is made to fit inside of the box, being of a shape to permit its easy working up or down. To the end of the outside arm is fixed a rod, which hangs down, being arranged to allow weights to be attached to it. The pressure required to lift the top of the box must thus be strong enough to also lift this arm with whatever weights are attached to it, and by this means the pressure is brought to bear upon the fabric. At the same time, by means of changing the weights, the pressure required is regulated. The goods, after being pushed into the box by the rolls, accumulate until the pressure is sufficient to raise the top of the box, and thus allow the goods to drop again to the bottom of the mill, the goods being thus shrunk in length according to requirements.

Again there is another class of goods, where instead of shrinking the goods in their length, they are required to stretch a certain amount, making them come from the fulling mill rather longer than when they entered it, flocks in many instances being relied upon to bring them up to a required weight.

Different pieces ought to be sorted, because every different structure of cloth will full differently, and if two pieces of a different construction are put into the mill together, one will come up quicker than the other, leaving one running alone, causing it to full slower, run longer, and in turn become weaker than if run with one of the same style.

The moisture required for felting is added to the fabric in connection with a good soap, which in turn also exerts a softening influence upon the fibre, besides being useful in removing the emulsion which has been given to the wool stock in the picking room in order to be able to card the wool and spin the roving into yarn. Again it will keep the goods from chafing and wearing off too much during the fulling process. The requirement for a good fulling soap is a hard soap, which is free from caustic, *i. e.* is neutral, for caustic, if present to any extent in the hard soap, is sure to injure the colors more or less, if not the fibre, and once the color has been injured, it is impossible to remedy the injury. The strength of this soap for fulling purposes depends upon the fabric handled, the same however must possess sufficient body to turn out the grease from the fabric, and hold it in such a state that, to all appearance, it might be scraped off the cloth any time, to the end of the process. If the soap is not heavy or has not sufficient alkali to start the grease, dirt, etc., in the cloth, cloudiness and dullness of colors are sure to result. For fabrics with extra bright colors, and which naturally have been more carefully handled from the fibre to the woven cloth (cleaner all around), use a good neutral soap liquor, lukewarm, pour slowly on the fabric, not too much at a time, the weight of the goods determining this point, using about one pound hard neutral soap to a gallon of water, and about 9 gallons of this prepared soap liquor to about 45 lbs. of goods. In solid colors, as mentioned before, a very small quantity of alkali might be used, if any difficulty found in forcing out the grease, dirt, etc. Some claim that alkali assists fulling, but the proper way is to only help to loosen the grease and dirt by means of it, the fulling not to commence until the grease and dirt in the fabric become loose. One pound of good soap used in this manner will do more towards getting the goods clean than double or more the amount used later on in the washing machine, by preventing the dirt from being first felted into the cloth structure, making it hard to get rid of in washing afterwards. Thin alkali soaps, if used, will run the dirty grease and dyestuffs through and through the fabric, staining the structure and causing the colors to become dead. There will be found a vast difference in the finished fabric between starting the fulling in a greasy condition or when this grease has been loosened, this being the reason why very delicate fabrics are first washed before brought to the fulling mill. Heavy goods and fabrics constructed with an extra high, heavy texture, and such as carry in their body a considerable amount of grease and dirt, will frequently be found to full with difficulty, for which reason, it is well to also wash such fabrics previously to fulling. This washing does not necessarily have to be as thorough as that which succeeds the fulling, however it has to be sufficiently vigorous to loosen up the foreign materials in the fabric, and give the fibres an opportunity to come in contact with the soap during fulling, and thus to get all the benefit which is to be derived from moisture, heat and friction.

It might be thought that washing the goods before fulling would make the latter operation, so far as time is concerned, shorter, but this is not so, however, the distinct advantage comes in the appearance of the finished goods, together with their handle or feel, and brighter colors obtained, all of which should repay the extra expense of a first washing of such fabrics. This previous washing will also aid when dealing with fabrics in the construction of which low grades of carbonized wools have been employed, and when there is a considerable difference in the amount of time required for fulling these goods when they are washed previously, and when they are not. If they have been thoroughly washed for three or four hours with a good supply of soda alkali, previous to fulling, the time required for the latter operation will be reduced nearly one-third. Again if shoddy is extensively used, as it generally is in these low grade woolens, then the washing before fulling will in many instances give the fabric the appearance of all wool cloth, pretty nearly covering the adulterant, however, the shoddy in this instance has got to be in the right condition, that is, if it is carbonized, as it usually is, it must be washed free of sulphuric acid, since where this free acid is present, and the goods are brought in contact with a soda alkali, the tendency is for the formation of a combination upon the surface of the fibres, which will act injuriously in connection with the fulling, since it is insoluble in water unless the water is considerably heated.

The water as used in preparing the soft soap for fulling (and consequently also for scouring purposes) must be also taken into consideration, since if said water contains lime, salts of magnesia, etc., it will decompose the soap, and consequently interfere with the fulling as well as the cleansing of the goods thus treated. It is thus a very important point to determine the quality of the water to be used in preparing the fulling liquor, or to be added to the fabric if so required, so that the proper source of any trouble in further departments of the finishing room is properly accounted for. To commence with, if the fulling liquor is made up of hard water, as mentioned before, the soap in this instance is rendered partly useless. Some finishers may claim that the excess of soap, always given for a bath, will counteract the effect, but this is a mistake, not only on account of the loss of soap, but also that what is left is lime soap, which is of little or no use. Such soap during fulling (as well as scouring) will continually separate, and the cloth will, despite all efforts, have a harsh, raspy, dry feel. Examining the cloth during or after fulling will show no soap froth, but in place of it a thin, weak lye; again soap has to be continually added, and even with this expensive remedy, the cloth will continue dry. After fulling then comes the difficulty of trying to remove these additions by excessive washings, and finally the result, a hard boardy fabric, too smooth to the feel or touch of the hand. The more fat there is used in the manufacture of the soap, the worse is the effect of hard water. Water only slightly hard, may be softened by boiling, whereas very hard water, provided it is the only one at our disposal, may be softened by boiling, provided bran is added and which then is removed before using. Wyandotte textile soda is an excellent medium for preparing hard water for fulling and scouring purposes.

In dealing with a fabric requiring gigging or napping, the influence of using a hard water is everlasting, for if the wool fibre is rendered hard by the water, the felt cannot be easily loosened on the gig or napper, nor can it, under any amount of work, be made as open and soft as it ought to be, or as it would be provided soft water had been used. If such a case occurred, the only way to remedy the trouble somewhat, is a free use of moderately warm condensed water. Soft water will even harden the goods if they are allowed to remain any length of time in a wet condition, and naturally hard water, under the same conditions, will aggravate this trouble. This explains why any piece of cloth if gigged or napped at once after fulling and scouring, can be handled easier, quicker, and will be more effective than if the fabric is allowed to lay in a wet condition for hours, or possibly for days. Now if this is the case when using a soft water, how much worse would it be if using a hard water. For this reason it must be remembered that the fulling of fabrics should under no circumstances be too far in advance of the gigging or napping process—both must go hand in hand for good results in the finished goods—and if for any reason the napping or gigging department falls behind the fulling department to any extent with their work, then the goods, after scouring, are better dried temporarily, especially when dealing with fabrics calling finally for a soft, pliable, velvety finish.

After the goods have been soaped in the fulling mill, and allowed to run long enough for the soap to spread and evenly wet the goods, the time for their first examination has arrived. The goods running in the mill should be examined at stated periods to see if they come up even both ways, for if lacking in either respect, this must be attended to at once. If the goods do not come up in length as fast as they should, more weight must be applied to the trap, but if the supply should be exhausted, as will sometimes happen, then the pressure of the roll must be lessened, and in this way the shrinking sideways retarded so that the goods may have a chance to come up lengthwise by the time they have sufficiently shrunk sideways. After thus examining the goods, it is a good plan for the fuller to scrape off, more or less, any soap which has spattered on the sides and other parts inside of the fulling mill, and put such soap back on the goods, thus not only keeping the inside of the mill in a better condition, but at the same time use the soap to its full value. Soap if deposited in quantities and for time on the metal parts of the machine tends to corrode them, and if left on them to dry, will form a hard scum which in time will become detached and fall on the goods, and in passing through the rolls is apt to do damage, however slight it may be. The accumulation of soap on the wooden parts of the machine will exert a tendency to warp them more or less, a feature readily seen when the doors of the machine will shut hard, hinges rust off, etc.

If goods are flocked, all the flocks and waste matter coming from the mill must be taken care of, *i. e.* away from the machine—to wherever they belong.

The sewing together of the ends of the fabric or fabrics, after they are put into the mill must be carefully done, making the seam firm and smooth, whether made by hand or by machine. In connection with hand stitches, take small and even stitches, whereas in connection with machine seams, see that the seam is not made too deep into the cloth and thus bulky, in turn creating a pounding each time such a seam passes between the rolls. Have the protruding ends of the seam turned inside, for this will greatly help its smoothness.

Pressure in a fulling mill for shrinking the fabric either way must be put on easy and a little at a time; this will be found far better than putting on full pressure at once, for the fact that if shrinking the cloth too suddenly, good felting is lost sight of. By taking this precaution, the goods, when finished, will not look starved, nor handle hard and wiry. If the goods shrink too slow in width, a little additional pressure put onto the top roll, will help, the same as additional weights on the trap will help to shrink the fabric in its length, and vice versa in both instances.

Provided fabrics come up continually too fast in their length, it is a good plan to somewhat draw down the rods of the elliptic springs, and thus increase the pressure of the rolls. But if this does not help, then the best plan is to double such pieces in the mill, thus increasing the volume of cloth at one time under the influence of the rolls (more pressure exerted) and at the same time shortening the piece by one-half, and when consequently the goods will be under the roll oftener than if they were single.

On light weights, two (or three) pieces side by side are generally run in the mill, in this way not only increasing the production, but at the same time the goods will run better all around.

If goods are fulling too long, take them out and reverse the ends in the mill, and when they have run about half time, shake them out thoroughly from end to end.

Heat is an agent necessary to the felting of the wool fibre, however care must be taken to avoid too high a temperature during fulling, since such would seriously injure the colors—about 85° F. is a good average, possibly 90° F. as a limit—again there are some classes of colors very sensitive to heat, and which consequently must be treated at a lower temperature according to fastness of color to fulling. Heat influences moisture, and consequently as the fabric gets warm in the mill, a good deal of the moisture then in or on the fabric will evaporate, and since it will not do to let the cloth run too dry, *i. e.* short of soap (since then goods will chafe, resulting in a loss in weight, creating more flocks — neither will the fabric thus fulled, gig or shear clean and clear) the fuller, as soon as he sees that the pieces are not as wet as they should be, must at once add a little more soap, however, remembering that it will not take much to bring them again to their proper moisture. If it should occur, either through carelessness or otherwise, that too much soap has been applied to the fabric, then the best remedy is to run at once, and quickly, a dry fabric in the mill, and which at once will absorb any surplus of soap from the fabric under operation, though it must be clearly understood that without sufficient soap and heat, goods will not felt—shrinking may be got without felting, but this is not proper fulling.

As soon as the fabric is up in its width and length, the fuller must test the soap in the fabric, and in every piece provided two or more fulled at one time, to see if it has turned watery or not. When the pieces are handled, and a gentle squeeze given, a little free soap should appear; this is a test that sufficient soap has been used, or that the soap has not lost its vitality by too long fulling. This test should not be omitted, since it will save trouble. In any case where the soap does not show up as thus mentioned, give the pieces an additional dipperful of soap before taking them from the mill, which will then help them in the washer.

When the fabrics are then taken out of the mill, remove the tacking strings, provided the goods had been tacked, after which, except they can go at once in the washer, open them out so that the air can get at all parts of the fabric, since they are then warm and if left lying in piles would start the colors and thus dullen them. Such an airing, in connection with goods to be piece dyed, will also prevent the formation of streaky and cloudy places in such fabrics.

The general construction of

A Rotary Fulling Mill is shown in Fig. 3, the same being a side elevation of the machine as built by the James Hunter Machine Co., having what is known as the Ryan Stop Motion applied thereto. This stop motion is used on fulling mills, where low grade or hard fulling woolen fabrics are treated, and in which case the work is facilitated by running the goods under operation, in double "runs," side by side, through the squeeze rolls of said fulling mill. When the cloth is run in this manner, one run is very apt to gain on the other, resulting, in one of the runs, in the formation of a short loop, as distinguished from the long or loose loop as should be the case in both runs. This short run will soon stop the progress of the cloth in the fulling mill, but as the latter continues in its motion, the rolls of the machine will soon wear out or burn the cloth, in places where

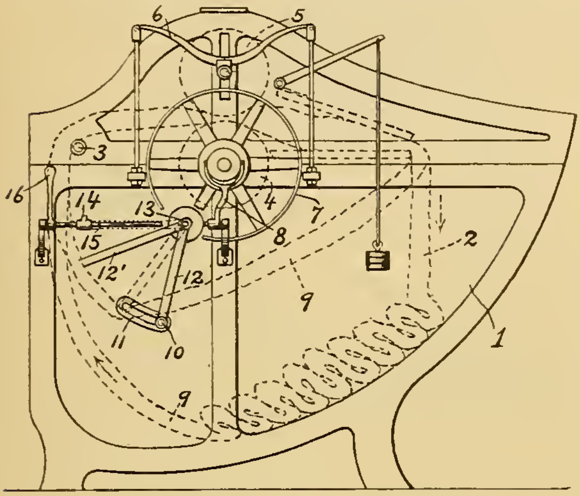


Fig. 3.

said rolls come in contact with the cloth, a feature which of course spoils the goods.

The object of the stop motion, therefore, is to automatically stop the fulling mill when such a short loop is about forming itself in one of the runs of the fabric and thus prevent damage to the goods, the stop motion acting before the loop in question becomes sufficiently short.

Referring to the illustration, 1 indicates the casing of a fulling mill, in which the cloth 2 travels during the operation of fulling, in the direction of the arrows. As the cloth comes up from the bottom or floor of the mill, it then passes over guide roll 3 to and between the squeeze rolls 4 and 5, the latter being in frictional contact with roll 4 by means of the elliptical springs 6 (one on each side of the machine). Roll 4 is positively driven from a pulley 7 when the latter has a clutch 8 thrown in with it.

The runs of cloth pass between these two squeeze rolls 4 and 5, side by side, and it often happens, from one cause or another, that one run will gain on the other in passing through the machine, which in time causes a short loop, as indicated at 9, to form itself and if the latter continues to shorten, it would finally shorten said short loop of the cloth shown at 9 to such an extent as to stop the motion of the cloth, which then would remain idle, and in one place under the action of the squeeze rolls 4 and 5, which by revolving under pressure on one portion of the fabric for some time would then soon wear out or burn holes in said portion of the cloth.

The stop motion, to prevent these short loops from forming, is composed of a rod 10, extending across the width of the machine and having its end in slotted pieces 11, one on each side of the machine. Attached to the rod 10 is an elbow lever 12 and 12′ as pivoted at 13. When a short loop begins to form, it will soon become tight enough to press against the rod 10 and move it in the slotted pieces 11 into the position shown in dotted lines, thus giving movement to elbow lever 12, 12′, and cause its arm 12′ to move against an arm 14, fast to the shipper rod 15. This action gives a partial rotary movement to shipper rod 15, which will take the clutch 8 out of contact with the driving pulley 7 and thus stop the rotation of the fulling mill.

When the short loop is afterwards straightened out again by the fuller, tne elbow lever 12, 12′, will drop to its normal position.

The stopping of the machine, when so desired for any cause whatever for example examining condition or width of fabric, taking fabric out of the machine, etc., is done by means of handle lever 16 as also attached to the shipper rod 15, this being done without interfering with the stop motion arrangement previously described; handle lever 16 in turn being also used to again start the machine.

Another Stop Motion for a fulling mill (showing in this case another make of a fulling mill) is shown in Fig. 4, the same consisting in an automatic belt shifting mechanism for automatically stopping the operation of the mill when a knot or other obstruction passes between the squeeze rolls thereof. The illustration shows a front elevation of a part of a fulling mill, having this stop motion applied thereto.

The frame of the fulling mill consists of parallel standards 1, connected at their upper ends by a cross bar 2; 3 designates one of the squeeze rollers, supported in bearings of the frame standards, and above this roller 3 is located a lever 4, fulcrumed on a bracket 5, secured to the outer side of one of the brackets 1. The inner end of the lever 4 is supported in a loop 6, depending from the cross bar 2, of the frame, and upon the lever 4 is mounted the other squeeze roller 7, which is in normal condition during the running of the machine, parallel to the lower squeeze roller 3. The outer end of the lever 4 extends beyond the framework of the machine, and is connected pivotally to the upper end of a rod 8, the lower end of which is pivotally secured to one end of a latch bar 9, which is centrally pivoted to the

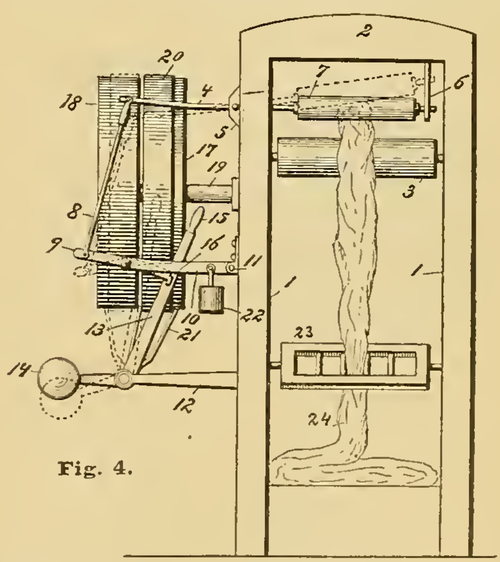


Fig. 4.

outer end of arm 10, the inner end of which is pivotally secured to bracket 11, projecting from the adjacent standard 1 of the machine.

Below the arm 10 a bracket arm 12 projects from the standard 1, and to the end of the arm 12 is fulcrumed a bell crank lever 13, the short arm of which has a weight 14 attached thereto. The long arm of the bell crank lever terminates in a handle 15, and below the handle a catch 16 projects from the lever in position to be engaged by the free end of the latch 9. This lug or catch 16 is of a length equal to the combined thickness of the bar 9 and arm 10, so that the latter will rest upon the lug after the latch bar 9 has been disengaged therefrom. 17 and 18 respectively designate the fast and loose pulley of the machine, and which are mounted on shaft 19. 20 indicates the driving belt and 21 a belt shifter fork, secured to the fulcrum point of the bell crank lever, its fingers being adapted to engage the edges of the belt to shift the latter from one of the pulleys to the other. Suspended from the pivoted arm 10 is a weight 22, which serves to hold the latch 9 in contact with the lug 16 of the shifting lever. 23 designates the guide, through which the cloth 24 passes from the bottom of the fulling mill to the squeeze rollers.

The operation of the mechanism is as follows: The cloth 24 passes from the guide 23 to the squeeze rollers 3 and 7 and from thence to the fulling mill proper for treatment. As long as no knots, kinks, or other obstructions are encountered during the run of the cloth in the fulling mill, the squeeze rollers 3 and 7 revolve and the parts of the mechanism retain the positions shown by the full lines in the illustration. If, however, the cloth contains a knot or kink, the passage of such obstruction between the rolls 3 and 7 will cause the lever 4 to tilt on its pivotal support 5, to the position shown in the dotted lines, thus depressing the connecting rod 8 and the outer end of the latch bar 9, thus disengaging the inner end of said latch bar from the lug 16. As soon as the latch bar 9 is disengaged, the weight 14 throws the shifting lever 10 outward, causing in turn the fork 21 to shift the belt 20 from the fast pulley to the loose pulley to stop the fulling mill. At the same time the arm 10 drops against the lug 16, which supports it until the parts are restored to their normal position. After the obstruction has been removed the parts are returned to their normal position and the operation of the fulling mill is resumed.

A description of the construction of

A Foreign Make of a Fulling Mill is shown by means of Figs. 5, 6 and 7; and of which Fig. 5 is an end view of this fulling mill, with the principal doors of the machine removed, in order to more clearly show its interior construction. Fig. 6 is a longitudinal sectional view of the machine, and Fig. 7 shows four different forms of squeeze rollers, having profiled working surfaces.

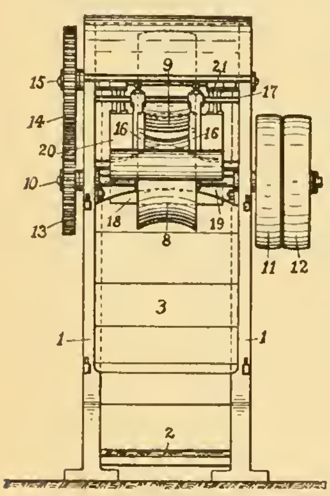


Fig. 5.

The frame of the machine consists chiefly of the two side parts 1, connected by the stayrods 2, and is closed on the under side by the feather and tongued boards 3, fastened to the inner flanges of said side parts 1. The upper part of the machine is likewise closed in order to keep out dust and other impurities. Admission to the interior of the machine is gained at the front by means of a double door 4 and an upper door 5; and to the rear of the machine by means of horizontally swinging doors 6 and 7.

The efficiency of any fulling mill greatly depends upon the squeeze rollers 8 and 9, which in this make of machine have profiled surfaces, so arranged as to form a passage or passages between them deeper in cross section at their middle than at their ends. The one end of the shaft 10 of the lower squeeze roller 8 is provided with a tight pulley 11 and a loose pulley

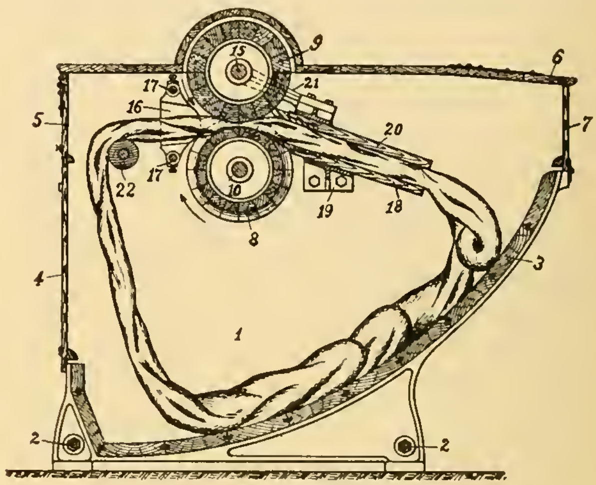


Fig. 6.

12, and the other end of said shaft 10 carries the wheel 13, meshing in turn with the wheel 14, seated upon the shaft 15 of the upper situated squeeze roller 9.

16 are two guide boards, adjustably seated upon the rods 17, placed in front of the squeeze rollers 8 and 9, while behind the latter is arranged the trap or clapper, consisting of the stationary bottom 18, carried by the bracket 19, and the swinging cover 20, attached by arms 21 to the shaft 15 of the upper profiled squeeze roller 9.

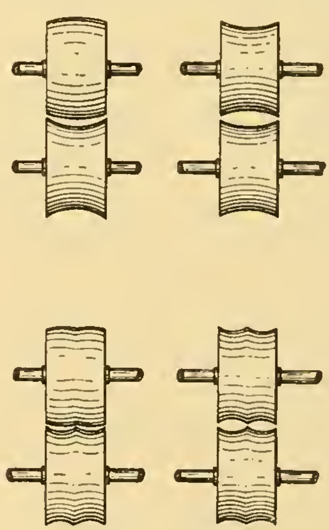


Fig. 7.

It will thus be seen that with the exception of the profiled squeeze rollers 8 and 9, this fulling mill is identical in its construction and operation with such as built here, the fabric (its end sewn together, in an endless string of cloth), after the machine is set in motion, being drawn by means of the friction of the coöperating squeeze rollers 8 and 9 through said rollers and in turn pressed into the trap or clapper 18, 20. On leaving the latter, the fabric drops to the bottom of the machine, and in turn is drawn up again over the small guide roller 22, in order to enter the squeeze rollers 8 and 9 anew. This cycle of operations comprises the operation of fulling and is continued until the fabric has been fulled to the degree desired.

Giving the squeeze rollers 8 and 9 profiled surfaces as shown (other similar shapes can be substituted) by means of the four diagrams in Fig. 7, is claimed to have for its purpose, *i. e.* advantage, to concentrate the cloth in the central part of said rollers, similar to a hank, so that it will full better in its width, the inventor of these profiled surface squeeze rollers (the most prominent builder of fulling mills in Germany) at the same time claiming that common cylindrical squeeze rollers will have a tendency to cause the fabric to broaden out toward the ends of the rollers, and which cannot take place with these new squeeze rollers, since the profiled working surface of these rollers concentrates the mass of the cloth under operation, more or less, in or toward the centre. The builder of these fulling mills further claims that the consequence of the marked concentration in the central part of the curved surface of the rollers is a more elastic and effective pressure of the upper squeeze roller on the cloth, and that this is another cause for the fabric fulling widthways more rapidly. Another advantage claimed for these profiled rollers is that they will cause the different layers of the fabric or fabrics under operation to slide one over another and thus cause the creases of the fabric to change their position as often as the fabric is passing between said rollers, owing to the different circumferential velocities of the working surfaces of these rollers. Still another advantage claimed for these rollers is that in consequence of the friction between the different parts of the fabric passing through the profiled rollers a better felting of the former is obtained.

The Hammer or Beater Fulling Mill. This is the original fulling mill, the Rotary Fulling Mill, as previously explained, and which is the fulling mill for woolen goods of to-day, being a more modern machine, having first come into use about the year 1820. This Hammer fulling mill, is at present chiefly used only in connection with fulling short length, all wool and woolen and cotton fabrics, such as shawls, blankets, underwear, knit goods, socks, etc., although in few special instances we may still meet with it in fulling heavily felted woolen goods.

The pressure to the fabric, necessary for felting the fibres by means of the hammer or beater fulling mill, can be obtained in two ways, viz.: such makes of machines in which the beaters, as hanging suspended from the frame work of the machine, are raised and lowered vertically by means of a roll having four projections on it, and which in turn engage projections on the beaters; or any similar arrangement for alternately raising or lowering said beaters may be used. There are two beaters used for each trough as holds the cloth under operation, said beaters working alternately, they being at their lower ends which come in contact with the cloth to be fulled step-shaped, at an angle of about 45°, and by means of which shape they impart to the fabric under operation a rolling motion, by means of which different portions of the fabric will continually come under direct operation of the beaters.

In the other construction of these kinds of fulling mills, the beaters are operated in a more or less horizontal direction (with a corresponding change of the trough) by means of suitable crank and lever connections; this latter style of a hammer or beater fulling mill having been illustrated and explained on pages 242 and 243 in the chapter on Knitting.

FLOCKING AND FLOCK CUTTING MACHINERY.

Flocks, if carefully handled, need not be a detriment to the fabric, although the latter, *i. e.* flocked goods, are always treated with more or less suspicion by the commission merchant and clothier, as well as by the consumer, possibly for the fact that flocks and the process of flocking the goods do not receive the care they should.

One of the disadvantages of flocked goods frequently met with, is the tendency of the flocks to drop out the fabric and gather in the lining of the garment; for this reason such garments as are lined, as coats, for example, have their lining loose at the bottom, so that whatever flocks work out of the fabric during wear, will drop out of the garment and not get a chance to lodge in the bottom seams of the lining. However, when flocks are thus coming excessively out of the fabric or garment (some certainly will always more or less come out), it is a sure sign of an error somewhere, either poor flocks, a wrong way of flocking, or more flocks used than is consistent with the structure of the fabric under operation, etc.

With reference to poor, *i. e.* low, cheap grades of flocks, one point is sure, and that is that these cheap grades of flocks are the most expensive in the end, since there is more waste in the first place, and in addition an excessive amount of these low grade flocks must be put on the goods to bring them anywhere near the weight wanted. Thus the necessity of using an excessive amount of flocks in order to bring the fabric under operation up to its required weight, will cause the flocks to get on the face of the goods, no matter how well they are tacked, and this, of course, lessens the attractiveness of the face of the goods. Flocks certainly are an adulterant to woolen fabrics, they are added with a view to get, in proportion, for this inferior article, the full value of the fabric, and as with all such adulterants, only the best should be used.

However, another important feature to be taken into consideration, besides the grade or quality of flocks at hand, is the structure of the fabric to be flocked, for the fact that flocks will not felt as readily to goods containing a considerable amount of shoddy, mungo, extract, waste or cotton, as to a fabric made of a good wool stock, where the wool fibres (may they be what we term wool or shoddy) have plenty of felting power. Some authorities quote: "Use good flocks with already adulterated structures, and poor flocks with pure wool structures." This may be all right provided a poor lot of flocks, by carelessness of the buyer is already in the mill, but to buy a poor grade of flocks for the sake of trying to save money to the mill, is a poor policy, the difference in price being too small an item and the cost of trying to use the poor flocks will certainly equal if not exceed the saving in the first cost of the flocks. At the same time let us mention that even with good grades of flocks in a mill, only the best can be used with lower grades of fabrics, for example, cotton warp goods, termed more generally union cassimeres, where the warp is mostly all cotton—with a fancy woolen thread possibly now and then introduced for a fancy effect—and where the filling is a mixture of a few per cent of wool, and any amount of per cent of shoddy, waste, mungo, or cotton. To try and stick a poor grade of flocks on such a structure can only result in failure, for in most cases a considerable amount of the flocks will sift out of the goods before they leave the mill, to say nothing of what happens afterwards during the manufacture of the clothing, and the wearing of the garment. There is nothing to retain the flocks, they have nothing in them to make them adhere to the structure on which they are simply pasted, and stay on while wet, but the moment the goods are dry, they drop off; whereas a flock which has felting qualities will be more apt to become part of the fabric, having more or less sufficient power within itself to do so.

This naturally leads us to the question of how to distinguish good flocks from poor flocks. In answer we must admit that it is a hard matter to determine the value of a lot of flocks until the same is tried, for even if the flocks have been made of good stock, it is possible for them to be spoiled in the process of cutting, and for this reason flock cutting machinery must be kept in good condition, for anything which will tend to grind instead of cutting the stock, *i. e.* the fibres, will at the same time destroy the felting properties of the flocks thus produced, the best of stock in this manner being frequently made practically worthless. Thus we see that the first and most important element in successful flocking is (1) the quality of the stock, and (2) the proper cutting of the same. This feature of a scientific cutting of the stock into flocks is readily seen by the value of what is known as shear flocks. These flocks are the clippings of the protruding ends of the nap obtained in shearing face finished goods or of protruding fibres of the threads in connection with threadbare finished fabrics; and since such flocks are cut most carefully at the process of shearing, they naturally retain all the felting capacity of the fibres.

The stock to be cut is of two kinds: (1) rags, which have to be first cut into small pieces on a rag cutter, previous to being submitted to the flock cutter, and (2) mill waste of every description, like gig flocks, sweepings, etc., which do not require handling by a rag cutter; however no matter what stock to be used, it must be first well cleaned of all such things as nails, pieces of metal, or any other hard substance, etc., before cutting, since otherwise the blades of the flock cutter would get ruined. This cleaning of flock stock is done by running the latter through a flock renovator, where the stock is not only opened and put in the best condition for cutting, but all foreign, heavy substances, as previously referred to, will fall to the bottom of the machine and not go through with the stock, and in turn spoil the blades of the flock cutter. This machine can also be used for blending and mixing several grades of stock, mixing up shades, as well as for thoroughly opening and dusting flocks which have become caked together in the bale from dampness, long standing or any other cause.

Of the accompanying illustrations, Fig. 8 represents the Curtis & Marble reversible rag cutter for preparing rag stock for cutting into flocks. This machine has blades about 15″ long made to work on the same principle as their flock cutter, of which an illustration and description is given later on. The blades in both the cylinder and the bed, are plated with steel on both edges, so that the cylinder may be run first in one direction and then in the other, the reversal of the motion of the cylinder rendering all the blades, in both cylinder and bed, self-sharpening. When one edge of the blades gets dull, the feed apron is taken off and put onto the other side of the machine, and the cylinder is then run in the opposite direction. The machine cuts the stock up into narrow strips or pieces about ⅜″ wide, leaving it in good condition for feeding into the flock cutter, and has a capacity of 2000 to 3000 lbs. a day, according to the kind of stock. The usual speed of the machine is from 250 to 300 revolutions a minute.

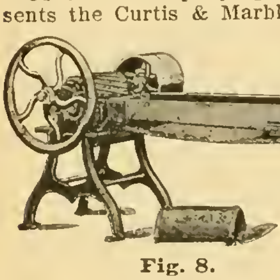


Fig. 8.

Fig. 9 is a perspective view of the flock renovator as built by Curtis & Marble, the object of which machine has been referred to before. The stock is fed into the small end of the cone from the hopper, as shown by the dotted lines, and after being opened is blown out by the fan through the outlet at the large end; the machine being usually arranged to blow the stock into a small room partitioned off for the purpose. The usual speed of the machine is from 800 to 1000 revolutions a minute.

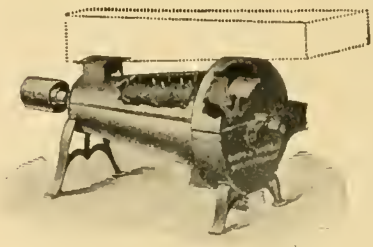


Fig. 9.

Fig. 10 illustrates the Curtis & Marble reversible flock cutter, *i. e.* the machine for transforming the flock stock as coming from either the rag cutter or flock renovator, into the product known as flocks. The special features of the machine consist in means for making the cylinder reversible and the blades self-sharpening; in the arrangement for feeding in the stock, and vibrating the cylinder; and in the mode of holding and adjusting the blades in the bed. The vibrating attachment prevents the cylinder from running in one place and wearing grooves in the blades.

In flock cutters where the cutting cylinder is made to revolve continually in one direction, the cutting edge of the blade soon becomes dull, and simply grinds or mashes the flocks; the only remedy in such cases is to frequently grind or sharpen the blades, which, of course, consumes much time and involves considerable expense and trouble. In the machine shown in the illustration, this frequent grinding is done away with, since the peculiar construction of the blades, the reversible feeding device and arrangement of the discharge orifices, render the blades self-sharpening. There are sixteen blades, 28″ long, in the cylinder, and nine blades in the bed. The central portion of the blades is iron, covered on each side with a plate of steel, welded onto the iron and hardened, so that the central portion will readily wear away and leave a steel cutting edge on each side. As the machine is used in cutting flocks, the natural consequence is that each of the blades is dullened at one edge and sharpened at the other. By means of the driving belts, the cylinder is made to revolve in either direction at will, allowing the sharp edge of the blades to be always used for cutting the stock, and as the motion of the cylinder is reversed, the flocks are carried in either direction and discharged at either end of the machine, while at the same time all the blades in both cylinder and bed are rendered self-sharpening. As the blades in the bed wear away, they may be adjusted from time to time either separately or collectively, as may be required. The machine has a capacity of 600 to 1200 lbs. a day, according to the kind of stock to be cut, *i. e.* ragstock or mill waste—hard or soft stock.

Directions for starting and running this flock cutter: The driving pulleys on the cylinder are 16″ diameter, 6″ face, and usual speed is 350 revolutions a minute. In starting the cylinder to run from you, close the inlet B and the outlet under A, and open the inlet A and the outlet under B, and feed in the stock at inlet A. Reverse the openings when the motion of the cylinder is reversed. Turn the screw D down hard enough on the spring to hold the bed blades up sufficiently close to the cylinder to cut the stock, but keep the bolt C tight enough to prevent the blades from coming together too hard. As the blades wear, unscrew the bolt C, and at the same time keep the screw D down onto the spring.

How long the cylinder will run before it needs reversing depends upon the kind of stock that is cut.

On soft stock it will run several days, while on hard rags it will need reversing every day; frequent reversing of the cylinder is desirable, as it will prevent the blades from getting very dull on one edge. The usual way of reversing the cylinder is to have two belts, one an open and the other a cross belt, changing the belts when it is desired to reverse the cylinder. Every time the belt is changed, the feeding box will have to be changed also to the other end of the machine. By this frequent changing, the cutting of the machine is kept in good condition all the time, and frequent grinding avoided.

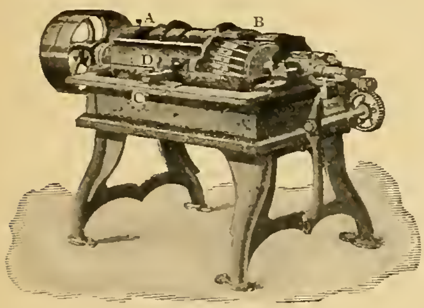


Fig. 10.

As the cylinder blades wear away, plane off the tops of the wooden lags between the blades so as to keep them about three-sixteenths of an inch below the cutting edge of the blades; when the blades are worn down considerably, take the wooden strips out entirely.

When the bed blades get worn down to within one-eighth of an inch of the iron lags, it is necessary to raise them, and to set them when they are raised, to the circle of the cylinder using the setting bar which comes with the machine for this purpose. Bring the blades up to the cylinder as you would in cutting stock, then take out the cylinder, lay the setting bar with the collars on it, which should be the same size as the bearings, into the boxes, and set the pointer to the bed blades; this gives the exact diameter of the cylinder. Then drop the bed sufficiently to allow the blades to be raised; loosen the four set screws protruding obliquely at the side of the frame, and raise all the blades by turning up the raising screws in the bottom of the bed 'till they touch the pointer on the setting bar; then put the cylinder back in its place, and grind the blades together with oil and emery, using about No. 70 emery. To grind the blades together with oil and emery, turn the cover of the machine over back and clean all the flocks from the cylinder and bed. Run the cylinder in either direction and apply oil and emery to the blades, the usual way being to have the oil and emery mixed together in a dish in the form of a thin paste, and apply it with a leather swab or pad made similar to a carder's strickle. Bring the bed blades close up to the cylinder and grind with the oil and emery until you have the blades of the cylinder and bed ground to a sharp edge. Be sure to vibrate the cylinder all the time it is grinding. After grinding, clean all the oil and emery from the machine before using. By drawing up on the four set screws, previously referred to, the knives are pressed together and are firmly held in position, even though the lower screws, by means of which they are placed in position, become loosened or even drop out altogether as sometimes happens.

In all ordinary use the cylinder will seldom need grinding, as the blades will be sharpened by reversing the motion of the cylinder. Should the blades get roughened or out of true at any time, it is well to grind them together, the same as is done when the bed blades are raised. When a new set of bed blades is put into the machine, the blades should be set to fit the circle of the cylinder and then ground together with oil and emery in the same way as described before. As soon as you commence feeding in the stock, it can at once be seen whether the grinding is done well or not. If the machine takes the stock without any effort on the part of the operator, then the work is done all right, but if the stock has to be pushed into the machine, it is a sign that the knives are not yet sharp enough. If the flocks leave the machine good and even and without nubs, everything is all right; but if they are all nubs and rolled up, and feel more like sawdust than flocks, then the knives should be drawn up a trifle and the effect noted. As soon as the product comes out even and smooth, proceed with the cutting and the machine will then do good work with frequent reversings, until the knives become worn down again. As it will not do to have the raising screws in the bottom of the bed fit tightly, on account of their liability to rust in, it is well to weave a string or lace leather around them from one to the other to prevent their jarring loose when the machine is running. Keep the bearings, worm gear and worm well oiled, and the boxes tight. On machines built within the last few years, there is an oiling device on the hub of the loose pulley, and in addition to oiling this pulley through the oil holes, take out the thumb screw and fill the recess with oil, which will work out through the wooden spline beveled into the hub; this aids very much in preventing its getting dry and wearing out the pulley. In feeding in from the hopper—which is set on top of the machine, though not shown in the illustration—the stock, unless it has been run first through a flock renovator, should be carefully examined, that no pieces of iron or other hard substances are fed into the cutter, otherwise the blades (by reason of there being two sets of blades working one against the other) will be broken. Even if the trouble should not be as serious as that, one point is sure, that the work turned out by the machine after a piece of iron has found its way into it will be inferior to that turned out before. The stock to be cut must be fed into the cutter as continuously as possible, so as to prevent the blades running without stock, since this would dull them quicker than when cutting.

Do not cut the flocks too fine for the reason that such a flock will not felt as well as a longer one, on account of possessing too little surface for the felting, and while such flocks apparently go on the goods more readily, they also leave or drop out just as quickly. A very fine flock indicates that the machine has been set too tight, so that the stock is being ground rather than cut.

With reference to the procedure of flocking the goods, there are several methods in use, all of which have their advantages and disadvantages; the best method in any given case will depend considerably upon how much weight has to be made up by flocking, how long the pieces will require fulling, and also upon the grade and condition of the flocks to be used.

Dry flocking is frequently used, for the reason that in this manner it is much easier to distribute flocks evenly all over the fabric than by wet flocking; this method of dry flocking may give satisfactory results in connection with lower grades of kerseys, meltons, beavers and similar fabrics, yet it cannot be used in connection with better grades of these fabrics, nor on fancy cassimeres, for the reason that too many of the flocks will work through the fabric, and thus get on its face, with the result that the colors and the face of the goods will have a dull, muddy appearance. When flocking dry, the amount of flocks required to be used is put on the goods immediately after starting the fulling mill, and after they are well distributed over the goods, then soap is applied.

Wet Flocking: The best plan to do this is to take about one-quarter the amount of flocks calculated to be used, and sprinkle them lightly on the goods when they begin to get warm in the fulling mill. Then after awhile, add another quarter of the flocks, and continue in this manner until all the flocks have been added. The flocks put on in this manner will adhere as firmly as possible to the fabric thus flocked and fulled, since the flocks are thus fed to the fabric when it is in a condition to absorb them best, *i. e.* when the fabric becomes heated, and thus felting starts.

Half dry and half wet flocking is used when a rather excessive amount of flocks must be added to a fabric, and where it would take too long to apply the flocks by means of wet flocking, for the reason that the goods would have fulled up in width and length before all the flocks were applied. For this reason part of the flocks are given to the fabric in its dry state and the rest after the goods have been wet and become warm.

WASHING.

This process, as a rule, follows fulling, and has for its object to thoroughly clean the fabric of all the impurities adhering to the structure. However there are instances in which the flannel is washed or scoured previous to fulling, either for special reasons or the fact that some finishers prefer such a procedure, claiming in this way more satisfaction with reference to production, as well as final finish. Again washing of the goods is also done in connection with piece dyes after dyeing, the same when goods are speck or burr dyed, or after carbonizing, etc.; however, in any of these cases the washing then is more or less a rinsing off (possibly using in connection with it fuller's earth or a mild scouring liquor or soap) for the fact that these goods originally had been once thoroughly washed or scoured previous to dyeing. In the present instance we refer to washing goods, as is practiced after fulling.

Closely examined, the washing of fulled cloth may be divided into two parts—the solution and loosening of the fulling filth, consisting principally of oil, soap, color residues and glue; and next, rinsing it away with either cold or warm water. These operations are sometimes performed separately, as many fullers first loosen the dirt in the fabric when the latter is still in the fulling mill, that is, after the fulling operation has ended, and then scour the cloth in the washing machine. They urge, as a reason for this procedure, that the dirt will come off better from the cloth still warm from fulling, than after it has been transferred to the washer, and possibly more or less laid around for a time. However in most cases, the goods after fulling has been finished in the mill, are washed in the washing machine or washer as the latter is called, and it must be remembered that the sooner the goods, as coming from the mill are washed, more particularly during warm weather, the easier and at the same time more thorough the process will be done. Whenever possible, never let the goods lay in a heap over night before scouring, try and enter them in the washer any way, even if only for a few runs, so as to cool them.

When the proper soap has been used at the fulling, and such soap retained its vitality to the end of the process and more, then there is no question but that the scouring of the goods is an easy process, in fact only a rinsing, especially if able to use luke warm water. However if the soap as used for fulling had lost vitality before the process finished or just at this point, the soap being of too light a body, then in this instance a scouring soap or liquor has to be used at the washing in order to get the goods clean.

Scouring Liquor. It is not necessary that the body of this liquor be heavy; quite the reverse, it is better to keep it light, and for which reason about one to one and one-half ounces of soap to the gallon water is sufficient. Again cheaper grades of soap may be used, for the fact that it is upon the strength of the liquor that reliance has to be placed, and for which reason the amount of alkali should be somewhat larger, than what is used in a fulling soap. The strength of the liquor however depends entirely upon the character and the condition of the goods. For example, if dealing with colors not fast to fulling, then it will not do to use too much alkali or else they may be injured. When the proper amount of ingredients has been well combined by boiling, the tank is filled up with water and left to cool. Just before the soap becomes cold, you may add to the mixture about one ounce of sal ammonia to the gallon, but if the alkali is ammoniated, one-half ounce will do. Stir frequently until well mixed.

Several pailfuls of this scouring liquor are given the goods, provided the lather does not show up good, *i. e.* the fulling soap has lost its vitality at the fulling, and after giving them 20 to 25 minutes in this, it is drawn off and the procedure repeated, and after that the goods are thoroughly rinsed. The same proceeding is applicable to goods that are washed before fulling.

Another good scouring liquor is made by adding about two ounces of pearl ash to each gallon of water the tank will hold. This mixture does not need boiling, since the pearl ash will readily dissolve. In connection with this liquor, use your regular fulling soap for scouring purposes. Wyandotte Textile Soda is also a most excellent article to use in connection with soap for scouring purposes, especially on account of its mild action on fibres and colors. On worsteds requiring no fulling, this scouring liquor made with pearl ash or Wyandotte Textile Soda will be found to give excellent results.

Water. Another important item for perfect washing is the kind of water to be used. The best to use is warm water, but unless this is plentiful at hand, cold water will have to do; however, there is nothing which will have as beneficial an effect upon the goods at the washing as a sufficient supply of luke warm water. To always have an even temperature for the water is another item of importance. The temperature for the water should not exceed 110° F. After the washer is started, turn on the warm water and fill its trough about half full, having previously closed all the gates, and let the goods then run in this water for about 20 minutes, and when there will be ample evidence of the vitality of the fulling soap used, for if it is right, the washer will be filled to overflowing with a thick, rich and creamy lather, although dirty, for it is tainted with all the impurities of the goods which have become loosened and entered into the lather by the use of the warm water. If the goods show such a lather, no scouring liquor will be required to be used for washing the goods, the procedure of scouring simply dissolving itself in a procedure of rinsing by drawing off the sud at the end of 20 minutes, and entering another supply of warm water, and allow the goods to run in this again 20 minutes. At this second scouring, the lather should show up white, and still be thick and creamy. When in turn this second sud is drawn off and the washer is about half empty, turn on the warm water and rinse the goods with it as long as the supply will last, and then turn on the cold water and rinse till all traces of the soap are gone. The time for this depends upon the supply of warm water at command and upon the nature of the fulling soap, which had been used. With an unlimited supply of warm water at hand, rinse the goods about half an hour and follow this with about half an hour in cold water, and when, as a rule, the soap will be found to be well out of the fabrics. Keep in mind that warm water will remove the soap faster than cold water, and that if no warm water on hand, the process will take so much longer. When using cold water entirely, it will be advisable to give the goods at the second water about a pint of diluted ammonia to each piece, which will help to loosen the soap and thus aid in its removal.

If however at the first water the lather does not show itself to any extent, and the suds look thin, instead of thick and creamy, it is a sign that the vitality of the fulling soap is gone, and for which reason a thorough washing must be at once given the goods, by drawing off this first water and giving each of the pieces several pails of a strong scouring liquor.

Ammonia. The action of the ammonia as an alkali for neutralizing fatty acids is strong. It saponifies fatty acids much better than potash and soda, and only its volatility makes it less suited for the manufacture of hard soaps for textile and other purposes. But then it is largely used as an agent for expediting the combination of other alkalies with the fats. This also explains its capability of increasing the action of other alkalies in washing, as well as that of soap. If ammonia is poured on cloth charged with soap, at the beginning of the scouring process, an essentially greater quantity of foam will be formed, the fulling filth will rise better and quicker, and the cloth is cleaned more perfectly. Ammonia is not only more effective for the raising of the filth, but it also expedites the rinsing off of the soap, a feature of the greatest importance in connection with goods to be dyed. As is well known, traces of soap will remain in the goods in spite of slow and careful rinsing. Such residues are for piece dyeing, just as those of oil or fat; but when ammonia is added before the final completion of the washing process, and an emulsion formed of it, then any residues left are almost entirely neutralized.

The ammonia is to be used diluted with from double to quadruple its volume of clean, cold water; adding one-half pint of this quantity at once at the beginning of the washing to expedite the dissolving of the fulling filth, and the other half only when the worst filth and foam have been rinsed away, so that the escaping water is of the appearance of clean soap water; a strong emulsion will then be formed again, which contributes essentially to the expulsion of the last traces of soap.

It is also of advantage to add a little ammonia to the fuller's earth, provided such is used for the final rinsing of the goods.

Ammonia may be used without fear for any tender shades, if a certain degree of care and a sufficient state of dilution are used. However there are several colors, the tones of which are slightly altered by ammonia—for instance, nearly all the reds, principally those of Brazil wool, madder, or cochineal. In doubtful cases the dyer can furnish the best information as to how far the use of ammonia is permissible for a certain shade. All the colors with some pretence to fastness—logwood black, alizarin black, indigo blue, alizarin blue, green and brown, also all the fashionable colors fast to fulling—may without fear be exposed to the influence of ammonia in washing, that is, provided if, as mentioned before, care and a sufficient diluted article is used.

It is not at all true that ammonia injures the feel of the goods, as is asserted sometimes, however, the use of ammonia requires the observance of one condition, and which is that goods treated with ammonia must not be placed in contact with metallic parts, at least not immediately after ammonia is poured on, since this contact will cause spots which are most injurious, especially for cloth intended for piece dyeing. Cuprous ammonia is formed instantaneously if such cloth touches copper or brass. The spots thereby are hardly noticeable in white or pale ground cloth, and only when held against the light do they appear as if colored feebly brown, but after dyeing, these spots are strongly pronounced and much darker, as cuprous ammonia makes the fibre more sensitive to the dye. The spots will appear almost black in indigo dyed cloth, and for which reason copper or brass bottoms or rollers must never be used in washing machines. For the same reason ammonia should never be used in fulling mills the lower cylinder of which has a brass rim, etc., etc.

Fuller's Earth. The softening and cleansing properties of this earth are appreciated by all finishers, who have come in contact with it, especially the refined product, and which is much to be preferred to the crude article, and like any other article in the end will be the cheapest; since the former will better combine with water, and the residue will not be as great. Do not attempt to use more of the earth than the water will hold in suspension without frequent stirring, since too much fuller's earth is worse than not enough. A good plan is to use to one barrel full of water, two pailfuls of the earth, using more will give unsatisfactory results. The proper time to use fuller's earth is any time after the goods are washed, *i. e.* fulling filth rinsed off.

If washing goods which had been burr dyed, a bath of the earth after rinsing will help much to prevent crocking, since the crocking of goods is always more or less due to insufficient rinsing after the goods have been burr dyed.

With reference to the machines for thus scouring the goods, there are two types, viz.: one where the pieces are dealt with, more or less, in a rope form, and several pieces or strings at one time, and the other where the pieces are dealt with in the open width.

The Rope Cloth Washer. Fig. 11 shows this machine (as built by the James Hunter Machine Co.) with portions of the framing cut away, portions of the machine itself being shown in sectional elevation, in order to show the interior arrangement of the machine which, as shown, consists of a more or less semi-cylindrical trough A for holding the water, the scouring liquor, and in which the goods are made to travel, each piece 1, 2, 3, etc., in one continuous string. Above this are two heavy wooden rolls B, C, one on top of the other, and in order to still more increase the pressure, the top roll is supplied with elliptic springs D, fastened by means of iron rods E, outside, to the framing of the machine. Outside of the machine (on the side not shown in illustration) these two rolls are geared to each other by means of very long toothed gears, which make the drafts uniform and prevent damage to the cloth. Rope scouring machines come in different widths, intended for either 4, 6 or 8 pieces to be washed at one time, and being known for this reason respectively as four, six or eight string washers, for the fact that each piece, after having its selvages sewn together, forms one continuous string. In some instances however, two or three pieces are sewn together to thus form one string. The strings of cloth, during the operation of washing, pass through guide rings F, G, and between the two heavy wooden rolls B, C, previously referred to, passing in turn over a small, prominently grooved roll H, set with its shaft considerably above the shaft of the top roll C, and which takes the strings of cloth from the two heavy wooden rolls, and allows them to run again to the bottom of the trough. If it were not for this roller, the goods would be liable to stick to either of the two large wooden rolls and be taken around with them, and thus bring things speedily to a snarl. This small back roller, therefore, must be watched to see that it works properly, in order to prevent possible damage to the goods. Below the bottom roll B there is placed a deep box I which catches all the suds and grease squeezed from the goods. In the bottom of this box is a gate, which, when open, allows the suds to pass down into the

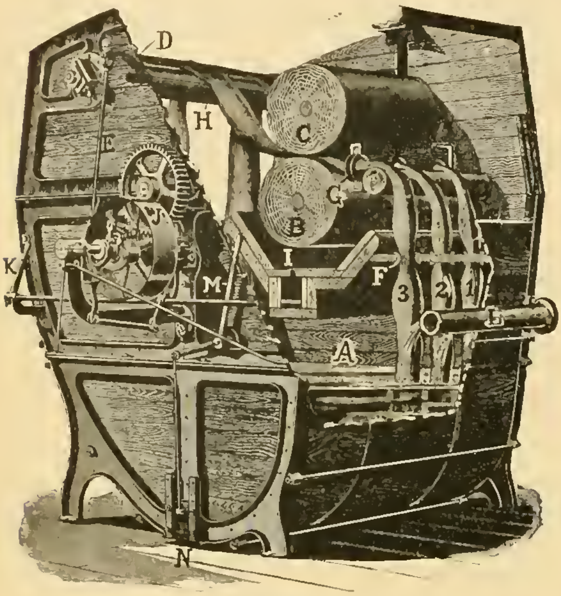


Fig. 11.

washer among the goods, until they are ready to be washed off, when, by opening a stop on the side of the washer, the gate in suds box is closed and the soap passes through a spout (situated on the side of the machine, not shown) on the outside and can be

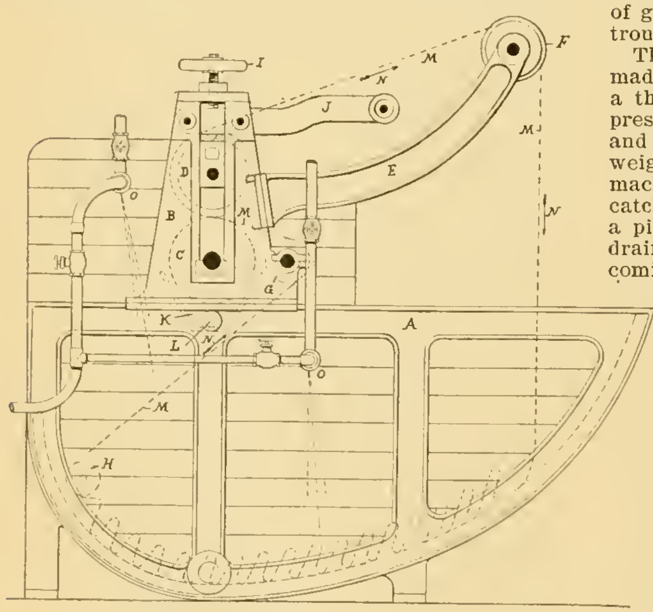


Fig. 12.

saved for further use if desired. All the greasy suds thus pass off without mixing with the goods while washing, insuring with the pressure on the rollers expeditious washing.

Power is transmitted to the machine by means of a friction pulley J, so arranged that it can be operated by hand levers K, one of which is placed in the front and one in the back of the machine (only one shown in the illustration), thus enabling the operator to stop the washer, when so required, quick and without damage to goods. L is the water inlet pipe delivering the water in heavy sprays onto the cloth under operation, as clearly shown in the illustration. M is a lever for raising or lowering slide valve N, for rinsing off the wash water, one of these levers and slides being placed on either side of the machine. When the washing has been properly effected, the goods are taken out of the washer, hydro-extracted, and when they are ready for the next process of finishing, as regulated by the character of the fabric under operation, they have to undergo.

The pieces scoured in such a rope washer, are certainly always more or less folded up, and are liable to contract creases, which, with fine goods, is undesirable; to avoid these creases and crimps, the pieces must be treated in a washing machine where they can be dealt with while full width or open. In general, these machines differ but little from the rope washer, previously explained, only they are made somewhat narrower, and only take one width of cloth at a time. Several pieces are stitched together, end to end, so as to make one long length, in order to keep the fabrics for a longer time in the wash water or scouring liquor, than if using one piece at one time, otherwise the manipulations are the same with each kind of machine.

The Open Width Cloth Washer. Fig. 12 shows such a washer in its side elevation, the same consisting of a strong framework A, which forms a support for the washing trough, which is of wood and is of a width to suit the class of goods to be washed. The upper frame work supports the gudgeons B which carry the two heavy squeezing rollers C, D. To the gudgeons B is fastened the arm E for carrying guide roller F, a second guide roller G being placed in the rear part of gudgeon B and a third, H, in the front part of the trough.

The bottom one of the two squeezing rollers (C) is made of wood, while the top one (D) is of wood with a thick sleeve of india rubber over it, and is kept pressed against the lower roller by its own weight and by the pressure of the hand screws I and weighted levers J (one of each for each side of the machine). A trough K below the bottom roller C catches the dirty suds squeezed out of the cloth and a pipe L in connection with it leads the suds to a drain, and thus prevents the main body of liquor becoming too dirty. The path the cloth follows is indicated by the dotted line M and arrows N. A service of warm water supply pipes are handily arranged, and from these two strong jets O play upon the fabric as it is fed through the machine.

SPECK OR BURR DYEING.

There is no other process in the finishing room as tedious as that of removing specks in the cloth by hand, either by means of the specking irons or by covering the specks by means of a pen with ink. Certainly, if the fabric contains only few specks, and when the construction of the cloth is such that it would be injured by the process known as speck or burr dyeing, then one or both of these hand processes certainly must be made use of, however in ordinary cases it is more advisable to use the burr dye process, since in this instance the face of the fabric is not disturbed as is the case when using specking irons, and when goods after this procedure, now and then, have to be sent back to the shear for smoothing the nap, before they are in a fit condition for being sent to the market. This in some instances may be due to the amount of specks taken out, or in other cases due to the dullness of the specking irons used, again it may be the fault of the girl who did the work. Since the process of burr dyeing is more or less a necessity in connection with a great many woolen as well as union fabrics, it next remains to explain how the process should be conducted, so as to give satisfactory results.

Burr dyeing has for its object to cover, *i. e.* color dark, only the vegetable specks or impurities in the cloth; it will not affect a wool speck, which the same as if no burr dye had been used will have to be removed by hand finally. Burr dye is made of logwood, blue vitriol and soda ash, a good recipe for it being:

Extract of logwood	48 lbs.
Soda Ash	30 lbs.
Blue Vitriol	12 lbs.

This should make about 100 gallons of a burr dye that can (properly diluted) be used with safety upon almost any kind of woolen or worsted, excepting cotton mixtures. The dye will stand at about 10°, and has to be diluted with cold water to suit the fabric under operation. This burr dye, as in fact all others, must be used only when perfectly cold, again it will not do to allow the goods to stand still in the liquor any length of time.

Another recipe for a burr dye is given thus:

Extract of logwood	200 lbs.
Soda Ash	110 lbs.
Blue Vitriol	50 lbs.

This should make about 200 gallons of a burr dye, and which also has to be reduced with cold water previous to using it. The extract of logwood as used for burr dye can without disadvantage be of an inferior grade, or hematine will do just as well. This logwood or hematine is put into a tank with sufficient water to fill said tank about ⅛ full. Then add the blue vitriol, turn on steam, and bring the mixture to a boil, after which turn off some of the steam and boil moderately, until all the vitriol has been dissolved; then turn off the steam and let the liquor stand for a few hours to cool, adding at the same time a pail or two of cold water. Then add the soda ash, but remember, very slowly and carefully, since as soon as the soda ash and the vitriol come in contact, fermentation sets in, and the liquor will begin to boil and rise, and possibly run over in the tank, and thus the best part of the coloring matter be lost. When all the soda ash has been added, let the liquor stand for some time, in order to give it a chance to slowly work, and at the same time, if at any time there are signs of it rising, add a little cold water. Agitate the ash gently until you can stir the liquor without it showing signs of much rising, then turn on steam and bring it slowly to boil, and in turn keep this up for about 4 hours. Next turn off the steam and fill tank with cold water, keeping the liquor well stirred while the tank is filling. When the process is finished, the liquor should possess clearness and richness (a clear plum or claret) of color, when however, if the color is muddy and of a dirty blue, gray or black shade, it is a sign that an error in preparing it has been made, and that the dye will give poor results when used. Never combine the coloring matter with the ash first and then add the vitriol, for in this manner the best strength of the extract of logwood is wasted, while if it is combined with the vitriol first and the ash added last, all of its power is retained. Combining the vitriol and ash with water, and then adding extract of logwood, will also give poor results, there being something in the extract of logwood which needs fermentation, and which is omitted by this combination of the ingredients. In the same manner adding all three ingredients at one time into a barrel or tank, and this to boil with a small amount of water, will also give a poor, if not valueless burr dye.

The more soda ash there is used, the deeper a claret the shade will be, while, if the amount of vitriol used is increased, then the shade will lean more towards the blue cast than the claret.

A point which sometimes puzzles a finisher is just how strong a burr dye should be in order to produce results. This, naturally, varies more or less with the kind of goods treated—that is, the character and abundance of specks and burrs which it has to conceal; also upon the method adopted in applying, as well as upon the time when the dye is used. Under ordinary circumstances, and upon a fair grade of stock, the dye will be found to work well at 1½ to 3°. The quantity of dye to be applied to the goods also varies with the amount of work which it has to do, and with the method of its application. Some finishers use the dye in the washers before gigging the cloth, and when about three pails of the 3° dye to the piece will do the work. The operation in this case is thus: Run the fabrics in the washer sufficiently long to thoroughly start the soap and dirt; and do not add the dye until a good clean lather has begun to show. Each piece should run in its three pails of dye for at least twenty minutes before the rinsing in cold water has begun.

However the best plan is to defer the burr dyeing until after the goods are gigged. In this instance, although we may use the same amount of dye,—about the same, viz., 3 pails to the piece—yet it is only necessary to have it about half as strong than if burr dyeing in the washer, in order to accomplish the same results, 1½° in most cases being then quite strong enough for all practical purposes.

A good method of applying the burr dye to the goods is thus: The dye is contained in a large square tank, a roller frame being adjusted in the tank and on which the cloth is run from a pile outside on the floor. The cloth is thus run up from the floor and down into the liquor, being passed over the top row of rollers and under the lower row alternately. Then just before it passes out of the tank, it is run between two large squeeze rollers, in order to save the surplus dye liquor, which thus runs back into the tank and is re-used. From these squeeze rollers, the fabric is run on a roller or directly into the washers for the removal of the loose dye and the final cleansing. In its passage between the squeeze rollers, attention must be paid that the cloth does not curl or wrinkle under at its selvages. By this method of burr dyeing, the cloth is not allowed to remain in the dye too long at a time, and the liquor is evenly and uniformly distributed over the whole piece, so that no part of the goods receives more than any other. Cloudy and shady goods will not be liable to form if care is taken.

In most cases however the burr dyeing is done in the washer, in which case let the goods run for about 20 minutes in the dye, after which they must be rinsed well, and given a bath of fuller's earth, which will prevent all danger of the goods crocking.

When dealing with union cassimeres, and all goods which have cotton warp and wool filling in their structure, we must resort to different plans for burr dyeing, or else a different effect will be produced upon the cotton from that produced upon the wool portion of the fabric, for the fact that if the dye were so made that it would produce exactly the desired effect upon the wool and cover nicely all the specks and dyes contained therein, it would be most likely to tinge the cotton in the fabric to such a marked extent as to materially affect the whole appearance of the piece. For such goods a good recipe for preparing the burr dye is thus:

Extract of logwood	175 lbs.
Soda Ash	140 lbs.
Blue Vitriol	90 lbs.

This produces 200 gallons of a dye which stands about at 15°, and which for dark shades should be reduced to 2°, and for light to 1°, while 2½ pails to a 6/4 piece, and from 10 to 15 minutes' application in the washer (considering a fabric previously gigged), will give proper results. The rinsing after this is a very important step, and must be carefully and thoroughly done, with a good rich flow of pure water, otherwise goods may crack. Plenty of time must always be given for this scouring or rinsing after burr dyeing, since, unless it is well done, this result is inevitable. If it is desired to produce a sort of a blue cast on these fabrics, a case often called for, it will be necessary to employ about twice as much blue vitriol and half as much soda ash. But here there will be trouble unless the greatest care is taken not to use too much of the vitriol for the good of the cloth. The amount which can be safely used will depend largely upon the condition of the goods, but under any circumstances enough should be used to cover all the burrs and specks, or else its purpose will have been in vain.

Any batch of burr dye should be always tested before it is used, and, if possible, kept exactly uniform for all similar styles of goods. Again it must be applied in even and regular quantities, and the goods must always be allowed to remain in the dye for the same length of time. The dye is always best in its action when perfectly cold. However, not only must we use a perfectly cold burr dye, but at the same time, the goods must be also in a cold state; and to make sure of this, give them about five minutes' run in cold water after putting them in the washer, but be sure and have them well drained before running them through the burr dye tank, or adding the dye in the washer provided no special burr dye tank is used. In the latter case, never leave water in the washer to thus reduce the dye, for such a procedure will result in uneven work. Always reduce your dye to the exact strength wanted before giving it to the goods.

CARBONIZING.

This process has for its object to liberate all vegetable impurities from woolen cloth. Although carbonizing should be practiced in connection with the stock before it is converted into yarn (see page 38), yet in many instances it is preferred to be done in the woven cloth. The carbonizing of goods will naturally omit their having to be speck or burr dyed. In most instances, *i. e.* the common way of carbonizing is by means of exposing the cloth for some time to the action of a sulphuric acid bath, and then dry, *i. e.* bake the cloth under excessive heat, and which then will reduce all vegetable matter to such a state of carbon that, with a vigorous beating, it will pass off as dust.

The carbonizing liquor for this process is made by adding sufficient sulphuric acid to the water with which the tank is filled, to make the liquor register 5° B., after which the goods are entered and well covered with the liquor and left there for about 25 minutes according to condition of the cloth to be treated. When ready to remove the goods, one of the ends is passed through a set of squeeze rolls as fastened to the tank, and thus any surplus liquor squeezed out and saved for future use in the tank. It must be mentioned here, that all the metal parts of the tank must be of bronze, for if not, the acid will destroy them. The tank also should be lined with lead, or if of metal, it must be of a non-corrosive kind. As soon as the goods leave the squeeze rolls of the tank, they should at once pass (guided into by means of a drum situated directly above the extractor) to the extractor with no more handling than absolutely necessary. This extractor must be acid proof, and its drainage such that all liquor extracted from the goods, returns to the tank, and is thus reused. Always be careful to keep the acid bath in the tank at its proper strength, by adding from time to time as required, more acid to it.

From the extractor the goods are then taken to the drying room to undergo the baking process, *i. e.* transfer the vegetable matters as now completely saturated with sulphuric acid, by means of drying under excessive heat, into carbon — dust, and in which state said vegetable impurities have to leave the cloth.

The drying room is supplied with numerous steam pipes in order to be able to quickly raise the heat to a high point, said steam pipes being so placed as not to interfere with the goods which are loosely hung up, in any way, to get the heat at all points of the goods. After being hung up, the room is closed and the steam turned on, and the heat run up to at least 175° F., since at that point only, the baking process will be completely accomplished. In other words, the strength of the acid bath, as well as the heat in the drying chamber, must be both, up to the required point for perfect carbonizing.

In some mills Can Dryers (as are used in connection with the drying of cotton goods) are employed in place of a drying chamber. Such Can Dryers consist of a series of metal drums, kept at a uniform temperature by a constant steam supply. These drums are driven (rotated) by power and the goods passed over them, and thus dried and in turn baked.

After thus carbonizing the vegetable impurities in the cloth, they in turn have to be removed, and which is done either by dry beating the cloth, or in case with bad pieces, by means of a heated fulling mill; this being a fulling mill supplied with steam pipes, placed out of the way of the run of the cloth. Running the goods in such a hot fulling mill, for about one-quarter hour or less, will remove every trace of carbonized vegetable fibre, provided the process itself was done well.

The next thing to be done is to send the goods to the washer and give them a bath in a solution of soda and water for about 25 minutes, in order to neutralize the acid, after which rinse them well; adding fuller's earth to the latter procedure will greatly assist. Previous to taking the goods out of the washer it will be advisable to ascertain if neutralizing has been thoroughly accomplished. If acid still remains in the goods, they will feel slippery, and when another soda bath, to be followed with a rinsing, has to be given to the goods.

STEAMING AND STRETCHING OR BOILING AND STRETCHING.

This process is generally practiced in connection with fabrics which are to receive a face finish. The "steaming and stretching" machine ordinarily receives the cloth from the extractor, and has for its object to smoothen out all wrinkles, prevent lightning effects caused by too long fulling, to sadden the cloth to its natural state, and finally wind the cloth under operation on to wood rolls ready for the gig or napper as the case may be. For improving the lustre and feel of face finished goods, as well as to remove wrinkles and creases in cloth that has laid around for a long time, and for steaming and stretching in general, this machine will be especially found of advantage.

The process itself is best explained in describing the construction and operation of the machine as built by the Parks & Woolson Machine Company.

In connection with this machine the cloth usually is run into the machine from the open fold, and passes first through tension bars, then over the first stretch or expansion roll to the second stretch or expansion roll. Between these two rolls there are several lengths of perforated pipe by which the steam is let on to the cloth as it passes over the fabric, thus receiving the cloth while it is in a perfectly smooth condition, and from where it goes directly to the winding roll. The machine will handle the heaviest or lightest goods equally well, as the tension of the cloth and the hardness of the roll can be regulated. All the running parts of the machine are gears or sprockets and chain, so there are no belts to be affected by the water or steam. Some of these machines are built to fold the cloth off on to the floor, in place of winding it on a roll, again some have both attachments applied, either one of which can be used as the case may require.

This machine is also built with a boiling tank, so the cloth runs through boiling water, the latter being boiled by perforated steam pipes set in the tank and in which instance, the machine is termed a "boiling and stretching" machine. Some machines again are built, having both attachments (steaming and boiling) added, either one of which may be used. Again the regular steam box (see Figs. 61 and 62, page 356, as then explained in connection with the article on "Steaming") can be substituted for the perforated steam pipes, if preferred. Larger machines having three stretch rolls, double the steaming capacity, and a large brush with two or three cloth contacts are also built.

The Curtis & Marble Cloth Stretching and Rolling Machine with Hot Water Box. The purpose of this machine is identical with that of the Parks & Woolson Stretching Machine, previously explained. Fig. 13 shows this machine in its perspective view. It has similar tension bars in front for giving any desired tension, a revolving stretch roll in the centre to draw out wrinkles, and a large drum at the back on which the cloth roll rests while winding, with heavy weights to make a firm, even roll. The stretch roll has brass trucks and slides inside, and hard wood slats on the outside, cut with ratchet like teeth. Both ends of the stretch roll turn exactly together, and any cramping or uneven drawing of the goods is avoided. The stretch roll is driven by gearing at the same speed as the cloth, so as to relieve the goods of any strain required in turning it.

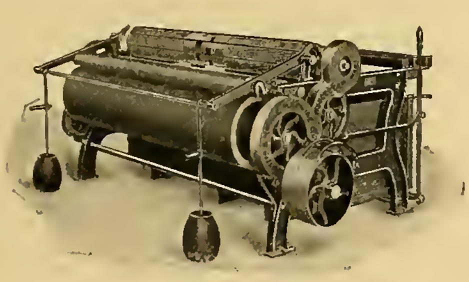


Fig. 13.

A revolving screw roll with coarse right and left hand threads, is commonly placed between the stretch roll and the winding drum. This roll is driven by gearing and prevents the edges of the cloth from drawing in or turning over.

A large hot water box is placed in front so that the goods may be run through hot water and softened before passing over the stretch roll. The rolls around which the cloth passes in the bottom of the hot water box are made of brass and run in brass bearings to avoid rust. As will be readily understood, the machine may also be used without the hot water box. When dealing with fabrics requiring softening, but containing colors not fast enough to stand the action of hot water, a steaming device is put on. Again a brushing attachment, to act on the goods after passing through the hot water and before reaching the stretch roll, can be provided, if so desired. For this purpose a brush cylinder, about 13 inches diameter is used, filled with either stiff bristles or wood fibre.

The heavy gearing on the machine is protected by gear guards, to avoid accidents, and the weights are provided with handles for convenience in lifting them on and off. The machine is built for handling either 6/4, 7/4, or 8/4 wide goods.

Boiling and Stretching Piece Dyed Worsteds, and Light Weight Union Fabrics. In connection with the latter class of fabrics, made with cotton warp and wool filling, the different hygroscopic, elastic, and other physical properties of cotton and wool, cause such materials, if they were simply scoured in the ordinary way to contract or shrink irregularly over the entire surface of the cloth, giving the finished fabric a rough shriveled appearance. To overcome this trouble, these fabrics, after first being singed, are subjected to the action of what is called the wet finishing machine (which is more or less identical with the boiling and stretching machines previously explained), in place of a crabbing machine as was formerly done, previous to scouring and steam lustring; this so called wet finishing process preventing any imperfect appearance of the finished fabric, on account of the different materials combined in its construction. This same feature will also refer to Union Worsteds, may it be Worsted and Wool, or Cotton and Worsted. In connection with piece dyed worsteds, the chief use of this wet finishing process rests in thus preventing their excessive shrinkage during scouring and more especially during dyeing.

Provided any of the fabrics quoted require any fulling, it will be readily understood that they are subjected to this process previous to said wet finishing.

As mentioned before, the purpose of this wet finishing process is to limit the shrinkage or felting capacity of the wool fibres in the fabric as much as possible, and at the same time lay the filling in its proper position in the texture. This prevents in a measure the subsequent shrinkage of the fabric, more particularly in its width, and also its drawing out of shape in the succeeding operations of scouring and dyeing. This process of wet finishing is based on the fact that the wool fibre becomes fixed by heat, humidity, and pressure, and the wet finishing machine enables the finisher to obtain this result.

Worsteds differ essentially with reference to their finishing operations from that of woolen cloth. With the latter, the aim of the finisher is to preserve the vitality, *i. e.* shrinking capacity of the fibres, as long as possible, while in connection with worsteds, all finishing operations are designed with the point in view to eliminate these natural tendencies of the wool fibre from the very start.

This wet finishing machine consists of a series of four tanks, of which the first three, as a rule, contain hot water, and the last tank cold water, each tank being equipped with guide rollers, stretching rollers, and squeeze rollers, for guiding, opening the fabric to its full width, and squeezing it. The wool fibre thus softened in the boiling water in the first three tanks, and cooled evenly and thoroughly in the last tank, retains its form in that position much more readily in the cloth structure, losing at the same time its felting capacity. Again all four tanks of the machine may contain hot water, the goods then, after leaving the machine, being rolled up and left to cool while lying in the rolls (similarly as done in connection with the boiling and stretching machines—previously explained), the fibres in this manner retaining their position (they being *set* as we might say) more thoroughly than if treated as before explained, they losing in the latter instance all tendencies for a further shrinking.

Figs. 14 and 15 are descriptive diagrams of the wet finishing machine as built by the Arlington Ma-

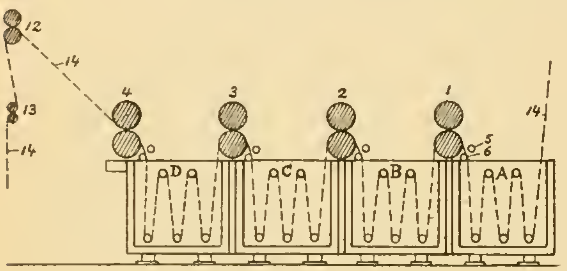


Fig. 14.

chine Works, and of which Fig. 14 shows a section, taken lengthwise through the machine, Fig. 15 being a view in detail, enlarged compared to Fig. 14, of the lower roller of one of four pairs of squeeze rollers 1, 2, 3 and 4, showing also the two spiral rollers as placed in front of each pair of squeeze rollers, the gearing for the various rollers, as well as a portion of the framing of the machine to which the parts referred to more particularly belong, being also shown.

As mentioned before, the wet finishing machine consists of four independent wood tanks A, B, C and D, each fitted with a series of five brass rollers in proper position for threading cloth, see dotted line, through each tank, so that it is thoroughly saturated and boiled.

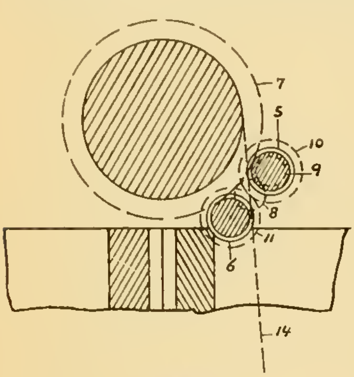


Fig. 15.

Between the tanks and at the end of the last tank, are arranged four pairs of iron nip or squeeze rollers 1, 2, 3 and 4, and before these rollers are placed within practical proximity to surface of each pair of squeeze rollers, revolving adjustable spiral rollers 5 and 6, as shown more in detail in Fig. 15, for keeping the cloth smooth before entering the nip of the respective pair of squeeze rollers. These adjustable spiral rollers are run in opposite direction to running cloth, by means of spur gear 7 on lower squeeze roll, meshing into a small gear 8, which is then meshed into gear 9, which drives spiral rollers 5 and 6 through gears 10 and 11.

The cloth, see dotted line, after leaving the last pair of squeeze rollers 4 of the machine, is then threaded through guide rolls 12 and in turn through plaiter 13, which folds it either on a truck or on the floor.

The wooden tanks are secured to their relative positions by iron framing running the whole length of the sides, and of suitable design for carrying housings for nip or squeeze rollers. The whole machine is driven by outside line shafts and bevel gears through bottom rolls. Dotted line 14 indicates the run of the fabric through the machine.

This machine by means of its most thorough construction, treats the goods evenly all over, every inch getting exactly the same treatment. The boiling water and the squeeze rollers tend to free the goods from soap, provided the goods were fulled any, or from other foreign matter, like size, starch, oil, dirt, dyestuffs, etc. The chances for water marks, washer wrinkles, and cloudiness, are by the use of this machine reduced to a minimum. If preferred, the machine may also be used after dyeing. The capacity of the machine, as claimed by the builder, is about 7000 yards of goods treated in 10 hours, certainly depending a great deal on the class of goods uuder operation.

GIGGING.

After the pieces of cloth are taken out of the washer, they in turn are allowed to drain for awhile and then are folded out evenly on trucks. The particular finish which the goods are to receive, plays now an important factor in the process of wet finishing. If the goods are to receive a face finish they should be run on a steaming and stretching or boiling and stretchiug machine (as previously explained) before gigging, and left in their rolled up condition for from twelve to fourteen hours according to the amount of felting required, before being sent to the gig; however, this process thus referred to is not required if dealing with goods designed for a "clear face" finish, also known as "threadbare" finish, or if they are what is termed "fancies;" it then being only advisable to partly extract the superfluous water from the goods, after they come from the washer, and then roll them up, and when, after draining for awhile, they are ready for the gig.

Low grade goods, containing cotton, or lots of shoddy, or colors liable to run, if they have to be gigged, on account of the finish required, are best dried at once after being taken from the washer, since if allowed to lie wet for any length of time, they are apt to have the colors run into each other, and thus spoil the appearance of the fabric, whereas if dried at once, when taken from the washer, and in turn gigged dry, they will more than make up in good looks what they lack in softness to the touch of the hand, on account of not being wet gigged.

If the fabrics are intended to be rolled up, after coming from the washer, they are taken to a "stretching and rolling" machine. The goods in connection with this machine, pass over a stretch roll, previously to being wound on a roller, to make sure that they are smooth and free from wrinkles. The tighter the pieces are rolled on this machine, the better they will drain, and the smoother they will be, a feature of special value when dealing with face finished fabrics. After the pieces are tightly rolled up, they are either laid down flat on skids or stood on end, and left over night to drain. In either case, even though the rolls are turned occasionally, the goods are sure to have more moisture on one side than on the other, a feature liable to create an unevenness in the gigging and thus in the final finish to the fabric, for which reason the use of squeeze rolls has come into much favor. Not only will their use result in fabrics containing as much as possible evenly distributed moisture throughout the roll of cloth, hut the time required for their draining is also considerably shortened, since the squeezing can be so controlled as to have the goods, except such as are intended for face finish, at once in the proper condition for the gig, certainly a saving in time.

However in connection with face finished fabrics this rush will not do, since they will finish better if they are not hurried through the wet stage, are boiled and stretched, and in turn allowed to remain for about 14 hours in a rolled up condition previously to gigging. Provided no boiling and stretching machine at the disposal of the finisher, let these goods lie a day or two in smooth even piles in the wet previously to gigging them. Having thus prepared the fabric for gigging, we now come to this process proper.

Gigging consists of the combing or teaseling out of the several fibres which in fulling have become felted together on the face (and back) of the goods. To make a really uniform fabric the gigging must be exactly alike in every part of the piece, and no spot must be subjected to any amount of working of which another is deprived.

In gigging as it is carried on to-day there are three considerations connected with the mere mechanical part of the work which it is very important to notice.

The first of these is the teasel,

The second is the tension of the goods as they are brought into contact with the running surface of the cylinder, as covered with teasels, and a

Third that may be mentioned is the condition of the fabric as regards dampness during the gigging process.

The Teasel is a part of the gig which usually gets but little consideration, far less indeed than it really deserves. The teasel is the fruit of the thistle, which by careful cultivation has been brought to such perfection that for hundreds of years there was nothing which could in any way compete with this natural product for the purpose of raising the nap on woolen cloth. It is held by many manufacturers and finishers of fine grades of face finished woolen fabrics, up to the present time, that it is impossible to displace the teasel, however, the wire gig, *i. e.* the Napping machine is fast winning friends amongst Woolen Manufacturers, certainly on account of economy, and in connection with some kinds of fabrics has completely superseded the teasel, whereas in connection with others both are used.

The teasel point possesses a certain rigidity and at the same time a degree of elasticity which no manufactured article that has ever been discovered can attain. If the teasel point comes in contact with a knot or lump on the surface of the cloth, it will be bent back by the velocity of the cylinder, but after the hunch is past, the point returns to its original position and no damage is done. From the nature of the teasel point the teasel certainly is particularly well suited for this gigging. Not only is it made up of a barb or point similar to a wire or steel point, but all along the edges of the barb there are little teeth or points which add their part to the ease with which the barb is enabled to do its work. It is for these reasons that the teasel seems so much better adapted for working up the felt of the fulled cloth into a nap and in opening up the fibres so that all imperfections and foreign substances are removed, for which reason where it is used in the mill, its care and preservation demand the special attention of those who have anything to do with it.

When a lot of teasels is received at the mill it should be stored in a dry place where the teasels will not absorb moisture and become limp and useless.

In making use of the teasel the two great points to be kept in mind are the mounting in the teasel slat, and the wear upon it after it is in use in the gig.

In the mounting of the teasels in the slats, which is a framework of iron designed to hold the teasels in place and present a smooth, that is even, surface to the cloth to be worked upon, much effectiveness to the teasel is secured. They must be set in the slat so firmly that they will stand all the speed and working about which will be brought to bear upon them after they are in the cylinder. There must be no open spaces between them, and the teasels must be as much as possible of one quality. Some advocate moistening the teasel before it is mounted so that it can be the more firmly and easily pressed into place. If such is made use of the usual practice is to take a basket full of teasels at a time and steam them slightly, which will soften them and in turn make them easier to be handled. However it must be remembered that a teasel in a moist state is soft and therefore useless, again moisture will destroy its life, so that in order to make the slats thus mounted of any use, they will have to be quickly and thoroughly dried. This means a corresponding loss in time and labor before the teasel ever reaches the stage where it can do work, a fact certainly against this procedure of steaming or moistening teasels for the sake of setting them easily. Again when the fingers of the teasel setter are properly protected, teasels may be set in the dry state just as evenly as if they were moistened, and this more effectively. It may at the beginning take more time for him to set a certain number of slats, but that will be only a short while and then he will be just as expert at it as if setting moistened teasels. The teasels are then not injured and can be pressed together just as solid and just as even as if they were moist. Teasels mounted in the dry state are apt to stay in the frame longer than those mounted in the moist state. Mounting teasels requires a good, quick eye, since it will not do to mount these teasels carelessly, they must be properly sorted first and afterwards still more or less selected as to size during setting or mounting the slats, since otherwise an uneven surface would result, and in consequence uneven and streaky work produced. Some shipments of teasels come to the mill with their stems cut off close, while others have stems 4 or 5″ long left on.

The slats for receiving the teasels are made of two strips of flat iron and the stems of the teasels are drawn through this opening between two strips of flat iron, which gives additional support for the teasels and helps to hold them in place. When the slat has been filled, the protruding ends of the stems are cut evenly off with a sharp knife. In connection with wood frame slats, teasels minus stems are used, and if they have any, they must be cut off and this previous to steaming, provided this is practiced in the mill. The teasels must be then pressed into the frame and against each other as solid as possible so that after they are put into the cylinder, and the latter is set in motion, they will not fly out.

The proper selection, *i. e.* buying of the proper size and quality of teasels is another important factor for good work at the process of gigging. There is no reason why the teasels should not be of a size to fit the slats. For instance why should we use a 2 inch teasel with what are termed "buttons" to fill out with, when a box of teasels ranging from 1½ to 1¾ inches would make a better slat and this with less trouble? It must be remembered that a 2 inch teasel as a rule is more expensive than a 1½ or 1¾ inch teasel, again that "buttons," *i. e.* small unripe teasels amount to nothing more or less than throwing away of good money for very poor material. Certainly growers and sellers of teasels must get rid of them, for they are of no use to them, neither to anyone else. However, the price of these "buttons" is somewhat tempting to manufacturers, the same being as a rule so low that it seems like a fair investment on their part to use them; but it should be remembered that these buttons or small teasels are not as well matured as the full grown ones, they being open and soft, and their usefulness in the actual process of gigging amounts to nothing; they simply fulfilling the purpose of holding the teasels which do the work in their proper place in the slats. If this purpose however is attained, by teasels which are effective in the process of gigging, certainly much less dead or useless material has to be handled. Again if the proper size teasel is bought by the mill, it must be remembered that it is not only easier for the teasel setter to mount the slats, but that every one of the teasels in such a slat will be of some decided usefulness, in turn reducing the cost of the teasels as well as the expenses in setting them in slats.

When the teasels are properly set, with the whole surface of the teasels as they are ranged in the slat, uniform and regular, there is no reason why they should not run on ordinary woolens for eight or ten days and do good work.

Tension.—With reference to the next question, that of the tension of the goods, we come to a matter which requires the most careful attention and manipulation of the operator. It has always been one of the greatest and most important points to builders of gigs to construct a machine by means of which it is possible to regulate properly the tension of the cloth as it is stretched before the cylinder of the gig, in order to allow the machine to do its most effective work and yet bring about the best results in the cloth. The difficulty however is one natural to the process, the trouble resting not so much with the machine as it is with the goods. If every piece of goods that has to be gigged came to the machine in exactly the same condition as regards weight, stock and construction, then the matter of tension would be very simple indeed; however this is not the case, since fabrics vary so much in weight that an equal tension on two different pieces which differ slightly in weight per yard would result in a perceptible alteration in the appearance of the face of the goods, and which difference would only be heightened during the successively following procedures at finishing. Again differently constructed fabrics take in turn differently to gigging, and when the latter process must be always more or less regulated to suit the kind of cloth under operation. If for example the pieces of cloth under operation are made with a different number of picks to the inch, then the same amount of tension given to the fabric cannot possibly bring about similar results. Thus it will be advisable for the operator to know enough about the construction of the goods to be gigged, in order to be able to regulate the tension so as to produce as nearly as possible uniform results to fabrics under operation. This however, is no easy task, and can only be accomplished after considerable experience and skill on the part of the operator. This difference in tension as required for different fabrics, may not amount to very much where the goods are heavy and do not require a great amount of work, but if the goods happen to be light and the gigging correspondingly light, the difference in tension required is then quite an item.

Condition of the Cloth.—As regards the third point, the condition of the cloth in the process, there are two different questions that arise. These are the differences between wet and dry gigging.

Where the cloth is gigged damp or wet, the fibres will naturally tend to lie down close to the body of the fabric, and when the piece gets to the shear the revolver blades pass over them and leave them much as the gig left them, at least so far as the bottom is concerned. The cause of this is found in the nature of the wool fibre, which more readily retains its position when damp. The teasel serves to comb and lay the nap in a certain way, and when the shear gets at it, it is with difficulty that it touches it at all. In cropping, a wire raising brush, run a little faster than the goods, raises the nap perfectly.

The wetting of the goods is accomplished by means of an ordinary sprinkling can, or by a series of perforated pipes, so arranged as to eject a stream of water at the proper time and place. It is in this way that such goods as doeskins, broadcloths and beavers, some kinds of worsteds, etc., are treated, and it is the distinguishing feature of many of the finest finishes in the market.

By the other method of gigging, *i. e.* dry gigging, a different kind of finish entirely is produced. The fibres being dry do not retain the position which they are given by the action of the teasel, but have a tendency to stand up in their natural position, the teasel points get down further into the body of the goods, and thus work up a fuller and richer nap, and leave it in such a condition that the blades of the shear can readily reach most all the fibres. None of the fibres are lying down close to the weave of the goods and there are none of them but what can be brought up into contact with the shears by the use of a hard brush, which every shear contains. The character which this treatment gives to the finish may be described as a close, threadbare or clear face finish, the nap as raised by the gig being in turn cut off short by the shear. Clear face goods, many classes of dress goods, and worsteds and fancy cassimeres, are as a rule finished by means of dry gigging.

In both cases, whether wet or dry gigging, care must be taken not to push the cloth too forcibly on to the teasels, or a tender fabric will be the result. The teasels should be started slowly and gradually and with the oldest and softest teasels first, then the sharper may be used as the work progresses. Again there is a certain limit for gigging, to go beyond which is harmful to the strength of the fabric thus treated. To give, therefore, to all pieces of certain style of fabric the same kind of treatment will in a great many instances result in failure, for although some of the pieces will finish perfect, others will be spoiled. Therefore, in order to perform gigging intelligently, it is necessary for the finisher to study the construction of the goods carefully, he must see what kind and amount of gigging each individual piece may need or is able to stand.

The Up and Down Single Contact Gig. With reference to styles of gigs used, this gig, as the oldest and most simple gig, will be best mentioned first. The same consists of a framework which supports a large cylinder from 36 to 40 inches in diameter upon which the slats containing the teasels are placed and by one or the other contrivance held in place. Above and below this cylinder are found the cloth receiving rolls and a little way above the bottom roll and also below the top roll there are brackets supporting smaller guide rolls, the upper one being movable so that it can be slid in or out at will. Before the cloth is put on the machine, the slats on the cylinder are examined as to the sharpness of the teasels, remembering that all gigging must be started with the dull teasels, since the fibres on the surface of the fabric are all more or less heavily felted or matted down to the body of the cloth, and when if teasels with sharp points were used, they would take hold too hard and the fibres would be torn out, both to the injury of the cloth as well as the teasels. After the proper teasels, *i. e.* "work" has been put on the cylinder, the fabric is put on with the head or number end on top, that is, the end from which the nap is intended to run. This gig closely resembles the Up and Down Wet Gig illustrated and explained later on (see Fig. 19, page 324).

The top as well as the bottom cloth rolls, previously referred to, are provided with aprons of a length sufficient to go once around the roll and then reach to the other. Each apron is fastened to hooks on the roll, the other end being either sewed or wired to the respective end of the cloth, *i. e.* one apron to the head end of the fabric, the other apron to the other end of the fabric.

After threading the fabric to the apron of the top roll, the guide roll below said top roll is then run out its full length and the cloth run on the top roll, starting the machine, by moving the shipper handle to the right hand as far as it will go.

This shipping mechanism is such that when the top roll is engaged by turning the handle to the right, the bottom roll is released and will turn as the top roll pulls the cloth upward. If again, the handle is turned to the left, the top roll is released and the bottom roll engaged, whereas when the handle is pushed in the centre, both rolls are released and therefore stand still, the cylinder alone continuing to rotate.

As soon as the cloth is very nearly wound on the top roll, the shipper lever is placed in its centre notch, which stops the rotation of the two cloth rolls, and when the apron of the bottom roll is sewed or wired to the other end of the cloth in the same manner as done with the head end of the fabric, taking care to have the apron run outside of the bottom guide roll. The shipper handle of the machine is then turned to the left, which sets the bottom roll in motion and in turn winds the cloth, as coming from the top roll, on it.

Each of the cloth rolls is provided with a brake by which the tension of the cloth is controlled.

The brake is now applied to the top roll until the required tension is reached and the top guide roll is run in until the cloth is brought lightly into contact with the teasels on the cylinder. When the cloth is run on the bottom roll and the apron has reached as far as the bottom guide roll in its downward course, the shipper lever is then turned to the extreme right and the cloth begins to travel upward. The brake, *i. e.* tension on the top roll is now released and applied to the bottom roll, and as soon as the apron is past the cylinder the upper guide roll is turned somewhat inward so as to bring the cloth somewhat more, *i. e.* harder in contact with the teasels.

When the end of the cloth has passed the upper guide roll, what is termed as one "run" of the fabric has been completed and by this unit of work the amount of gigging done is expressed, by what we mean that for example "four runs" mean that the cloth in question passed over the cylinder eight times, *i. e.* has passed from top to bottom roll and back again four times.

When the fabric has been sufficiently gigged, the machine is then stopped by running the belt on the loose pulley, and the respective wire pulled out of the apron and the cloth, and the latter folded nicely on a truck. With full runs, and which is generally the case, the cloth is thus folded as coming from the top roll.

Now upon examination of the slats it will be found that the teasels have gathered and retained any amount of fibres, as combed from the cloth, and known as "gig flocks," in fact enough to make it impossible for the teasels to do any more work, and, therefore, the slats, *i. e.* the teasels must be cleaned from these gig flocks. Various methods are employed for doing this work, in some mills they are cleaned by means of hand cards, whereas in other mills the slats are turned on the cylinder, thus presenting a fresh side of the teasels for gigging, and then when both sides of the slats have become filled with flocks, they are taken out of the cylinder and brushed, *i. e.* cleaned on a special machine (revolving brush) provided for this purpose. Next the fabric is turned bottom end up, and the truck turned. What was before the last end, but is now the first, is then sewed or wired to the top apron and the goods run on the top roll; the bottom apron is then put on and the process of gigging, as explained before, repeated, this procedure being known as "reversing."

Up to this point most all goods are treated practically alike, but now we face the question of the finish for the fabric required, regulating the further process of gigging; the process as until now explained having been more particularly only quoted in order to be able to explain the general construction and operation of the most simple built gig, but which, at the same time, holds good in its principle for any make of modern gigs, the construction of which will be later on treated.

A feature of the greatest importance in connection with gigging is the grading of the slats into sets of different and increasing degrees of sharpness in order to be able to give fabrics of one style practically the same amount of gigging, and not have some of them treated one way and the others another way. To do this properly, the number of slats required to fill the cylinder must be taken into account and this number divided into sets with equal numbers and have that many degrees of sharpness of teasels; however, when dealing with face finish fabrics, it will be advisable to have more degrees of sharpness to slats than could be well made by dividing the slats of one cylinder into sets, in this case, for example, grading the slats in sets of six each and make from eight to ten grades of teasels. This grading of the teasels is made necessary for the reason that all gigging must be started with dull teasels, and the sharpness of the teasels used increased as the progress of gigging demands. If we would start with all, or even too much, new work, *i. e.* slats of new teasels, known as "breakers," both the fabrics, as well as the teasels, would suffer, for, being stiff and sharp, the points of the teasels would, as soon as they come in contact with the cloth, get caught in the felt and tear out the fibres, thus destroying the strength as well as the finish of the cloth under operation, and at the same time the teasel points would become so mutilated that the slat would be of very little use thereafter.

Always remember during gigging to closely examine how well the felt is raised, as well as the strength of the cloth, so that no tender fabrics will result. The slats must also be carefully watched, in order that the several grades are kept at a uniform sharpness, as well as to use up the slats, *i. e.* teasels in the frame, completely. It certainly will be understood, that slats, *i. e.* teasels as used, correspondingly change in their grade, *i. e.* gigging properties.

When testing the fabric under operation for its strength, take both of your hands and pass the cloth between the forefinger and thumb of each hand, having the thumb on top, and bring the hands close enough together to have the finger ends touch each other, then hold the cloth tight between the fingers and bring the knuckles of the thumbs together, being careful that the cloth will not slip between the fingers. In this way you will readily ascertain the strength of the cloth under operation. It is a well known fact that by means of this procedure, by some practice you are able to burst the strongest fabric. However it is not at all necessary for you to do this, simply strain the fabric gradually and you can easily note when there is a tendency for the goods to part. Always test the fabric near the end, in order that if a hole is burst in the cloth, the damage thus done will be at a minimum expense to the mill.

In order to ascertain the amount of gigging given a fabric, insert one of the small blades of a penknife under the nap and lift and lay back the fibres, in this manner exposing the ground. You can then easily tell if all the fibres are raised or if some of them still cling to the body of the structure.

Never take a fabric from the gig until thus tested with reference to its strength, and more particularly yet, regarding nap sufficiently raised, and there will be no trouble at the shear and goods will not have to be sent back to be re-gigged.

Besides the single contact gig previously explained, there are several makes of other gigs in the market, viz.: the up and down two contact gig, the rotary gig, and the two cylinder gig, they all having their special points of advantage in their construction, their chief aim being increase in production, without increase in labor.

The Up and Down Two Contact Gig will do much more work per day and per man than the common up and down single contact machine previously explained, the increased output being effected by a cylinder of increased diameter (42 inches) with two applications of the cloth to it. A perspective view of this gig as built by the Parks & Woolson Machine Co., is given in Fig. 16, showing that two large adjustable contacts or breasts, in this machine, are the means for about doubling the amount of gigging as compared to the single contact gig. These two applications have a quick acting geared adjustment from two of the heaviest possible contacts, to a distance of four or five inches entirely free from the cylinder, which feature enables the operator to conveniently run on new pieces, sew the seams and apply temples or stretcher sticks.

The path of the cloth is free from sharp turns and any number of temples will run nicely on it. Reversing and stopping the cloth is governed by one lever, independent of other motions. The friction to the cloth rolls is handy, efficient, and capable of the heaviest or lightest tensions. There are twenty-four iron flats to the cylinder used in connection with this gig, and which are staggered or set alternately to the right and left by pairs so the cross irons will not rotate in the same line.

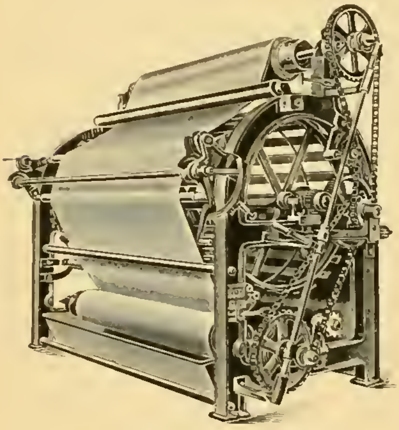


Fig. 16.

Special attachments, as may be used in connection with this gig, are a rolling attachment located in front of the machine, which rolls the cloth onto a removable wood roll from the lower draft roll. It is operated by a clutch, and will make a hard even roll. A cylinder vibrator, for a two inch stroke, is another one of these attachments, and which by means of vibrating the cylinder during gigging will greatly assist the teasels in raising a most uniformly even nap all over the surface of the fabric. A sprinkler pipe is placed just beneath the lower cloth application, and which applies water directly to the face of the fabrics under operation. Two stretch rolls, one for each contact, are also sometimes met with in this construction of a gig. By shifting the application roll gearing up onto the stands as fastened to the side frames of the machine, the latter can be readily changed into a one contact machine, when it is desired to get a very long heavy contact, *i. e.* application of the cloth on the cylinder; thus the machine can be used either as a single contact or two contact machine, as best adapted for certain fabrics made by the mill. When this gig is used with the two contacts, the length of those two contacts combined, can be made about twice as long as that of the regular one contact machine.

The Rotary Gig. In this make of a gig the cloth after once put on, the ends are nicely sewn together, either by machine or hand, in such a way that the seam ends are on the back, presenting a smooth face to the cylinder, the fabric or fabrics if two pieces are gigged at one time, thus being made into an endless piece and handled in this manner, the cloth running continuously over the cylinder and through the scray as placed beneath the machine until sufficiently gigged. The machine has a cylinder, the same as the up and down gigs previously explained, revolving at from 150 to 175 r. p. m., but the cloth, instead of rolling up on drums on top and bottom and getting only one or two contacts in its passage over one side of the cylinder, passes now around the cylinder and gets either one or two contacts on each side of the cylinder, according to the construction of the gig, a machine in the first instance being known as a "Double Acting Gig" and in the latter case as a "Quadruple Acting Gig."

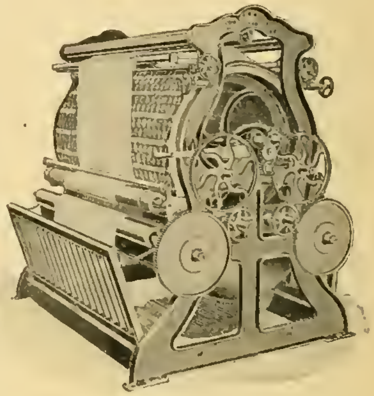


Fig. 17.

Fig. 17 shows a double acting gig, as built by the Curtis & Marble Machine Co., in its perspective view; at the same time explaining a similar machine as is built by the Parks & Woolson Machine Co. Once the cloth has been started in a rotary gig, the seam only has to be watched in order to tell how many runs the piece has had. The degree of application of the cloth to the cylinder, in these machines is regulated by means of a hand wheel at each side of the machine, said hand wheels operating the contact rolls of the gig. The rotation of the cylinder is reversible, the same being done by means of a cross belt provided to this machine besides the straight belt (the machine having three pulleys, viz.: two loose pulleys—one for each driving belt—and one driving pulley, situated between the two loose pulleys). The cross belt turns the cylinder in the opposite direction from that of the straight belt, the direction of running the cloth being reversed by means of a lever operating a set of gears, which reverse the travel of the cloth. Stretch rolls hold the cloth out to its full width and prevent wrinkles while being gigged, so that it may be left smooth and even for further finishing. The stretch rolls are made with brass trucks and slides, and are a decided improvement over the stretch rolls formerly used, and on which rubber bands were required for holding the wooden slats in place. The draft and friction rolls are driven by a special arrangement of gearing, so that any required tension to the fabric can be maintained uniform on either light or heavy goods, throughout the whole length of the piece.

The goods may be napped in both directions without being taken off the machine by reversing the cylinder and turning over the teasel slats, which are arranged to slide under plates on the cylinder, so that they can be changed quickly. The cylinder is regularly arranged to hold 21 of the common 4½″ slats, or 24 of the 4″ slats, as desired. By having an extra pair of stretch rolls, as each width of the cloth must be stretched from its centre, the machine can be used on 6/4 and 3/4 goods.

When ordered, there is placed a special rotary teasel cleaner beneath the cylinder, consisting of a rotary wire brush which can be lifted up in contact with the points of the teasels by means of a conveniently located hand wheel. The peripheral speed of this wire brush is in the same direction but much faster than that of the cylinder, and consequently frees the teasels from flocks during the operation of actual gigging the cloth and without stopping or reversing the cylinders. This effects a very great saving of time over the old method of cleaning with hand cards or taking out the teasel slats and applying them by hand to a separate rotary brush cylinder cleaning machine.

The Two Cylinder Six Contact Gig. The same is the standard machine with reference to quality and quantity of work done, and is characterized by its smooth and noiseless running, accomplishing, as will be readily understood, more than two rotary gigs could do, permitting contacts and tensions for each cylinder to be adjusted at will while the machine is running; all the operations being accomplished by means of conveniently located handles on the machine. The power is almost wholly transmitted by belts and chain, there being but four gears in all, a feature resulting in a quiet and easy running machine. There are three applications of the cloth to each cylinder and these are independently adjustable while gigging, so that the gig effect for one run, and this for each cylinder, can be regulated to a nicety; however, if it is desired to apply the cloth but twice to each cylinder it can be readily done. The cylinders may be run in the same or reverse directions by the connecting belt being either open or crossed, a tightening pulley mounted on an adjusting quadrant, taking up this belt when it runs open; certainly a handy feature, since it saves splicing the belt when reversing the cylinders. The cloth is carried through the machine by five draft rolls of large diameter, two of which have large plate frictions. The tension of the cloth can thus be adjusted independently for each cylinder according to its work and direction of rotation, and all while the machine is running. On account of the application rolls being covered with brass, the cloth can therefore be left on the machine over night or any length of time without danger of rust marks. A large diameter stretch roll is located in front of each cylinder, making two to the machine, and their stretching capacity is adjustable so they may be set to stretch the fabrics under operation as much or as little as wanted within their range. The cloth feed can be stopped and the cylinders left running by means of a clutch and lever arrangement.

The construction and operation of this machine will be readily understood by reference to Fig. 18, being a side elevation of the Parks & Woolson two cylinder six contact gig, showing the passage of the cloth through the machine by dotted lines. In this machine the cloth having been deposited in the roller scray A, passes from it over guide roll B and draft roll C, and then under stretch roll D, in contact with the first cylinder E of the machine, and where by means of five application rolls, three contacts of the cloth, with the cylinder E are produced. The purpose of the stretch roll D is to free the cloth from wrinkles so that there will be no streaky gigging. Leaving the last application roll, as situated just below the cylinder, the fabrics pass around shaft roll C′ and stretch roll D′ in contact with the second cylinder E′ of the machine, and where by means of five application rolls, again three contacts of the cloth with the cylinder E′ are produced. F and G are guide or carrier rolls, carrying the fabric between the two sections of the machine. Leaving the last application roll in connection with cylinder E′, the cloth passes under draft roll C″, and between it and guide roll H,

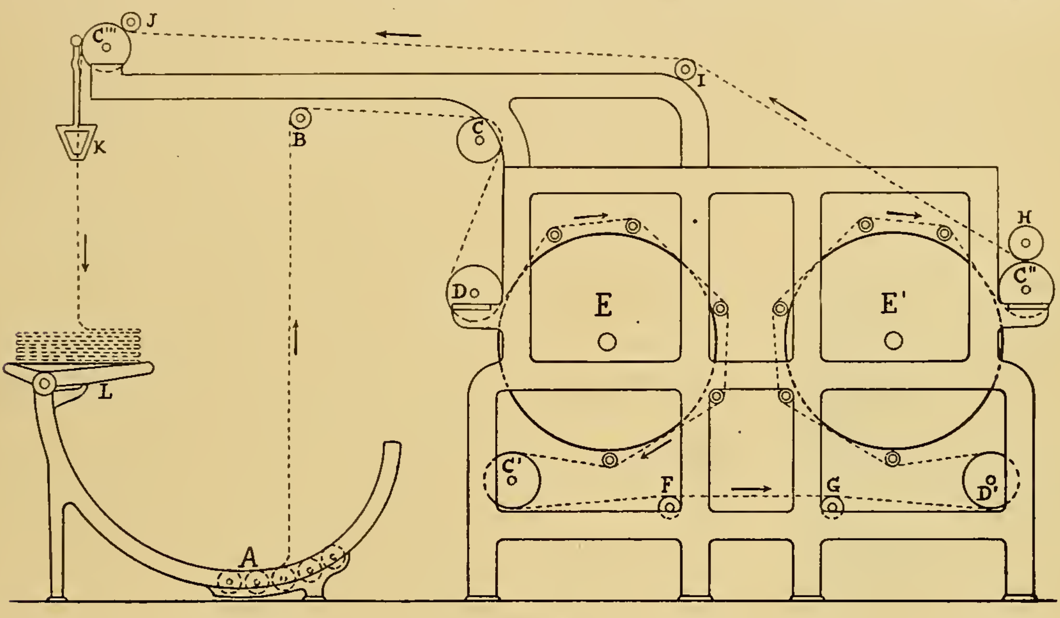


Fig. 18.

over guide roll I, between folder draft roller C''' and guide roll J, into the folder K, to which, by means of suitable cam and lever arrangement, a to and fro motion is imparted. During gigging, the run of the fabric through the machine is uninterrupted, *i. e.* the number of pieces to be gigged at one time, after having been sewn or wired to each other, and after threaded into the machine, and finally wired or sewn in an endless piece, when leaving the folder K, run back again into the roller scray A and in turn through the machine until their gigging is completed. When this is the case each seam or wire when leaving the folder K, in its turn, is pulled out, tilting table L pushed in position, as shown in illustration, and when the fabric will fold itself on said table. After one fabric is thus folded, it is put on a truck placed handy near the table and the next piece of cloth folded in the same manner.

In this manner we may handle one, two, three or four pieces at one time, either taking them out of the machine at one time, provided they gigged alike, or provided one or the other needs an extra run, this can be readily done by running this particular piece back into the roller scray A and thus again through the machine, taking pieces out of the string, and thus out of the machine, when sufficiently gigged. Previous to the last piece of the string of fabrics taking its last run through the machine, either the first of a new string of fabrics to be gigged or the "apron" is wired to it.

Each cylinder E and E' has a stationary cleaner brush set beneath it, which are brought into contact with the teasels by hand wheels, with a rack and pinion mechanism. The teasels are thus cleaned quickly, thoroughly, and without doing them harm. A reverse driving pulley is placed inside the regular tight and loose pulleys so the cylinders can be run backward when cleaning. Again, in place of these stationary cleaner brushes, special rotary cleaner brushes can be provided, and which are thrown into their operative positions by separate levers, which at the same time set them to rotating. By letting go of the lever the brush drops away from the teasel cylinder and ceases to revolve. It has adjustable stops and adjustable boxes. The peripheral or surface velocity of these cleaner brushes is in the same direction but greater than that of the cylinders, so that the teasels are perfectly freed from flocks with no injury whatever to themselves. Its advantage over the stationary cleaner is evident at once, since it cleans while gigging and without stopping to reverse the cylinders, and consequently effects a great saving in time and labor.

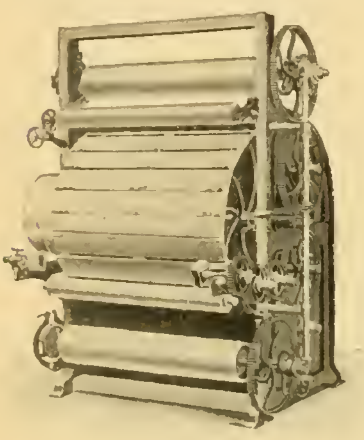


Fig. 19.

Wet Brushing Gig. Gigging done by means of this machine, though termed wet gigging, is really only wet brushing, performed on an up and down single contact gig, using either slats containing old worn out teasels for this purpose, or what is more modern, using in place of it brush lags filled either with stiff bristles or wood fibre. Fig. 19 shows this machine as built by the Curtis & Marble Machine Co., in its perspective view. The purpose of this process of wet gigging, *i. e.* wet brushing is to impart smoothness to the face of the fabric and at the same time create some slight lustre. The supply of water must be plentiful for this process, otherwise the effect aimed at will be lost, and besides unnecessary gig flocks produced. The process is always used in connection with a "face finish," whether the goods are steam lustred or not, also in connection with "burr dyeing" after said procedure. While as a rule used only in connection with face finished fabrics, it also may be employed on close finished fabrics with satisfactory results.

Face Finish. Gigging is one of the most important operations in the finishing of woolen napped goods, for only a well gigged piece of cloth will do justice to the other manipulations of the finishing department, and to properly perform the operation requires years of practical experience. The appearance and, before everything else, the "feel" of the goods, are important guides.

The nap which is required to bring about this finish cannot possibly be formed at the gigs unless there is already in the goods a good, firm, basis on which to work. For this reason the stock, which is put in these goods must possess plenty of the felting property, which makes the production of a good solid felt possible, and when the teasels then can work into this felt without being in danger of cutting down into the threads and consequently weakening the fabric.

A person with any expert knowledge can, of course, readily determine in the case of a finished piece of cloth, whether it has been gigged too much or too little. This, however, is rather difficult during the actual process of wet gigging. Insufficiently gigged cloth, when dry, presents a more or less coarse and unclean appearance and invariably has a more or less raw "feel" when the flat hand is passed downward with the nap, caused by the unloosened felt remaining at the bottom. It is the fundamental principle of correct gigging, to loosen the felt down to the plane of the weave, and to thoroughly lay the nap thus obtained; and the more thoroughly this is done, the finer and smoother will be the surface of the cloth, in appearance as well as in feel. Again the surface of a cloth that has been gigged too much will look indistinct and cloudy, but of course, be very soft in feel.

No definite rules for gigging a face finished fabric can be laid down or learned by rote, still, a few material points useful for beginners may be given. The most important considerations to be taken into account are:

(1) Quality and character of the wool, (2) Texture and weave employed, (3) Kind of fabric under operation and its purpose of wear, (4) The finished effect desired, and (5) The strength of the cloth.

The quality and character of the wool are most important factors, since it will be readily understood, that a cloth made from a fine sound wool will withstand far more gigging than one made from an inferior stock, because upon the fineness of the wool depends its felting capacity, and the finer the wool the more compact the felt, requiring in turn more forcible gigging, in order to produce a smooth and elegant face. The cloth during the gigging has a very soft and open feel, but becomes much firmer and more compact when in a dry state, so that when the piece is dried, an inexperienced person, having previously examined it in the wet state would hardly recognize it. On the other hand, there are wools met with, which increase in resistance during the gigging; they "swell," as the practical finisher says. After the first few runs on the gig they begin to grow thicker and firmer, instead of softening, and when naturally such fabrics demand a forcible gigging. It is not a rare occurrence to find that cloth which has been gigged almost ready in the evening, and has been left lying wet over night, requires the next morning two, three, or even more runs in order to finish it. This "swelling" is a characteristic of the best and finest wools, and may be accepted as an infallible indication of the excellence of the wool used in the construction of the fabric.

The texture of the cloth, especially that of the warp, also demands special attention, since the higher this texture, the slighter is the effect the teasels have upon the cloth and the more it may be gigged without incurring the danger of making it tender. Again the weave, *i. e.* the interlacing of the warp and the filling, and which certainly has some relation with its texture, must also be taken under consideration in gigging. Fabrics interlaced with short, smooth binding weaves, like the plain weave, 4 harness broken twill, 3 harness twill, etc., are not as readily attacked in gigging as pronounced twilled goods, diagonals, etc., *i. e.* looser interlacing weaves of any of the many divisions of weaves.

Fabrics in which the filling forms the face will suffer more than fabrics in which the face is produced by the warp, and in connection with which (filling face cloth) the finisher must exercise the greatest of care, since such fabrics generally require only little gigging and this with dull teasels, whereas goods having their filling well covered by the warp, such as satins, doeskins, kerseys, beavers, etc., require a strong and forcible gigging.

In considering *the desired finishing effect*, it is apparent that a cloth which is to have a fairly long nap, need not be gigged as deeply as one which, if possible, is to be steam-lustred several times, and then shorn short. Melton-like goods require only little superficial gigging, while on the other hand, doeskins, kerseys, beavers and kindred cloths are to be gigged very thoroughly, in view of the subsequent operations. Fabrics destined for wear, like "Uniform-cloths," and in which attention is paid more to their strength than their elegance, gigging must be restricted to its minimum.

In many classes of face finished fabrics, it is necessary to crop down the nap during the gigging process. That is, the piece is taken to the cropping shear and the nap is partially shorn off so that when the goods are run again on the gig, the teasels can get down well into the body of the felt. This more particularly refers to heavy weights. In gigging kerseys for a water finish, it is a good plan to gig very slowly and as much as possible one way only, since these fabrics as a rule are of medium to low grade, and therefore the material used in their construction is usually not of the best felting quality. For this reason make what felt that is there, go as far as possible towards producing a good face, a good plan being to gig them somewhat moister than would be advisable in other cases, since the less moisture the goods have, the easier fibres are pulled out and for the same reason do as little reversing as possible, in order so as not to lose any fibres on that account.

The strength of the cloth is one of the most important points to be considered at gigging, and is frequently the check that retains the finisher from giving a fabric of cloth a workmanlike elegant appearance, however much he may desire to do it, for the fact that a certain strength for it, when finished, is demanded. It is admitted that the finisher cannot impart a good appearance to the cloth without gigging it well, and, of course, deteriorating its strength to a certain extent. To perform this operation successfully, one of two things is necessary—the cloth must either be manufactured from such strong material which, in spite of a sufficient amount of gigging, will remain strong enough to comply with all reasonable demands, or its good appearance must be considered as secondary to its strength. A middle course might, it is true, be followed, and the cloth gigged more and correspondingly longer with dull teasels than with sharper ones. But even in this case success in many instances is uncertain, leaving out of consideration the loss in time and consequent expense to the manufacturer.

The Velvet Finish. This finish, as indicated by its name, shall impart to the face of the fabric a finish having the characteristics of plush or velvet appearance, *i. e.* in that the nap is to be thick, and stand as nearly in an erect position as it can be got. It is a finish relying entirely upon the proper gigging, although a proper cloth structure and proper fulling, previous to gigging, must have been attended to. The stock used in the construction of the fabric should be of good felting capacity, and the fabric handled at the fulling, so as to produce a bottom upon which much work is required. Gig them as moist as possible, but not enough to have them drip, therefore, extract them slightly, to stop the dripping, but no more. When dealing with a double, *i. e.* two cylinder gig, keep both cylinders going in opposite directions all through the process. After gigging is finished, extract and dry them, and give them a thorough dry beating, which will make the nap lofty. All the after processes in connection with this finish must be conducted with care so that at no time there is a tendency to lay the nap much and also to avoid turning it over too much, which is just as bad.

Chinchilla Finish. These fabrics, including Ratine's, Whitney's, etc., also require the greatest of care during the gigging, and as there is much danger of cutting the filling and thus causing streaks, as well as tender goods, it is advisable to keep them as moist as possible during gigging, extracting them only enough to prevent dripping. The common "up and down" single contact gig is a good gig for handling these fabrics, using dull teasels more or less throughout the entire process. Raise a good velvet nap by means of constant reversing. These fabrics are "whipped" just previous to drying on a Rotary Dryer connected if possible directly to the "whipping" machine in order that the nap as erected on the latter machine, is dried before folding the fabric, and thus preserved in this position as much as possible for its clipping at the shear, previous to submitting the fabric to the Chinchilla machine.

Threadbare Finish. This finish, from its name, indicates that the fabric destined for this finish requires its face well "cleaned out," as it is called, quite down to the weave or thread, and for this reason, mainly, it is one of those finishes in which we must be careful not to gig down close at the start. Since this class of goods requires a considerable amount of gigging, see that the cloth is kept well moistened throughout the operation, as a dry thread will cut, *i. e.* get tender much more quickly than a wet one; for the same reason see that the piece comes from the fulling mill in condition for it; however, the real place for laying the foundation for good gigging, *i. e.* a good final finish, is at the loom and not at the fulling mill. The cloth when it comes to the finishing room should be almost heavy enough already, and require but comparatively little felting either way. Scouring, with a very slight fulling, should be all that is required, since it will be readily seen that if a thick, close felt is formed in the fulling mill, it will be almost impossible to gig down to the weave so as to clear out the threads completely, since the thickness of the nap would cover and conceal the threads, and no matter how hard we would try to get down to the bottom with the teasel points, it would be a hopeless task.

Union Cassimere Finish. These fabrics are usually better if gigged dry instead of wet, for the fact that the condition of the cotton in the structure is never bettered by the fabric being allowed to stand about in the wet, for which reason these fabrics are dried just as quickly as possible after the scouring has been done. Gigging dry, certainly has a tendency to harden the goods, but lying about in the wet has a tendency to deaden the colors and make their brilliancy and clearness almost an impossibility, and since it is upon the latter characteristics that this class of fabrics depends for its value, it is best to gig dry, even if it does have a slight effect upon the feel of the goods themselves, since the colors will come up brighter and the general appearance superior. In these fabrics we do not have a thick, close felt to break up, since the fulling is not an important part of the work, and frequently nil, nevertheless, care must be taken not to gig too close on the start or with work which is too sharp for the beginning of the process.

Worsted Finish. A worsted fabric does not require much fulling, frequently none at all, *i. e.* only as much as the fabric may felt during scouring the flannel. All worsted fabrics that are to receive a finish that requires gigging should be taken from the washers to the steaming and stretching or boiling and stretching machine and rolled up to give them a smooth face, free from wrinkles and pits and streaks. They should remain on the rolls from two to three hours. At the gig it is absolutely necessary to begin with "old work." After this "old work" add a few slats of a sharper grade of teasels in the cylinder just before the operation is complete. To obtain the lustre required on worsteds it is necessary to gig all the one way and to use only a fine class of teasels or there is danger of making the goods streaked and consequently unsatisfactory.

The Saxony Finish. This, although more or less a close finish, is not a worsted finish, more closely resembling what we might call a face-finished cassimere. Although some of the nap is left on the face of the fabric, yet the same must lie so that it will be impossible to feel any pronounced spring, at the same time the threads must be more or less visible and not hid by a felt.

NAPPING.

The use of napping machines in the finishing of woolen and worsted goods, has long passed the experimental stage, in fact, they have, for the sake of production as well as a saving in labor, become a necessary adjunct to the finishing room of any mill. It used to be formerly considered an established fact that nothing could successfully take the place of the teasel point, in the gigging (or napping) of face goods, at least; but with the indisputable evidence before us, we must admit that this is no longer wholly true, and undoubtedly there must be some decided point of merit in these machines, otherwise their adoption would not be as universal as it is now; however it is a question if gigging by means of teasels will ever be wholly abandoned, for it must be remembered that the teasel gigs are with us and will continue to be used to quite an extent in connection with certain fabrics.

The Napping machine in itself consists of a series of workers or napping rolls mounted upon a large cylinder, rotating in one direction, while the motion imparted to the individual workers is in the reverse direction. By means of suitably placed application rolls, which can be controlled simultaneously, the contact of the cloth with the wire clothing of the workers is regulated, the production of the machine depending to a considerable extent upon the number of contacts the cloth has with the napping rolls. All nappers are provided with a cleaning device of some kind of construction and which keeps the workers or napping rolls always in the same clean condition, and when therefore each contact of them with the cloth is of uniform efficiency, whereas in connection with teasels, every contact of the cloth with them, reduces their efficiency.

To imitate the teasel point, or at least the elasticity of the teasel point, has been the chief aim of all inventors of napping machinery, and we must acknowledge that most of them have succeeded admirably. They all adopt the metallic point which is rust proof, for which reason the efficiency of the workers is not impaired by moisture as is the case with teasels. Besides being more efficient and uniform in its action, as compared to the gig, the napper does away with the difficult labor of properly setting the teasels into the slats, as well as keeping these slats, *i. e.* teasels, up to their proper point where they ought to be.

Such an absolute uniformity of the working surface as is found in a napper, is certainly never attainable with the teasel, no matter how closely we may watch them and try to keep things as they should be.

The efficiency of the napper being constant and known to the operator, it will be readily seen that any piece of cloth run through the machine will get practically the same amount of gigging as another piece, provided the application of the fabric to the action of the workers is not varied, and the number of runs given, equal to that of the first piece.

On clear face finished fabrics, and where it is an object to clear out the face, and do it quickly, nothing can in any way surpass the efficiency of the napper, for one run over the machine will do more good in the direction of clearing out the face than any number of runs given on a gig. The different speeds at which we are enabled to run the workers of the napper, as well as the goods, and this with the ease with which the contact of the goods with the workers can be regulated, make it possible to produce most any desired finish required by means of the standard makes of nappers in the market. If slow napping is advisable, all we have to do is to reduce the speed of the workers; and if we want to nap fast, we simply have to increase the speed of the workers to the desired point of efficiency.

Another point in favor of the nappers, wherever they are used, is the fact that every fibre pulled from the goods is found right under the machine. Nothing remains in the workers, as there will be on the teasel slats, to be knocked out with the teasels on the refuse heap.

The principle of construction of all nappers to a certain extent is identical, the chief difference being found in their mode of contact, the number of these contacts, and the number of workers. On most of these machines it is necessary for straight work to put on the piece reversed, for as mentioned before, while the cylinder rotates in one direction, the workers rotate in the other, which has a tendency to have the nap in a slightly erect position, leaning somewhat towards the opposite direction in which the cloth travels, and which tendency is increased by means of a stiff wire brush placed at the back of the cylinder, which brush lays the nap in the direction towards which it tends. The cloth is therefore run tail end first for straight work and head end first for reversed work.

On account of the great number of nappers in the market, it would be impossible to describe them all, but as the principle in all of them is practically the same, we will confine ourselves to a description of the more prominent makes only.

Borchers' Eclipse Napper. About 20 years ago napping machinery was introduced into this country from France, the machine then consisting of a series of rollers (workers) arranged in a circle around a common shaft forming a cylinder similar to a teasel drum. The wires of these workers pointed forward or in the same direction as the cylinder revolved, while at the same time each worker turned around its own axis backwards. It is apparent that if the surface speed of the workers around their own axis backwards would be equal to the surface speed of the drum (formed by these workers) forwards, that the workers would roll over, without working, any goods brought in contact with them. Only when the surface speed of these workers backwards became less than that of the drum forwards, could these workers do any work. The difference between these two speeds is called the "energy of the machine" and all napping machines in use to-day are provided with some mechanism by which the speed of the napping rollers can be varied as much as is necessary to produce certain results of naps. In the older napping machines, the goods were brought in contact with the periphery of this drum by being stretched under and over rollers forming tangents to the outer circle of the drum. By this method however the fibre is dragged out parallel to the face of the fabric, and because the rollers or workers are not in constant contact with the fabric, when a worker comes into contact with the fabric it strikes the tightly stretched fabric so hard that it causes the same to vibrate and some of the points of the wire will let go of the thread where they have taken hold and slip over a certain space before they take hold again and thereby produce an uneven nap. To overcome this is the object of the Eclipse Napper as built by R. C. Borchers & Co. In this machine the drum carries around its periphery the napping rolls which are divided into two series, each series comprising every alternate roll, the rolls in one series (and which we will term the outer series) being situated farther from the axis of the drum than the rolls of the other series (and which in turn we will term the inner series). The clothing on the outer series of rolls is arranged to have its wires point in one direction, while the wires on the inner series of rolls point in the opposite direction.

Fig. 20 is a diagrammatic view of a portion of the napper, showing the relation of the rolls, direction of the points of the wire on the rolls, and the cleaning apparatus for the wire. From this illustration it will be seen that the goods to be napped are constantly in contact with the wire points on the rolls. The principle of napping by this machine is based on the relative surface speeds between the cloth under operation, the drum and the napping rolls. Taking the conditions as given in the illustration, with the teeth of the wire on the outer series of rolls pointing in a forward direction with reference to the direction of rotation of the drum, and the direction of axial rotation of the napping rolls opposite to that of the drum, and the cloth being passed in the same direction as said drum revolves, it will be seen that in order to produce any napping by this outer series of napping rolls, the surface speed of the drum must be greater than the surface speed of the napping rolls in relation to their own axes, and the surface speed of the cloth must be less than the difference in speed between said drum and napping roll, in order that the outer surface or point of contact of the napping roll with the cloth should move in a forward direction and at the same time should be faster than the speed of the cloth, in order to have a pull or drag on the fibres with which the points of the teeth come in contact. The main shaft A of the napper, as carrying the drum, has the driving pulley secured to it, while the outer series of napping rolls is driven from the right end and the inner series from the left hand end of the machine, thus allowing the rate of speed of these two series of napping rolls to be varied, independently of each other when required.

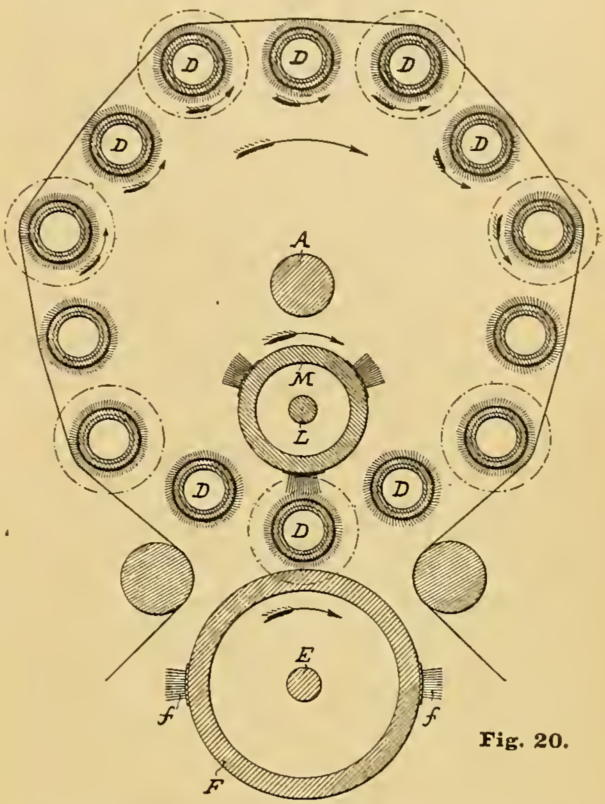


Fig. 20.

From the illustration it will be seen that all of the napping rolls D are rotated in the same direction as indicated by the arrows, but as stated before, by making the surface speed of the outer series of rolls less than the drum, they will revolve in a forward direction, and owing to the direction of its wire points will nap the goods. On the other hand, the series of inner napping rolls are driven more rapidly than the drum, that is, in surface speed, so that the rolls of this series will have a backward motion with relation to the direction of the revolution of the drum, and owing to the direction of its wire points, will also nap the cloth. The relative speed of the napping rollers in this machine is controlled by change gears, thus enabling the machine to always produce the same energy on a certain class of goods.

The cleaning of these two sets of napping rolls is very important and may be done either by putting two cleaners underneath the drum (but by doing this a great deal of working surface of the cylinder is lost), or what is better by placing one cleaner outside and one cleaner inside of the drum, as shown in the illustration, both being positively driven by gears. The outside cleaner is used for the inner series of napping rolls, while the inside cleaner is used for the outer series. For the details of the cleaners we will again refer to the illustration.

Mounted on a shaft E, running from end to end of the machine, is the outside cleaning drum F, corresponding in its length to the napping drum, the greater part of its periphery being free from clothing. At two points opposite each other, it carries a small longitudinal zone of brushing cloth, as is shown by *f* in the illustration. The distance of the shaft E from the axis A of the napping drum is such that when the clothing of the outer series of napping rolls passes the cleaning drum, it is not touched or interfered with by the smooth portion of this cleaning drum, if set properly. On the other hand, the clothing of the zones *f* is long enough to reach to and through the clothing of the inner series of the napping rolls when at its highest point, therefore the rate of revolution of the cleaning drum F, with reference to the drum, is made such that the zones *f*, with their clothing, are presented alternately to each of the inner series of napping rolls as they pass over drum F. This rate of revolution is accurately determined by the number of cogs in the train of gearing, and which cogs must be changed should more zones be used. The inner cleaning drum M, as mounted on shaft L is constructed similarly to the cleaning drum F, part of its periphery being without clothing and having longitudinal zones at equal intervals furnished with clothing, which zones perform the function of cleaning the outer napping rolls with which they come in contact. In the illustration three of these zones are shown, and which number can be varied, but in which case requiring different gearing. As before, the rate of rotation of the cleaning drum M and the position of the clothed zones are such that as the napping rolls of the inner series pass beneath it, the smooth surface of the cleaning drum only is presented, while as the napping rolls of the outer series pass beneath it, a clothed surface is presented and the cleaning function performed.

By reason of there being but one cleaning drum outside of this napping drum, it will be noticed that it is possible to place these napping rolls so near together that out of the fourteen napping rolls shown in the illustration, only one, or at the most two, are ever inactive at a time, thus greatly increasing the production of the machine. These machines are used for any kind of fabric to be napped, wool or cotton, woven or knit.

The American Napping Machine Co.'s Napper. The novelty of construction in this napper consists in providing a skeleton cylinder or rotating head with napping rolls covered with card clothing whose points are all in a backward direction with reference to the direction of movement of the rotating head, and with means for so relatively driving the rolls that one set will act with and the other against the nap, together with means for cleaning the rolls.

Fig. 21 is a sectional elevation of a sufficient part of this napping machine to illustrate its working; showing that the napping head D is mounted upon a shaft C, having its bearings in the two end frames of the machine, and carrying a pulley K.

The napping head D is driven in the direction represented by arrow S in the illustration, from the main driving shaft H by means of belt J passing around pulley I as fast to said main driving shaft H, and the pulley K, previously referred to.

Upon the napping head D are carried a series of napping rolls A, B, provided with card clothing having its teeth inclined in the same backward direction. These rolls may be driven part in one direction and part in the opposite direction, or all may be driven in a backward direction with reference to direction of movement of the rotating head, but at different rates of speed, always, however, so that some of the napping rolls act with the nap and some act against the nap, a feature which is novel in connection with rolls all having teeth inclined in a direction the reverse of the head. The proportion of rolls working with and those working against the nap may be varied as desired, and they may be arranged alternately or otherwise, as the case may require. In our illustration we show the rolls all rotated in a direction the reverse of that in which the head D turns; but the napping rolls A are driven at such a speed in the direction of their arrows in respect to the speed of rotation of the head and travel of the cloth as to effect a picking

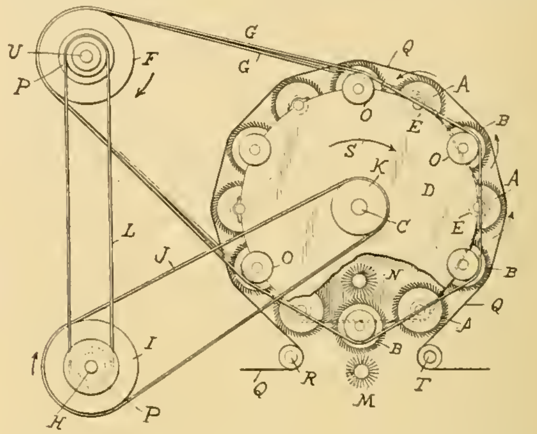


Fig. 21.

action upon the cloth; that is, these rolls travel with the nap, while the rolls B, while turning in the same direction, do not exceed the speed of travel of the head, so that they act against the nap; that is, they travel over the face of the cloth in such a manner as to effect a sort of brushing action, which the builders of the machine claim has been found to impart a better finish to the cloth than would be otherwise secured.

The two series of napping rolls A and B may have the proper movements imparted to them in any desired manner. For instance, the shaft of each roll may be provided with a pulley, the pulleys E on the rolls A being less in diameter than the pulleys O on the rolls B, and a belt G may pass around each series of pulleys from a belt wheel F on a countershaft U, driven from the shaft H by a belt or otherwise. This arrangement, however, is only one means whereby the desired movements may be secured, since the belt L, between the two shafts H and U, may be carried by reverse cone pulleys P, and may be used open or crossed, so as to secure any desired given speed and different directions of movement. Again, the pulleys on the napping rolls may be of the same size, but driven from pulleys of different sizes on the shaft F or from two separate countershafts, thus securing the desired different speed ratios of the napping rolls working with and against the nap.

In order to effectively clean the napping rollers, rollers M, N, are provided, one outside and the other inside the drum, and to which rollers movement is imparted in any suitable manner, each cleaning roll operating on all of the rollers, which is practicable, as the points of the teeth in all of the rollers extend in the same direction. But in case part of the napping rollers are journaled at a greater distance from the drum shaft than the other part, either cleaning device will intersect with but a part of the napper rollers unless there is a difference in their diameters. However, if required, only a single cleaning roll may be used.

The fabric Q, to be napped, enters the machine around guide roll R, from where it passes around the series of napping rolls A, B, leaving the machine again around guide roll T. The speed by which the cloth thus travels around the napping rolls may be varied as well as its direction reversed so as to properly co-operate with the napping head.

The Parks & Woolson Napper. Fig. 22 is a perspective view of this machine from the pulley side, the machine being shown empty. Fig. 23 is a perspective view of the napper from the other side, the machine being shown with the fabric threaded, the roller cloth scray being omitted. Fig. 24 is an end elevation of the main or napping portion of the machine, clearly showing its construction and action, the run of the cloth through the machine being shown by means of dotted line.

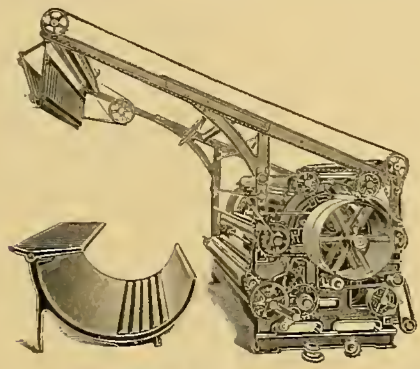


Fig. 22.

The cloth to be napped, after leaving the roller scray, as shown separate in Fig. 22, passes over two guide or idle rolls secured in the framings of the machine, the second one of these rolls only being shown in the diagram of the machine Fig. 24. From this guide roll A, the cloth in turn passes over a tension roll B, around guide rollers C and D, and from there around a stretch roll E. It will be noticed that this stretch roll is of a large diameter, giving a long contact, and consequently exercising a great stretching capacity onto the fabric under operation. This stretch roll is operated by cams, which can be set to give as much or little stretching within their range as may be desired. It operates upon the back of the cloth just before the latter enters upon its first napping contact, presenting the cloth thus to the workers of the cylinder, up to width, smooth and free from wrinkles.

From stretch roll E, the fabric passes next around the first application roll F, and of which there are eight of these rolls used in connection with the machine, in order to produce the four applications—1, 2, 3, 4—between cloth and the workers of the cylinder of the machine. These application rolls are frequently made brass covered, for the purpose of making them rust proof and in turn prevent rust marks on the goods when handling them in a wet condition.

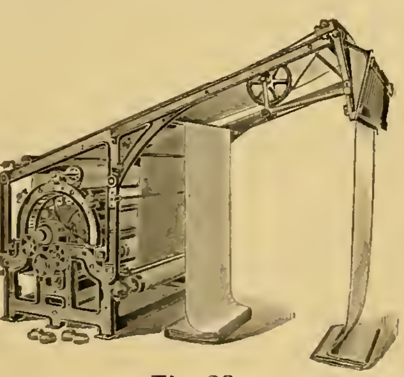


Fig. 23.

On wide machines, and especially for blankets, it is advisable to have these application rolls around the cylinder right and left screw threaded. They are driven by power in the same direction as the cloth, but at a higher peripheral speed than the cloth, for which reason the latter is therefore spread out at each of the four napping contacts 1, 2, 3 and 4, and is thus absolutely held up to width, free from wrinkles, during napping. However where it is difficult, from the nature of the goods, to keep them from narrowing, or the edges from turning, it will be found advisable to use these threaded application rolls, no matter what is the width of the cloth under operation. When the threaded application rolls are used, the stretch roll E can be dispensed with.

G, G′ and G^2 are three draft rolls, made of iron piping, thus are not affected by moisture and which consequently will always run true.

H to H^{15} are sixteen workers as mounted on the cylinder I, which rotates in the direction shown by the large arrow; whereas each one of these sixteen workers rotates in the opposite direction, as shown by small arrows in connection with worker H^6, so that the points of the card clothing on the workers, which point in the same direction as the cylinder speed, rotate fast enough backward to give the proper carding energy to the fabric under operation. This energy is varied by change gears to suit the finish required by the fabric under operation.

J is what is termed the "fancy," it being a rotary wire brush that rotates at a high peripheral speed and in the same direction as the workers. Its purpose is to strip or clean the workers from the flocks, in order that their clothing will be always uniformly effective, and not get filled with flocks. It also aids in brightening and sharpening the wire of the workers, and runs in adjustable boxes.

From the last application roll F^7, the fabric in turn passes from guide roll K, over application rolls L, L′ to guide roll M. Between this course, the fabric is subjected to the action of the brush N, rotating in the direction of arrow, *i. e.* with the run of the fabric, but at a considerably higher speed, in order to lay down the nap on the fabric, and comb the fibres parallel. As will be seen, there are two applications to the brush, the force of which can be readily regulated by means of levers from the outside of the machine during the running of the latter. The brush itself is covered with the best quality of wire clothing, is 16½ inches in diameter, and is positively driven by chain direct from the main shaft, in order to do reliable work, since brushing is a great help to perfect napping.

After leaving guide roll M, the fabric passes over draft roll G^3, as fast to the upper portion of the framing of the machine, and from there over a suitably located guide roll to the draft roll of the folder mechanism of the machine.

The cloth may be of course run through the machine any number of times, either single pieces, or two, three, or more pieces, may be sewn together and napped in an endless chain arrangement. When one or all of the fabrics in the chain have been sufficiently napped, the until now tilted table of the roller scray is raised in position, the seam taken out of the fabric, and the latter made to fold on the table. The width of fold made by the folder can be varied both by adjusting its height above the scray and also changing its stroke.

Characteristic features of this machine are:

(1) It is strongly built, and for which reason it can readily withstand the racking and vibrating stresses of the operation of napping, due to the very nature of the planetary motion of napping machinery. A light napper will soon become shaky and out of line, and consequently will require extra power to

drive it, will not nap even, and require constant re-adjustment and repairs.

(2) The energy, the cloth contacts both on workers and brush, the cloth feed and the cloth tension, are all capable of the widest range or regulation, which renders the machine able to raise the nap on

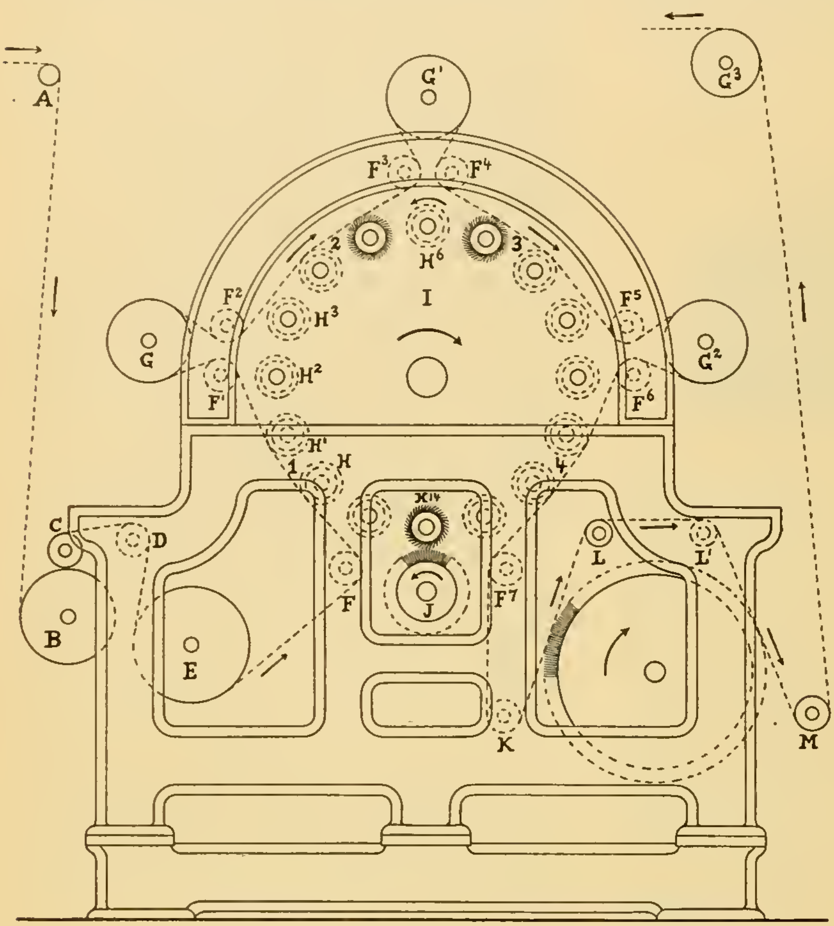


Fig. 24.

any kind of fabric, from the heaviest beaver to the lightest weight dress goods. The napping is done as uniform on the sides of the cloth as in the middle, and the process does not narrow the fabrics under operation. The machine is positively geared, so that there is no slip possible either in the energy or cloth fed, and for which reason one piece gets exactly the same amount of napping as the next, the same setting of the machine always giving the same result.

(3) A slow speed internal gear encircles and engages the sixteen worker gears on their outside, and runs about one-fifth the speed of an external gear, meshing on the inside of the worker gears. This construction effects a great saving in the power required for running the machine, eliminates vibration and consequently wear on the machine. A sleeve loosely mounted on the cylinder shaft passes through the main box to connect the internal gear with the energy change gearing, an arrangement which gives a stiff setting and long bearing, and steadies the planetary motion, and makes it run smoothly and evenly, a feature which naturally considerably prolongs the life of the machine.

(4) The relative speed of the workers around their own axes and around the drum axis is governed by a train of gears on the left end of the machine beneath the gear guard. These gears are rigidly mounted on studs set directly into the frame. The change gear is set on the end of the main shaft and is connected with the train by an intermediate gear on a swinging arm with a screw adjustment, for which reason a change in the energy of the machine is quickly and easily made. The range of the energies is divided into fine gradations, and for which reason you never have too low an energy because the next one above is too high.

(5) The cloth feed is positive, chain and gear driven, and can be varied between ten and twenty yards per minute by means of quick change gears, a feature which permits the use of the highest possible energies by speeding up the cloth. Frequently it will be found that with advantage the cloth speed can be increased, instead of reducing the energy, a feature which often is the case in the last run or runs of the piece on the machine, and when besides accomplishing the same result with reference to napping, you at the same time increase the output of the machine.

(6) The four cloth contacts with the workers are operated simultaneously by one hand wheel conveniently located outside the machine, and which is operated while the machine is running, permitting any degree of contact required, instantly and uniformly to each of the four contacts in the machine by one movement. A graduated dial with indicator gives the exact setting, and consequently accurate records of this, with reference to a certain finish, can be made and readily duplicated any time.

(7) The worker bearings are self oiling, the cylinder heads being for this purpose made hollow and used as oil chambers, automatically supplying each worker bearing with oil.

(8) With reference to napper clothing, for wet work, what is termed "bronze clothing" and which is perfectly rust proof is used, and which varies in fineness; selecting the required grade of it with reference to the average work to be done by the machine, *i. e.* where coarser goods are used, select a heavier clothing, whereas for finer goods, a finer grade will be advisable. For dry napping, steel clothing is good enough.

The Parks & Woolson Machine Co. also builds a napper which they call their "Cotton Napper," but which is so closely related to the construction of their woolen napper thus described, that no special reference to this machine is required, the main difference being that in this cotton napper there are four or five shorter applications of the cloth to the workers, that the application rolls are of steel only in place of brass covered, and that a stationary hot ironing roll with steam connections is provided, over which the cloth runs before it reaches the napping rolls.

Method of Clothing the Rollers of Nappers. The object is to clothe the napping rollers with card clothing, so that said clothing is wound spirally and oppositely on each side of the central transverse plane of the roller, and this in such a manner that any uncovered space extending circumferentially may be avoided, thus preventing wrinkles in the cloth when treated by napping rollers thus clothed.

The reason for having one-half of the card clothing wound spirally in one direction and moving toward the nearest end, with the other half of the roll wound oppositely, is to keep the fabric, which is passed over it, extended in its full width.

The improvement more particularly consists in a specially shaped tongue of card clothing which is used at the central portion of the circumference of the roll, as a start for each oppositely disposed strip of card clothing. The shape of the tongue is shown in Fig. 25, which is a diagram showing the tongue lying straight. From this diagram it will be noticed that the tongue is V-shaped, the small end having a hole 1 for the insertion of a screw, while the other end is made with ears or ends 2 and 3, with a converging space 4 between said ears, corresponding in size and outline to the opposite or small end of the tongue, since when placed on the roll, the small end will fit into said space 4. Each ear 2 and 3 is provided with holes 5 and 6, respectively, for having buckles attached to them, the other portion of said buckles being attached to the respective ends of the strips of card clothing which are to be placed on the roller.

Fig. 25.

When covering a roll, the tongue is first secured to it by its small end with a screw in the hole 1, then the tongue is wrapped around the roll, the buckles having previously been attached, so that the ends of the card clothing may be secured to the ears 2 and 3. The clothing is then put on the roll in the usual manner.

Although there are no wire teeth at the places occupied by the buckles and hole, yet this space is so small as not to affect the proper working capacity of the rolls thus clothed. This mode of clothing the rollers of nappers is the invention of David Gessner, Worcester, Mass.

Roy's Grinder for Napper Rolls. The old way of trying to grind napper rolls by running them together is becoming obsolete. They are now run together only to burnish them after being ground. They cannot be ground true and with a proper point without a traverse grinder fitted with two wheels—one an iron wheel covered with emery (about No. 8) same as is used for card grinding—for surface grinding, and the other wheel made up of a number of thin emery wheels or "saws," usually from 10 to 15 in number and about $\frac{1}{16}''$ thick, for side grinding the wire.

The frame, in which this grinder runs, must be heavy and rigid and made with bearings, for the napper rolls, which are adjustable to the grinder and also adjustable for shafts of different diameters. The latest style machines are constructed so that while two rolls are being ground, two pairs of rolls are run "back to back" (after being surface and side ground) to burnish them, all six rolls running at the same time on the one grinding machine.

Fig. 26 shows a machine of this type, as built by B. S. Roy & Son, in its perspective view, clearly showing that two rolls can be ground at the same

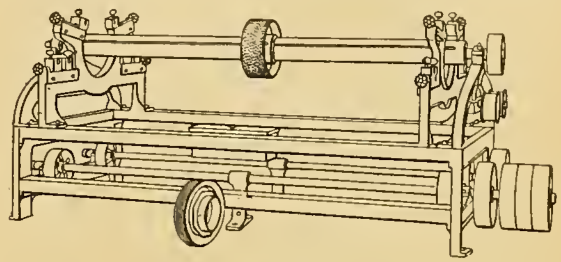


Fig. 26.

time in the two upper bearings, and, while these are being ground, two pairs of rolls which have already been surface and side ground, can then be run "back to back" in the four lower bearings. All rollers are thus first surface ground with the iron wheel in order to true them, then side ground with the disc wheel, and then run "back to back" to burnish them.

As napper rolls are very wide—72″, 80″ and wider —it is absolutely necessary that the traverse grinder should be very rigid and true. Nothing smaller than a 5″ steel shell should be used. With a machine of the style shown in the illustration, different widths of napper rolls can be ground on the same machine as the heads are adjustable to any width narrower than the full width of the machine, a feature especially useful where more than one width of nappers are used.

STEAM LUSTRING.

This process has of late come into general use in connection with the wet finishing of Kerseys, Beavers, Broadcloth, Thibets, Venetians, Tricots, Plushes, Uniform-cloth, etc., also for setting Worsteds and freeing them from wrinkles; the time that in connection with face finished woolen goods a common water finish would pass inspection, having gone by, nowadays nothing but a thorough steam finish will satisfy the buyer.

The best cloths to take a lustre are made of fine short staple wools, long naps well brushed, so the fibres all lay flat and straight, giving the highest lustres. For short naps a five leaf satin or four harness broken twill, warp effect, a five or seven harness corkscrew are weaves giving the best lustre. As a rule, the wetter the gigging, the better the lustre.

The old boiling process, as used in years gone by so extensively, in order to produce a highly finished and lustred fabric, although excellent in its ultimate results, fell short of giving production; hence special machinery had to be designed for doing the work equally as well, and at the same time give the so much desired large production by manufacturers; the boiling process only being practiced yet in few mills, and this only where help is cheap. However for the fact, that boiling is still used in some mills, and that it was the foundation for the modern steam lustring machine, a short description of the process will greatly assist in understanding the object of the latter machine.

In the boiling process, the goods after proper gigging and also a thorough wet brushing, on the wet brushing gig (see Fig. 19, page 324), are tightly wound on wooden rolls at the latter machine, a burlap or canvas cover being then wound around this roll of cloth and the ends tied. A number of these rolls of cloth thus prepared, are then placed by means of the protruding ends of the wooden rolls, in framings in a tank, arranged in such a manner, that the cloth of one roll will not come in contact with that of another roll nor with the sides of the tank. Two or more tiers of rolls of cloth are thus placed in one tank. After the tank is filled with rolls of cloth, water and steam are turned on, so that by the time the tank is filled with water, the same will be quite warm. The tank is then covered and the water allowed to boil, and kept at a moderate boil as regulated by the amount of finish required by the goods, on an average for from four to six hours, care being taken to keep the goods during the process always under water.

The hot water is then drawn off and replaced with cold water and the goods allowed to cool in this for from two to three hours, after which the water is drawn off and the rolls of cloth taken out and sent again to the wet brushing-gig and subjected to another thorough wet brushing, after which they are rolled up again on the wooden rolls for another boiling, but being this time rolled in the reverse way from before, in order to subject both ends of the cloth to the same amount of boiling. These two boilings, as thus referred to, go hand in hand, they form one process, which must be repeated, provided one process should not be sufficient for a certain finish required, giving a thorough wet brushing each time the goods are intended to go to the tank. Goods treated in the manner described, will acquire a finish which is lasting, since the heat is slow and gradual, permeating the whole piece evenly, and by reason of slow boiling, the finish becomes set in such a way that it cannot be easily destroyed. However, it was and is too slow a process for large production in a mill, a most important item nowadays.

The first machine to take the place of the boiling process was *the upright steamer*, which may yet be found in many mills. The object of this process is to force steam through the cloth for a certain length of time, and then cold water, until the goods are well cooled. While the action of the steam upon the wool fibre will bring out the inherent lustre of the fibres, one would think that this would be sufficient for the process of steam lustring a fabric, however it is the action of cold water which tends to set the lustre which has been obtained by means of the steam passing through the goods. Besides this, as soon as the steam passes through the goods, a great many impurities, adhering to the structure of the fabric, will thus be loosened and which will be carried off by the water, thus leaving the fabric in a practically cleaner condition than when it went on the machine.

This upright steamer consists of an upright frame with projecting arms at the top and bottom into the sockets of which a perforated roll, upon which the cloth to be steamed has been previously wound, can be set and firmly locked in place. An arrangement of pipes connects the top and bottom end of this perforated roll, with pipes through which either steam or cold water can be introduced, and in turn forced through the cloth, the amount of either, being regulated by suitably located valves. After winding the fabrics tightly on these perforated rolls, previously to steaming them, a covering, the same as was used in connection with the boiling process, is wound around every roll of cloth, said covering however, being this time about two feet wider than the fabrics under operation, and of sufficient length to cover the roll of cloth at least with three thicknesses. After this cover is wound around the roll of cloth, its overlapping ends are fastened down on the roll by a strip of cotton cloth run spirally around the roll, being finally securely fastened, in order to prevent the covering from flopping when the force of the steam comes through the roll of cloth. After this has been done, and the roll placed in the sockets of the projecting arms of the steamer, then steam is turned on and allowed to penetrate the cloth until appearing evenly on the outside of the covering. How long to keep up this process is regulated by the kind of fabric under operation, *i. e.* finish required, say about five minutes for a fair average time after the steam appears evenly on the covering. After then turning off the steam, the water valves are opened and a powerful stream of water thus forced through the roll of goods until they are thoroughly cold, in some mills a special force pump being used for this purpose. After the goods are thus cooled and the water turned off, the roll is then taken from the steamer, back to the wet brushing-gig, unrolled, and given a good wet brushing, after which the process of rolling, steaming and cooling the fabric is repeated, but winding on in this instance the other end of the fabric first, or next to the perforated roll, in order to have the finish uniform throughout the fabric. The number of these steamings with its respective windings on the perforated roll, cooling, unwinding and wet brushing may also be repeated, taking the strength of the fabric and the finish required for it under proper consideration.

However when we take into consideration this amount of labor required in winding and unwinding the cloth onto and from its perforated rolls respectively, and more particularly in being compelled to cart the goods between the operations, back and forth to the wet brushing-gig, it is no wonder that manufacturers looked anxiously for the introduction of a machine to do away with this waste of labor, and it was then that

The Steam Gig made its appearance amongst wet finishing machinery in woolen mills. The same is still in use in mills, and practically resembles, or is an up and down gig, the only difference being that its cloth rolls at the top and bottom are hollow, perforated, copper drums, the lower one being set into a trough the same as at the wet brushing-gig, both the top and bottom rolls being suitably connected with steam and water pipes.

Fig. 27 shows the steam gig as built by the Curtis & Marble Machine Co. in its perspective view. The advantage of the steam gig over the old fashioned boiling process or the upright steamer consists in the fact that the goods do not leave the gig until the steaming and wet brushing processes are both completed, a feature which naturally results in a considerable saving in time and labor. Both ends of the fabric under operation at the steam gig, are supplied with a canvas apron, projecting on each side about one foot outside the width of the fabric under treatment, and of a sufficient length, to permit proper handling of the fabric on the machine. In running the cloth first on the perforated top roll, proper care must be exercised so that the fabric runs on smoothly and evenly and at the same time under as much tension as possible. When the fabric is wound on this roll, its apron is then fastened to the bottom roll and the goods started to run under a strong tension downward and wind on the bottom roll as is revolving in water, supplied to the tank through the bottom roll and its connections. The cylinders of these gigs are also—if so required—clothed with stiff wood fibre brushes, in place of using slats containing old, *i. e.* more or less worn out teasels.

Next the fabric is run again on the top roll, the apron in turn liberated from the bottom roller, run around the roll of cloth and secured to it similar as was explained in connection with the upright steamer. When this is done, open the water valve for the top roll and close the one for the bottom roll. When the water is seen to come evenly through the roll of cloth, turn its supply off and admit steam the same as explained in connection with the upright steamer, then cool again with water, run fabric on lower roller, covering it in turn with the other apron, and steam the roll of cloth at once. During running the fabric from one cloth roll to the other, the same receives a good wet brushing by the stiff wood fibre brushes the cylinder of the machine is clothed with. A good strong tension during the winding, and a perfect even winding as well as a thorough cooling by water after steaming, are absolute requirements for the process, otherwise cloudy goods will result.

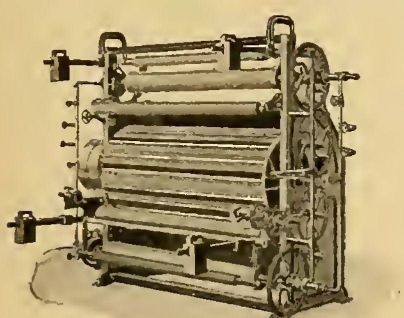


Fig. 27.

The Steam Lustring Machine. However the hollow, perforated, rolls of the gig, and on which the rolls of cloth were steamed, are frequently found to be too small for large production, and since on account of lack of room on the gig they cannot be made much larger than 7 inches, the demand for an increased production soon led to the building of the modern steam lustring machine. It was soon seen that there was quite a chance to increase the capacity of the machine, and while the first machines of this kind were built with 7 inch cylinder, it did not take long before the at present used 18 inch cylinders were introduced, and where it formerly took about 22 inches of cloth to go around the roll of the steam gig it now takes about 56½ inches to go around one of the cylinders of the modern steam lustring machine, certainly a feature which makes it plain that much more cloth can be steamed at a given time with this machine as compared to the steam gig. Again the cylinders being so much larger, they in turn give more chance for a good head of steam to do its work, and therefore we must carefully look after these cylinders in this machine to see that they are in the proper condition, else steam is sure to be wasted, and in consequence production reduced.

The principle of steam lustring by means of this machine remains the same, and for all practical purposes the work is in a measure identical with that of the steam gig, as previously described, but on account of the improvements made, it is possible to handle more pieces of cloth at a given time than can be done on the steam gig.

With a machine of this kind and large capacity of fabrics it has to continually handle, it is reasonable that extra precautions should be taken to insure the best results, and for which reason a few practical points on "how to handle the machine as well as the fabric during the process" will not be amiss. After carefully leveling the machine so that the two hollow, perforated, copper cloth steaming cylinders will run free, and, with the clutches out, can be turned freely by hand, pipe steam and cold water into the tees in the overhead pipes, both front and back, using one inch pipe for steam into the smaller openings, and one and one-half inch pipe for water into the larger openings. The valves controlling the steam and water supply should be placed near the tees so they can be handled from the same position as the valves on the machine. The pressure of the steam is not important, as it can be regulated by the inlet valve. It is well, however, to have it fairly even, so that uniform finishing will result, ordinary mill pressures of fifty to seventy-five pounds being about right. Each of the two cylinders is set in a tank, supplied with drain pipes to take care of the surplus water.

The driving belt for the machine should be a three and three-quarter inches wide, mineral tanned leather belt, which will withstand the steam and moisture better than a common leather belt.

The two cylinders are each seventy-four inches long to the outside of the end collars, and since it is necessary to allow at least four or five inches at each end to tie in the bag, it would not be convenient to steam cloth on the regular machine over sixty-five inches wide or thereabouts; however special wide machines, for wider fabrics are also built. The perforated length of the cylinders is fifty-four inches in the regular machine. These perforations should not come inside of four inches from the end of the cloth when it is wound onto the cylinders, and two inches is better. When there is a wide variation in the widths of cloth to be steamed in a mill, the perforations should be made right for the widest goods. If they then extend outside of the narrowest goods, the tying in of the bag at each end will confine the steam to its work. Cloth can be rolled onto the cylinders up to thirty-six inches in diameter, more than this will result in imperfect work, since it is not practical to steam through a greater thickness. The cylinders should be wound about once and one-half around with clean, smooth burlap, of which it will take about two and one-half yards, seventy-two inches wide, to each cylinder. Wet it thoroughly in warm water to soften it. Smooth it out carefully when laying it on, rubbing it back by hand. The outside end should be straight, and sewed flat to the layer beneath. Wind tightly with common cotton twine for about six inches close to the end, leaving a tying end exposed, then diagonally three inches between threads to the other end of the cylinder, where another six inches in width is wound closely. Return diagonally across to the first end and tie down with the tying-end. This will bind down the burlap so the steam pressure will not bulge out the middle and pull the ends inward. Cover this over with about six layers of cotton sheeting of medium weight. Wet it as before, and start the end at the seam just made. Smooth it with care. Sew it down about two feet from the end, leaving a loose flap. About twenty yards in all of seventy-two inch sheeting will be needed. These burlap and sheeting jackets should be kept clean by frequent soaping on the outside, and running steam and water through from the inside. They will become dirty, however, even with these precautions, and will have to be occasionally taken off for separate cleansing by running through the washers. Whenever they become stiff to the touch, it shows the pores are full of dirt, and they should be washed.

From three to six pieces may be steamed at once, according to the style and weight of the goods, and the finish required. A few trials will readily show the number of pieces to give the best results on any particular style. The pieces to be steamed together should be sewed one to the other with the nap of each on the same side and pointing in the same direction. A leader should be sewed to each outer end. The sewings should be as flat, smooth, and even as possible to prevent marking the goods, a mill sewing machine being the most desirable for this purpose. The leader or apron should be of good, smooth ticking, twenty-four to thirty-six inches wider than the goods, so that the end of the completed .roll on the cylinder can be well wrapped down. In length said leader should reach once around one of the copper cylinders, and to a good distance beyond the brush, so that when the cloth is started, no part of the fabric will remain unbrushed, about five or six yards to a leader being sufficient.

In order to give a clear understanding of the construction and operation of this machine, as well as the process of steam lustring, the accompanying two illustrations are given, and of which Fig. 28 is a perspective view of the machine as built by the Parks & Woolson Machine Co., and Fig. 29 an end elevation, in outline, of it.

The cloth is commonly run into the machine from a truck set in front, and is first threaded through the "tension bars" and wound onto the "loading drum," with the face toward the operator, and the nap pointing upward. Care should be used to get an evenly ended roll. The leader is then threaded over the "front break roll," under the "front stretch roll," over the two "brush application rolls," under the "back stretch roll," over the "back break roll," and under the "back cylinder" on the inner side. The leader should be laid around the cylinder with the sheeting flap over its end, the whole being neatly smoothed out. Usually the brush applications are put on to give the most brushing possible.

The back cylinder may now be started. The amount of friction to be applied to the loading drum must be found by experiment. When the friction is once set, however, it can be thrown out and in, giving the same tension every time. A hard and compact roll is wanted, but not so hard that the weave of the fabric will be imprinted on the face of the goods, or the sewings leave their mark. A little time given to the first setting of the frictions will make the machine turn out faultless work. A six inch heading of cloth, similar to that being steamed, can be laid on the back of each of the sewings as fast as they appear. By the "back of the sewing" is meant the side showing the raw ends of the pieces sewed together. The heading will, therefore, be wound in under or over the sewing according to which side of the seam these raw ends appear. Winding in these headings over the sewings will absolutely prevent their pressing creases in the goods. There should be no touching or handling of the cloth whatever between the brush and the cylinder, so that it will be entirely free from all marks that might be set in steaming.

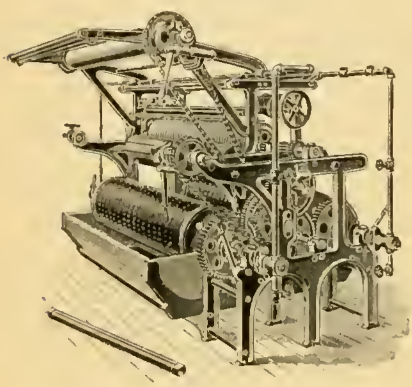


Fig. 28.

When the outer leader has been laid smoothly around the cloth on the cylinder, it should be tightly wound with cotton duck tape about four inches wide, and which is especially manufactured for covering these rolls, and can be bought of any supply house. In winding on this tape, catch the end under the first turn, beginning at one end on the loose part of the leader outside of the cloth. Wrap the end well in, then wind across the cylinder, bringing the sides of the tape evenly together, but not lapping them. If it is lapped, it is liable to print on the cloth beneath, and also to slip sideways when the steam is turned on. Finish the other end the same as the first, drawing up the end of the tape under the last turn. This will form a bag to confine the steam properly. All leakage from this bag not only means loss in coal, but also loss in the time of steaming; it should, therefore, be tight and well made. It is the practice in some mills to wind the tape on an empty winding roll in the winding attachment, keeping a roll for that purpose. In this case a winding attachment on both sides of the machine is required, which in turn enables the operator to make the bag perfectly in a much shorter time.

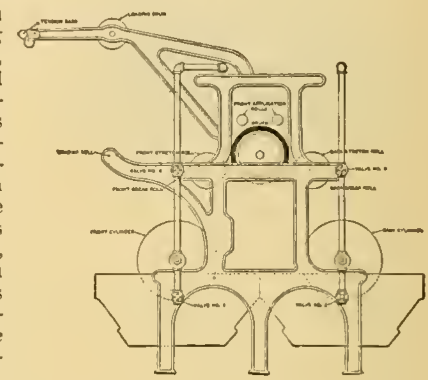


Fig. 29.

The cold water should be turned on for wetting while the cylinder is revolving. Open valve 1, so the water will run in at both ends and see that valve 2 is shut, to prevent waste. When the water appears uniformly all over the bag, turn it off. The water should now be blown out of the cylinder. Shut valve 1, open valve 2, and turn the steam on gradually, meanwhile keeping the cylinder revolving to prevent the water settling and clouding the goods. When the water is about blown out of the cylinder, which can be told by the sound after a little experience, shut valve 2, and open valve 1.

In timing the steaming, figure from the time the steam appears uniformly on the outside. The duration of the steaming must be determined by actual experiment. It differs according to the pressure of the steam, the quality of the goods, and the finish required. Practice varies in every mill.

Goods that have been steamed will dye about two shades darker than if not steamed. In general, low grade cloths, light weights and dress goods are steamed a comparatively short time, say five to twenty-five minutes. High priced goods and heavy weights should be steamed longer—anywhere from twenty to sixty minutes, and sometimes more than an hour. Any fabric over twenty ounces takes at least a half to three-quarters of an hour for the process. Be careful not to steam low grade goods too long, lest they be made stiff and tender. Too much steaming of any cloth will make it tender, and too little will not give a permanent lustre. The longer the steaming, the more the strength and elasticity of the cloth will be reduced. For dull finishes, the steam may generally be turned off as soon as it begins to come through the bag.

After the steam has been shut off, close valve 1, open valve 2, and let in the water for cooling very slowly. The cylinder is now full of steam, and if suddenly condensed, the partial vacuum thus formed will bring too great a pressure from the outside air, and a collapse of the cylinder will follow. The opening of valve 2 acts as a safety valve. When a few seconds have been given the steam to condense, shut valve 2 and open valve 1, so the water will be admitted at both ends of the cylinder. The cylinder must be revolving all the time to give quick and even results. The water should be kept turned on until the roll is thoroughly cool all over the outside. This can only be tested by touching with the hand. When uniformly cool, turn off the water, leaving valves 1 and 2 just as they are, open and closed respectively, and ready for the next set of pieces.

The tape should now be unwound, the leader threaded over the break and brush rolls, under the stretch rolls, and under the "front cylinder" on the inner side. The wrapping tape should be wound off on a roll, so it will be left in convenient shape.

The same process of rolling, wetting, steaming, and cooling as just explained are now repeated; and when valves 4 and 3 in connection with the front section of the machine, equal valves 1 and 2 respectively of the back section of the machine, and in turn are operated upon correspondingly as explained.

The cloth should now be wound off directly onto a wood roll set in the "winding attachment" in front, first removing the leader, as it should not be wound in. Start the end of the cloth straight, and see that it lays perfectly flat around the roll. The other leader should also be removed, as a much shorter outside wrapper can take its place. This should be bound well at the ends and middle. Headings, as are cut off from the finished fabrics before rolling them for the market, are good for this purpose.

While steaming on the back cylinder, cloth may be wound onto the loading drum or winding attachment, and, while steaming on the front cylinder, the cloth may be wound onto the back cylinder. During these several winding and steaming operations, there is also ample time to get new pieces, make the sewings, and take away the finished rolls. Thus it will be seen that the machine is designed to be operated in a double and at the same time continuous manner, a feature which cannot help but result in a large production.

After removing the roll from the winding attachment, it is generally stood on end until the next morning. The best length of time to let it stand should be ascertained by a few trials. The longer it stands, the more it will lose in elasticity and strength, especially the former. Pieces steamed in the white that are to be dyed in light shades, should be left on the rolls the same length of time. A variation of two or three hours might not be noticeable, but it will be found that the longer the cloth remains on the rolls, the darker the resulting shades. For dark colors, little care is needed in this particular. Piece dyes should be turned end for end, so they will stand about the same time on each end. Wool dyes will not need to be reversed.

Some mills boil the cloth while steaming, by filling the drip pans with boiling water. The steam and water pipes necessary for this purpose can be easily put in by the user with no alteration in the machine. Boiling alone will not give a lustre so high nor so quickly as steaming, besides more or less unevenness is common to the boiling process.

The brush is clothed with stiff wood fibre in order to lay the nap well, being for this reason also run at a high rate of surface speed.

For handling worsteds, and where the machine is more particularly used for setting them and freeing them from wrinkles, the brush, together with its application roll mechanism, is not needed.

TENTERING AND DRYING.

After the cloth has been washed, gigged, napped, steam lustred or in other words passed through any of the processes of wet finishing required to be given to it in order to obtain the proper final finish for it later on, it must then be dried, so as to be able to handle the fabric afterwards in the dry finishing department. During this drying, the fabric under operation must be somewhat stretched in length and width in order to keep them smooth for the operations of shearing, etc., as performed afterwards. When this precaution of maintaining this smoothness at the drying machine is neglected, then the after processes will act upon the cloth in such a way so as to make all uneven places and creases in the fabric past remedying, a feature which by previously keeping the cloth properly stretched during drying, cannot occur. This tentering and drying of the cloth is done on what is known as a Return Tentering and Drying Machine, and of which two specimens of makes are given, viz.: the machines as are built for this purpose by D. R. Kenyon & Son, and the H. W. Butterworth & Sons Co.

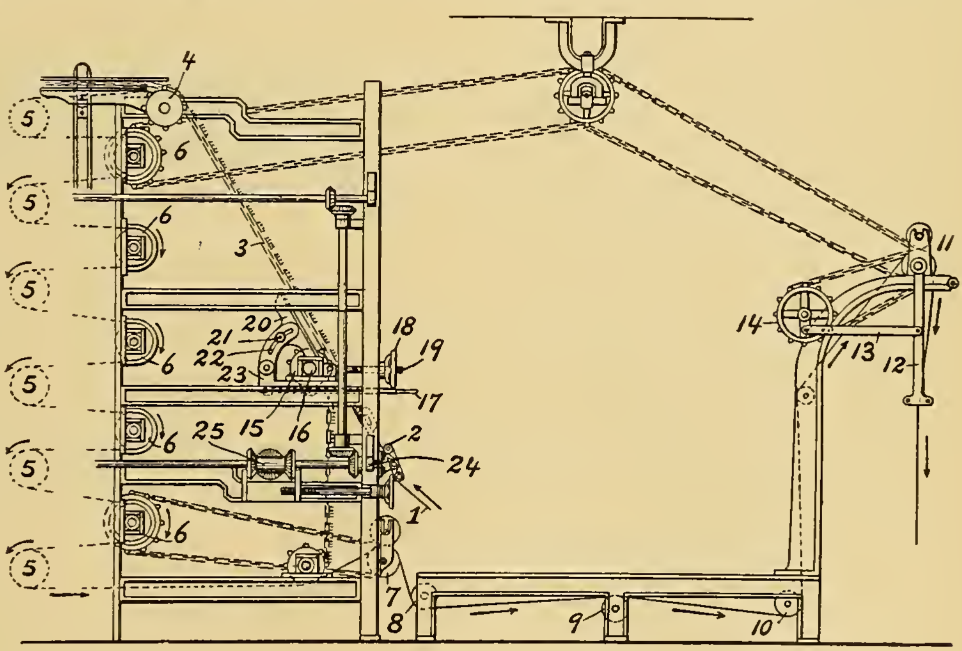


Fig. 30.

Fig. 30 refers to the machine as built by D. R. Kenyon & Son, the illustration being a partial side elevation of this machine, showing the feeding and delivering mechanisms, and also indicating the passage of the cloth through the machine.

This machine is designed on the pipe system of drying and is characterized chiefly by the arrangement for feeding the cloth to and delivering it from the machine, said feeding arrangement being known as the "low-down feed," from the fact that it is located near the bottom of the machine, and which thus enables the operator to attend to the feeding from the floor, instead of having to work on an elevated platform, as in the case of overhead feeds. This "low-down feed" is one of the most important improvements ever made on this machine, all other machines with low-down feed, as claimed by the builders of this machine, being copied from it.

Referring to the illustration, the wet cloth 1 as coming from the steam lustring machine, gig, napper, washer, as the case may be, according to fabric under operation, is deposited in a folded condition on the low platform at the front of the machine, and from where it passes, in the direction of the arrow 1, to the machine, under tension rolls 2, from whence it passes in an upward inclined direction until it is caught, by its selvages, upon the pins of the cloth carrying or gill chains 3, there being one for each side of the cloth. Each respective chain passes over a sprocket wheel 4 and thence through the drying machine, back and forth, around the rolls 5 and 6, said rolls 5 being located at the rear end of the machine, although for convenience, they are shown close to the front series of rolls 6 in the illustration.

The steam pipes for drying are formed in coils and arranged in tiers in the spaces between the passages of the cloth, from the front rolls to the rear rolls and vice versa. The cloth in thus passing under tension, warp and filling ways, between these series of steam pipes, several times throughout the full length of the drying chamber, is thus thoroughly dried and tentered to the proper width. The path of the cloth through the drier is indicated by broken dotted lines, and after leaving the bottom roll of the series 5, said cloth passes to a guide roll 7, and from there successively under a guide roll 8, over a guide roll 9, under another guide roll 10, then up to the delivery rolls 11, situated above the folding mechanism 12. (Guide rolls 8, 9 and 10, are below the platform from which the wet cloth is fed to the machine and upon which the operator of the machine—more or less—stands, the return of the cloth from the machine thus being out of the way of the operator.) After passing the delivery rolls, the cloth is folded by passing down between two horizontal rods of the folder 12, to which is given a vibratory motion through an arm 13 and sprocket 14 to which the latter is attached.

In order to accommodate different widths of fabrics fed, each sprocket wheel 15 (one on each side of the machine), as secured to the shaft 16, and over which each respective chain 3 passes, is made movable laterally by a lever 17, and the whole arrangement on each side is made movable forward and backward through a hand wheel 18 on a screw rod 19, one for each side, said screw rods being attached at one end to the bearings of the shaft 16. An inclined frame 20, is also mounted on the shaft 16, on each side of the machine and serves to support its respective gill chain at the point where the cloth is first secured upon their pins. Its angular position may be adjusted when desired, by changing the position of the bolt 21 in the slot 22 of the curved arm 23, on each side of the machine.

The machine is made in different styles, of various lengths and widths, according to the amount of cloth to be dried, and from six to ten feet in height.

By having the low-down feed, the operator is enabled to occupy a position very near the floor, and at the same time properly attend to both the feeding of the wet cloth into the machine and the delivery of the dry cloth therefrom. The operator thus, while receiving the dry cloth, always has the feeding-in devices under his eye and can see that they are operating properly, and also he can at any time promptly adjust the chains to suit varying widths of cloth, without leaving his position. The whole machine can be widened or narrowed from 27″ to 65″ by means of right and left hand screws, which move the screw bars to which are attached the chain guides and sprocket wheels. These screws are operated by means of worm wheels and worms, the latter of which are attached to shafts 24 which can be moved either by power or hand. When run by power, the bevel gear mechanism 25 is used, and if turned by hand, it is operated by means of handle attached to lower shaft 24. Machines are also made to take goods up to 100″ in width.

Fig. 31 shows in its perspective view (complete) the Return Tentering and Drying machine as built by the H. W. Butterworth & Sons Company.

These machines are of very substantial construction and will deliver the cloth uniform in width, with straight and even selvages.

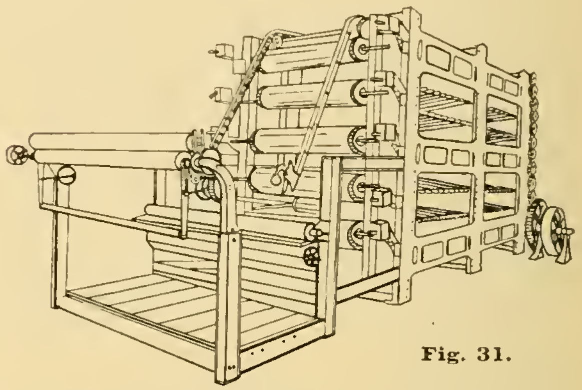


Fig. 31.

Special attention is called in this machine to the patent bearings for automatically taking up the slackness of chains.

They are made in any number of sizes, same being adapted to the production desired by the manufacturer.

SHEARING.

The object of this operation is to level the nap, as previously raised by means of gigging, napping or brushing, on the fabrics, and which nap or pile is, of course, more or less irregular in length and has to be sheared off level to different lengths in different fabrics, to permit a certain finish required by the particular fabric under operation to be produced. In some instances the nap or pile is completely sheared off, in order to produce a "clear face," or "threadbare" finish on the fabric, and in which instance the interlacing of the threads as producing the weave or pattern is clearly shown; in other instances a short nap is left, standing more or less erect, on the fabric, to produce a "velvet finish," and again the nap or pile may be required to be laid down on the face of the fabric, producing in this manner what is termed a "face finish" to the fabric. In the latter two instances, the interlacing of warp and filling is not discernible, neither the individual threads, both being in this instance hid or covered by the pile or nap on the cloth.

With reference to treating worsteds, cotton worsteds, or union fabrics for a clear face finish, singeing, as used so extensively in connection with silk and cotton fabrics, is made use of in its stead.

Shearing should be practiced with the greatest of care especially in connection with woolen face finished fabrics, such as beavers, kerseys, broadcloths, etc., and which have to be most skillfully treated in order to get the evenness of pile required by these classes of fabrics, which necessarily requires a considerable amount of experience on the part of the operator to produce the required result.

Although shearing is generally one of the final operations in the finishing of most fabrics, yet in connection with some woolen, face finish, fabrics, the goods are sheared (cropped) at an intermediate stage of the finishing process, in order to thus be able to produce a fuller nap on the goods.

The operation of the shear requires a most careful manipulation, for instance, any inattention on the part of the operator is liable to result in cutting the cloth, due to folds, or wrinkles forming in the cloth as it passes to the shear cylinder of the machine; or again he may shear too low in some instances, thus influencing the wearing qualities of the fabric, in others the finish required, or again both.

There are two general styles of shears used in connection with finishing woolens and worsteds, known respectively as "single" and "double" shear, indicating in the first instance a machine with one shearing mechanism, and in the second instance, two shearing mechanisms in the same machine for operating in unison on the same piece of cloth.

A double shear is thus simply two single shears set tandem on the same frame, the two sets of blades being stationed at different heights on the machine,

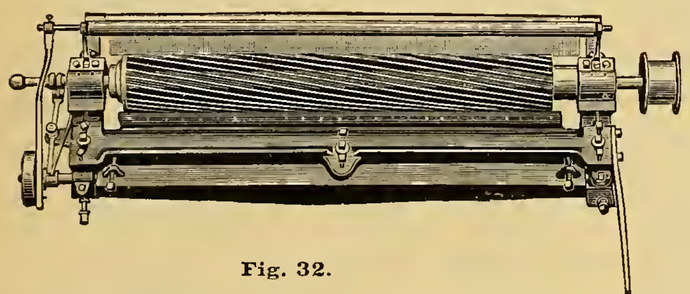


Fig. 32.

thus allowing the operator to watch both cutting lines at the same time.

The parts comprising the shearing mechanism in a shear are best explained by means of illustrations Figs. 32, 33, 34, and of which,

Fig. 33.

Fig. 32 shows in perspective view, a complete set of shear blades, the same comprising the shear cylinder and its boxes, the ledger blade and back, the

Fig. 34.

frame which holds the back for ledger blade, and boxes for the shear cylinder, the oil swab, and the vibrate attachment for the shear cylinder, all ready to set onto the machine.

Fig. 33 shows the shear cylinder, and

Fig. 34 the ledger blade and its back, in detail.

These three illustrations refer to the narrow

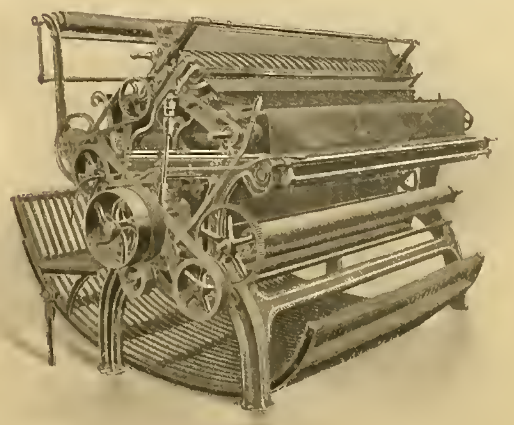


Fig. 35.

woolen or worsted shear as built by the Curtis & Marble Machine Co.; however blades for broad shears are similar, only that more adjusting screws are used.

The modern single and double shear, as built by the Parks & Woolson Machine Co., with all its latest improvements is shown by means of Figs. 35 to 41, and of which

Fig. 35 is a perspective view of a single shear.

Fig. 36 is a perspective view of a double shear, and

Fig. 37 is a sectional view of this double shear, also showing the passage of the cloth through the machine.

Figs. 38, 39, 40 and 41 are illustrations in detail of various shearing mechanisms used, viz.:

Fig. 38 shows in outline section the position of the shear cylinder and ledger blade in connection with a "plain steel rest;"

Fig. 39 shows in outline section the position of the shear cylinder and ledger blade in connection with a "steel rest," having a "list saving device" applied thereto;

Fig. 40 shows in outline section the position of the shear cylinder and ledger blade in connection with a "rubber rest," having a "list saving device" applied thereto;

Fig. 41 shows in outline section the application of a "felt cushion" to the "steel rest."

Referring now to Fig. 37, the cloth to be sheared, as shown by dotted line, is passed from the scray 1, up over a guide rod 2, then down around another guide rod 3 to a front draft roll 4, which with another guide rod 5 acts to put tension on the cloth as it is passed to the shearing mechanisms. From the rod 5, the cloth passes upwardly and over a guide rod 6, then around a specially shaped brush rest 7, which puts the cloth in position to have the nap on the face raised to a perpendicular position on the cloth by means of a raising brush 8 and in this condition the cloth travels to the cloth rest 9 of the shearing mechanism. The brush rest 7 is made adjustable, so that the cloth can be given more or less raising (brushing effect) as may be required. In passing from the brush rest 7 to the cloth rest 9, the back of the cloth is operated upon by a flock brush 10, which is used to clean off any loose threads, flocks, etc., from that side of the cloth, so that they will not get under the cloth at the cloth rest 9 and lift the corresponding places in the fabric into the path of the blades of the shear cylinder 11.

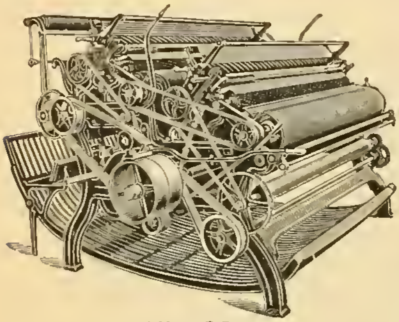


Fig. 36.

The shearing mechanism consists of the cloth rest 9, over which the fabric passes, the ledger blade 12 which acts as the lower part of the mechanism for the actual shearing, and the shear cylinder or revolver 11, which is made up of a series of (10 or 14—according to kind of rest used) spirally placed blades, with their cutting edges extending the same distance from the centre, said shearing cylinder being revolved at a high rate of speed. The shearing width of the cylinder in a regular woolen or worsted broad shear is 66½ inches, but it varies in width for other fabrics from 30 to 120 inches.

The cloth rests are made in various patterns, according to the class of goods mostly under operation, and in order to show their shape and the position of the ledger blade and shear cylinder to them, special illustrations Figs. 38, 39, 40 and 41 are given.

The common or plain steel rest is shown in its outline section by diagram 38, in which A indicates the rest, B the ledger blade and C the shear cylinder (having 14 edge fly blades). The run of the cloth (as shown by means of dotted line in connection with Fig. 37) has been omitted in this illustration for the sake of clearness; the cloth passing in the direction of arrow D over the cloth rest, coming under the action of shearing mechanism, where cloth rest, ledger blade and shear cylinder nearly meet, and leaves the shearing mechanism, passing between cloth rest and ledger blade in the direction of arrow E.

The List Saving Steel Rest. If the selvage or listing of the cloth is thick or curling, a list saving rest is used, which has a jointed portion at each end, by which the thick or curling selvage is guided away from the path of the blades on the shear cylinder, by means of a self operating mechanism which automatically extends or lessens the effective edge of the cloth rest.

An illustration in section of this list saving steel rest, showing also position of ledger blade and shear cylinder to the rest, is given in diagram Fig. 39, and in which A indicates the cloth rest proper, B the ledger blade, and C the shear cylinder (having 14 edge fly blades). D indicates the dial screw for setting the shear cylinder nearer or farther away from the cloth rest according to amount of shearing to be

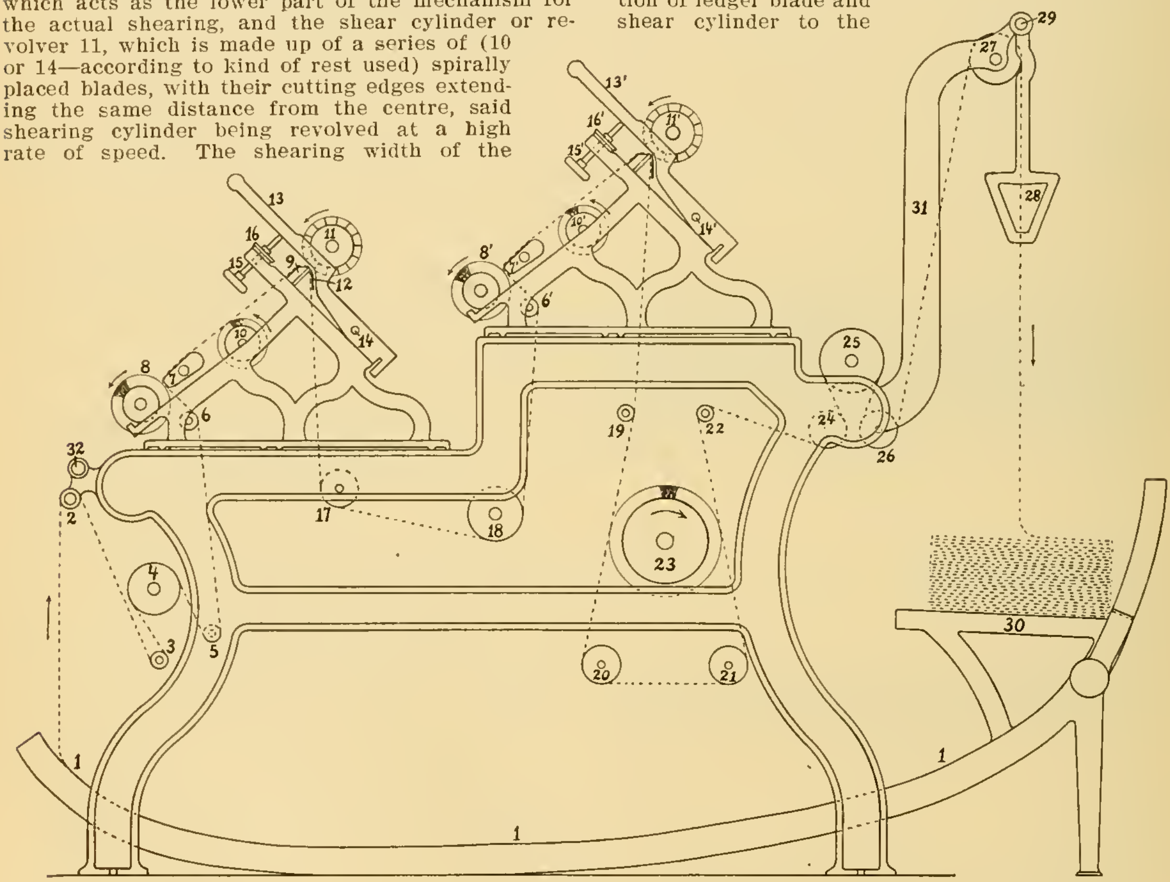


Fig. 37.

done (and which corresponds to numerals of reference 15 and 15′ in Fig. 37). E is the dial (corresponding to numerals of reference 16 and 16′ in Fig. 37). F indicates the frame for carrying the shear cylinder, being pivoted at G (13, 13′ and 14, 14′ respectively in Fig. 37). H is the feeler of the list saving attachment. The passage of the cloth to be sheared (and

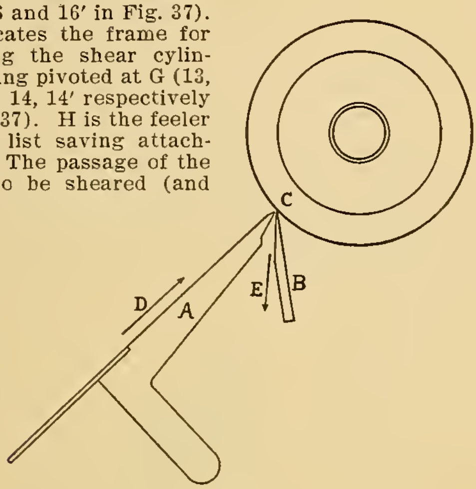


Fig. 38.

as shown by dotted lines in Fig. 37) has not been shown, in order to better show up the various parts composing this shearing device.

The Rubber Rest. There is also built a rubber rest, *i. e.* a rest having a soft edge in place of the solid steel rest as previously explained. The purpose of

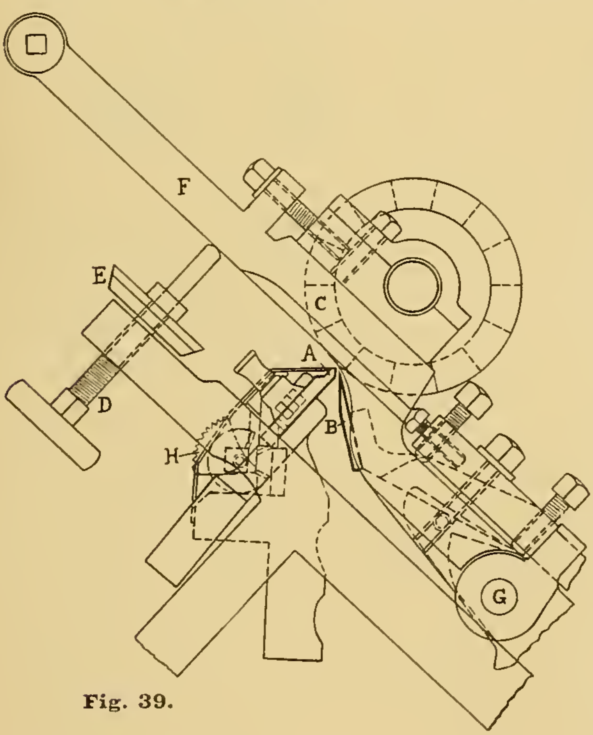


Fig. 39.

this soft edge is to prevent knots, if present on the back of the goods, from lifting the cloth at such points into the path of the shear blades and causing injury (shear marks, holes, etc.) to the cloth, since the softness of the rubber allows the knots to sink into it, and in this manner the face of the fabric under operation is not raised. The rubber rest is used both in connection with the ordinary and the list saving style of cloth rest.

Diagram Fig. 40 shows this rubber rest in section, showing also position of ledger blade and shear cylinder as used in connection with this rest and which differs considerably from the mechanism used in connection with the solid or steel rest, especially the position of the ledger blade to the rubber rest and the blades of the shear cylinder, and which item plays a most important part to be considered in the difference of shearing, using either a common or a rubber rest. Besides these three parts of the shearing mechanism there is also shown in the diagram the list saving device applied.

Letters of reference in the illustration indicate thus: A = rubber tube, B = the passage of the cloth through this shearing mechanism, C = the apron as passing over the rubber tube in order to protect the latter from wear as well as to keep it properly in place. The ledger blade is shown as coming towards the shearing point at an angle of nearly 90°. D = feeler catch roll of list saving device.

In connection with the rubber rest, the metallic part of the rest, both the solid part as well as the pieces of the list motion, is grooved sufficiently to receive the rubber tube A, and after this is placed in the groove, an apron of tracing cloth C is passed over the tube as a protector and to keep it in position. The metallic part of the rest is flexible, that is to say, it can, by means of screws, be adjusted, which is necessary on account of the more or less unreliable nature of rubber, of which the tube is composed. By having the rest made flexible there will be frequent occasions when the rest needs to be trued up. To keep the rest perfectly true at all times is an impossibility, but it is a fact that any unevenness in the rest is not as likely to produce bad results as an unevenness in the steel rest would do. The operator may have the rest perfectly true when he starts a piece, but he cannot be sure that it will be true by the time the piece is finished.

The rubber tube is raised or lowered by means of compression or expansion, which is done from the side. In order to raise the tube, the groove is compressed, or made smaller, while, when the groove is expanded or made larger or wider, the tube is lowered. The metal part of the rest remains in the same position all the time, and any unevenness of the surface of the rubber rest must be thus remedied as explained before. The tube is about three-eighths of an inch in diameter, the thickness and also the degree of hardness of it varying according to the cloth to be sheared. Some use a tube with very thick walls while others use a tube with very thin walls, and some of them use either one of these kind of tubes composed of very hard rubber while others prefer very

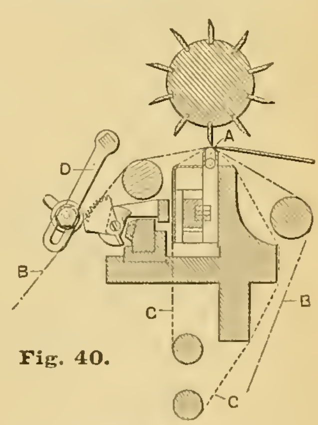


Fig. 40.

soft rubber. It depends altogether on the finish required and the goods sheared. The whole final object in view in the selection of a tube is, of course, to have the knots or lumps on the back of the goods bury themselves into the soft surface of the edge of the cloth rest and yet raise the pile or nap of the goods into the path of the blades of the shear cylinder. Experience will show best the kind of tube wanted.

The use of the rubber rest is now very largely confined to "running the shear on backs," which means pushing the knots as on the face of the goods, through the cloth, into the back, then running the goods over the rubber rest, face down, and shearing the back. This takes all of the knots off the back of the goods that were there in the first place and also those that have been pushed through from the face of the goods. After the fabric has been thus sheared on the back, it then can be sheared on its face, over a regular steel rest, because the back has been cleaned from knots and lumps and consequently no chance for shear marks.

From the fact that rubber and oil are antagonistic to each other, the operator must be careful to keep the tube free from oil, since if the latter should come into contact with the rubber, the first thing to be noticed is an increase in the size of the tube, due to swelling. Although this would seem like a small item, yet it is often enough to make the tube useless. Oil, when it does get on, generally gets on the list motion, causing the tube to swell at that point, and thus making the part of goods passing over those places shear closer there than on the other part of the goods, and if allowed to get worse, the selvage will be cut. To a certain extent, the evil can be remedied by adjusting the motion, although this is only temporary, so that it is best to replace the tube with a new one.

With reference to the tracing cloth apron C, which is put on over the rubber rest, (unwinding from one roll onto another), if said apron is damaged from any cause, the rubber tube which is somewhat compressed by it, will come through, and the cloth, being operated on and running on top of this will be cut as a result. For this reason the apron must be very closely watched, and should not be allowed to have too many pieces of cloth pass over it before its position on the rubber rest is moved, the reason for this being that the cloth under operation comes in contact with the apron for not quite half an inch, and will therefore wear only at that part, but if the apron is moved so as to subject a new surface about twice or three times a day, there will not be much danger of its breaking.

When shearing coarse and wiry goods, it will be necessary to move the apron after every two or three pieces of cloth have passed over it, in order to keep the apron from wearing through quickly at the one working surface. This changing of position of the apron C is readily done by slightly turning the rollers upon which said apron is winding and unwinding itself.

When replacing old tubes, care should be taken to see that the new tube to be put on is of the required diameter, since the groove in the rest is of a definite size, and if the tube is slightly larger, it must be pressed into the groove which, however, is not so bad as if the tube were too small, because in the former case, after the apron has been put on, there will be no trouble, but in the latter case, the tube being too small for the groove, the same is liable to rest against one side of the groove at one place and another side at some other place, thus producing an uneven surface for the cloth. When a smaller tube than the required size has to be used, it is a good plan to apply a thin coat of glue to the groove and then place the tube in it, keeping said tube pressed evenly down (leaving the cylinder down on it lightly, just enough to hold the tube in position) until the glue hardens; however, the best plan in all cases is to have the tube of the right size.

A felt cushion for the steel rest is one of the latest devices designed for a similar purpose as the rubber rest, for the reason that with a cushion formed of felted fibre, in this instance, interposed between the cloth rest and the cloth, knots and other imperfections in the fabric will cause the cushion to yield locally, so that an even surface of the cloth is maintained and the nap is shorn evenly.

The application of a felt cushion to a steel cloth rest is best shown by means of Fig. 41, which is a cross sectional view through the cloth rest of a shear, also showing the passage of the cloth to be sheared, through the shearing arrangement.

Referring to the illustration, 1 indicates the cloth rest, 2 is the shear cylinder, and 3 is the ledger blade. The felt cushion is made up of a folded sheet of cotton cloth 4, made to form an apron, the felt 5 being secured between the two pieces of the cotton cloth. The fold of the cotton cloth is secured to a rod 6 by means of a clamp 7.

This apron extends from the rod 6 over the cloth rest and around the nose 8 of the same, being held in position by a sheet of tracing cloth 9 extending from the roll 10, over the apron 4 and 5, to the roll 11, the object of the tracing cloth being to give as smooth a passage way for the cloth under operation as possible.

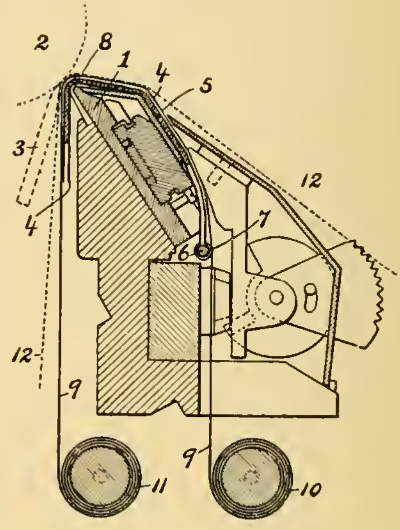


Fig. 41.

The felt (5) used in the make up of apron 4—5, is made of short fibre material, and of such thickness as will best support fabrics of a weight most frequently required to be handled by the shear. The felt may be made of any desired density, so as to form a more or less yielding cushion. 12 indicates the run of the fabric over the cloth rest.

The shear cylinder 11, see Fig. 37, is carried in a pivoted frame 13, having its pivot at 14, and can thus be swung away from the cloth rest 9, when the seam in the cloth is to pass over said cloth rest, a special lever arrangement being provided for this purpose on each side of the machine for the convenience of the operator. The amount of nap sheared off by the shearing cylinder is regulated by setting its blades to the ledger blade, which is done by means of dial screws 15 (one on each side of the shearing mechanism) and against which the frame 13 rests. A dial 16 is also provided for each screw, and which indicates how the dial screw is set. The nap of the cloth can, in this manner, be sheared gradually, by turning the dial screw, to thus set the blades slightly closer to the ledger blade after each run of the cloth through the machine. The back side of the shear cylinder is encased in a tin casing, the purpose of which is to collect the flocks, which are being cut off of the cloth, so that they can be drawn away from the cylinder into a suitable receptacle, by means of a conductor connected at one end to the centre of the casing, having an exhaust fan located at the other end of said conductor.

After leaving the cloth rest 9, the cloth passes down under the guide roll 17 and draft roll 18, and from there it passes over a guide roll 6′ to a second brush rest 7′, similar to the one at 7. The cloth now undergoes similar operations to those explained when describing the first shearing mechanism on the machine, and in order to simplify the description (wherever convenient to place) corresponding prime numbers of reference have been used in the second shearing mechanism to indicate parts similar to those of the first mechanism. Lever arrangements are also provided on each side of the machine, for raising the second shear cylinder out of contact with the cloth when so required.

After leaving the second shearing mechanism, the cloth passes down past a guide roll 19 and under two rolls 20 and 21, and up again over a guide roll 22. A laying brush 23 is conveniently placed, so as to act on the face of the cloth twice, once by each side of the brush, which thus does the work of two single contact brushes. From the guide roll 22, the cloth passes under a guide roll 24, then up over a draft roll 25 and down again under another guide roll 26, and from there it passes up over a folder roll 27 to the folder 28 which is given a vibratory motion, using the point 29 as a pivot for this motion. From the folder, the cloth drops back into the scray 1, until, on the final run through the machine, it is folded, as shown in the illustration, on the table 30, which when not needed, is turned out of the way. The folder is mounted on high cock tails 31 to give more room, up and down, for the pile of cloth when being folded on the scray table.

32 indicates the shipper rod extending across the front of the machine being connected at one end to the shipper lever so that the machine can be stopped or started by the operator from either side.

In starting to shear a piece of cloth, the same is first threaded through the machine by attaching (wiring) one end of the cloth to an apron, previously threaded through the machine, and then sewing the two ends of the cloth together. Care must be taken to make a good, fine seam, using for this purpose a regular Mill Sewing Machine. A carefully made seam will more than repay for the time it takes to do this, and it will enable the attendant to finish the ends of the piece as nicely as the middle, and as close as possible to the seam, whereas if a poor seam is made, the goods may be more or less streaked for about a yard at the seam.

The machine is then started and the cloth run through the required number of times until the proper length of nap remains, the shear cylinders being always raised out of the way when the seam is about to pass under them. At the last run, the seam is taken out and the cloth folded on the table 30, as shown in the illustration, a new piece of cloth, or the apron, having been previously attached (wired) to the end of the cloth, before the latter runs out of the machine.

The double shear is just as easy to run as the single shear, requiring only slightly more attention and a no more expert operator than the single. Each run of the cloth in a double shear equals two runs on a single shear, resulting in about double the output of the former compared to the latter. The double shear is but a trifle larger than the single and consequently finishing rooms, can by using double shears, as compared to single shears, about double their shearing capacity, and this without requiring more floor space. Again, should an accident occur to either set of shearing mechanism, the whole shear is not put out of use, because it can then be run as a single shear until the proper repairs have been made.

The cloth is always in sight from the front as it runs over the folder roll 27, so that the operator can easily see the condition of the cloth or note when a seam is going over it, so that he can stop the machine at the proper time to take the seam out at the last run. This double shear, as mentioned before, is generally built with a shearing width of 66½ inches, however, when so required by the width of fabrics manufactured by a mill, they are built to order in any width from 30 to 120 inches.

In order to produce even and smooth work at the shear, before the goods are put on the machine, they should be again carefully back burled, an operation which consists in removing all bunches and knots in the goods which have been missed during the first burling of the flannel from the loom. The operation at this point should be performed most carefully, it being advisable to use the burling irons only for the raising of the bunches or knots, and then clip them off by means of a pair of scissors. By removing the bunches or knots with burling irons, there is a liability of threads being broken and thus damage done to the goods.

Rubber Rest vice versa Steel Rest. The main reason why there is apt to be more damage done to the cloth on the rubber rest shear than on the common, *i. e.* steel rest, shear, is the fact that the burling previously referred to, when this style of shear is used is not as thoroughly done as for the common shear, the person in this instance relying on the rubber rest to prevent all damage to the cloth, but which is not always the case; however he knows that the burling of the cloth for the common shear has to be thoroughly done, since otherwise there will be damage done to the cloth. In many instances, when dealing with the rubber rest shear, this operation of examining or burling the cloth again previously to shearing is omitted, which certainly is wrong.

A feature in favor of the rubber rest shear is, that when the same is intelligently handled, there is little, if any, chance for holes, from one reason or the other, to be made, and it is only when the person relies on the rubber rest to do everything that damage will be done. This feature also refers to the felt cushion rest.

In the common shear, flock holes are liable to be made when the flock pan of the back brush is allowed to become too full, but on the rubber rest shear there will be no damage done, even if this is the case. While the rubber rest shear does away with some difficulties characteristic to the common shear, the former presents a great many points for careful consideration, which are not to be met with on the common shear. Aside from the rubber rest, a radical departure is made on these shears in the construction of the cutting mechanism, for, while in the common shear, we find fourteen fly blades in the shear cylinder, we find that in the rubber rest shear there are but ten of these, for which reason it is necessary to run the shear cylinder at a much higher rate of speed. The cylinder on the rubber rest shear runs from 1200 to 1500 revolutions a minute, and this is required in order to do good work, while on the common shear 1000 to 1200 revolutions are sufficient for good work. On account of the smaller number of shear blades, it is also necessary to keep these in the best of condition and therefore these shears require grinding oftener than is necessary on the common shears.

On account of the rubber tube, as placed in the rest of the rubber rest shear, it is necessary to bring the cutting mechanism down to the cloth in such a way that the ledger, as well as the revolving blades are brought down on the top of the cloth, thus forming very nearly a correct right angle, or 90 degrees, instead of meeting it at an angle of about 45 degrees, and the cutting point is found at the corner of the angle. Care is required to get the blades in the right position with reference to the rubber tube, for, if they are not placed in the proper position, the rubber rest is sure to be more of a source of damage than a help.

For some classes of fabrics, for example in connection with fancy cassimeres, a plain rubber rest (no list saving device) is preferred, since these goods, as a rule, have body enough, so that the blades of the shear will not come in contact with the tracing cloth apron, even when shearing for a threadbare finish.

The selvage or list motion, although a most delicate device, is as simple and effective a piece of mechanism in its principle of construction as there can be found. It consists of a series of metal blocks whose tops are shaped exactly like the blade rest, said blocks having a groove on which a bar runs, which has a projection on the under side which fits the groove and runs in it. One half of this projection is on the upper side of the bar and the other half on the lower side, with a slanting piece connecting the two. To this bar are attached the feeler catches, (see H Fig. 39) which are half round and have teeth on one side, having on their inner side two teeth which fit into a ratchet, which moves back and forth and has teeth both on the top and on the bottom. The teeth on the top, face outwardly and those on the bottom, inwardly. The feeler catches, previously referred to, sit right over this ratchet, so that when it falls, the lower tooth is caught by the tooth of the ratchet and with it taken inwardly, while when it rises to a certain point, the other tooth of the feeler catches is caught by the upper teeth of the ratchet and with them taken outwardly. As the feeler catches move in or out, the bar to which they are attached also moves in or out, and the projection which runs in the groove of the several metal blocks will either raise or lower them according to the way it travels. As the cloth passes over the feeler catches, their outer teeth get caught in the fibres of the cloth under shearing, and are by them lifted and when in turn the ratchet moves the bar outwardly. As soon as the feeler catches leave from under the cloth and there is nothing to hold them up, they consequently drop and get engaged in the lower teeth of the ratchet and are taken inwardly. The device is very effective in preventing the selvages of the cloth from being sheared, requiring however to be kept in good order by the operator. He must keep the several metal blocks composing the device clean and free from dirt, since they must run free and easy but without being loose, since if the latter is the case, the goods will not be sheared as close under the list motion as they will be at the other parts, again if they are made to fit too tight they will run too hard and consequently will stick, and when the cloth will then pass over the feeler catches without being able to work them, or, if the cloth is leaving the feeler catches, they will not be able to follow as fast as they should. The list motion should be lubricated, but not with oil, since the same will attract dust and in this way soon get the list motion clogged up, but instead, when cleaning the list motion, wipe every piece clean and dry, and then, before the several pieces are again assembled, shake them up well with flake graphite, being careful that any loose graphite is removed from each individual piece of the motion, before putting it again in position in the shear. All the pieces are numbered by the builders of the shear, and consequently can be readily assembled. The bar which passes through the groove must be also well cleaned and wiped and then lubricated with graphite on the under side, which runs in the groove. The list saving steel rest should be lubricated with a fine machine oil.

The raising brush, performs also a very important function in the shear, although its action is simple compared to some of the other devices on the machine. The same has a large influence on the amount and quality of shearing done by the shear cylinder, especially when dealing with face finished fabrics like beavers, kerseys, etc. Frequently the cutting part of the shear is blamed for what really is due to the improper performance of its work by this brush. Many times in a mill a fabric is sheared lower on one side than on the other, and when the operator naturally may adjust the cutting mechanism of the shear, only to find, that with the next piece he puts on the shear, that perhaps opposite results on the cloth are produced. It should be remembered that in such cases, it may be found that the raising brush will bear harder on the cloth on that side where lower shearing has been done, than on the other, and for which reason, if such trouble shows itself, the first thing to do, is to examine the raising brush before any adjustment in the shearing mechanism is attempted.

Care must be taken not to force the cloth too hard against this raising brush, and thus reversing the nap on the cloth, from the way it was gigged. The proper way to adjust this brush is to have it raise the nap as nearly straight as possible on the cloth, so that the shear blades can act on the nap to the best advantage. When this brush gets badly worn and will not raise the nap uniformly all across the width of the cloth, the brush must be cut down to make it cylindrical, or when in too bad a condition for this, refilled. Upon face finished goods or fancies having a heavy nap, the intelligent operation of the brush greatly influences the proper finish for such fabrics. The brush should be set off so as to touch the nap lightly on the first few runs, and as the shear cylinder is lowered, the brush must be put on the cloth somewhat harder, until when the shear cylinder has been lowered to its last notch, and when the brush must be put on the fabric, so that it will bring up the last of the bottom fibres in the nap of the cloth. Such a procedure will considerably enhance the beauty of the finish.

In connection with goods that have not been gigged, such as cheviots, meltons, etc., it is best to give them several runs with the brush after the shear cylinder has been lowered to its last point, since the raising brush cannot raise all the fibres on such styles of fabrics at the first application, as it does with face finish fabrics and where the nap has been uniformly laid by gigging, in fact, as the free fibres lie in all directions in connection with cheviots, meltons, etc., the brush is as likely to lay as to raise them, but acting in conjunction with the laying brush, which acts on the fibres in the opposite direction, all the fibres will be sufficiently raised, after three or four runs through the machine, for the final run of the fabric for shearing. This will prevent the face of the cloth from roughing up in the garments.

The flocks taken out by the under brush should not be allowed to accumulate in the receptacles provided for them, since this would force them back into the brushes. A frequent cleaning of the brushes will avoid the possibility of their surfaces becoming caked or clogged, a feature which, of course, would interfere with their working capacity.

Directions for Grinding the Blades. See that the edge of the cloth rest is perfectly straight and see that it is kept so. Fit the ledger blade to the rest, not the rest to the blade. The shear cylinder must also be perfectly straight, and it must be of uniform diameter throughout its cutting length. A straight edge will show at once if the cylinder is high or low in the centre, but if it is tapering, that is, higher at one end than the other, a pair of calipers only will show it. It is impossible to keep shear blades in good order without using a steel straight edge, now and then, when so required.

In starting up a new shear, or blades that have been refitted, first, lay the blade frame (which has the ledger fastened to it), on the shear, then bring the cut of the ledger to the edge of the rest, see that it is perfectly parallel—that is, the edge of the ledger should come up as high at one end of the rest as it does at the other. Then take a piece of thin paper and slide it along between the rest and the ledger blade, and see that it bears all the way alike. If you find any places that pinch harder than others, then use a fine file taking off a trifle from the rest, until it pinches all the way alike, however only a very small amount should ever be taken off the rest in this manner. Should the ledger touch hard at both ends and be open in centre, or vice versa, then try the straight edge on the back edge of the rest, also front edge of the ledger, and if the ledger is full at the ends and hollow in the centre, then grind the blades, by laying in the cylinder and running it backwards, using for this purpose emery not coarser than No. 120, drawing up the ends of the ledger with set screws while grinding, but not the centre, until it is brought up straight on the front side. If the centre of the ledger is full when you commence with it, then draw up the centre instead of the ends. After grinding, fit the ledger and rest together as before; when you have done this to perfection, lay in the cylinder and screw down the cap screws a little tighter than can be done with the fingers. Be sure the caps do not bind too hard on the bearings, so as to cause them to heat; if they do bind, put some paper under the caps and screw down tightly. After running a few weeks, they can be put down a little closer and the paper can then be taken out.

Should the blades refuse to cut, after running a short time, start the upper set screws on the ledger a trifle in, which consequently will press them a little tighter together. Sometimes when the blades do not cut near the end, the turning out of the conical headed screw on that end, just a hair, will often remedy the difficulty. If this does not remedy it, then lay out the cylinder and with a hone held on front side of ledger with the lower end out, about one inch from the bottom of the blade, hone the edge of blade thoroughly, then lay back the cylinder, turning it forward by hand, to cut off any feather edge that may have been turned over with the hone. You are now ready for shearing again, and many times this will save grinding and besides will be much better for the blades. Always have your blades run as lightly as possible — that is, press the ledger to the cylinder as little as you can and have it do the work. If your blades rattle, slacken the ledger a trifle at the ends; sometimes honing off the bevel of the ledger at the ends will remedy the trouble.

By careful and skillful attention to the preceding directions, shears may be kept in good order, without grinding, for some time. But if they have been in use for a long time, and the ledger is worn down, and the bevel becomes long, it is advisable to grind the shear cylinder together with it. For this purpose all the flocks should first be cleaned from the cylinder, and then the list motion detached and the vibrating wheel taken off as well as all the belts, except the cylinder belt. Every part of the shear which is likely to be hurt by emery should be well covered. Loosen the screws that bind the box which holds the cylinder to the frame, then turn the screws that hold the box up to the ear, say once around, which lets the cylinder down a trifle, then tighten the box again that holds the cylinder, and commence to grind.

With reference to grinding, a good mixture may be made of equal parts of No. 120 and flour of emery mixed with a good lard oil to a thick paste, and when the grinding is nearly completed, finish up with a mixture of flour of emery and oil. When the proper mix is made, we should have what is called a fiddle, about 4 inches wide, made by having a piece of wood 4 inches wide by 20 inches long and putting cleats on 16 inches apart, leaving 4 inches for a handle, and fasten some old 4 inch belting on to the cleats. After having previously covered up all parts of machine where needed, commence grinding. Put your belt on with a cross instead of straight, so as to run the cylinder backwards. Put the paste of emery and oil on fiddle and apply it to cylinder from one end to the other, and have your cylinder all through the grinding operation vibrated by hand. It is a good policy to change the place of beginning to apply the fiddle each time a fresh supply of emery is applied, since wherever the fiddle is first applied, that part is sure to get the most grinding and in this way things can be kept nearly even. Run for about 15 minutes, then tighten up all top rows of screws a little. Remember not to grind longer than absolutely required, since grinding takes the life out of the blades. Keep at it this way slowly and watch front of the ledger blade to see how evenly the emery comes through, as that is a good way to see how evenly we are grinding the cylinder. Grind until the shear blades cut wet tissue paper all the way across. As soon as they cut evenly all the way across take out the cylinder, clean it from emery and oil, and also the ledger blade. Now use a hone and rub lightly on ledger blade at a 20 degree angle to remove feather edge by grinding, and finally finish honing by running the hone straight across from end to end. Wipe ledger blade after honing, and replace the cylinder, bringing it about $\frac{1}{32}$ of an inch forward, so as to take a little away from the heel of your bevel. Put on the bevel and run the cylinder backwards for about ten minutes, so as to polish the blades and insure smooth running, using for this purpose, oil and crocus. Take out the cylinder and wipe all clean, using for this purpose saw dust and a whisk broom; also hone ledger blade slightly, put back, put on swab and you are ready for shearing, but do not force the machine to take off too much nap of the cloth at once. Keep your blades well oiled, and never run them when they are noisy.

A special shear grinding machine in which the ledger and cylinder blades are ground at the same time will be found a valuable adjunct to any mill since it is unhandy and keeps a machine idle when obliged to send the blades to a shop to be ground, thus clearly showing the advantages of having a suitable grinding machine in the mill. To accomplish this many machines have been designed. Some were made with a long roller grinder, run in oil or water, but which would only either grind the fly or the ledger blade and not both at the same time.

Fig. 42 shows the grinding machine as built by B. S. Roy & Son, designed to grind both fly and ledger blade at the same time, without oil or water. The same consists of a suitable iron frame in which is situated a traverse grinder, fitted with a solid emery wheel, with about 4″ face, and a differential motion for traversing the wheel very slowly while revolving. On each side of the grinder is a set of bearings, one set for the fly blade, and one for the ledger blade. These bearings are adjustable to the grinder, the ones for the ledger blade being made to be adjusted to any angle while the blade is being ground.

By using a traverse grinder, the grinding wheel runs dry, oil or water being unnecessary as is required when a roller grinder is used. Different widths of blades can be ground on the same machine.

With this machine, accurate and rapid grinding can be made, thus resulting in a saving wherever used.

Grinding does not have to take place as often if the blades are kept in good condition, in fact, if it is

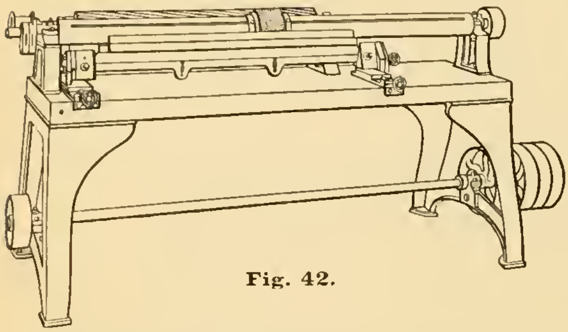


Fig. 42.

handled with a little attention, to the blades at frequent intervals, the shear should do good work for from one and a half to two years. After this procedure has been resorted to for quite a while, there is a time when remedies suggested will fail to give the desired results, and when the finisher may think that it is a good sign that the shear needs grinding. This, however, is not always the case, for as the blade needs honing, it is reasonable to suppose that the cylinder will require a little touching up also, for which reason loosen the stay bolts which hold the cylinder boxes and raise these away from the frame, enough to slip a thin sheet of pasteboard under them, and then secure the stay bolts again and cross the cylinder belt. Get the fiddle, as used for grinding, clean it well of all emery, and give a light sprinkling of lard or sperm oil and apply it to the cylinder while it is running backward, moving it briskly to and fro from side to side. Keep this up for about 10 minutes and then the pasteboard may be taken out from under the boxes, letting things settle back in their accustomed place and when the trouble will have disappeared. These remedies thus mentioned, however refer more to mills which do not possess one of these shear grinding machines previously explained, and thus—for grinding the blades, are compelled to send them to the machine shop where built, in order to have them ground.

However, after shear blades have been run for years and years, and have been ground innumerable times, there will come a time when they will get so that even grinding will fail to make them cut properly, they will heat frequently and get rough and it is next to impossible to do any good work with it. When examining the blades closely, it will then be seen that the bright streak at the point of the ledger has disappeared, it having been ground away, and when of course a new knife must be riveted to the ledger casting.

Oiling. One of the first and foremost essentials connected with the care of a shear is the oiling, since there are any number of movable parts in this machine, all of which need more or less oil, according to the swiftness with which they travel, and while certainly some require less oil than others, still a certain amount is necessary to make smooth work. Many of the places in the machine which need oiling are situated where they are not readily visible, and hence are sometimes overlooked, certainly due to carelessness of the shear tender. Amongst these we find the break roll situated under the brush rest, which turns and therefore needs lubricating. The two application rolls which serve as contact rolls for the laying brush are also out of the way, and easily omitted by the operator, but they need oil just as regularly as the more prominently located moving pieces. So do also the two wood rolls, set beneath the brush pan and which serve to keep the cloth from rubbing against this pan, need oiling at intervals. These several rolls do not always squeak when they need oil and it sometimes happens that the arbors wear off completely before it occurs to the shear tender that oil is required on them. Oiling up a machine is certainly a very simple process, but after all it must be done right and not one place slighted. Again oil must not be poured on until it can be seen running off on the framework of the machine, since one or two drops may be all that was required.

The oiling of the swab on the shear is also another place where much oil is frequently wasted. The cloth part composing the swab is tacked to a round or square stick and this stick is placed on the cap of the journal box frame, and by means of suitable holes bored into it, is held on and overlapping the blades of the cylinder by the top screws. The cloth part hangs rather straight, in fact almost too straight, to retain the oil to any great extent, thus provided its oiling is done carelessly, the oil will drop off and in turn on the cloth to be sheared, this being a frequent cause of oil stains and consequent damage to the fabrics.

The object of the swab is to keep the blades on the cylinder cooled, since said cylinder revolves at a high speed (from 1000 to 1500 revolutions—according to make of machine—per minute), again the cylinder is running against the ledger blade, which has a tendency to heat them, and which must be avoided. However this does not necessitate the continually applying of oil to the swab, a light oiling, about four or five times a day being all that, as a rule, is required to make the shear run well without heating; whereas, if only oiled once, or at the most, twice, and this with a large quantity of oil each time, it will result in oil spots to the fabric sheared. Another trouble by not oiling frequently enough is that the blades run too dry, which, as mentioned before, causes them to heat. The blades when warm will expand, and consequently run very tightly together. They soon get burnt and roughened up, and cannot do good work, until sharpened again, this being a process as previously explained which takes up time, and consequently causes loss in production to the mill. The flocks which accumulate in between the fly blades on the cylinder should not be disturbed, as they absorb all the superfluous oil, whereas if the cylinder was clean it would throw this superfluous oil out and onto the fabric. If, with a proper oiling of the swab, there should still be a tendency for the blades to get hot, it then is a sign that the blades are running too hard, that is, the ledger and cylinder blades have been drawn together so tightly, in order to make them cut, that the friction thus produced, speedily heats them.

An improved swab consists of a strip of perforated leather fillet, such as is used by card clothing manufacturers. This leather swab rests directly against the fly blade cutters and has two strips of felt on its outside to retain oil and apply it to the leather beneath. This kind of a swab wears much longer than a common swab, and applies the oil evener and also acts as a strop on the blades of the shear cylinder to keep them sharp.

Practical Points. In shearing a piece of goods, do not have the ledger blade too high, or above the cloth rest, as this will injure the cloth, and provided the selvages are poor, the shearing arrangement will cut them, also every little knot or bunch on the fabric will be cut off. Draw the frame, holding the cylinder, down so that when the last notches have been reached, there will be a slight tremble, or jar, on the cloth, caused by the cylinder touching it lightly, but which action will not be perceptible when the piece is finished. This applies only when shearing woolen or cassimeres, while for worsteds, the cylinder should not be allowed to touch the cloth, as it is liable to injure the threads.

It is impossible to lay down hard and fast rules for regulating the amount of cutting to be done, by the shear cylinder, the class of goods under operation regulating the practice; for example, with a full heavy nap, the blades would have to be set higher than where the nap is found short and thin. The lowering and raising of the cylinder, as the occasion requires, must be carefully done, for, if too much nap is being taken off the cloth at once, the flocks will soon show by being thrown in front, and the cutting effect of the shear will be very quickly impaired.

For light weight meltons, cheviot and suitings, which require but little shearing, the machine may be run with the blades set as low as is required to finish the goods with one or two runs.

On goods having a nap, like beavers, kerseys, broadcloth, the blades should be raised, so that but a little of the nap will be cut off on the first run, and lowered gradually until the piece is sheared as closely as required. Care should be taken not to lower the blades too fast, since this would cause them to pull, instead of cutting the nap properly. In connection with these fabrics it can be noticed that the nap is getting thicker, the shorter it gets, which is due to many of the shorter fibres which have been raised and which have not been exposed to the shear blades in former runs. When the blades are set low enough down, in order to cut the nap as closely as is required, the fabric (nap) should get several runs at this point to insure a clear and even nap. Much of the difficulty met with in shearing these face finish fabrics, is due to the work being improperly done in the processes of finishing before shearing. Such trouble being frequently caused by having the goods improperly scoured and gigged, which, if done as it should have been, would have permitted them to be sheared perfectly. Should it appear to the finisher that a piece of cloth to be sheared is not sufficiently gigged, it should be sent back to be re-gigged, and this with as much of the original nap on as possible. Any attempt on the part of the finisher to clear its pile in this case by shearing, while in a measure it may be successful, at the same time will produce a hard, wiry face, and if re-gigged after a close shearing, the result may be a tender fabric.

When shearing piece dyed goods, the whole number of pieces in the lot must be sheared the same as the first, because if one is sheared closer or faster than the others, there will be a difference in the shade of these goods.

The shear tender, on account of its being impossible for him to carry in his mind exactly the appearance or shade required of the fabric to be sheared, should always be supplied with samples of the styles of fabrics he has to shear, being careful to shear to match the respective sample as near as possible. On account of a variation in the weight of most all fabrics, the variation in density of the nap, the variation in yarn and cloth during its manufacture, it is impossible for the finisher to give his shear tender rules for shearing to depend upon, neither to closeness of pile nor number of runs to give the cloth, etc., the use of correct samples to shear by, and the exercise of good judgment on the part of the shear tender can only produce good results. In the matter of uniformity of shade in connection with "case goods," much depends upon the careful work of the operator, not that the shearing can change or regulate the shade as relates to the colors, but in the clearness with which the colors are brought out by shearing, and the effect of the light upon a long or short nap, together with the prominence of the threads or pattern, the shearing may result in what would be termed in the market a variation in shade or "off shade." In many cases a slight variation in fulling, the density of the felt resulting in turn in a corresponding density of nap will render it necessary for the shear tender to give the fabric in question an extra "notch" or run or two, on the shear, in order that the pattern may show up as clearly as in the sample.

Another important matter for the shear tender to notice is to see that the two sides of the cloth shear exactly alike, so that they also in turn will shade alike. If there is any variation, he must discover it at once, and correct it before the piece is sheared down to the final notch, or there will be trouble. The two sides and the middle of the cloth should be compared, and must be kept uniform, and the shearing made to compare with sample as nearly as possible.

Another important point to be considered in connection with shearing, is the proper tension of the fabric while passing through the shear. The tension is controlled by means of a friction plate attached to the take-up or draft rolls of the machine (see 4 and 18 in connection with Fig. 37). This plate of each draft roll should be kept well oiled and taken off at least once a week and the leather thoroughly scraped and oiled. It should be set so that it will slip if the cloth pulls too tight. The cloth should be run through with enough tension to keep it smooth, but not more, since the tighter the cloth runs, the harder it is to shear it evenly, and on a threadbare finish, it would be next to impossible to properly clear out the face of the fabric, provided an excessive tension is employed. Neither is it advisable to have the friction too loose, especially on worsteds and threadbare finished woolens, since although it will aid the clearing out of the face on these fabrics, it must be watched closely to see that it is not overdone, for when the friction is too loose there is liability of cutting the sides of the cloth. The proper amount of tension to the fabric is readily ascertained, by placing the hand on the cloth as it runs over the rest, (about the middle of the rest) ana pressing down lightly. If by doing so a slight wrinkle forms itself to the fabric it is a sign that the tension is about right, while if no wrinkle shows, there is too much tension on the fabric. Again if a slight pressure produces a wrinkle, it shows that there is not sufficient friction on the cloth for proper shearing.

Should the selvages be very slack, so that they are cut in spite of the list saving attachments, it certainly is too late to correct this trouble in the finishing room, the only thing that can be done is to increase the tension of the cloth by adjusting the friction plate on the take up rolls, thus tending to take up some of the slack in the selvage.

When dealing with a rubber rest all knots and bunches left on the back of the goods, must be buried in the rubber rest as they pass over it, in order to present a smooth surface of the cloth to the cutting part of the shear, and in order to accomplish this, the cloth must be drawn over the cloth rest tight enough to press these knots and bunches into the rubber tube. This shows that it requires in connection with the rubber rest shear to use more tension on the goods than is necessary to be used on the common shear. Again too much tension on the goods in connection with the rubber rest shear must also be avoided, for, if there was too much tension used, the goods would be drawn into the tube, causing the sides or ends of the rubber tube to stand much higher than where the cloth is passing over it, and when shearing the cloth, the apron as well as the tube would surely be damaged. In connection with shears having list saving attachments applied, there will be little trouble from this source, although it will not be advisable to have the tension too tight.

As mentioned in the beginning of this article on shearing, in connection with some fabrics, singeing is made use of in place of shearing; for which reason one of the most prominent makes of this class of machines is herewith given, viz.:

Butterworth's Gas Singeing Machine. This machine, as built by the H. W. Butterworth & Sons Co., and of which a perspective view is given in the accompanying illustration is very economical in the use of gas, and so constructed that either one side or both sides of the cloth can be singed at the same operation.

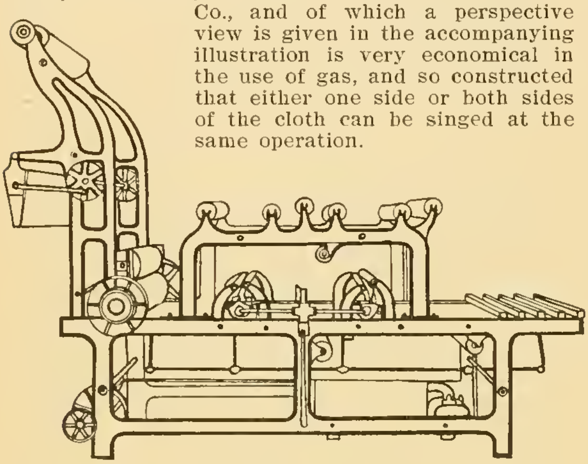


Fig. 43.

The cloth can always be seen by the operator, and the flame can be removed and the machine stopped instantly, thus avoiding any chance of damaging the goods.

The burners are so constructed that the width of the flame can be limited to exactly the width of the goods, thus preventing any waste of gas.

Compressed air is delivered into a large receiver, and the air and gas are mixed at a uniform pressure, which insures a steady and perfect flame. Combustion being complete, the cloth is entirely free from traces of soot. Besides being used for handling Worsteds and Woolen fabrics this machine is used very extensively in connection with Cotton and Silk.

For description of the gas singeing machine as built by the Curtis & Marble Machine Co., see Cotton chapter, pages 366-367.

BRUSHING, PUMICING, POLISHING, SANDING.

Brushing has for its purpose to clean out the body of the fabric under operation, from any dust, dirt, loose long and short fibres, and at the same time in connection with face finished fabrics, lay the nap smooth and even, all over the surface, in one direction.

Polishing or pumicing imparts a lustre to the face of the goods, rounding out each thread and giving it the full rich finish that can be accomplished in no other way. The pumicing cylinders are sixteen inches in diameter, and have iron heads with six arms, upon which the lags are mounted. The cloth when applied to a broken cylindrical surface of such large diameter receives a heavy beating effect and vibratory motion. This limbers and softens up the cloth and produces the fine velvety feel that is so desirable. These polishing or pumicing lags are set with alternate rows of the stiffest Russian bristles and fibrous whalebone with an adjustable steel supporting blade on each side of the lag. This blade prevents the breaking down of the outside rows of bristles and whalebone and greatly increases its durability. It also gives adjustment for wear. For tightly woven and stiff fabrics, polishing or pumicing is unequaled by any other finishing process. Although primarily designed for finishing plain and fancy worsted and all hard faced goods, it is now used in a more general manner on flannel and light fabrics, golf cloths, and many other goods.

Sanding clears out the face of the cloth, smooths it up, and removes all projections like knots, lumps, and threads. The sanding lags, and of which there are also six to the cylinder, are covered with the best grade of garnet paper, which is held on by adjustable clamps. Worn out paper can thus be readily, evenly and quickly replaced, the whole expense of reclothing the lags, in labor and material, being insignificant. However, if so preferred, emery, garnet, ruby, or sand may be applied in the grain direct to the cylinder, when the same is used without lags, or to the lags, if such are used on the cylinders.

In order to give a description of the construction and operation of the machine used for these processes, the accompanying illustrations are given, and of which Fig. 44 is a perspective view and Fig. 45 a side elevation of the machine as built by the Parks & Woolson Machine Co.

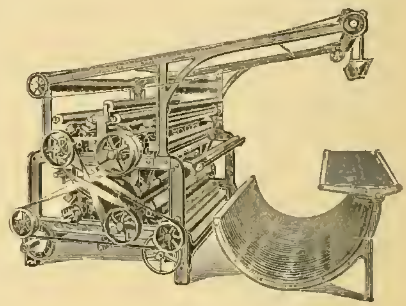


Fig. 44.

The cloth, as is shown by means of dotted line, passes from the cloth scray 1 (a portion of which only is shown in order to bring the illustration within compass of the page), successively over the tension rolls at 2, guide roll 3, steam box 4 and guide roll 5, into the machine. The steam box 4 may be omitted, if dealing with fabrics requiring no steaming.

When using the steam box, the fabric rests upon the guide or application rolls 3 and 5, running also over the top of the steam box. For operating the steam box, open the drip valve provided for this purpose, then wait until steam issues through the felt cover on top of the steam box, then start machine. After box is thoroughly heated, close drip valve. Leave drip valve open when machine is idle.

The cloth is then applied twice to each one of the four cylinders, 6, 7, 8 and 9 (revolving at from 350 to 400 r. p. m.), by the adjustable application rolls 10, 11, 12 and 13. The illustration shows cylinders 6 and 7 as solid brush cylinders and 8 and 9 as what are called "six lag" polishing or pumicing cylinders; this combination being purposely given to show the construction of these two kinds of cylinders.

Brushing cylinders are too well known to need lengthy description, they being simply cylinders covered with brush lags, whereas the polishing or pumicing cylinders as previously mentioned, consist of six lags mounted equidistant on the cylinders, said lags being set with alternate rows of stiff Russian bristles and whalebone, having on their two sides a steel strip (not shown) to keep the rows of bristles from bending over when they hit the cloth. No sanding cylinder is shown in the illustration, the same being either a cylinder having six lags like cylinders

8 and 9, covered either with emery, etc., in the grain or on cloth, or a solid cylinder covered similarly to the lags. As a rule these machines are built with four brush cylinders, or four polishing cylinders, or four sanding cylinders; however any combination of these kinds of cylinders, or any other kind of cylinder in connection with any one or more kinds of cylinders thus explained may be used to fulfill many varied conditions. Again the machine can be so arranged, so that one, two or three of the cylinders will treat one side of the goods and the remainder the other, an arrangement especially advantageous for flannels.

The cloth application rolls 10, 11, 12 and 13 are adjustable by a hand wheel for each cylinder, so that the cloth contact can be regulated quickly for light or heavy work, a dial with indicator showing the setting.

After having passed the action of the last cylinder (pumicing cylinder 8 in this instance) the fabric is then guided by means of guide roll 14 and draft roll 15 to the flock brush 16, which cleans off the back of the goods. 17 indicates another draft roll for the fabric, from which the latter travels to the folder 18, and from there back into the cloth scray which is provided with a tilting table (see Fig. 44). The folder 18 is shown broken away from the machine in Fig. 45, in order to bring the illustration within compass of the page. The direction of running the cloth through the machine is shown by means of dotted line, accompanied by arrows. The average speed of the passage of the cloth through the machine is 16 yards per minute.

When the cloth is to be run out of the machine finally, the tilting table is put in a horizontal position as shown in Fig. 44, and the cloth thus folded automatically on it by means of the folder 18, whereas when the cloth is to be given a number of runs in the machine, the table is swung into a perpendicular position, letting the cloth drop into the scray for the next run through the machine.

This machine can be also specially arranged for wet work, requiring in this instance a heavy chain drive, draft rolls covered with perforated brass, and wide faced pulleys; dampening rolls or stretch rolls being added if so required.

Steam Brushing. Although the machine just described will, besides Pumicing, Polishing and Sanding, fulfill this purpose in a most satisfactory manner, we must mention, that special machines are also constructed for the purpose of only steaming and brushing the fabric, and a specimen of which is given in connection with Figs. 46 to 49, the same representing the steam brush as built by David Gessner. Points of advantages of this machine are its cloth guiding mechanism and the means for shifting the same, by means of it providing three (in place of two or one point only) points for the main brush to operate upon the cloth, at the same time providing for a convenient removal of the main brushing cylinder (for repairing, etc., purposes).

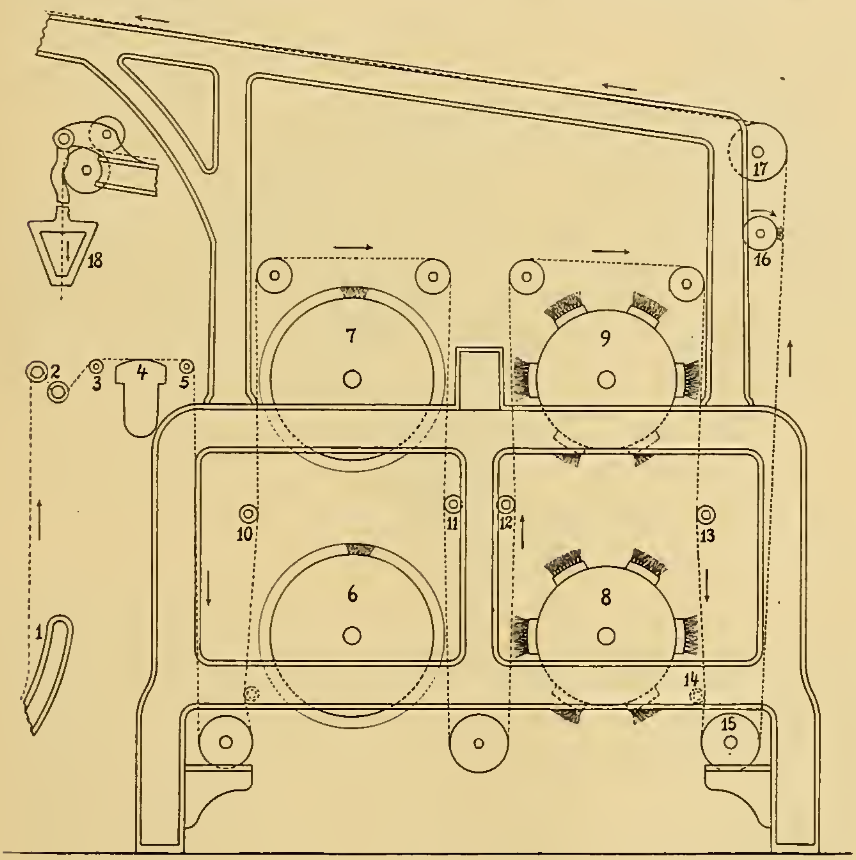


Fig. 45.

Of the illustrations, Fig. 46 is an isometric view of the front and one end of this steam brush, with the brushing cylinder cut away for clearness of illustration. Fig. 47 is a section at right angles to the brush shaft through the middle of the machine. Figs. 48 and 49 are details of the cloth folding device, shown broken away from the frame, *i. e.*, stands 3 and 4, respectively, of the machine.

A description of the construction and operation of this steam brush is best given by quoting numerals of reference accompanying the illustrations, and of which 1 and 2 indicate the two side frames of the machine, which are held together by cross ties *o*. To the top of said frames are fastened, in rear, the folder carrying stands 3 and 4, and to the rear, two brackets 5 and 6 (only one being visible in either illustration, a duplicate being situated on the other side of the machine) for holding, when required, the cloth table board 42, shown in Fig. 46 in its dropped position, having automatically folded the cloth upon it by means of folder guide 15. Fig. 47 shows said cloth table board 42 raised, *i. e.*, in the position to permit the cloth (see dotted line 7) from the folder guide 15 to drop into the cloth trough 8 for a further operation upon by the machine. The broken line 7 in Fig. 47 shows the course of the cloth through the machine as it is passed from trough 8 successively to the brush 9, acting on the back of the cloth, draft roll 10, the steam-box 11, main brush 12, acting on the face of the cloth, rear draft roll 13, folder draft roll 14 and folder guide 15.

The mechanism for supporting the main brush 12 and presenting the cloth thereto is as follows:

On the top of the end frames 1 and 2 are stands 16 and 17, containing the bearings of the brush shaft 18, held on said bearings by removable caps 19 and 20.

21 and 22 represent, respectively, the loose and fast pulley for the belt by which the shaft 18, *i. e.*, the machine, is driven.

23, 24, 25 and 26 represent a compound pulley formed of one casting, fixed on the shaft 18. The part 23 constitutes the pulley for driving through belt 27 and pulley 28 the brush 9, and parts 24, 25 and 26 of three different diameters constitute a step pulley for driving the feed. The compound pulley 23, 24, 25 and 26 is provided with a hub adapted to be fixed on either end of the shaft 18, and pulleys 21 and 22 are provided with a sleeve and collar, so that the main brush 12 may be reversed end for end by slipping these pulleys off the ends of the shaft 18, removing the caps 19 and 20, turning the brush end for end and replacing the caps and placing the pulleys on opposite ends of the shaft.

A hand wheel 30 is connected through shaft 31 and bevel gears 32 and 33 with shaft 34, which in turn is connected by the spiral gears 35 and 36 with screw shaft 37 and by corresponding spiral gears (not shown) with a similar screw shaft (not shown) as adjusted to the inner side of end frame 2. The screw shaft 37 is fixed against longitudinal movement in bearings 39, 40, and is held by said bearings parallel with the guideway 41, running horizontally on the side of the end frame 1, near its top. The other screw shaft (not shown), as running horizontally on the inner side of end frame 2 near its top, is fixed against longitudinal movement in similar bearings as screw shaft 37, and held by said bearings parallel with the guideway (the front end 38 of said guideway being visible in illustration Fig. 46), running horizontally on the inner side of the end frame 2, near its top.

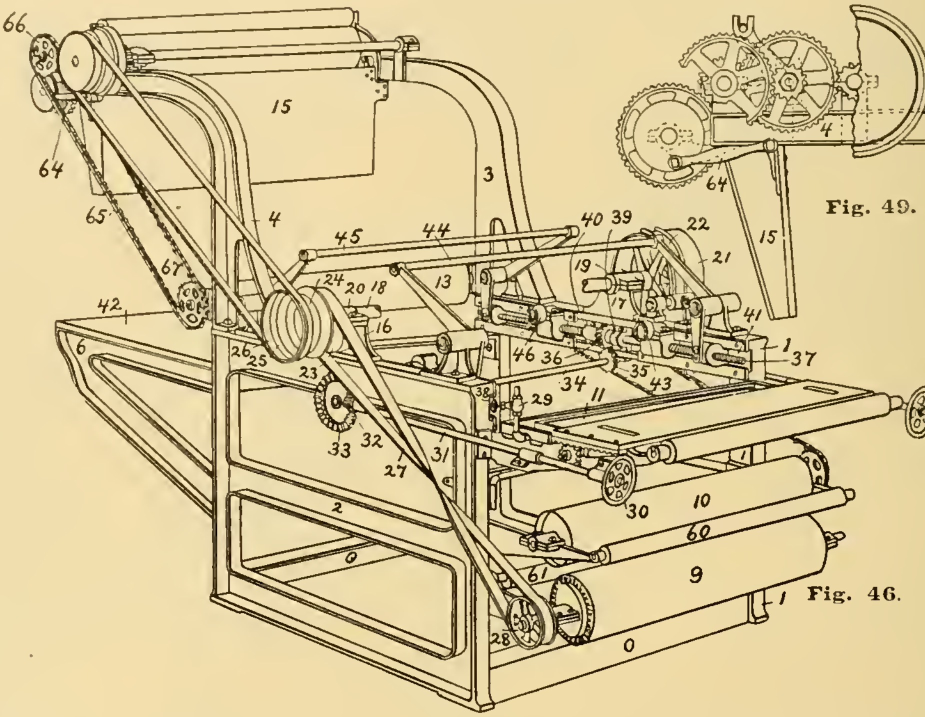


Fig. 49.

Fig. 46.

43, 44, 45 and 46 are guide rolls, by the relative movement of which the cloth is pressed against, or removed from, the brush 12. Locating these guide rolls in the position shown and providing for their lateral movement, enables the operator to conduct the cloth tangentially against the same brush at three points of its circumference, a feature forming the chief point of advantage of this machine. This feature of presenting the cloth at three points (see dotted line 7, near brush 18, in Fig. 47) to the action of the brush is accomplished by locating the axes of the guide rolls 43 and 46, around which the cloth passes to and from the brush in the same, or nearly the same, horizontal plane below the level of the brush shaft 18 and the rolls 44 and 45 above the level of the brush shaft 18.

How to Regulate Amount of Brushing: The means by which the lateral movement of the guide rolls 43, 44, 45 and 46 is produced at one end of the machine from the shaft 37 is the same as that by which it is produced at the opposite end of the machine (not shown), hence a description of one will suffice for both: 47, 48, are inversely-inclined screw threads and 49, 50, are other inversely-inclined screw threads. The screw thread 48 is also inversely inclined with respect to the screw thread 50, and the screw thread 47 with respect to the screw thread 49. Screw threads 49 and 50 are of equal diameter, but smaller than screw threads 47 and 48, which again are of equal diameter. 51, 52, 53 and 54 are carriages mounted to slide in guideway 41, and are threaded, respectively, on to the screw threads 47, 48, 49 and 50. The carriages 51 and 52, respectively, carry the bearings of the guide rolls 43 and 46. The carriage 53 is pivotally connected with one arm of the angle lever 55, 56, which has a fixed fulcrum at 57 and carries the roll 45 at the extremity of its other arm. The carriage 54 is pivotally connected with one arm of the angle lever 58, 59, having a fixed fulcrum and carrying the guide roll 44 at the extremity of its other arm. When the screw shaft 37 is rotated in one direction, the guide rolls 43, 44, 45 and 46 will all approach the brush 12, and by the proper inclination of the screw threads, their relative movements are so timed that whatever slack in the cloth is produced by the movement of the rolls 44 and 45 is taken up by the movement of the rolls 43 and 46. Conversely, when the shaft 37 is rotated in the opposite direction, it causes the guide rolls to retreat from the brush 12 with such relative movement that the slack produced by the retreat of the rolls 43 and 46 is taken up by the retreat of the rolls 44 and 45. The approach of the four guide rolls toward the brush presses the cloth against it at three points of its circumference, as shown in Fig. 47, while their retreat removes the cloth from the brush to any distance required. All of this is accomplished by the operator by simply turning the hand wheel 30, without necessitating the stopping of either the running of the brush or the travel of the cloth through the machine.

To Remove the Main Cylinder from the Machine: By simply removing the cloth from the machine and moving the levers 58, 59, and 55, 56, so as to separate the rolls 44 and 45 to a distance as great as the diameter of the brush and removing the bearing caps 19 and 20, the brush can, without disturbing the position or adjustment of any other part, be raised bodily from the machine and in turn repaired, reversed or replaced. The shafts 34, 37, and the other screw shaft (not shown), as running horizontally on the inner side of end frame 2, near its top (similar to shaft 37 on the side shown), are all located beneath the level of the brush shaft 18; thus either of them is prevented from intercepting the necessary path of removal upward of the shaft 18. The rolls 44 and 45 are provided with open bearings, as shown in the lever arms 59 and 56, so as to permit of their being lifted out of their bearings, if desired.

Since the four levers 55, 56, and 58, 59, diverge from their upper extremities downward, they will carry the guides 44 and 45 in arcs, so that their movement is such as to cause the cloth to approach or recede from the brush at the three points marked *a*, *b* and *c*, in Fig. 47. The guides 44 and 45 move at 45 degrees to the horizontal and the guides 43 and 46 move in a horizontal plane, thus it is necessary that the guides 43 and 46 move farther than the guides 44 and 45, so that the resultant of the horizontal movement of 43 and 46, on a line at 45 degrees to the horizontal substantially equals the movement of 44 and 45. This result is accomplished by the proper inclination of the screw threads 47 and 48 with respect to the screw threads 49 and 50 and the lever arms 55, 56 and 58, 59.

The mechanism for regulating the amount of back brushing to the cloth, *i. e.* the contact of the cloth with the brush 9 is as follows: 60 is an idler guide roll and 61 a guide mounted upon eccentric journals 62, so that by being oscillated on its journals the cloth may be made to approach or recede from the brush 9. Connected with one of these journals 62 is a slotted segment 63, provided with the handle (not shown) whereby the eccentric guide 61 may be oscillated. For the purpose of locking the segment at the desired point, a set screw (not shown) is provided, which extends through said slot, but is provided with a shoulder adapted to enter an enlargement (and of which there are several) of the slot in turn locking the segment 62.

The cloth after leaving the brushing machine (see broken line 7) passes over a guide roller onto and partly around draft roll 14, and from there into the cloth folder 15, to which a swinging motion is imparted by means of lever 64 through gearing shown in detail in Fig. 4, in order to fold the cloth, when required, onto the tilting table 42.

Sprocket chain 65 connects sprocket gears fast on draft rollers 66 and 67, the shaft of the latter (the rear draft roll 13) having on the opposite side of the machine from that shown in Fig. 46 another sprocket wheel, which in turn meshes with a second sprocket chain, in turn meshing on its other end with a fourth sprocket wheel fastened to the end of the shaft of front draft roll 10.

11 indicates the steam box, live steam being admitted (when wanted, and if so, under such pressure as required) to this apparatus by means of valve 29, the steam escaping through minute holes in the top of the box, throughout its entire width, the steam penetrating through the cloth from its face side.

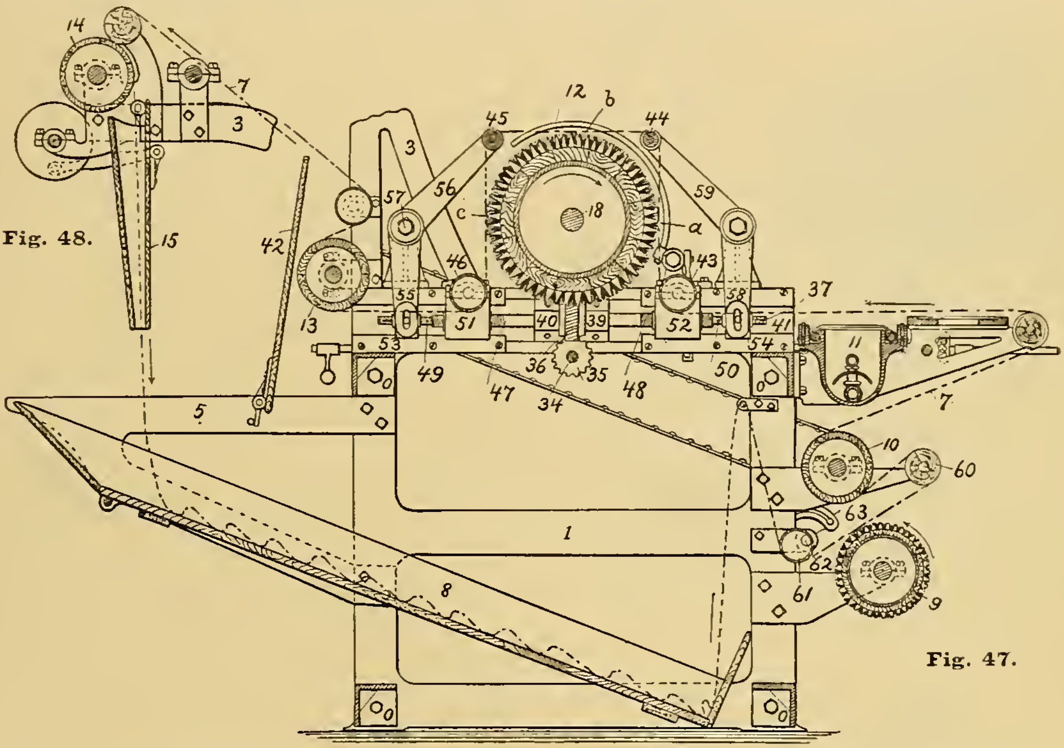


Fig. 48.
Fig. 47.

SPRAYING, DAMPENING OR SPRINKLING.

The object of this process, designated by any one of the above quoted four names, is to dampen, *i. e.* condition the fabric either before or after pressing. It is important that this dampening or moistening of the fabric is done even, uniform, as well as thorough, for which reason the water must be thrown against the cloth in a very fine spray (mist) and this with such force that it will penetrate into the structure.

A description of the process is best given by means of illustrations Figs. 50 and 51; and of which Fig. 50 is a perspective view of the Spraying Machine as built by the Curtis & Marble Machine Co., and Fig. 51 a sectional view of such parts of this machine as comprise the spraying device proper.

With reference to Fig. 50, the cloth is laid on a platform in front of the machine, at a convenient height from the floor, then passed around the necessary guide rolls and a stretch roll, over the spraying device, and then to the draft roll, where it is wound up in smooth, even rolls, so that the moisture is evenly absorbed by the entire fabric. Weights are provided for giving sufficient pressure to make a firm roll. If it is desired to lay the goods off in loose folds, a folding attachment is put on the machine for this purpose.

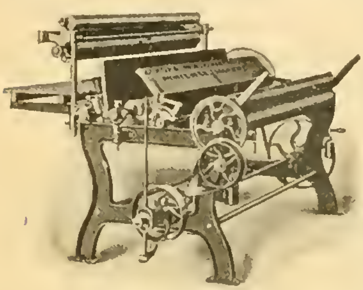


Fig. 50.

The operation of the machine with reference to its object—spraying, dewing, sprinkling or dampening the cloth—is best explained by means of quoting letters of reference on the sectional view of the spraying device, and in which A indicates the spraying cylinder, which is caused to rotate at a high speed in the direction of the arrow by means of a belt from the main shaft of the machine. This cylinder is composed of a steel shaft on which are packed a series of disks made of thin, sheet metal, preferably brass, with spacing collars between, to give suitable distance between the disks. B is the water tank or reservoir arranged on the main frames of the machine, and provided with inlet pipe for the water, and an overflow pipe F, the latter serving to carry away the surplus water and at the same time insure a uniform depth or supply of water in the reservoir. At either side of the spraying cylinder is a deflector D, hinged at the bottom, and a shield C likewise hinged at its lower portion. Both the deflector and the shield are adjustable in their position by means of segment handles G, acting through fingers H and connecting links I, and they may be clamped in any desired position by means of thumb screws or hand wheels J. The passage of the cloth through the machine is shown by dotted lines N, the same passing above the spraying device in the direction of the arrow. In the operation of the machine, the rapidly revolving disks on the spraying cylinder A take up films of water from the upper surface of the reservoir, and throw these against the inner surface of the shield C and deflector D, whence they strike the goods N in the form of fine spray or mist, free from individual drops of water. The fineness and volume of the spray depend upon the position of the deflector and shield relative to the spraying cylinder. When the shield C is fixed over and quite close to cylinder A, the volume of spray thrown by the cylinder will be reduced, aud as the shield is moved in a direction away from the cylinder, the volume of the spray is proportionally increased. The same is true regarding the position of the deflector D. Thus the operator has at his command, at all times, means for governing the amount and the fineness of the spray which different classes of goods under operation may require. Drip boards E, located at either side of the water tank and inclined as shown in the illustration, take any surplus spray or water back into the reservoir. The overflow pipe F has an adjustable top which can be screwed up or down for regulating the depth of the water in the reservoir.

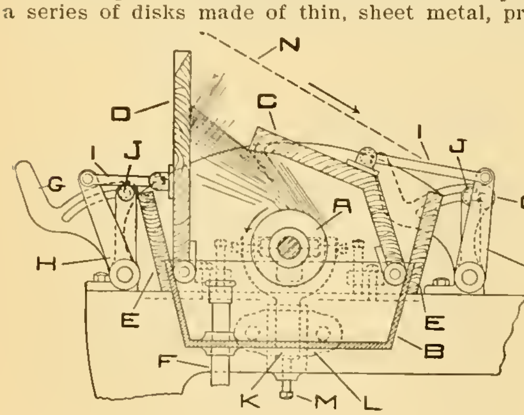


Fig. 51.

If it should be desired at any time to make the water of greater depth so as to lap more on the disks of the spraying cylinder, the top of the overflow pipe can easily be raised by turning it with the fingers. This adjustable top allows the depth of the water to be regulated to a nicety.

The spraying cylinder A runs in adjustable boxes which are held in a forked stem K, and this stem is adjustable up and down in the stand L fastened to the frame of the machine. By turning the set screw M at the bottom, either one or both ends of the spraying cylinder can be raised or lowered so as to bring the surface of the disks parallel with the surface of the water, and thus insure an even spray being thrown throughout its entire length. A brass rack is placed in the bottom of the reservoir B, though not shown in the illustration, to prevent agitation of the water by means of the constant revolution of the spraying cylinder A, and consequent unevenness in the amount of spray that is thrown off. At the ends of the reservoir are sheet metal guards to prevent the water from splashing over the ends of the reservoir.

For a description of the machine as built by the Textile Finishing Machinery Co. see Fig. 31, page 379, and for such as built by the Arlington Machine Works see Fig. 32, page 380.

PRESSING.

This, as a rule, is the last process the fabric is subjected to, previous to measuring, doubling and rolling, and for which reason it must receive due attention by the operator, in order that the work is done well.

The object of pressing is to smooth the fabric, by means of ironing it, of all its wrinkles and folds, as well as to enhance its beauty of finish. Certainly with reference to the process, the same as with all the other finishing processes, various notions prevail, and the kind of pressing required for a certain fabric, may be frequently regulated more or less by the whims of the commission merchant than by the actual requirements of the fabric under operation.

There are two methods of pressing in use, viz.:

(1) The old fashioned method of pressing the cloth in folds between press paper boards and heated iron plates, by means of hydraulic presses, and to which process some manufacturers, in connection with some face finished fabrics, like Beavers, Tricots, Uniform-cloth, Kerseys, etc., still may adhere, claiming that by this process the heat permeates the cloth slowly, and in the same manner cools it slowly, and consequently that thus the pressing is set better. In some instances, belt power is used in place of hydraulic power; again pressing by means of electricity in place of heated plates, is also practiced.

(2) By means of the modern steam heated rotary press, which besides perfect pressing—and this as good as by the hydraulic press—will result in a considerably larger production, and consequently saving in labor, time and expenses to the mill.

Hydraulic Cloth Press. The fabrics to be pressed, after proper steam brushing, are then—face inside—doubled and folded, being careful to omit the forming of wrinkles in the cloth. The fabric is then taken to a special bench, for putting it in press papers, it being laid with the selvages towards the operator and a press paper between each fold. When a sufficient number of pieces to fill the press (or less), have thus been papered, the setting of the latter in the press follows. For this purpose a heavy piece of press board is laid down on the bottom of the press, and upon it three iron plates, previously thoroughly heated, are placed. Then another heavy press board, the same as the one previously used, is placed on top of these hot plates, after which two men take one of the papered pieces of cloth, previously referred to, and lay it upon the heavy press board, being careful that the selvage of the fabric rests on the side and so that it comes square on the plates, so as to get the whole benefit of the heat. Another heavy press board is then placed on the fabric, three other hot plates on top of this, and then another heavy press board, and when the next, previously papered, piece of cloth, is then put in the press, it being placed so that the selvage rests on the opposite side of the previously inserted fabric. In this manner all the pieces to be pressed (and of which there may be from eight to ten, according to length and weight of fabrics thus handled, to go in the press) are treated, until the press is filled. It will be readily understood that in some instances, what we might call incompletely filled presses have to be made use of, on account of not having a sufficient number of pieces of cloth on hand for filling the press complete.

When thus the press is filled or partly filled, as the case may be, pressure is now applied, and the fabrics thus set in the press, left under pressure until the plates get cold, and when the pressure is then taken off, the fabrics, one after the other, taken out of the press, and in turn to the bench, to have the position of the press papers changed, for the reason that at each end of the fold there is about one-quarter of an inch of the cloth that has received no pressing, and for which reason, the folds are changed, *i. e.* the press papers are changed in re-folding the fabric in such a manner that each press paper is moved about five inches, thus giving a chance for pressing, in the next operation, such portions of the fabric, which previously received no pressing.

After all the pieces that were in the press have thus been changed, the press is again set as before explained. When the plates in turn are again cold, the pressing is completed, and the pieces taken out of the press, to the bench, to have their press papers finally removed. For a lustrous finish, the fabrics are then ready for measuring and rolling, whereas, for a dull finish, the fabrics are opened out and steam brushed, after which they are then ready for measuring, doubling and winding.

In place of the solid iron press plates, thus referred to, in some instances hollow plates are used, and which are not heated until the pieces of cloth are all in the press. These hollow plates are severally connected by compensating tubular joints to valved steam pipes, whereby the plates are heated by the steam circulating through them, the hydraulic press at the same time being set in operation.

There are objections or disadvantages inherent to these pressing operations—that is to say, in the application of the interposed iron plates, whether direct or steam heated, since they are necessarily disposed at quite a distance apart vertically between the layers of cloth, due to the fact that the necessary thickness of the plates occupies so much room in the press that it would be impracticable of using such a method if said plates were interposed between each layer or even between three or four layers, on account of the too small amount of cloth thus possible to be inserted in one press. Moreover, in such a case the plates would produce streaks in the fabric, thus making an uneven finish in the goods. Again the iron plates are necessarily heated to a temperature considerably exceeding that which is required to finish the cloth, as otherwise the interposed layers would not be evenly warmed through; but even then the cloth nearest or contiguous to the heating plates will become overheated and consequently overfinished, while the other or intermediate layers are insufficiently heated and finished, the result being that the goods when taken from the press may be found to be more or less unevenly finished. These disadvantages are overcome by means of using electrically heated press boards, placed between every third fold of the cloth (a common press paper being placed between the other folds) after which the goods are placed on the vertically-movable bed or platen of a suitable hydraulic press. The pieces of thus folded fabrics are laid in superposed layers on the preceding one, and so on until the desired quantity of fabrics is mounted in the press, thus when a current of electricity having sufficient strength is passed simultaneously through the several (to permit electrical heating) press boards, the heat thus generated is transmitted to and acts upon the adjacent layers of the confined fabric, the latter at the same time being compressed in the press under considerable pressure, and since the degree of heat or temperature can be adjusted or regulated as desired, it follows that none of the layers of cloth will become overheated or overfinished, while the time required for conducting the heat from the press boards is greatly reduced, since the applied heat permeates the cloth almost immediately.

Of the accompanying illustrations Fig. 52 represents in front elevation such a hydraulic press, adapted to be used in connection with electrically heated press boards, and which in its general character is identical with the hydraulic press as used in connection with heated plates as previously referred to. Fig. 53 is a horizontal section taken on line *x-x* of Fig. 52. Fig. 54 is a partial vertical section taken on line *o-o* of Fig. 52. Fig. 55 is a perspective view of one of the press boards or plates adapted to be electrically heated; and Fig. 56 is a plan view showing the interior construction of said press boards.

A description of the construction and mode of operation of the press and the press boards as used in connection with this procedure, is best given by quoting letters of reference, of which A indicates a hydraulic cloth press, provided with a vertically movable bed or platen B, having a piston or plunger *p* extending downwardly therefrom and mounted in the cylinder *e*. The platen is adapted to be actuated through the medium of water or other suitable agent under great pressure admitted to the cylinder and pressing against the end of the piston. At the upper portion of the press is located a strong head *h*, the

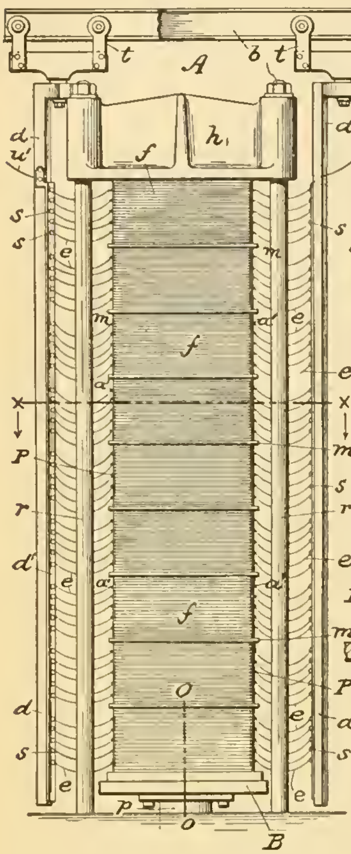


Fig. 52.

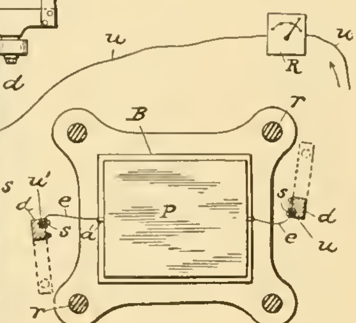


Fig. 53.

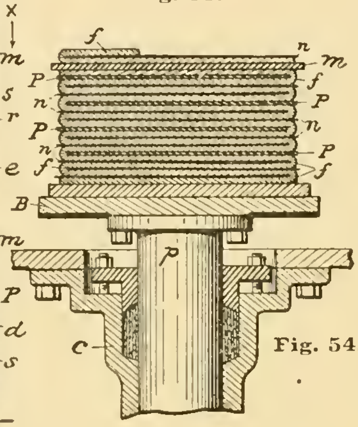


Fig. 54.

same being supported by and secured to the four vertical heavy tension columns *r*, the lower ends of the latter being fixed to the cylinder.

The to be electrically heated press boards P are composed of two pieces or sheets of hard and smooth cardboard, laid flatwise one upon the other and cemented together. Arranged between the said pieces of cardboard is an interposed electrical conductor *a*, made of thin sheet metal or wire, the same being bent or cut out in a zigzag shape, as clearly shown in Fig. 56, so as to form a resistance to the free passage through it of the electric current, the result being that when the conductor is electrically energized it also becomes heated, say, to incandescence. The heat thus generated permeates or is transmitted through the press board, thereby heating it. The ends of the conductor *a*, extend through the corresponding ends of the press board and form terminals *a'*, adapted to be readily coupled to circuit wires or conductors. Located contiguous to the press is a pair of vertically arranged posts *d*, each having an insulating plate *d'*, secured thereto along its side. These bars *d* are grooved vertically to receive the corresponding live conductor of an electric circuit, said conductor being at the back of the insulating plate *d'*. At short intervals, vertically, the plates are provided with flexible branch conductors *e*, the latter being insulated from one another through the medium of the plate and also by means of individual switches *s*. Thus it will be evident that any or all of the conductors *e* may be energized at will by the current with which the main conductor is charged. In Fig. 52 one of the vertical bars *d* is represented as being connected to the positive conductor *u* of an electric circuit, while the other bar is connected to the negative conductor *u'*.

The conductor carrying posts *d* is suspended from trolleys *t*, mounted to travel on overhead tracks *b*, as is clearly shown in Fig. 52. The posts are also adapted to swivel or turn axially. As thus constructed the relation of the posts to the press or to each other may be changed, such feature being especially desirable in case a number of presses are arranged in a row, the posts in such event being rolled along from press to press to effect the pressing and finishing operation.

The pressing operation, in connection with a press thus described is as follows: The cloth *f* is first folded in a zigzag manner, meanwhile inserting or interposing the press boards P and the usually used common boards or press papers *n* between the folds of the cloth and then placing the whole on the platen B of the press A, as shown enlarged (compared to Fig. 52) in Fig. 54, wherein the relative thicknesses of the cloth and press boards are considerably exaggerated, the operation being continued until the press is filled with the several pieces of cloth to be pressed.

The several short flexible conductors *e* of each post *d* are next coupled to the respective terminals *a'* of the corresponding press boards P, followed by gradually forcing the piston *p* upwardly, thereby compressing the goods mounted in the press. At the same time the electric current of the circuit flows from the main or positive conductor *u*, through the corresponding post *d* and branch conductors *e* into the press boards, and from the latter, by means of the other series of conductors *e* and their post *d*, to the negative conductor *u'*, thereby closing the circuit. Owing to the presence of the resistance, conductors *a* in the press boards, the flow of the electric current is retarded, thereby increasing the temperature and heating the press boards to a corresponding degree.

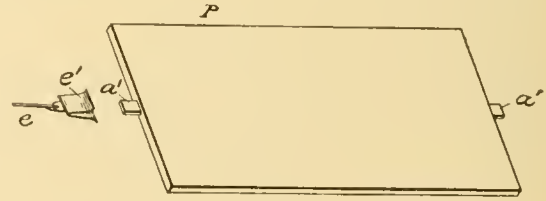


Fig. 55.

The heat thus produced is continued as long as desired and is taken up or absorbed by the cloth. Heavy metal or cardboard plates, as *m*, are placed at intervals throughout the press load giving in turn greater stability to the pile of folded cloth, and at the same time insuring more uniform pressure to the goods. The free ends of the flexible branch conduct-

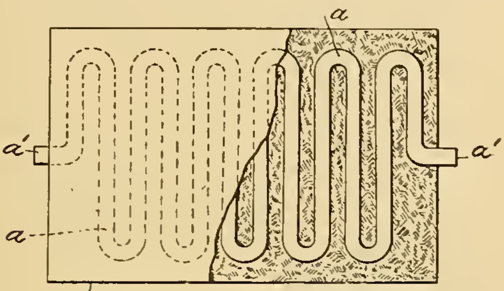


Fig. 56.

ors or connections *e* are arranged to be readily and easily coupled to or uncoupled from the terminals *a'*. (See Fig. 55, wherein the spring clip *e'*, being a conductor of electricity, is adapted to frictionally engage the terminal.) When the connections *e* are not in use or disconnected from the press boards, they hang freely from the posts *d*. In order to produce varying degrees of resistance to the electric current, a resistance box R may be interposed in one of the line conductors, as *u*, Fig. 52, the same, however, being in addition or auxiliary to the resistance members *a*, mounted in the press boards.

The Rotary Cloth Press. Considering the construction of the various rotary cloth presses from their introduction to the present modern machine, we will notice that various modes of constructing and running them have been in use, such, for instance, as leaving the cylinder cold, and heating the press bed, or leaving the press bed cold and only heating the cylinder, again heating them both; the last arrangement certainly being the best, since satisfactory pressing of the fabric can only be had when the machine is properly heated, both with reference to cylinder and press beds, a difference with reference to the final finish having to be gotten by the variation in this pressure, or a final steaming or steam brushing, if such is required.

When fabrics are pressed in this way in connection with one of our modern rotary cloth presses, there should never be a cause for any person to say that the old fashioned hydraulic process was the best, since by means of one of these modern presses, and a good steam brush to be used in connection with it when so required, the fabric will have a finish to satisfy even the most particular commission merchant.

With reference to the kind of pressing to give a fabric, its construction and style of finish required regulate this. For example, in connection with fine face finished fabrics where pressing has for its object to enhance the inherent lustre of the fibres, the fabric must be run "face down" in the machine, *i. e.* with its face to the press beds, and consequently with its back to the cylinder, which arrangement in turn will bring out the full lustre on the face of the fabric, the latter in this instance being what we might consider ironed on the press beds. If then the lustre obtained is too glossy, run the fabric once or oftener over a steam box or the steam brush, as the case may require, in order to get this glossiness off its face. This feature at once will indicate to us, that when dealing with fabrics requiring a dull finish, as for example fancy cassimeres, worsted trouserings, suitings, etc., it will be advisable to run these fabrics "face up" in the machine, *i. e.* with their face to the cylinder (which takes the cloth along—hence no ironing effect to the face) and the back to the press beds.

It certainly is a foregone conclusion, that fabrics previous to running them in one of these rotary presses must be perfectly clean, on both sides, since any foreign matter adhering to the fabrics will leave marks on them, caused by the hot, heavy, pressing required in connection with some makes of fabrics. This feature will indicate to us that the brushes, as on the press, must be of the best of make and at the same time be kept in the best (clean) condition and watched carefully in order that they fulfill these requirements. These brushes, as a rule, deliver, *i. e.* throw the dirt, as for example, flocks, loose fibres, etc., adhering to the fabric in what is known as dirt pans, for which reason it will be advisable for the operator to carefully examine the contents of these pans, now and then, in order to see that they do not get too full, since otherwise the brushes will throw this refuse back on the fabric.

Another item which must be taken into consideration is to let the operator carefully watch the fabric when running it in the machine, in order that no wrinkles will occur, since if the latter should form, it will be hard to remove them after pressing; especially must he be careful when the fabric in question has a somewhat long selvage, which in turn readily might be the cause of wrinkles on the sides of the cloth. To avoid this trouble, tighten the tension as much as possible, but this without overdoing the affair, thus giving the stretch roll a chance to assist in preventing the formation of wrinkles. Do not use more tension than required during pressing, *i. e.* use just enough to keep them smooth, and consequently giving the stretch roll a chance to work, *i. e.* stretch the fabric properly in its width. Provided not sufficient tension is used, the stretch rolls will not work, since in this instance they will get no hold on the fabric, in order to stretch it, and for which reason it will be readily seen that the proper tension for the fabric is one of the most important items for perfect work of the press.

In connection with mills which make different classes of fabrics, some of which requiring a lustre, others a dull finish, care must be taken with running the fabric either under or over the stretch roll, according to whether the face of the fabric has to be run against the press beds or the cylinder, for the purpose of obtaining either a lustre or dull finish for the face of the fabric. This running the fabric over or under the stretch roll, is in some instances frequently neglected, and yet at the same time it is an important item, since by means of changing the running of the fabric in this manner over or under this stretch roll, we at the same time guide either the face or the back of the cloth in the action of said stretch roll. It will be readily understood that the stretch roll should always work on the back of the cloth, since the surface of said stretch roll is generally covered with some Brussels or Tapestry carpet structure, in order to take a better hold of the fabric, and consequently should only come in contact with the back. This will indicate to us that the fabrics have to run over the stretch roll when they are pressed with face up, and under the stretch roll when they are pressed with face down. Another item must be taken into consideration now, and which is, that if this stretch roll works perfect in one of these instances it will not work perfect in the other instance, for the reason that the pieces which compose the stretch roll are set upon a series of cams, and which cams are securely fastened upon a shaft which has to be placed so that the cams bring the pieces of wood composing the stretch roll outward on top, if goods are to pass over the roll, and just the reverse if goods are to pass under the roll. This will also explain to us that if this shaft is not securely fastened, that when tension is applied to the fabric, the stretch roll is apt to turn over, and when in turn the stretch roll would have a tendency to narrow the fabric instead of stretching it, being a case which also might result in forming wrinkles in the centre of the goods. If such a case occurs, it will be found necessary to wet the fabric again, since this is the only way to get rid of these wrinkles as pressed into the fabric. In some instances it will be necessary to wet the wrinkles first, let them get well soaked, and pull out the fabric smooth before wetting it again.

It also may happen that fabrics refuse to run properly through the press, *i. e.* wrinkle up badly, in some instances the press grinding parts of the cloth, a feature which may have for its cause several items, the most important of which is the dirty condition of the fabrics, again certain colors on account of the dyestuff used may be the cause of it, again imperfect speck dyeing may be at the bottom, especially if the latter is made with sumac and iron, whereas if made with logwood, blue vitriol and soda ash, as it should be, this trouble is not likely to occur.

Again the trouble with reference to wrinkles may rest in the machine. It may be the cause of the cylinder, which on account of running for any length of time under heavy pressure (especially if dealing with poorly scoured fabrics) may become smooth, and in turn refuse to carry the fabric as it should, in turn causing wrinkles, besides pulling the fabrics out of shape. In such a case, the fabrics will also have to be wet out again, and after drying, etc., re-pressed.

If this occurs, scour the cylinder, a process technically known as "rusting the cylinder," and which is done thus: After the press is cold, apply muriatic acid with a brush, then let the press run with all the weights off for a little while, say about 20 minutes, seeing that the cylinder is wetted evenly. Then wash the cylinder thoroughly, turn on steam, and clean up. The muriatic acid may be used either in its full strength or diluted according to circumstances. Be careful not to touch any other parts of the press but the cylinder. Although brass is not affected by the process, yet it is a good plan after drying the cylinder, to pull out the brass bed jackets, and thoroughly clean and polish them, and then return them in their proper place, and when the press is ready for work again. Be careful to clean the cylinder after this operation for a few days in the morning before starting work, since on account of the process the same will be full of rust after standing all night.

Voelker's Cloth Press. The same is shown in the accompanying illustration Fig. 57, which is a cross sectional view of it, showing also the passage of the cloth through the press. It consists principally of a large hollow iron cylinder, placed about in the centre of the machine, and having concave presser beds (with two contacts on each bed) situated on each side of it.

The cloth is passed to the press first over an adjustable tension rail, shown at the left hand side of the illustration, then down under a bottom adjustable rail and again up to an expansion, *i. e.* stretch roll. Between the two adjustable rails is situated, on the inside, a brush which brushes one side of the cloth as it passes to the bottom rail, another brush being situated a short distance from the bottom rail, and which brush cleans the other side of the cloth from that cleaned by the first brush. The cloth may be passed either over or under the expansion roll (shown under, in the illustration) and which can be adjusted to stretch the cloth to different widths. From here the fabric passes over a rod (shown in full black), then around the steam heated cylinder between the two steam heated presser beds, where it is ironed and pressed. The cloth when emerging from between the cylinder and presser bed, passes again over a rod (shown in full black) then up over a draft roll, then under two guide rolls to the take-up rolls, and from where it is folded automatically on a conveniently placed truck, by the arrangement shown. The pressure given to the presser beds is obtained through the levers shown, thus making it a yielding pressure and one which may be regulated. The beds do not come against the cylinder fixed, which is an important feature in its construction.

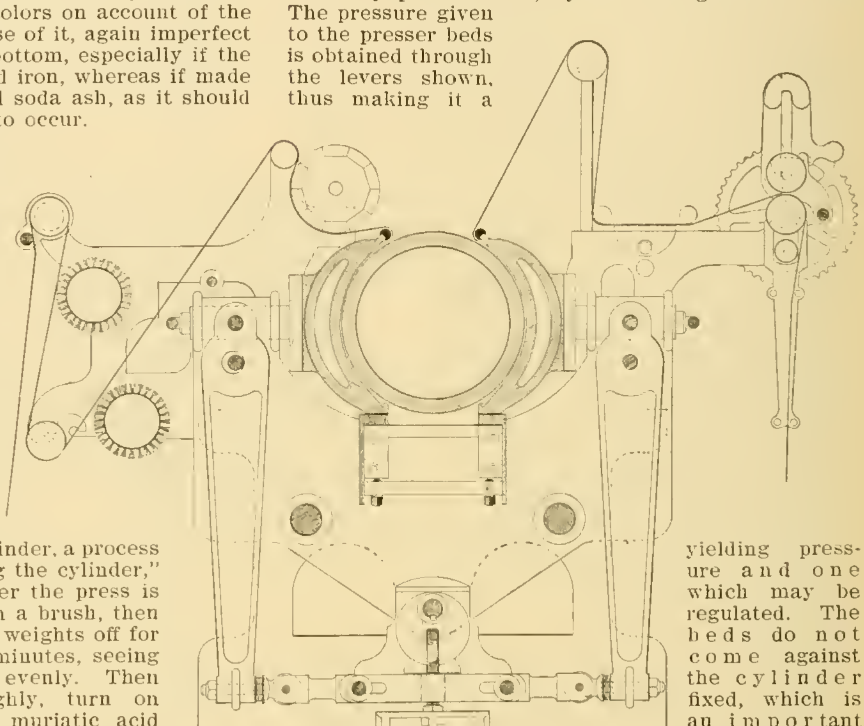


Fig. 57.

A new attachment to this press is an adjustable stop for use between the outer ends of the presser beds and cylinder journals, so that either bed, independently of the other, or both can be stopped at the desired distance from the cylinder, which limits the compression, and thus prevents an unnecessary pressure, which in some cases might glaze or otherwise injure the fabric, or it may be used when only a limited compression is called for, in order to give the fabric under operation a different and softer finish than the machine as thus explained will do.

To explain this new attachment, illustrations Figs. 58 and 59 are given and of which Fig. 58 is an end view of the cylinder, press beds and connecting parts of a press, having the improved devices added, Fig. 59 being a detail (enlarged) in section.

The press, as previously explained, consists of a steam heated cylinder A, rotating upon its axle B in horizontal bearings, and having hollow beds C on either side of the roll, pressed against the roll or withdrawn from it by means of the vertical levers D, pivoted near their upper ends at *d* to the frame of the machine and operated by toggle-links (not shown) between their lower ends.

To prevent the beds C from coming too near the roll, and thereby pressing the cloth more than is desirable, and yet at the same time to permit the press to be readily opened for the insertion of a

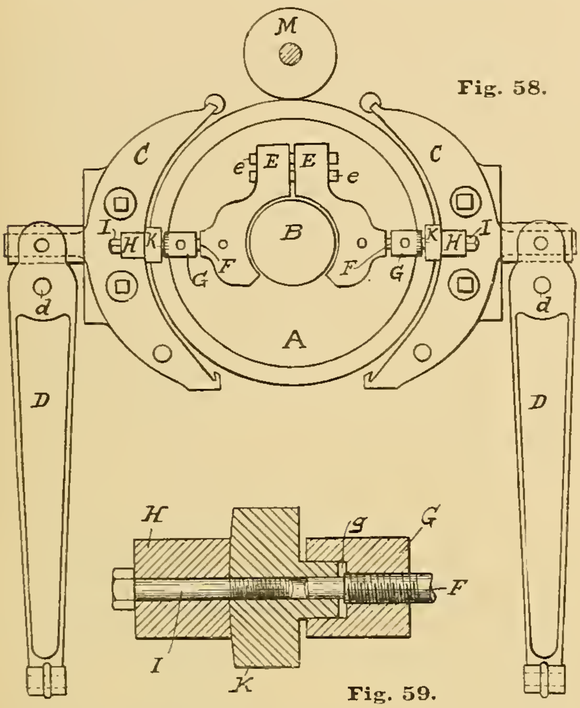


Fig. 58.

Fig. 59.

new piece of cloth, we find placed upon the axle or bearing of the cylinder A, a collar partially surrounding the axle and made in two pieces, (shown as E). Rods *e* pass through the upper extensions of the two portions of the collar and are made rigid in one portion by set screws, while the other portion is free to move upon them, and by reason of the slight space between the two portions take up any wear upon the inside of the collar, so that it will always press closely upon either side of the axle B. Inserted and fastened in each portion of the collar are screw threaded rods F, upon each of which are screwed nuts G, which are made with a recess *g* in their outer ends, and the ends of the screw rods F extend outward through these recesses, with their unthreaded portion. Upon each of the beds there is a lug H, made integral with its bed, and bolts I pass through each of these lugs, with a lock nut K on their ends, the bolts I being made so that they will not pass wholly through the nuts. Each of the nuts K is made with a projection *k* to enter the recesses in the ends of the nuts G and is also made with a hole or recess within the projection to receive the end of the corresponding rod F. These lock nuts K are screwed up tightly upon the bolts I.

To set the bed plates so that they will not press too tightly upon the cylinder A, the nuts G are turned upon the threads of the screw rods F so as to come into contact with the lock nuts K just before the bed plates come into contact with the roll. The required adjustment is very slight, and the threads upon the rods F are therefore cut fine, and the nuts G are marked with horizontal numbered lines upon their circumference, which, with a fixed line upon the lock nuts K, serve as a micrometer screw and guide. As the screw rods F, with their nuts G, are entirely separate from the lugs H and lock nuts K, the press may be readily opened the required distance for inserting new pieces of cloth, etc.

When working light weight fabrics, a roll M is sometimes placed on top of the cylinder A, and on which the cloth when emerging from the second presser bed is wound, instead of using the folder arrangement shown in Fig. 57, said roll receiving its motion from contact with the cylinder A, it being held in position by levers, the ends of which are weighted in order to have the cloth wound tightly on the roll. By this method of winding the cloth, another advantage is obtained, in that the nap is not disturbed after pressing, since there is no tension on the cloth that might cause it to stretch in length, which might be caused by draft and take up rolls (as are used in connection with a folder arrangement) provided said rolls are driven somewhat faster than the cylinder delivers the cloth. The cloth by being made to wind on a roll on top of the cylinder of the press, also retains all heat after passing between the hot press beds and cylinder, a feature which of course is desirable when pressing light weight fabrics. The minimum speed for the heaviest fabric to be pressed with the machine thus described, should be about six yards per minute.

The Curtis & Marble Double Bed Rotary Press. This press is shown in its perspective view in Fig. 60. It has a large size cylinder, with two press beds, extending three-quarters of the distance around the cylinder, thus giving a great amount of pressing surface. The press beds are self adjustingly mounted to the cylinder, giving an equal and uniform pressure the whole length of the piece, and allowing the cloth to be pressed close up to the seams; also from the manner in which the beds are hung and connected together, both press beds must always press with equal force against the cylinder. The machine is provided with brushes to clean both sides of the goods, a stretch roller for keeping the goods out to their full width, a steamer for moistening the goods before pressing, rolling and folding attachments, so that the goods may be either rolled up or folded, as desired. A pressure gauge or dial is attached to indicate the amount of pressure applied, to enable

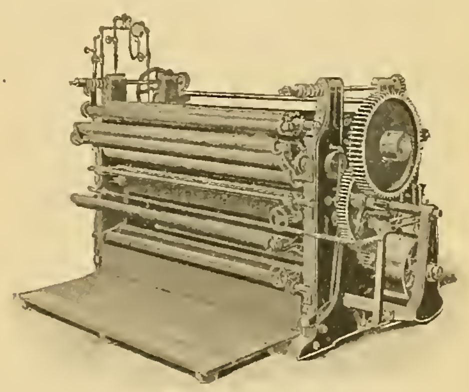


Fig. 60.

the operator to regulate the pressure to a nicety to suit either light or heavy goods at any time, and at the same time to give the same degree of pressing to the same styles of goods when pressed at different times. (Curtis & Marble Machine Co., Worcester, Mass.)

STEAMING.

Steaming the cloth, as previously referred to in connection with pressing, both by means of the hydraulic as well as the rotary press, is done for two reasons, viz.: it removes the gloss on the fibres left by the heat and pressure, and at the same time takes away the harsh, hard, feeling given by this pressing process to the cloth. During pressing, every fibre in the fabric is simultaneously heated and pressed, in consequence of which they lose portions of their moisture and at the same time shrink in themselves and thus to a certain extent become glossy, harsh and hard, a fêature not desirable in connection with a great many finishes. Steaming, either alone or in connection with a light brushing, will remove the glaze, and at the same time impart a softer feel to the fabric thus treated after pressing, for the reason that the dampening action of steaming, swells the fibres back to their condition before pressing. Care must be exercised not to overdo the matter, nor the opposite, since in the latter instance the object aimed at is not obtained, whereas too much steaming will take hold not only of the fibre, but of the structure, *i. e.* finish of the cloth, at the same time, thus impairing the latter. The proper process requires such a quantity of steam as will jnst remove the glaze without softening too much the finish.

For perfect steaming, allow the cloth to thoroughly cool down from the pressing process, since a highly heated fibre will not only, to a considerable extent, counteract the influence of the moist steam, but at the same time, give rise to the formation of electricity, a feature preventing a uniform and even finish to the fabric thus treated, and which in turn in some instances may ruin the finish of the fabric entirely. For this reason be sure to allow the pressed fabric to cool thoroughly so that the finish becomes set or fixed before subjecting it to steaming, *i. e.*, that the fibres, which the hydraulic or rotary press has made to assume new and unnatural positions throughout the body as well as the face of the fabric, must have a chance to get sufficiently cold, *i. e.* set, so that they will retain this new position, and will not be influenced by the after steaming.

The steaming is done by means of what is known as a steam box, a perspective view of which is given in Fig. 61, Fig. 62 showing a section of it, on an enlarged scale. Both illustrations refer to the steam

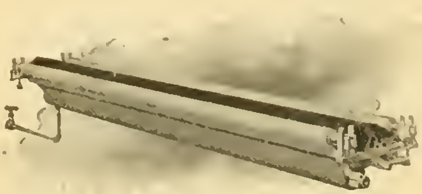


Fig. 61.

box as built by the Parks & Woolson Machine Co. The characteristics of this box are a uniform steam distribution, resulting in absolute even steaming. The cloth in its passage over the box rests on the two application rolls, the shafts of which rest in journals, which in turn can be raised by means of suitable set screws, thus regulating the application of the cloth on the felt cover of the box. The ingenious construction of the box, as seen more particularly from Fig. 62, compels the steam to enter the lower and in turn the upper chamber in such a roundabout way as to result in a uniform escape of it, all over the surface of the top of the box.

When starting to operate the box, open the drip valve, enter steam and wait until the latter issues through the felt cover, and then start the cloth. After the box is thoroughly heated, close the drip valve. Leave the latter open any time the box is not in use.

This steam box, besides being used independent as a machine, is also frequently found applied to other finishing machinery, viz.: in connection with the brushing machine, as generally used between shear and press for the purpose of softening the cloth so that the brushes will do good work, to drive away the electricity and condition the cloth for the press and when this combination machine is then known as a steam brush. Another machine to which this steam box is frequently applied is the stretching machine, and when the combination machine is then known as a steaming and stretching machine; it being also applied to pumicing, polishing, and sanding machines, etc., all the various finishing machinery thus mentioned, having been previously illustrated and described in their respective chapters.

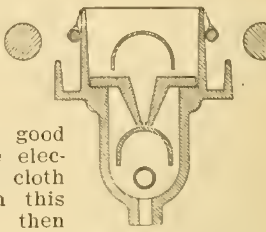


Fig. 62.

INSPECTING, MEASURING, DOUBLING, ROLLING AND WEIGHING.

After the goods have been pressed and steam brushed if so required, they are ready for final examination previous to getting them in shape for shipment to the market. In most mills however the goods are inspected before they are sent to the press, since in this way, provided the finish in any way is lacking, there is a chance to have it remedied, and not after the goods are pressed and ready to be sent to the market. When the pieces are thus inspected before pressing, there are many things which will show up plainer than after pressing and which in many instances can be corrected.

After pressing and inspecting or inspecting and pressing, as the case may be, the fabric is measured and in turn rolled in order to bring it in a shape for shipment to the market. Most mills now use machines for this work, although some smaller mills yet measure the goods by hand.

If the goods are to be measured by hand, the best plan is to pull them over a table, four or five yards long, with the halves and quarters of each yard correctly marked on the edge of the table its entire length. Two persons are required to do the work. After cutting off the heading, and bring the folded fabric even with the end of the table, have the second person, a boy or girl, put in a pin at the other end of the table. The piece is now pulled along until the pin is even with the first end of the table, and is then taken out, while another pin is put in at the other end, and the procedure repeated until the last length of the fabric is measured off (in fractions) on the table. Another method of measuring by hand refers to an attachment fastened to the table with a wheel which operates a dial, upon which the yards, half, quarter and eighth, are marked. The running parts of the device are mounted on a swinging frame, so they can be thrown back to place the cloth in position. The measuring wheel rests on the cloth, which is pulled through by hand, the weight of the swinging frame adjusting it to any thickness of goods. The dial is of bronze, and is very plainly read and records up to 75 yards. It is directly geared to the shaft of the measuring pulley by a worm, so that one revolution of the measuring pulley gives one-half yard on the dial. The measurement is adjusted by expanding or contracting the measuring pulley, which in turn varies the ratio between it and the dial, so it can be set with absolute precision. If the measurement of the cloth falls short, the pulley should be contracted; if it runs over, it needs expanding. The two adjusting screws should be set alike.

Besides being used in smaller mills, this measurer is especially adapted for taking stock in commission houses, wholesale and retail dry goods stores. In both ways of measuring the fabric by hand mentioned, the rolling or winding of the goods forms a separate operation, and there are various machines in use for this purpose. With hand measuring, in connection with 6/4 goods, one of the greatest drawbacks is the doubling of the goods, which then has to be done by hand and naturally is a most slow operation, especially if one man has to do it alone, but if two men work together, *i. e.* one man doubles and the other folds, the work may be done somewhat faster.

In winding the goods as measured by hand, whether 3/4 or 6/4 goods, on the rolling machine, care must be taken to keep them free from wrinkles.

The Measuring, Doubling and Rolling Machine. The object of this machine, as its name indicates, is to measure "double width," *i. e.* broad goods, and double or plicate them in order to have them rolled up into a compact package of half the width of the fabric, by means of the winding mechanism on the machine. The machine, if so desired, can be also used for rolling, or measuring and rolling "single width," *i. e.* narrow goods.

The construction and operation of this machine are best shown by means of illustrations Figs. 63 and 64, and of which Fig. 63 is a perspective view of the machine, showing the doubling of a broad fabric and rolling it afterwards, and Fig. 64 a side elevation of the measuring mechanism for broad goods, said mechanism being located to measure the cloth just before it goes on to the plicator, *i. e.* doubling arrangement.

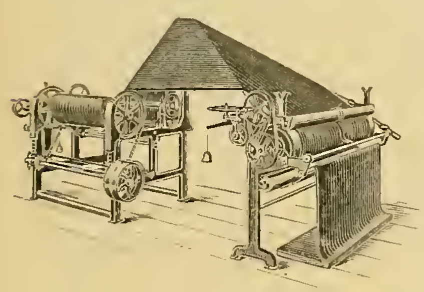


Fig. 63.

Both illustrations refer to the machines as built by the Parks & Woolson Machine Co.

The cloth, as shown in dotted lines in connection with illustration Fig. 64, is laid in its open width in front of the measuring mechanism, and is passed over the front rod or a stationary friction roll 1, then under an idle roll 2, and over the measuring drum 3, from where it passes up and over the triangular bars composing the plicator (see Fig. 63) and then down between diagonal bars, under a narrow drum and over a small steel idle roll to the rolling or winding mechanism, as shown at the left hand side of said illustration.

At the end of the drum 3 (see Fig. 64) and fast on the same shaft 4, is an expansible pulley 5 connected by a belt 6 to pulley 7, fast on the shaft 8, which also carries a worm 9, meshing into a worm wheel 10, whose upper surface 11 is graduated to form a circular dial which registers the measurement of the cloth. A hand nut, as clearly shown on top and in centre of dial, in the illustration, is provided for re-setting the dial finger to zero after each measurement. The expansible pulley 5 is made to contract or expand, as may be required, when setting the machine, so that the relation between the surface speed of the measuring drum 3 and the measuring dial 11 can be slightly varied in order to regulate the accurateness of the latter. This may be required to be done to compensate for any possible error in circumferential size of the measuring drum, or for a varying stretch due to elasticity, etc., in a certain kind of cloth. The measuring drum 3 is one yard in circumference, and has a finely sanded surface, upon which the cloth has a long firm contact. There is a weight roll 12 on the measuring drum 3, to keep the cloth smooth, so that the fingers governing the automatic stop will work properly. The machine works entirely on the back of the cloth, it therefore does not rough the nap.

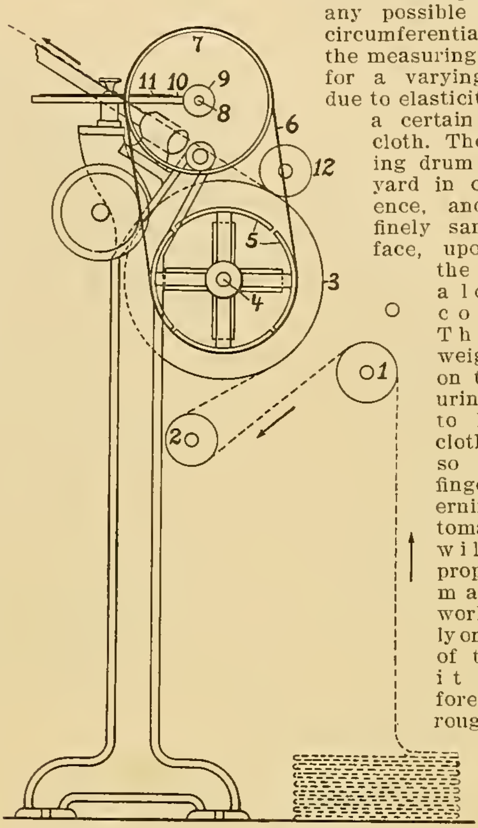


Fig. 64.

In case the measuring device requires re-setting, first carefully measure a piece of cloth by hand, then run it through the machine. If the dial registers below this length, the pulley 5 must be expanded, whereas if over, said pulley must be contracted; a few of such trials setting the measuring mechanism of the machine to a nicety. Four binding screws hold the four segments of the expansible pulley 5, and must be loosened before turning the adjusting hub to either expand or contract. After each regulation these four binding screws must be tightened so that the adjustment made will not change. Every machine is adjusted for ordinary light and heavy weight goods before leaving the shops, and only an extreme change in the weight or nature of the cloth to be handled may necessitate a readjustment of pulley 5. After once carefully setting pulley 5, the mechanism will always measure the same. The same takes care of itself during the operation of the machine, in that an automatic stop motion prevents the dial from over-running.

At the end of the narrow drum located in front of the rolling mechanism, a similar measuring device is found and which is used when single width, *i. e.* narrow goods, or broad fabrics previously folded, are to be measured, and in which case the cloth does not pass over the plicator, *i. e.* the doubling board, but simply goes direct into the rolling mechanism of the machine.

The revolving parts of the rolling mechanism are fitted with six inch jaws, for seven inch wide boards, on regular machine, but other sizes of jaws are provided if so desired, to suit different widths of boards used, they however, should be always from one-half to one inch narrower than the board used. When desired, a flat iron board or square iron rod, to be pulled out after the roll of cloth is finished, can be used in place of the wooden board, and which is left in the roll. Any length of board, from the machine's extreme working capacity down, can be put in the rolling mechanism, the machine being equally good for winding any length of roll of cloth, convenient for the handling. The board adjustment has a quick acting screw, and opens and shuts instantly, stays where you put it, and does not become shaky, and thus is enabled to wind a uniformly compact roll of cloth. The edges of the cloth are kept evenly together by the turn of a hand wheel, the control of the selvages thus being perfect, and no temples required.

The regulation machine is built for handling fabrics up to 66 inches wide, however, if required, as for the manufacture of extremely wide goods, like for example felts, the machine can be specially built to handle up to 120 inches wide fabrics.

The regular machine is what is known as a "right hand" machine and rolls the cloth into a right hand roll, however there are also "left hand" machines built when so desired. A right hand machine will roll left handed by running the driving pulleys with a crossed belt, which reverses the rolling mechanism; however the cloth end in this instance is not quite so conveniently started on the board than if using a "left hand" machine for this purpose. When a "right hand" machine has to be often run in this manner, it will be found more convenient to have the machine fitted with an extra driving pulley and shipper for the crossed belt, which saves changing belts when shifting from one hand to the other. In the same way a left hand machine will also roll right handed, by running the driving pulleys with a crossed belt.

Another measuring, doubling and rolling machine is shown in its perspective view in Fig. 65. Examining this illustration we see on one side of the machine, traveling on a track *a*, mounted a movable cloth table *b* on which the cloth to be in turn measured, doubled and rolled, is deposited in its full width folds as coming from the folder of the brush or press.

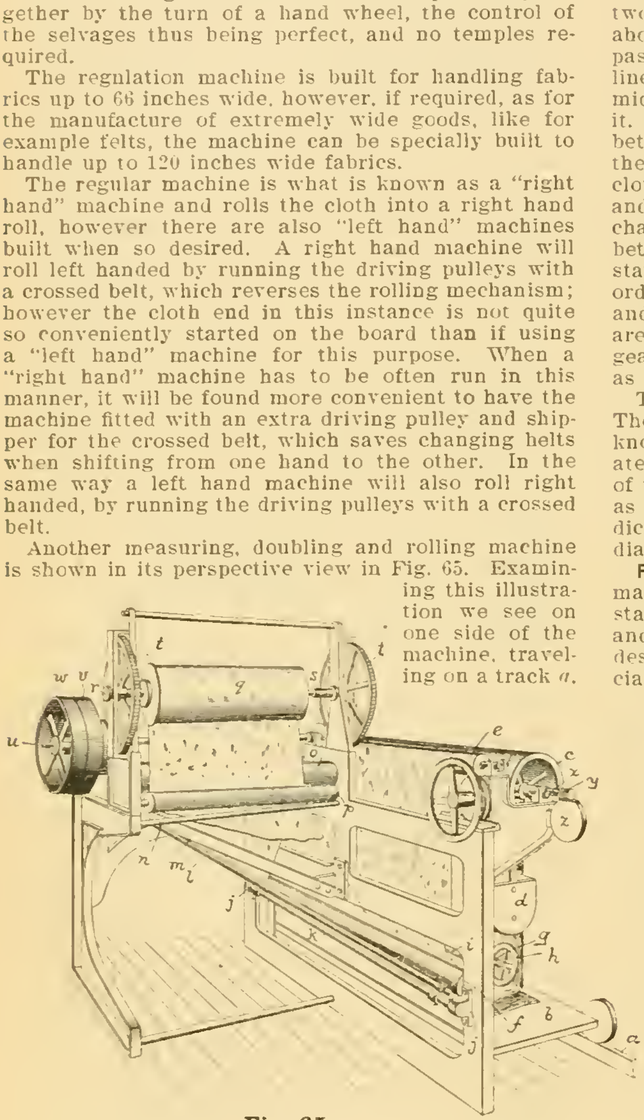


Fig. 65.

The cloth passes from this table *b* around the revolving measuring roll *c* and down into a cloth trough *d*, from which it passes again upwards over a guide roll *e*, thence downwards through a tension device and under a second guide roll *f*. The tension device thus mentioned consists of a shaft *g* having a hand wheel *h*. This shaft *g* is provided with two arms, which carry a rod *i*, the cloth being drawn between said shaft and rod. Thus by simply turning the hand wheel *h* the cloth is wound more or less around the shaft *g*, in turn, more or less, as the case may require, increasing the tension to the cloth.

On the frame of the machine are mounted two brackets *j*, carrying a rod *k*, from which extends at each end a rod *l* formed into a V-shape and attached to an inclined blade *m*, as fastened to the frame of the machine.

These two rods *l* constitute a truncated "former," two "smoothing" rods *n* being extended transversely above the same. From the guide roll *f* the cloth passes beneath this "former" (as shown in dotted lines), the point where the rods *l* meet engaging the middle of the cloth and in turn act to double or fold it. The cloth then passes in this folded condition between the "smoothing" rods *n* and which smooth the cloth from its centre fold toward its edges. The cloth next passes through the pressure rollers *o*, *p*, and then winds itself on the cloth board, forming the characteristic roll of cloth *q*. This cloth board is held between the two stub shafts *r*, *s*, of which one, *r*, is stationary, the other, *s*, being spring actuated, in order to permit ready inserting of the empty board and removal of the roll of cloth. Both stub shafts are driven respectively by gears *t*, which mesh with gears fast to the main driving shaft *u* of the machine as carrying the fast and loose pulleys *v*, *w*.

The measuring of the cloth is accomplished thus: The circumference of the measuring roll c is of a known size; its shaft *x* carries a worm *y* which operates a dial wheel *z* graded to suit the circumference of the measuring roll *c*, the number of yards of cloth as coming in contact with the roll *c* being in turn indicated through a fixed pointer (not shown) as the dial wheel *z* rotates.

Fabric Measuring and Packaging Machine. This machine is designed to accurately measure cloth and stamp the measurement on it at frequent intervals, and also register the measurement on a dial, when desired, without stamping it on the cloth. Any special trade mark of the goods which are passed through the machine, may also be stamped on the cloth at frequent intervals, all stamping being done along one edge on the back of the cloth. The machine also plicates or folds the cloth lengthwise as it passes through the machine, and then winds it into a smooth and compact package, which is then in a convenient form for handling and selling.

Fig. 66 shows this machine as is built by the Fabric Measuring and Packaging Co. of New York, in its perspective view, also showing the passage of the cloth through the machine.

It will be seen that the measuring and marking arrangements are located near the back side of the machine, there being also a stop motion arrangement connected with the measuring motion, by which the machine is automatically stopped when the desired number of yards have been wound into a package at the front of the machine. The stamping arrangement is located on the same side of the machine as the dial, but is placed on the inside of the framing in order to be in the line of the passage of the cloth, and consequently cannot be shown in the illustration. It consists of a platen wheel against which the cloth is pressed and the stamping arrangement, which stamps the correct length of the fabric automatically as it passes to the measuring roll of the machine, shown near the back of the machine. The measurements are stamped on the cloth at intervals of one-eighth of a yard, thus, 1, ⅛, ¼, ⅜, ½, ⅝, ¾, ⅞, 2, ⅛, ¼, ⅜, etc., etc.; the trade mark being stamped separately, one on each yard.

The mechanism for passing the cloth through the machine is independent of the stamping and measuring motions and thus leaves them free to be adjusted, started, stopped, etc., at any point in the length of a piece of cloth; or when one section of a long piece of cloth has been measured, the arrangement may be released which causes a spring to turn it back to zero, and started again to measure off and stamp another section, and thus divide the entire piece of cloth into two or more separately measured sections.

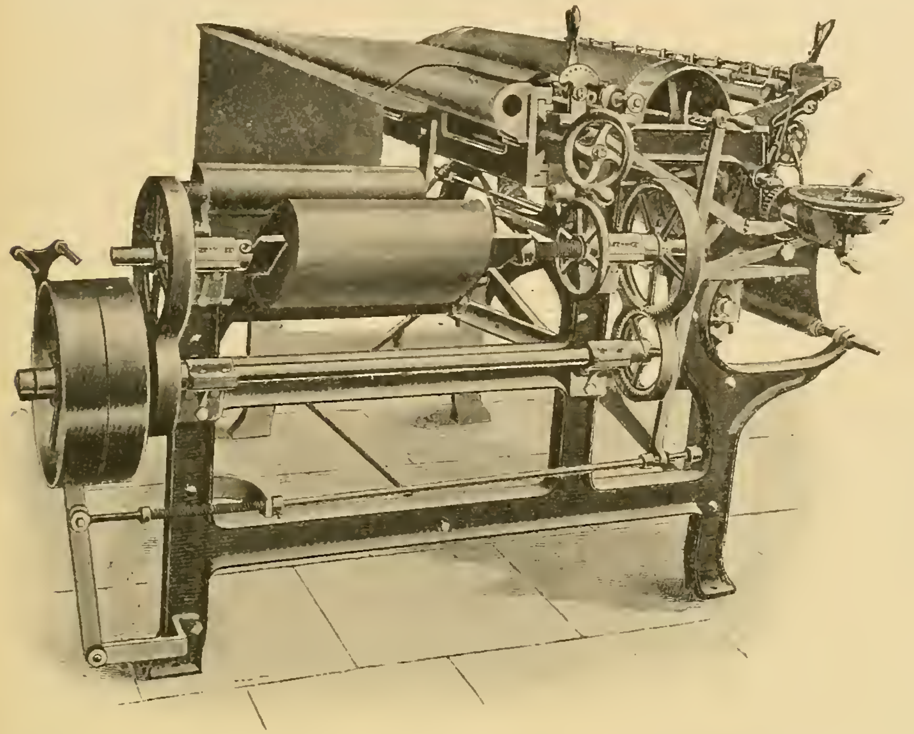


Fig. 66.

If, because of a delicate color of the fabric, or for any other reason, it should be undesirable to mark it with ink, the stamping may be omitted by having the type run dry, the correct measurement of the piece being indicated on the circular dial shown on the machine as always.

The cloth passes from the measuring cylinder to an actuating cylinder, and having been measured and stamped before leaving the measuring cylinder, it is easily seen that whatever tension or stretch is afterwards put on the cloth, the measurement before such stretch is already indicated on the cloth and serves as a guarantee to the buyer. The cloth is thus allowed to be drawn by the winding motion with sufficient tension to make a compact package.

After leaving the measuring roll, the fabric passes over the actuating cylinder and then between a stretching rock shaft and stretching rod. From the stretch rods, the cloth passes around a guide roll to the plicator or folder, which is shown at the front in the illustration and consists of two tapering and converging side bars, around which the two edges of the fabric are passed to begin the plication, and which is finished by drawing the two partly folded sides of the fabric through between two guides or fingers under the plicator, only one being shown in the illustration. The two guides are placed so as to make a small space between them and through which space the two folds are passed, thus bringing them together and completing the plication. From the guides the folded cloth is passed down and around a smoothing roll, and from there to a tension regulator and equalizer, after which it is passed to the winding board and wound into a compact form, the amount of tension put on the cloth being regulated by the stretch rod, previously mentioned, a handle for operating the rod being seen in the illustration between the measuring roll and the plicator.

The stop motion, for regulating the length wound into one package, is actuated by placing a peg in the bowl portion of the dial at the proper figure, and which peg will at the proper time come in contact with a finger and push it over, and as said finger is connected to a piece which supports a horizontal lever, shown in the illustration, when the finger is actuated, this lever is released, thus allowing it to drop, which motion is transmitted, through the levers shown, to the belt fork and the belt is shifted from the fast to the loose pulley.

Weighing. After the pieces have been properly wound in a roll, they are then placed in the cradle of a special beam scale and weighed. A special scale is required, for the reason that it is necessary for us to thus ascertain at a glance, the weight of one yard of cloth in the roll of cloth weighed—expressed in ounces. The compound sliding weight to use, for sliding on the scale beam is made up according to the number of yards in the piece.

One side of the scale beam is graded for showing the units and fractions of ounces per yard, and the other side for showing the total weight of the fabric, expressed in pounds, provided in either case the proper compound sliding weight, according to number of yards in fabric, is used. The denominations, *i. e.* value of minor weights, at the disposal for making up the compound sliding weight, are such as representing respectively—ten, five, three, two and one yard, and quarter and half yard weights.

When a fabric is to be weighed, the gross yards are taken in consideration; for example, if the fabric measures 37¾ yards, then 3 ten yard weights, 1 five yard weight, 1 two yard weight, the half yard weight and the quarter yard weight, are put on the sliding hook in order to make up the proper compound sliding weight, which then is slid out on the scale beam, showing the ounces and fractions of ounces, per yard, at whatever point said sliding weight balances the fabric in the cradle.

Provided of interest to know the total weight of the roll of cloth in the cradle of the scale, read the corresponding number on the other side of the scale beam. At the end of the scale beam is a hollow balance weight, filled with shot, to permit balancing the scale, on account of the cradle to hold the piece and the cloth board.

After weighing, the piece is ready for wrapping in paper and shipment to the market.

CLOTH TESTING.

The object of this process is to ascertain the strength of cloth, *i. e.* to ascertain the amount of tension required to tear it apart, thus ascertaining the quality of the material (as to strength) used in its construction.

Of the accompanying illustrations Fig. 67 is a plan view and Fig. 68 a central longitudinal vertical section thereof of a cloth tester, *i. e.* a device to be used

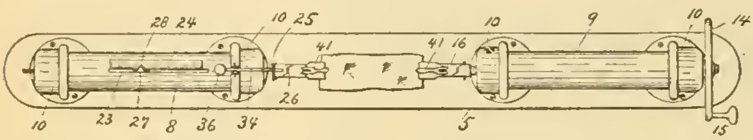


Fig. 67.

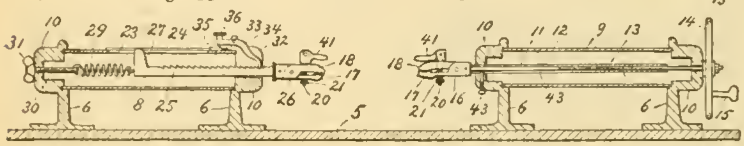


Fig. 68.

in thus testing, and at the same time recording, the breaking point of a fabric.

A description of the construction of this cloth tester is best given by quoting numerals of reference of which 5 indicates a base plate or support at each end of which is supported, by means of vertical standards 6, the tubular casings 8 and 9.

The standards 6 are provided with heads 10, between which the casings 8 and 9 are placed and secured and passing through the tubular casing 9 and centrally through one of the heads 10 thereof is a tube 11, the outer end of which is provided with an internal screw-thread, and passing through the tube 11 is a shaft 12, a portion of which is correspondingly screw-threaded, as shown at 13.

The outer end of the shaft 12 is provided with a wheel 14, having a crank handle 15, and secured to or formed on the inner end of the shaft 12 is a clamp head 16, which consists of a jaw 17, formed on the tube 11, and a pivoted jaw 18 and passing loosely through the outer ends of the jaws 17 and 18 is a bolt 20, the lower end of which is screw-threaded and provided with a set nut 21, and the upper end of which is provided with a head which passes through the head of a cam lever 41, which is pivotally connected therewith and mounted on said bolt between said jaws is a spring. The opposite tubular casing 8 is provided in the top thereof with a longitudinal slot 23, at one side of which is placed a scale plate 24.

Mounted in the tubular casing 8 is a rack bar 25, which projects outwardly through the inner head 10 of said casing and which is provided with a clamp head Fig. 26, which is in all respects similar to the clamp head 16, before described, and the inner end of the rack bar 25 is provided with an upwardly directed arm 27, which projects upwardly through the slot 23 and which is provided with a pointer 28, which projects over the scale on the plate 24, and connected with the inner end of the rack bar 25 is a strong spiral spring 29, the outer end of which is connected with a screw-threaded bolt 30, which passes through the outer head 10 of said tubular casing 8 and which is provided with a head 31.

The inner head 10 of the casing 8 is cylindrical in form, and formed in the top thereof is a slot 32, in which is pivoted at 33 a spring operated lever 34, the inner end of which is adapted to operate in connection with the rack bar 25 and beneath the outer end of which is placed a spring 35, one end of which is secured to the casing 8 and the other end of which bears upon the outer end of the lever 34, which is provided with a head 36.

By manipulating the bolt 31 the tension of the spring 29 may be adjusted, and the jaws 17 and 18 may be caused to securely grasp and hold the cloth by simply manipulating the cam levers 41 or by turning the same downwardly and inwardly and when said cam levers are turned upwardly and backwardly the springs will force the jaws 18 upwardly and release the cloth.

The bottom of the tube 11 is provided with a longitudinal slot 43, which extends from the end thereof, with which the jaw 16 is connected, for about one-half of its length, and passing through the bottom of the inner head 10 of the tubular casing 9 is a set screw 43, the inner end of which works in said slot and limits the movement of said tube, and as the wheel 14 is turned in one direction the said tube will be moved inwardly or in the direction of the jaw 26, and when said wheel is turned in the opposite direction said tube will be drawn into the casing 9 and in this operation the strength of the cloth which is held by the jaws 16 and 26 will be indicated by the pointer 28, which moves over the scale plate 24.

Another make of a cloth tester is shown in Figs. 69 and 70, the object of which is to provide not only means for indicating the strength of the material tested, but at the same time also means by which the texture or structure of the fabric may be examined while testing its strength.

Fig. 69 is a perspective view of this tester, and Fig. 70 a bottom or back view of it.

The frame of this tester comprises parallel side members 1, an end member 2 at right angles to the side members, and a curved or semi-circular member 3 at the opposite end. At the junction of the member 3 and the side members a cross bar 4 is formed. Movable in the frame thus referred to is a block 5, which has a recess 6, one wall 7 of which is provided with teeth, which, coacting with a corrugated block

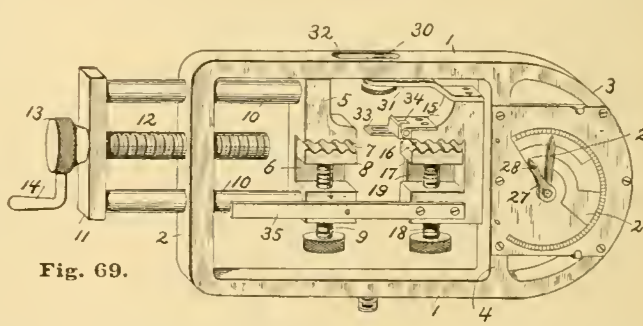


Fig. 69.

8, form jaws for clamping the material to be tested. The part 8 is movable in the recess 6, and it is moved toward and from the jaw section 7 by means of a screw 9, engaging in a tapped opening in the block 5. Guide rods 10 extend outward from the block 5

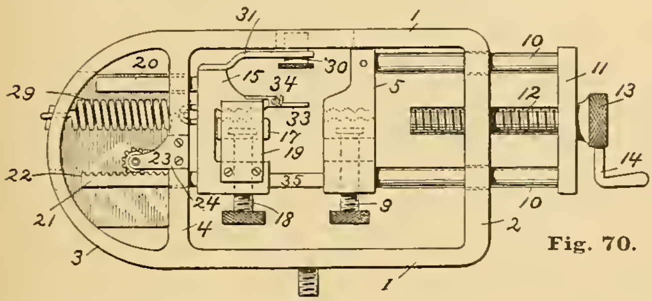


Fig. 70.

through openings in the end portion 2 of the frame, and at the outer end these guide bars are connected by a cross head 11, and mounted to turn in this cross head 11 is a screw 12, which engages in a tapped hole in the portion 2 of the frame. The screw 12 has a milled head 13, and also a handle 14, so that it can be easily turned while stretching the material. Another block 15 is also movable in the frame and has a recess, one wall 16 of which is corrugated to provide a jaw section coacting with the corrugations or teeth on the other jaw section or block 17 in the recess in the block, and this block 17 is adjusted by means of a screw 18. A plate 19 is attached to the rear side of the block 15, and the rear side of the recess 6 is also closed by a cross piece or bridge. These closures provide a stop against which the straight edge of the fabric to be tested is placed when between the jaws, to insure the placing of the threads lengthwise of the pulling strain. From the block 15, guide rods 20, 21, extend through openings in the cross bar 4, guide rod 21 being provided with a rack 22, engaging with a pinion 23, one end of the shaft of said pinion having a bearing in a plate 24, extended from the cross bar 4, and the other end of said pinion shaft extends through an opening in a dial plate 25, secured to the frame of the machine.

Loosely mounted on the shaft of the pinion is the indicating pointer 26, and rigidly connected to said shaft is a shifting arm 27, having a pin 28, adapted to engage with the pointer 26. A coiled spring 29 is attached at one end to the frame section 3 and at the other end to the block 15, said spring serving as a counterbalance for the strain on the material.

As a means for observing the texture and structure of the fabric while being stretched, a magnifying glass arranged in a tube 30, attached to an arm 31, extended from the block 15 is employed. The upper member 1 of the frame is provided with a slot 32, into which the upper portion of the tube passes and wherein said tube moves as the block moves. Also attached to the block 15 is a plate 33, having a rectangular sight-opening in line with the magnifying glass. In order that the plate 33 may be swung upward to permit the blocks 5 and 15, to move close together, the said plate has a hinge connection 34 with the block 15.

In operation, after clamping a strip of material to be tested in the clamping device and the outer edge is trimmed off close to the outer surface of the clamping device, the screw 12 is operated to draw the block 5 outward. The block 15 is also drawn against the resistance of the spring 29. The rack 22 in its movement with the block 15 rotates the pinion 23, and consequently also the arm 27, and the pin 28 on said arm 27 will engage with the pointer 26, moving it over the dial.

When the fabric breaks, the block 15 is immediately drawn back to its normal position by means of the spring returning the arm 27 to its normal position, but leaving the pointer 26, having frictional contact with the dial at its adjusted place on the dial, from which the strength of the material may be observed.

The texture of the material may be observed through the magnifying glass during the whole operation of testing it for strength—that is, by its use the parting of the interlacing (weave) of warp and filling can be observed.

This device if desired may be made quite small and comparatively light, so that it can be conveniently carried in the pocket.

To observe the stretching quality of the fabric being tested, a gauge 35 attached to the block 15 is employed, its scale coacting with a pointer or indicator mark on the block 5.

TO ASCERTAIN WEIGHT OF CLOTH FROM A SAMPLE.

Frequently the manufacturer, commission merchant or the buyer is compelled to ascertain from a small sample the weight of the fabric in ounces per yard. The more experienced person certainly will be able to promptly judge said weight to a nicety, by simply handling the sample between his thumb and forefinger, *i. e.*, ascertaining its bulk in this manner, as well as by lifting the sample in his hand, taking into consideration in this instance the size of sample. However, it will also be of benefit to the most experienced person to test the correctness of his practical guesswork by weighing the sample on hand on accurate scales, and ascertaining from it, by figuring in proportion, the weight in ounces per yard for the fabric.

How to Proceed: Trim your sample, most accurately, to the greatest possible size, for the greater amount of surface you can obtain, the more accurately your figures will be. After thus carefully trimming sample to a known size, put it on the scales and ascertain the weight in grains, calculating then, by proportion, the weight in ounces per yard, from the size of sample and its weight in grains previously obtained.

The whole procedure will be best explained by a practical example.

Suppose we trimmed our sample, which was a 6/4 (*i. e.* 54″) fancy cassimere, to 3 × 3 inches = 9 square inches, and found it to weigh 45 grains; thus:

$$\binom{\text{sq. inches}}{\text{in sample.}} : \binom{\text{its weight}}{\text{in grains.}} :: \binom{\text{square inches in one yard}}{\text{of the piece of cloth.}} : \binom{\text{its weight}}{\text{in grains}}$$
$$9 : 45 :: 1944 : x$$

and $45 \times 1944 = 87480 \div 9 = 9720$ grains.

$9720 \div 437\frac{1}{2}$ (grains in one oz.) $= 22.21$ ounces or practically $22\frac{1}{4}$ oz. per yard. Ans.

Above rule given in the proportion might thus be expressed for a standing

Rule: Multiply weight in grains of sample with number of square inches in one yard of the piece of cloth and divide the product by number of square inches in sample; the quotient divide by 437½, thus obtaining the weight of the fabric for one yard expressed in ounces.

The same result is obtained if proceeding after

Another Rule: Cut your sample to a known size and divide the number of square inches thus derived into the number of square inches one yard of the fabric contains, multiply the quotient of this division with the weight in grains of your sample and divide the product by 437½.

The previously given example will figure according to this calculation:

54″ fabric = 1944 square inches.

$1944 \div 9 = 216 \times 45 = 9720 \div 437\frac{1}{2} = 22.21$ oz. weight of fabric per yard, being the same answer as before obtained.

FINISHING COTTON FABRICS AND ITS MACHINERY.

The finishing of cotton goods varies greatly according to the different kinds of goods in the market, consequently no definite rules for finishing them and which will apply in a general way to all kinds of fabrics, can be given. For this reason we will under this sub-chapter of finishing explain in detail such modern machinery for each of the various processes, which possess points of merit with reference to their construction over other makes.

CLOTH INSPECTING AND TRIMMING.

This is the first process the woven cloth when reaching the finishing room is subjected to, the machine used for assisting in this work being shown in Figs. 1 and 2, representing the Cloth Inspecting and Trimming Machine as built by the Curtis & Marble Machine Co., and which machine is designed for permitting a convenient and rapid inspection of the goods, either in separate cuts as they come from the loom, or in large rolls after the ends have been stitched together. Means are also provided in the machine for disconnecting the operating mechanism of the brushes and then imparting reverse rotative action to the feed or draft roll, so that the cloth can be stopped and automatically run backward by said draft rolls for re-inspection of any portion of the fabric after it has passed the inspection table, without having the surface of the cloth subjected to the brushing action during this backward draft movement, or while the cloth remaining idle thus subjecting one position of its web to excessive brushing.

Of the illustrations, Fig. 1 shows this machine in a photo-perspective view, in connection with a rolling head in rear of the machine, for winding the fabric, after inspection, on rolls; Fig. 2 shows a perspective view of this machine —in outlines and lettered—showiug in this instance a folding attachment applied in the rear of the machine, for laying the goods off in loose folds.

A description of the construction and operation of the machine is best given by quoting letters of reference in connection with Fig. 2 and of which A indicates the main frame, carrying upon its tip the inclined inspection table B, having a central hinging joint for turning up of the lower part. C indicates the cradle, upon which the cloth is placed, in a roll or plaited web, preparatory to its passage through the machine. Extending across the frame, beneath the front of the table, are the guide and tension bars *b*, *b′* (a third one situated somewhat higher is not visible in the illustration) for smoothing out the cloth as it is drawn from the cradle. At a more rearward position are the lower and upper guide rolls C′ and C^2.

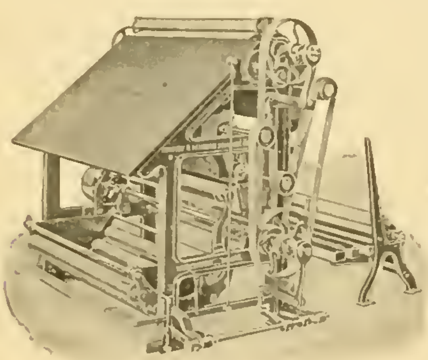


Fig. 1.

G is the main driving shaft mounted in bearings at the lower central part of the frame and provided at one end with the tight and loose pulleys G^2, and at its other end carrying the draft operating pulley G′ and the brush operating pulley F′.

D indicates the draft roll or feeder, consisting of a frictionally surfaced or cloth covered roll arranged adjacent to and parallel with the upper rear edge of the table B, with its shaft mounted to turn in bearings on the end frames, and surmounted by the pressure or top roll *d*, resting on the draft roll surface and having its journals running loose in upwardly forked bearings.

Mounted upon the shaft of the draft roll, there is a

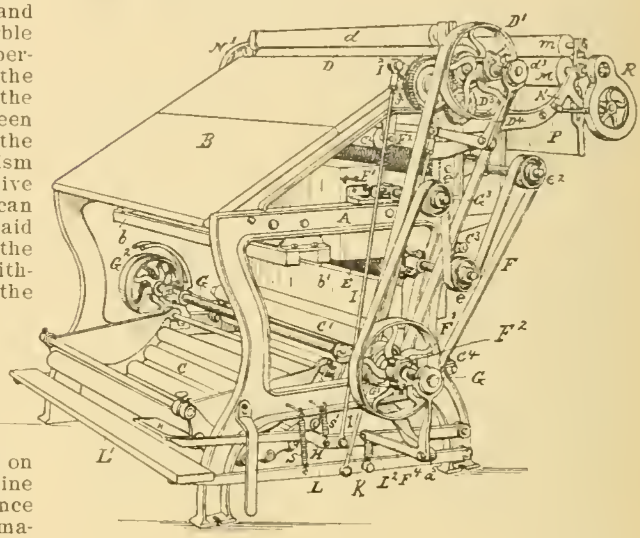


Fig. 2.

loose running pulley D′, carrying at the inner end of its hub or sleeve a spur gear that rotates with the pulley, which latter is operated by belt G^3 from the pulley G′, fixed on the driving shaft. A friction clutch D^3 is provided for connecting the pulley D′ to the draft roll shaft for direct operation of the draft rolls, the sliding clutch-controlling cone d^3 thereof being embraced in the fork of the angular shifting lever D^4, fulcrumed on a stationary part of the frame and having its inwardly projecting arm connected by a rod K with the treadle lever L, so that depression of the treadle board L′ effects engagement of the clutch and elevation of the treadle releases the clutch. A train of reversing gearing is arranged for actuating the draft roll D in backward rotation. The arm I^2 of this train of reversing gearing is connected by the rod I with a secondary treadle lever H, so that depression of said treadle throws the friction gearing into action for reversing the rotation and feed of the draft roll D.

Two primary brushes for clearing the cloth before it passes to the inspecting table are used; one is indicated by E for cleaning the face, the other for cleaning the back, being situated in box E′; E^2 is the secondary brush for clearing the face of the cloth after it has passed the table and draft-rolls for removing any loose threads or lint which may remain on the face of the goods after being inspected. These brushes operate during the forward movement of the cloth by the draft roll feed and cease operation during any backward movement of the draft roll feed, as well as when the feed movement is stopped, again the arrangement is such that the backward feed action of the draft roll effects a power actuated movement of the cloth.

The brushes are arranged at the positions shown with their rotating shafts mounted in bearings on the frame A, the primary brushes acting upon the fabric where it is extended between the lower guide roll C′ and the upper guide roll C^2 and the secondary brush acting on the fabric as it runs from the draft roll D to the guide rolls C^3 and C^4. The brushes are inclosed, excepting at their working line, in suitable boxes, which receive the lint or matter cleared from the cloth. The brush shafts are respectively provided with pulleys e e' e^2 for the brush driving belt F, which runs from the operating pulley F′ on the driving shaft G and passes around the several brush pulleys e e' e^2. The pulley F′ is loose on the driving shaft G, and a friction clutch F^2 is provided thereon for connecting the pulley for operation with the shaft. Said clutch is thrown into and out of engagement by an angle lever fork F^4, fulcrumed at a^5 upon a bracket or arm fixed to the frame. The horizontal arm of the fork lever F^4 is connected by a link L^2 with the treadle lever L, so as to be moved at the same time with the clutch actuating lever D^4, that controls the draft roll clutch. Springs S and S′ are provided for returning the treadles L and H to the position when relieved from pressure thereon.

M indicates a delivery feed roll having its journals mounted in bearings on backwardly projecting arms A′, fixed on the main frame at the rear part of the machine. Said roll M is operated by a belt from a pulley N′ on the left hand end of the draft roll shaft. A pressure roll m rests upon the roll M and is journaled in open fork bearings.

P indicates a swinging plaiting down device operated in conjunction with the delivery feed roll through suitable gearing at R. The guide roll C^4 is arranged at the lower rear part of the frame and guide or roll C^3 for steadying the cloth below the brush E^2.

In the operation of the machine the draft rolls, delivery feed mechanism, and brushes are simultaneously put into effective action by depression of the treadle lever L, the attendant placing a foot upon the board L′. The cloth moves forward over the inspecting table in an upward receding direction, thereby enabling the eye to readily detect imperfections, and this, too, with the cloth moving at a comparatively rapid speed. The draft rolls and delivery feed are put into reverse action without any operation of the brushes by depression of the secondary treadle H. Release of the treadles stops the action, and thereby arrests the feed of the cloth.

The driving pulley and operating shaft G of the machine continue in constant motion, while the control of the draft rolls and brushes is effected by the quick acting frictional-clutch devices responding to the depression and rise of the primary and secondary treadles, so that the starting and stopping of the draft rolls and brushes for feeding and arresting the cloth in its passage over the inspection table and the reversal of the draft rolls are effected instantaneously or as quickly as the foot can act on the treadle, the reversing of the action of the draft rolls requiring only such instant of time as is consumed in passing the foot from one treadle to the other.

If desired to roll the goods after inspecting, in place of laying them in loose folds, as previously explained, the machine is provided with a rolling head to set on the floor back of the machine, and with spreader bars for taking out wrinkles and turned edges; this arrangement being shown in Fig. 1, the folding attachment, previously explained, being in this instance omitted.

These machines are also built without brushes for handling goods which are run through a brushing or shearing machine, on which the threads and dirt are removed, or on such goods as do not require brushing.

SEWING MACHINES.

The Railway Sewing and Rolling Machine. This machine, as built by the Curtis & Marble Machine Co., is shown in Fig. 3 in its perspective view, and is one of the most complete and convenient machines designed for handling goods in the cloth rooms of cotton mills.

The cloth from the loom is placed in the cradle in front, and the ends stitched together as fast as it is unrolled from the loom bolt, and then as many pieces as desired are rolled up in a large roll ready for the brushing, shearing, folding machines, etc., or for the

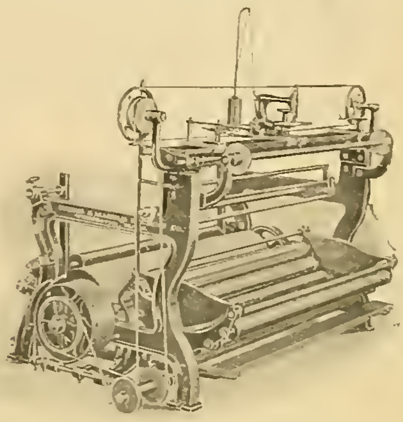


Fig. 3.

bleachery. Before being sewed, the cloth is drawn out to its full width, and held smooth and straight by steel pins on the machine. The sewing machine head then travels across it (the cloth remaining stationary), and sews the ends together with a continuous chain stitch, making a perfectly straight and even seam all the way across. The sewing is done close to the ends, thus causing but little waste in headings; the stitches at the same time can be drawn out easily whenever desired. The machines are adjustable for different widths of cloth, and the sewing machine head stops automatically at the end of each seam. As soon as one sewing is finished, a small hand wheel is turned and the sewing machine head drawn back to the starting point ready for the next seam; the operator controlling the stopping and starting of the machine by means of a foot treadle in front. The sewing machine used is a "Singer" head, which will run with a minimum amount of care and attention in keeping it in adjustment.

The cloth cradle in front, for folding the cloth from the loom, will take in any size roll up to 18″ diameter, and is made with wooden rolls in the bottom so as to lessen the amount of friction on the cloth in unrolling it from the loom bolt. By handling the goods on rolls in this way, they are kept clean and free from wrinkles, and put in good shape for brushing, shearing, folding, or other processes.

A folding attachment, to lay the goods off in loose folds, as well as a measuring attachment for measuring the goods as they are rolled up, can be added to the machine when so desired.

The Portable Hand Power Railway Sewing Machine. This sewing machine, also built by the Curtis & Marble Machine Co., is shown in its perspective view in

Fig. 4, the sewing machine (a "Singer" head) being in this instance mounted on trucks so as to be readily moved about the room, for stitching together the ends of the pieces, in finishing rooms, bleacheries, printeries, etc., where it is not convenient to use a stationary machine run by power. The machine is built in different widths as required.

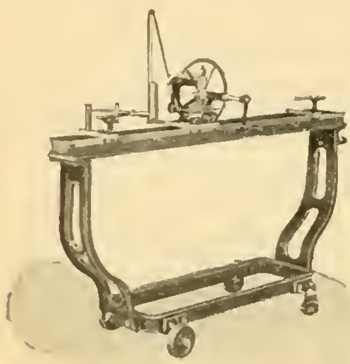


Fig. 4.

The cloth is held out smooth and straight by pins on the machine, and as the operator turns the crank by hand, the stitching mechanism is operated, and at the same time the sewing machine head is made to travel in a straight line across the goods, stitching the pieces together with a continuous chain stitch. By means of the casters and either iron or rubber wheels at the bottom, the machine is readily turned or moved about as desired.

The Portable Foot Power Sewing Machine, as built by the Arlington Machine Works is shown in its perspective view in Fig. 5, the object of this machine, similar to the machine previously explained being, to sew piece goods together about the bleachery and other parts of finishing works.

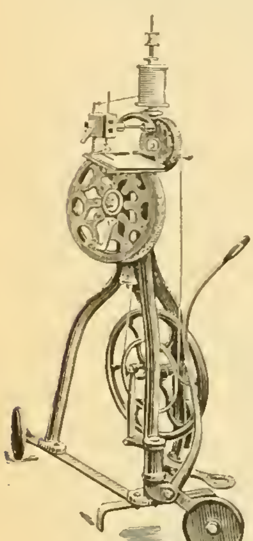


Fig. 5.

The needle in this machine is operated by means of an internal gear working on a smaller gear, which causes the spindle on the end of which is a cam, to revolve. This cam fits into a cavity on the needle slide and so works the needle bar up and down.

The looper, instead of revolving as in usual machines, is made to slide back and forth by means of a lower spindle, which is driven by an internal gear. On this lower spindle is also placed an eccentric, which by means of a suitable lever, causes the pawl to operate in a small ratchet, which in turn is attached to the tooth pinion fitted into a steel ring having needle points, and this ring, by means of the eccentric, lever, ratchet, and pawl, is made to run intermittently, permitting the needle to pierce the cloth whilst at rest.

SCUTCHING OR OPENING.

The purpose of this process is to take the fabric, as in a more or less rolled and twisted condition resting in the "white bins" and take out, *i. e.* beat back, its twist, open out the folds in the goods and deliver them perfectly smooth, *i. e.* free from wrinkles, creases and curled selvages, for further operations, may it be to drying or dyeing machinery, water mangles or any other process, the scutcher in this instance delivering direct to one or the other of these machines as the case may require.

Fig. 6 shows the scutcher as built by the Arlington Machine Works, in its perspective view, and which machine will open the finest and the heaviest goods without any fear of fraying or being damaged in any way, the goods being delivered by the machine in a much better condition than when opened by hand labor, any intelligent lad being capable of taking charge of this scutcher.

In many instances this scutcher is made to work in connection with, *i. e.* deliver to a plaiting machine, the same consisting of two pairs of rolls, one pair being carried in a hanger adjusted below the delivery roll of the scutcher, which in this machine carries on its top an additional weighted pressure roller, the other pair of the plaiter rolls being carried in a swinging lever adjusted to the shaft of the first mentioned pair of plaiter rolls. To this lower set of plaiter rolls, *i. e.* the folder rolls, more particularly, a to and fro motion is imparted by means of an adjustable disk crank and lever on each side of the machine, connected, at proper distance, to the swinging lever which carries the folder rolls, previously referred to, the folding motion to said swinging lever and thus to the set of rolls carried by it, being obtained by means of a large pulley, on the shaft carrying the two disk cranks, the same being driven from a small pulley on the shaft carrying the bottom roll of the upper set of rolls of the plaiter and which in turn is driven from a pulley on the shaft carrying the delivery roll of the scutcher, *i. e.* the main shaft of the combination machine.

It may be mentioned here that this scutcher, either with or without plaiter, is also used in some woolen mills in connection with the cloth as coming either from the hydro-extractor, washer or any other machine where the fabric during the process gets more or less twisted, and where it is of importance to deliver the fabric to the next machine in an open condition, free from folds, wrinkles or curled selvages.

SINGEING.

Most all cotton goods before being bleached and finished have to be singed; which process has for its object to singe, *i. e.* burn off the natural fuzz or fibre from the yarn or cloth. Different kinds of machines are used for doing this work.

Many finishes demand a perfectly clear face, that is as much of this fuzz as is possible, has to be burned off, for which reason it is necessary to have a machine that will do this work in the most economical and thorough way possible. The style of the machine to be used also varies with the kind of goods under operation. Closely woven, flat goods being run over what is termed a "plate" singer, whereas open goods and goods with raised figures are run over what is termed a "gas" singer.

In former constructions the plate singer was a machine containing one or more iron or copper plates heated by coal and held in place with heavy masonry or brick work, somewhat set like an ordinary steam boiler. This method however is objectionable for the fact that, first the setting or bricking-up is very expensive, especially as to foundation, which must be always very heavy and substantial; and second, that on account of the excessive heat used in heating the plates to a red hot or almost melting point, the wear and tear on the brick work is very severe, the same continually cracking from expansion and contraction and in turn requiring continual repair. A third disadvantage of this kind of singer being, that besides dirty work for the help, it at the same time constitutes expensive and troublesome work to keep the plates heated at the proper temperature with a coal fire on account of the time taken to get the fire thoroughly going after first started, on account of the cold draughts that are let into the furnaces when they were made up throughout the day, as they have to be, on account of the dirt and dust coming from the removing of the ashes.

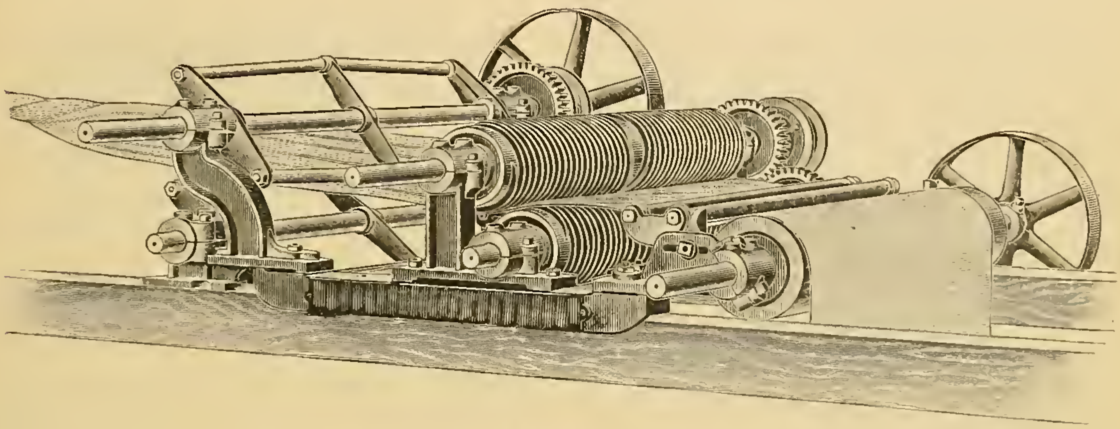


Fig. 6.

The Combined Portable Oil Singer. To avoid and overcome these disadvantages, the "Combined, Portable Oil Singer" has been constructed. Fig. 7 shows a diagram of this machine (with all details omitted) as built by The Textile-Finishing Machinery Co., the advantages of which are that the singer is self contained, has an iron frame work that supports both the iron fire boxes, lined with fire brick, and a carrier arrangement for conducting the cloth through the machine in order to bring it in contact with the plates. The construction of the machine being very light, renders but a small foundation necessary; again, it is so tied together and held that the heat has little or no effect upon it. The plates are heated by a flame obtained from crude petroleum oil which in turn is atomized for combustion by either compressed air or steam, as may be preferred.

The entire plant as furnished by the builders includes oil storage tanks, large enough to take a whole carload of oil at a time; a compressor if air is used to atomize, or pump and attachments if steam is used.

There are several advantages besides in using the oil for heating the plates, viz.:

(1) In most instances, it is far cheaper than coal.

(2) There is no dirt or dust, as from ashes.

(3) There is no fireman required to keep fires up. The man that tends the machine can adjust his fires in the morning and leave them without attention all day.

(4) The degree of heat on the plates can be regulated to a nicety and maintained without change for any length of time desired, for the fact that no doors have to be opened to bank or make up the fires. There is also material time saved in first heating the plates in the morning as an oil fire can be started far quicker than coal.

Other advantages of the machine are: that in connection with the plates there are one or more flame chambers through which the goods can be passed as they go from one plate to another, which will save the extra expense of the gas singeing. The machine can be run either as an all plate machine, as a flame machine, or as a combined plate and flame machine.

The machine can be run to singe either both sides or one side only of the goods, in one run of the latter through the machine.

These machines are built to contain from one up to five plates, and either with all the plates arranged horizontally in one or two rows, diagram Fig. 7 showing the latter arrangement, viz., three plates on the bottom and two on top, the flame chambers as above coming in between the plates. In a single deck, *i. e.* single row machine, and if dealing with a five plate singer, the two plates (4 and 5) as shown in the illustration in the upper deck, are then taken from there and put on the floor deck, either in front or back of the three bottom plates (1, 2 and 3) shown in

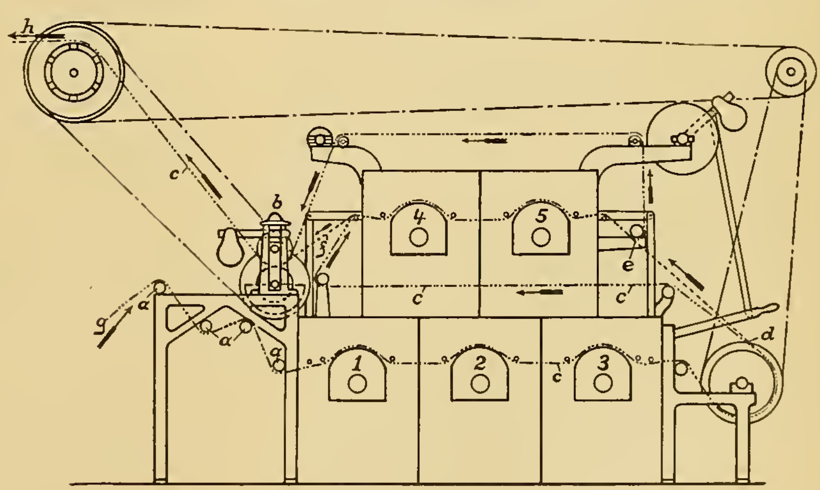


Fig. 7.

the illustration, leaving the machine then open at its top. Such a single deck, *i. e.* one row machine, can be used to singe either both sides of the fabric or only one, whether built with two plates only, or with up to five plates. When required to singe only one side, the fabric is run from one plate to the other (over as many plates as there are in the machine) and in turn out of the machine, whereas in connection with singeing both sides, the fabric is first guided over and in contact with one or more (as to number of plates in machine) plates, then overhead over the remaining plate or plates to the end of the machine, then down and in turn in a reverse direction over the plate or plates not touched before, at the end of which it is guided again downwards and in turn out of the machine, suitable guide rolls being interposed wherever necessary for the fabric to make the required turns as well as to bring it properly in contact with the plates.

The arrangements for bringing the goods into more or less contact with the heated plates are also complete in this portable oil singer (whether a single or double deck machine) as built by the Textile-Finishing Machinery Co., so that the closeness of the singe can be regulated to a nicety in this machine.

The machine is usually driven by an independent engine, so that the speed, at which the goods pass through the machine, can be easily regulated. As the goods come from the machine, they pass through a water nip, so that all sparks are extinguished before damage is done.

One of these machines will handle far more goods in proportion to the number of plates than one with the plates heated by coal. The product of a three or five plate machine in ten hours being from 2000 to 2200 pieces of 50 yards each. The cost of heating the plates, while of course depending upon the relative cost of oil and coal, being, roughly speaking, about 60% that of coal.

With reference to the diagram Fig. 7 numerals 1, 2, 3, 4 and 5 indicate the five singe plates; *a*, four tension rolls for entering the fabric into machine and *b* the water nip.

The singeing of the cloth on one side only is shown by means —·—·—·—·— line *c*; whereas if singeing the cloth on both sides is required, the same, after passing the lower section of singe plates at point *d*, is then guided direct to the upper section, see - - - - - - - - - line *d*—*e*. After passing the upper section of singe plates it then goes direct to the water nip *b*, see - - - - - - line *f*, and in turn out of the machine in the same way as when singeing one side of the cloth only. Arrow *g* indicates the entering, and arrow *h*, the leaving of the cloth, to and from the machine respectively.

Sometimes, in place of using smooth copper plates, it has been lately suggested to use corrugated plates, a specimen of which is given in diagram Fig. 8. Said corrugated plates are made either out of a special metal or cast iron, and have formed on their cloth engaging surface a plurality of channels 2, which are connected by cross grooves or air ducts; it being claimed that said channels and grooves serve the double purpose of permitting complete combustion of the nap and also of maintaining the cloth in a smooth unwrinkled condition while it passes over the singe plate. The portions of the surface of the plate between the channels are grooved, thus forming ribs 3, the grooves and ribs being inclined at an angle of about thirty degrees on the channels 2, the ribs on one side of the median line of the plate inclining in an opposite direction from those on the opposite side thereof. It being claimed that with this construction, the cloth has contact only with the ribs 3 or the portions of the plate between said grooves, the movement of the cloth over the singe plate drawing air into the channels 2 at the edge of the plate where the cloth first contacts therewith and also at the sides of the plate, and from said channels 2 the air traverses through

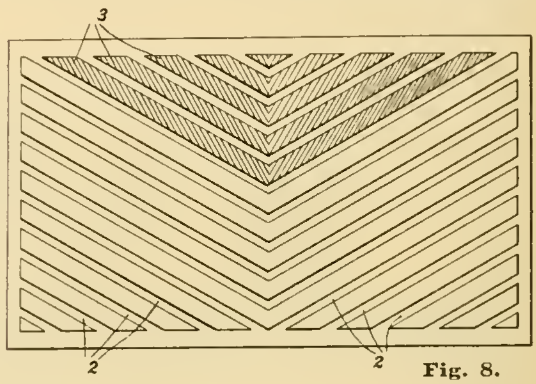


Fig. 8.

the ducts to other channels and along the channels beyond the cloth, and therefore there is a constant sheet of air passing in under the cloth at one side of the plate and traversing through the channels and grooves toward the other side thereof. This complete circulation of the air between the cloth and the singe plate, it is claimed, causes complete combustion, and any smutting of the cloth due to charring of the nap is avoided. It is also claimed that the ribs 3 of the plate, which are outside of the path of the cloth, are prevented by the surrounding air from becoming so hot as to burn the selvage in case the cloth has a slight traverse.

The Gas Singeing Machine. The purpose of this machine, similar to the singer previously explained, is to clear the face, or face and back of the cloth, as the case may require, from any fibres protruding from the structure by bringing the latter in contact with a gas flame; in turn giving the cloth a smooth appearance, clearly revealing the individual threads and their interlacings, *i. e.* bringing out the grain, so much required and sought for in many classes of fabrics; in other cloths however only a slight dressing (as in shearing) may be all that is required, and when consequently less powerful singeing is necessary. In its results singeing closely resembles shearing, only that the procedure is quicker.

Fig. 9 shows a two burner singeing machine, as built by the Curtis & Marble Machine Co., in its perspective view; Fig. 10 being a sectional view of it, more particularly given to show the passage of the cloth through the machine, both for singeing the goods either on one or both sides as required. In the machine illustrated, when singeing only one side, the goods have four contacts with the flames, whilst when singeing both sides they have two contacts on each side at each passage through the machine. The burners have a continuous slot their whole length, and give a solid and uniform sheet of flame from selvage to selvage; there being brass slides which go over the ends of the burners to shorten the flame when singeing narrow goods, so that it may be no wider than the goods, thus avoiding all waste of gas at the ends of the burners. The burners are so arranged that air under pressure is mixed with the gas just before combustion; and, by varying the quantity of air and gas admitted to the burners, various degrees of heat can be obtained, so that heavy, light, or very thin fabrics can be singed with equal facility. Each flame comes in contact with the goods at two points, so that the heat from both sides of the flame is utilized, and as the flame strikes the goods when running first in one direction and then in the opposite direction, the fibres are thus removed in the most thorough and efficient manner possible.

The method of threading the cloth in the machine is shown by dotted lines in Fig. 10.

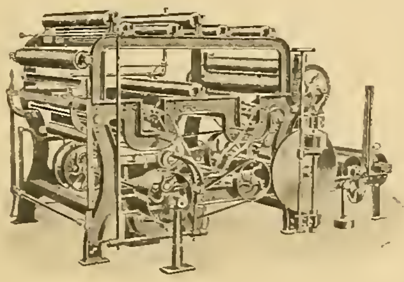


Fig. 9.

When both face and back of the goods are to be singed, the goods on entering the machine, pass over tension and spreader bars in front, to straighten them out and take out wrinkles; they then pass over friction roll A, where they receive the desired amount of tension; thence in sequence around rolls B, C and D, to the burner roll E, where they are first acted upon by the flame V″; thence they pass upward around rolls F and G, and thence down to burner roll H, where they are acted upon the second time by flame V″; they then pass upward around rolls I and J; and down to burner roll K, where they are singed on the opposite side by the flame V; thence to rolls L and M, and down to burner roll N, where they receive a second singeing from flame V. They then pass over the steamer W, where a vapor of steam may be applied to put out any sparks; thence through the draft rolls O and P, which serve to draw the goods through the machine; thence to the rolling-up attachment, where the goods are wound on roll Q, which rests on two winding drums R. The necessary pressure for making a reasonably hard and firm roll as the goods are rolled up, is given by means of cams and weights. The speed of the draft rolls O and P, is easily regulated by means of the differential friction plate S, or in some cases the change of speed is effected by means of a series of cone pulleys on shafts underneath. A supply of air to mingle with the gas to give complete combustion and as intense and hot a flame as possible, is supplied by the fan blower T. The machines may be quickly stopped and the burners turned away from the goods by means of levers, to prevent damage to the goods while the machine is not running; these levers being so ar-

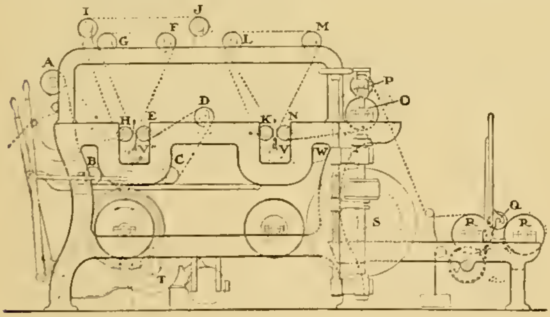


Fig. 10.

ranged that the burners must be turned before stopping the machine. Small lighter pipes are provided, by means of which the flames are re-lighted when the burners are thrown back into working position. The burner rolls around which the goods pass as the flame acts on them, may be kept cool by a continuous stream of water passing through them, thus presenting a cold surface against the back of the goods and prevent the flame from penetrating the goods to "exhaust" them.

In place of the rolling attachment, as shown in the illustrations, and as is most commonly used for cotton goods, a high folding attachment to lay the goods off in loose folds is provided in machines used in connection with such fabrics as worsted dress goods, upholstery goods, etc.

When only one side of the cloth is to be singed, the goods pass from the friction roll A, directly to the first burner roll H, where they are singed by the flame V″; thence over rolls G and F to the second burner roll E, where they are again singed by the flame V″; thence over roll D to burner roll K, and around rolls L, M and N, the same as referred to above; the rolls B, C, I and J not being used when only one side of the goods is being singed.

The illustrations show a machine with two burners V and V″, though larger machines are built with more burners according to the amount of singeing which goods may require and the total product to be put through in a given time. In large mills, bleacheries, printeries, etc., at the present time, singeing machines with three, four or five burners are very commonly used. For goods where a very large amount is singed off, brushes may be added, if desired, to remove the burnt particles after singeing. A smoke hood may be attached over the top of the machine, arranged to be connected by piping to an exhaust or ventilating fan for carrying off all gases and products of combustion.

Where the Singeing Machines are run in connection with a shearing machine, as in print works, etc., an extra pair of draft rolls may be added in front to draw the cloth through the shear, connected by bevel gearing to the back draft rolls, to maintain a uniform draft on the goods through both machines, without any excessive strain.

For an illustration and description of the Gas Singeing Machine as built by the H. W. Butterworth & Sons Co., see page 346.

STARCHING.

This is one of the most important operations in connection with the finishing of cotton goods, being also known as the stiffening or the filling process, the first on account of the final result of the process to the finished fabric, the other on account of the procedure itself, which consists in applying to the fabric under operation a paste or size, principally prepared with starch, farina, etc., in connection with a softener such as prepared oil or tallow; although with some fabrics the latter may be omitted.

There are two methods in use for starching the fabric, viz.: (1) starching both sides, (2) starching its back only; which procedure to use depending upon the nature and character of the fabric under operation.

(1) Starching both sides of the Fabric. For this work the machine used consists either of two or three squeezing cylinders or bowls, through which the cloth to be treated is made to pass, after it has been first impregnated with the size contained in a trough placed below the cylinders or bowls, previously referred to, and of which the lower cylinder or bowl is generally allowed to revolve in the size.

Fig. 11 is a sectional diagram (in order to be able to more clearly explain the construction and operation of the machine) of the "Three Roll Starch Mangle" as built by the Arlington Machine Works, the same being adapted to be used in connection with three different methods of saturating cotton goods, viz.: either with heavy, medium, or light starch or stiffening (of any character) during its transit through machine.

(1) *Heavy Filling.* In connection with this style of starching or stiffening, the routine of the cloth to be treated, through the machine is as follows: 1 indicates the reel of cloth as wound on a wooden roller, through the centre of which runs an iron square bar with round ends 2 for bearings, placed in brackets on each side of machine. 2′ indicates a flange on the wooden roller to which an easy tension is applied by means of a brake 3, through tension wheel 3′ connected with it. The cloth 1′, as coming from the reel of cloth 1, is then threaded through three wooden tension rails 4, 5 and 6, and then under a brass roll 7, which is located in wooden starch box 8, below level of stiffening matter. From brass roll 7, the fabric passes around the upper part (circumferentially) of bottom roll 9 and thus through first nip 10, then following in same direction the rotation (superficially) of middle, 11, and top roll 12 (second nip 13). The cloth is then reeled automatically, by contact, to surface of top roll 14.

It will thus be seen at a glance, that by this arrangement the cloth is assured of a thorough pregnation by starch matter, which occurs when entering the starch box, and is unrelieved by any protecting surface. By the two nips 10 and 13, the effect of laying the starch evenly on the cloth is assured.

Compound levers and weights are arranged in the machine so as to be able to apply any reasonable percentage of weight in nip on rolls desired, the construction observed being: 15, 16 fulcrums for compound levers, 17 stud hole for dead set when required, 18 top lever, 19 bottom lever, 20 weights, 21 hand wheels, 22 adjusting screws for regulating lift of compound levers.

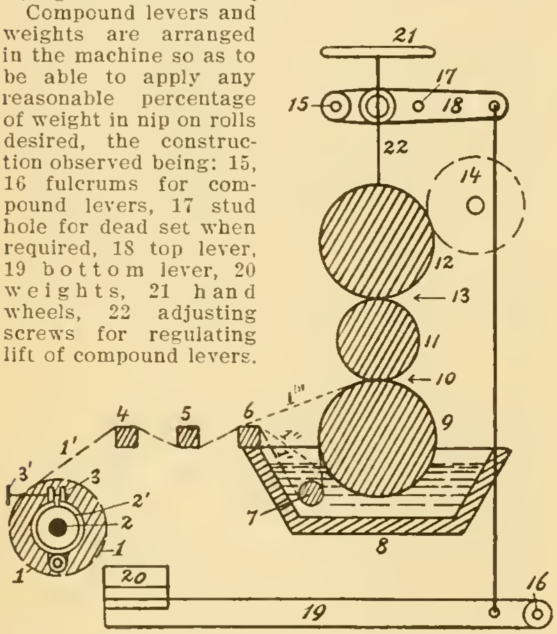


Fig. 11.

(2) *Medium Filling* of cotton goods is accomplished by avoiding use of brass roller 7 in the wooden starch box as a guide for the cloth, applying instead the cloth directly from wood tension rails 6 to the somewhat protective lower surface (circumferentially) of bottom roll 9 (see dotted line 1″), which is immersed in starch, and the cloth collects only that amount of starch that may occur from one side of the surface of cloth being exposed to treatment, and which the fibres of cloth would naturally carry while being conveyed, during its momentary rotation in the filling compound. The cloth is then subjected to the two nips 10 and 13, which perform the even distribution of starch desired for medium weight finish.

(3) *Light Filling* of cotton goods is accomplished by avoiding the entrance of cloth into the starch box at all, taking it direct from tension rail 6 (see dotted line 1‴) through nip 10, in this manner applying to the cloth only starch, or other filling compound, that the bottom roll 9 may collect during its rotation through starching composition, in which it is immersed to about one-third its diameter, and which in this instance is relied upon to be sufficient, the two nips 10 and 13 rubbing in this small percentage of starch or similar filling compound most evenly into the whole texture of the cloth.

Starching the Back of the Fabric only. When the size is to be applied on one side of the cloth only, as is mostly the case with printed fabrics, shoe goods, etc., then a differently constructed mangle must be used.

Fig. 12 is a sectional diagram of the "Back Filling Mangle" as built by the Arlington Machine Works, and designed for the laying of starch on back, or unfinished side, of cotton fabrics, leaving the face side of cloth untouched. The machine consists of a large roll made of wood, or more preferably husk, cotton, or paper; the latter three materials being preferable to wood, on account of their greater durability in maintaining a clean and perfect surface. This roll is made to revolve, partly immersed, in a wooden tank containing the starch or filling, as is to be applied to the back of the fabric under operation. Parallel with the surface of this roll, above the tank containing the filling composition, are two adjustable doctors or scrapers, one on each side, which are made to traverse by means of a crank disc; one doctor to rest on face of roll on one side, and the other to rest on filled side of cloth on the other side. A brass roller is arranged in a suitable position above the large roll, previously referred to, so as to apply a mild tension to the fabric, and guide it to overhead wood drums, which are placed at a sufficient altitude to clear the head of operator and convey cloth in turn either to a folder or dry cans. A wooden box for holding the starch or filling composition, and in which the large roll previously mentioned is immersed, and an agitating roll, made adjustable to keep starch from settling, completes the details of this machine.

The routine of the cloth to be treated, through the machine, is as follows: 1 indicates the reel of cloth as wound (face out) on a wooden roller through the centre of which runs an iron square bar or spear with round ends 2 for bearings, placed in brackets on each side of machine. 2′ indicates a flange on the wooden roller, to which an easy tension is applied by means of a brake 3, through tension wheel 3′ connected with it. The cloth 1′, face side up, is then threaded through three wood tension rails 4, 5 and 6, and then around the lower circumference of the large roll 7, which is immersed to about one-third its diameter in the filling composition as contained in the wooden trough 8, in which is arranged an adjustable agitator roll 9, within the most suitable proximity of the cloth, as passing partially around roll 7, and which keeps the filling composition 10 well stirred and unable to settle at bottom of the trough 8. The cloth 1, 1′, as mentioned before is run face up in the machine, *i. e.* face against roll 7, and consequently does not come in contact with the filling composition, which only acts, *i. e.* saturates the back of the fabric structure. The cloth just previously to leaving the roll 7 comes under the action of the nip of the doctor 11, and roll 7, *i. e.* a combination which lays on the filling composition evenly, and at the same time rubs it thoroughly into the texture of the cloth under treatment, the moving doctor 11 insuring every fibre in the cloth to get an equal share of treatment. The object of so constructing the machine is to avoid any squeezing, which might force the filling composition, *i. e.* stiffening paste, through to the face of the fabric under operation.

The moving doctor 11, as situated on the other side of roll 7, has for its object to free the surface of the roll 7 from any filling composition matter, caking or collecting thereon, insuring all the time a perfectly clean surface of the roll 7 for the newly entering fabric. Both doctors 11 and 12 are adjustable, so is agitator roll 9 in trough 8 fitted with harbors and splash boards for refuse in the filling composition.

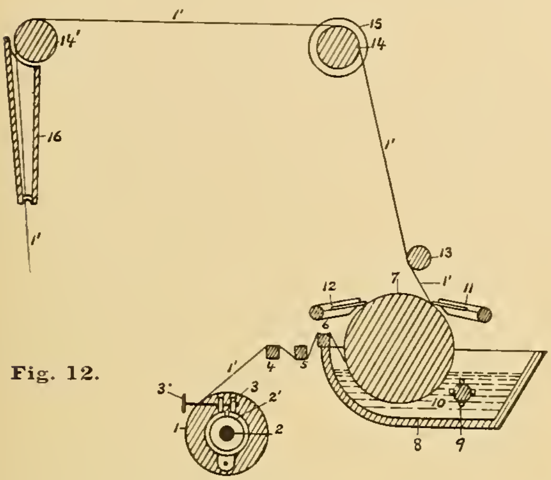


Fig. 12.

After the cloth passes through nip of doctor 11 and roll 7, it is then guided by the brass roll 13, as is placed there to exert proper tension and positioning of the cloth while under the action of the doctor 11, to a wooden guide roll 14 as positioned in the top framing of the machine, and which roll 14 is driven by an expansion pulley 15, so as to regulate the drawing away of cloth from machine in as delicate a way as possible and without any undue tension. The cloth then passes over another wooden guide roll 14′ into the folder 16, to which a to and fro motion is imparted by suitable lever and pulley arrangement, and when it is nicely folded on a truck; or it is conveyed from guide roll 14′ direct to the drying machine, the folder in this instance being omitted.

In some mills, the fabric in connection with the back filling mangle then used, simply passes, face up, through two rollers, or squeezers, the lower of which revolves into the starch, *i. e.* filling composition, as placed in a wooden trough. The composition then is also only applied to the back of the fabric, said application however being not as perfect as the one previously described, since the pressure exerted upon the fabric, between the two rollers, presses the size, *i. e.* the filling composition more or less into the structure, *i. e.* the starch does not remain entirely on the back of the fabric as is the case with the back filling mangle previously described.

SOAPING AND WASHING.

The object of this process is to thoroughly soap and wash printed goods, dyed goods, and fancy cottons, such as ginghams and madras shirtings, etc., and it is particularly recommended for goods whose colors are apt to stain or mark off.

Fig. 13 is a sectional diagram of the open soaping and washing machine as built by the Arlington Machine works, the same being made up of shallow iron compartments or tanks (A, B, C, D, E, F, G, H) placed in successive order; between each two tanks, a space I is permitted, to allow for escape of dirty liquor; however this space can be filled temporarily or otherwise, according to the goods which are being run through the machine, the object being to save soap and water, which may be in condition to be used in the preceding compartment, or to get rid of the same if too soiled to be used again. The illustration, for convenience, shows an eight compartment machine, although be it understood that any number of compartments may be added, or taken away; an eight compartment machine being usually desired for printed goods, whilst for other classes of work a four, five, six or seven compartment machine is sufficient.

Each compartment contains four rollers—1, 2, 3, 4—two of which, 1 and 3, are usually of plain brass, whilst the others, 2 and 4, are two patent flushing rollers, one of which is shown in its section, in detail, in Fig. 14. At the leaving end of each compartment, a pair of squeeze rolls J, preferably of brass and rubber, or two rubber rolls, are fixed in suitable standards, with weights and levers for pressure, for squeezing the water out of the goods and back into the compartment, thereby permitting the goods to enter into the next compartment in a cleaner and better condition for further soaping or washing. Over each compartment is arranged a series of brass carrying rolls—5, 6, 7, 8—supported by suitable rails, approximately five feet above the lower range of tank rolls.

The first compartment A is often used as a fixing tank, whilst the last two compartments G and H in

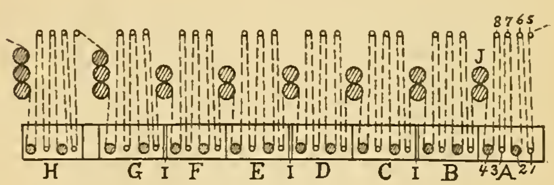


Fig. 13.

the combination machine shown, are used for washing, the other compartments B, C, D, E and F being used for soaping; although be it understood that each mill usually adopts its own method, using at the same time either more or less compartments. The goods are sewn together and made into a continuous string, and enter the machine over suitably placed tension rails, over brass carrying roller 5, and then down under the first roller 1, submerged in the liquor in the first compartment A, then up to the upper roller 6, and then down under the flushing roller 2, and circulated up and down and through the machine, as per dotted lines, and finally delivered over a reel or folder into trucks, or direct to drying machine.

There is a distinct advantage in the construction of this soaper and washer: The shallow compartments or tanks permit the attendant to thread up the machine quickly, the upper range of carrying rolls allows the goods to be in the machine a longer time under operation, and at the same time permits the attendant to watch them closely, as they are in sight during almost the entire run. There is another very important reason why the carrying rolls are placed so high, and this is that every time the goods are dipped into the tanks, the liquor is carried up a certain height, and then on account of its weight and the slight pressure on the cloth as it comes in contact with these rolls, it flows down and washes the ascending goods, at the same time, taking with it all surface color and dirt adhering to the fabric, thus causing the cloth, every time it goes into the next tank to be in a better condition for further treatment.

The flushing rollers (see Fig. 14) are made of wood *a*, into which deep grooves *b* are cut. The liquor flows into these grooves, and is displaced by the brass bars *c*, in such a manner as to be forced or pumped through the fabric, thereby washing out every particle of matter, and thoroughly cleanses the goods.

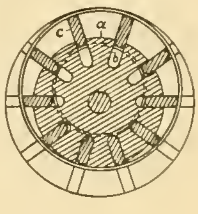


Fig. 14.

The soap and water are arranged to enter at the delivery end of each tank, and flow in the reverse direction to the motion of the goods. Each compartment is fitted with piping for heating the liquor. The machine is driven by jack shaft, side shaft, and bevel gears on lower squeeze rolls.

STARCHING AND FINISHING YARN DYED COTTON GOODS.

This practically includes all cotton goods, in the manufacture of which the yarn has been dyed before the goods are woven, may it be either by dyeing the raw cotton previously to converting the same into yarn, or by dyeing the spun yarn in the form of warps, cops or skeins.

Yarn dyed goods, with reference to their process of starching and finishing, can be conveniently divided into two general classes, viz.:

Goods which after starching must be dried on a tenter in order to obtain a proper finish, and second,

Goods which after starching are dried on a cylinder drying machine.

Whether the tenter or cylinder drying machine is used for drying, depends upon the finish required, as regulated by the demands of the market.

Tentering, compared to cylinder drying, is not only more expensive in proportion on account of less output of one machine, but at the same time the machine requires more floor space and more labor to operate, however it has the great advantage, that besides drying the goods, it leaves them with a soft, clothy, feeling; stretching them at the same time, after starching, uniformly throughout the entire length of the fabric to nearly their original width, from loom. The selvages of the fabric, at the same time are kept more even, since they are kept taut throughout the operation, as compared to the loose running when the fabric is handled on a cylinder drying machine.

The cylinder drying machine, on the other hand, leaves the goods after drying, with a harsh, papery feeling, and of more or less uneven width, for the fact that the goods pass through the drying process without being stretched width-ways.

Tenter drying, as a rule is practiced with ginghams, madrasses, fancy shirtings, fancy dress goods, etc., the better grades of these goods, when coming from the loom being often sheared, singed, soaped and washed previously to starching, on machinery especially built for this work by The Textile-Finishing Machinery Co., whereas the lower grades of these fabrics, before mentioned, previously to tenter drying, however are not sheared, singed or washed, but when coming from the loom are simply inspected and brushed, and are then ready for starching and finishing. Both, the finer and lower grades of these fabrics are starched on a mangle and dried either on a straightaway tenter, on which the goods enter at one end and are delivered at the other, or on a tenter commonly called a return tenter, and on which the goods enter at one end, pass over the machine, turn and return underneath, are taken off near the entering end, and then led to a winder, as most conveniently located at either end of the tenter. The straightaway tenter is fitted with either clamp or pin clips and is by far the most popular in New England, while the return tenter usually fitted with pin links, is extensively used in Philadelphia and vicinity, and in the South. Both styles of these tenters, with starch mangles applied, are built by the Textile-Finishing Machinery Co.

With reference to the cylinder drying machine, the class of goods handled by it includes tickings, denims, awning goods, etc. These goods, after coming from the loom, are usually inspected, frequently brushed, in turn are then starched or filled on a starch mangle and finally dried on a cylinder drying machine.

Almost all yarn dyed cotton goods are finally finished on either a 3-roll or 5-roll calender, which to give the best result, should be provided with the patent combination "cotton husk" rolls, as described in a special article on pages 382-383.

For starching and drying tickings, denims, awning goods, and many other yarn dyed goods, the outfit or arrangement of machines shown in the accompanying illustration Fig. 15 has been especially designed, the same being the style of machine as is built by The Textile-Finishing Machinery Co. It consists of a 2-roll starch mangle A, a horizontal drying machine B, and either a 2-drum winder C for rolling up the goods after drying, or a folder (not applied in this case) for plaiting the goods when leaving the machine, down into trucks.

The mangle A consists of heavy iron frames or housings *a*, with the necessary boxes *b* for supporting the rolls *c* and *d*, and of which the bottom roll is of brass, or what is superior, a copper deposited roll, the top roll *d* being a rubber covered roll.

Pressure to the latter roll is supplied by means of weights *e* through levers *f*, *g*, *h*, and connecting rod *i*, the two levers *f* and *g* being fulcrumed respectively at *j* and *k*. Lever *h*, as directly exerting the pressure upon the roll *d*, is supplied with adjusting wheel *l*, and connecting rod *i* with a double threaded socket bolt for regulating the length of said rod, in order to keep weight *e* in proper position. *m* is the starch tub and *n* are two series of three tension rails each; *m'* is an immersion roll for guiding the cloth into the starch tub. This mangle is driven by means of belt *o*, through expansion pulley *p* from a pulley *q*, fast to a shaft carried in the frames of the drying machine B.

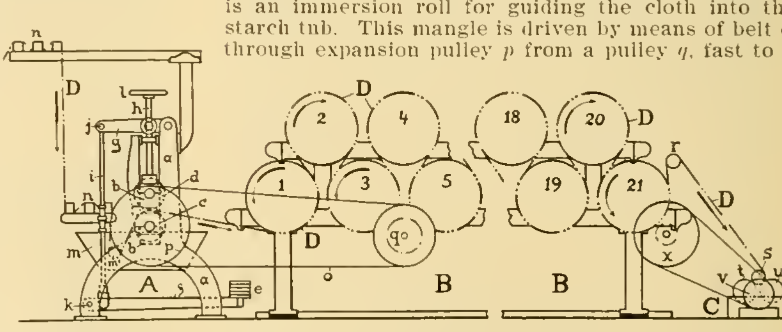


Fig. 15.

This drying machine B is of the horizontal type, with a sufficient number of cylinders (twenty-one) to dry at most any speed desired, and of sufficient width (face of cylinders) to run either one, two or three pieces of goods at a time through the machine. The centre portion of this drying machine is shown broken out, in order to bring illustration within compass of page, nine cylinders of a twenty-one cylinder machine (which is a number of cylinders most frequently used) only being shown.

These drying machines are made with heavy iron cored frames, hollow boxes and hollow journals in the cylinders, so that steam is admitted at one end of the cylinder, and water discharged by means of patent spiral scoops, described on pages 373-374, at the other end. These cylinders are generally 23″ diameter, and made either of Lake Superior sheet copper or English tinned iron, and have iron heads with vacuum valves, to prevent collapse, and spiral scoops for ejecting the condensed water.

The goods after leaving cylinder 21, pass over and partly around guide roll *r*, and in turn are wound on cloth roll *s*, from cloth contact with the 2-drum winder rolls *t* and *u*, driven by means of pulley *v* and belt *w* from pulley *x* as situated on the delivery end of the drying machine.

The whole outfit is driven in unison, so that goods (as shown by line D) enter the starch mangle A pass without break to the drying machine B and are wound up on the winder C, thereby requiring the minimum amount of labor.

For starching and drying ginghams and many other of the better grades of yarn dyed goods, the outfit of machinery shown in Fig. 16 in side elevation and in its plan view, furnished by The Textile-Finishing Machinery Co., is the standard in use in the vicinity of Philadelphia and in the South, although it is frequently varied by them in detail to meet special conditions of location, of finish required, or to satisfy the preferences of their customers.

This outfit consists of the following machines:

1st.—A 2-roll Starch Mangle (A) which has iron frames or housings supporting a bottom brass roll *a* and top rubber covered roll *b* with attachments for putting pressure on these squeeze rolls, starch box *c* with immersion roll (if wanted), tension frame *d* and bars *e* for feeding on the goods, and which is driven by iron cone pulleys *f*, *g*, from the drying machine. *h* is the chain for changing cone speed and *i* the cone belt.

2nd.—A small Upright Drying Machine (B) which usually has six 23″ tinned iron cylinders fitted with the spiral scoops described in detail on pages 373-374, but may have four, eight or ten cylinders either of tinned iron or copper if desired.

3rd.—A standard 60-ft. Return Tenter (C), (the centre portion of which is shown broken out in order to bring illustration within compass of page), with either pin links or clamp clips to hold the goods at the selvages. As these tenters are made in sections of ten feet in length, the tenter may be varied in total length. They are fitted with a shaft driven by power by means of which they can be made narrower or wider according to the width of the goods to be run. The tenter is frequently provided with automatic feeding attachments (not shown in illustration) which assist greatly in getting the goods on to the tenter.

4th.—A Blower D with Heater E, which usually stands near the entering end of the tenter and is connected with it by a galvanized iron pipe *j* which leads hot air to the tenter.

5th.—A 2-roll Winder F, for batching or winding up the goods previous to taking them to the calender. The winder is sometimes placed in front of the mangle where the goods enter, again sometimes a folder or plater is substituted for the winder.

This entire outfit with the exception of the blower is either driven by a separate double angle 5 × 6 engine or from the main shafting in the mill through a pair of 3-step cone pulleys for varying the speed and a friction clutch for stopping and starting. The tenter is driven at the end opposite to which the goods enter, from pulley *k*, driving by means of gears a shaft *l* running the entire length of the tenter and from which the cone pulley *g* which is supported from the ceiling is driven, and which in turn, as previously indicated, drives by pulley *f* and belt connections the upright dryer B.

These cone pulleys *f* and *g*, serve as a means by which the speed of the drying machine B and mangle A is varied as compared with that of the tenter C.

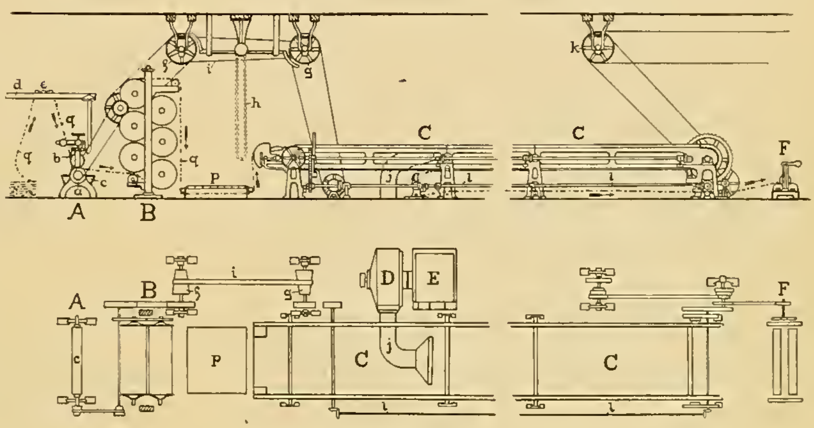


Fig. 16.

The mangle A is driven from the drying machine B by another pair of cone pulleys *m* and *n* so that the speed of the mangle can be varied as compared with that of the drying machine. The blower D is usually driven separately from the main shafting in the mill by means of its pulley *o*.

p is a wooden platform, for the operator to stand upon, or pass from one side of the machine to the other when required to do so, the cloth passing, from the upright drying machine B to the tenter C, below said platform and is thus out of the way.

The goods are brought to the machine in rolls or in trucks and are fed (see dotted line *q*) on to the mangle (A) over the three tension bars *e*. They either dip down into the starch by passing under an immersion roll (not shown, furnished if required) or pass directly through the nip of rolls *a* and *b*, receiving in this case the starch as it is lapped up by the bottom roll *a* from the starch tub *c*. The cloth then passes on directly to the upright drying machine B, where it is partially dried and in turn guided to the tenter C, where the goods under operation are stretched and fully dried.

On the return tenter the goods held by the clips pass the entire length of the machine near the top and then return underneath to the take-off rolls which receive them from the clips and from which they are led by means of floor carrier rolls to the winder F.

This arrangement of machines gives the greatest production and best results in proportion to the floor space occupied.

The goods are starched, stretched, dried and wound in large rolls in one run without rehandling, thereby reducing the cost of labor to a minimum.

Sometimes a back starching machine is required, to suit a certain class of fabrics made by a mill, and when this machine then is substituted by the Textile Finishing Machinery Co., in place of the usual 2-roll mangle A, as shown in connection with the illustration. The drying machine B is frequently omitted, in which case the floor space required is reduced, but the capacity of the tenter cut down from one-third to one-half. This upright drying machine B, however in all instances, must be kept comparatively small, for if the goods are too dry they cannot be fed to the tenter, are very hard to stretch and become harsh and more like goods that are dried on cylinder drying machines.

Cylinder Drying Machines. We will now examine a few of the various constructions, *i. e.* arrangements of cylinders possible, in connection with cylinder drying machines, and which allow either both sides or the face, or the back of the fabric only, to be dried on the same machine—whether the cloth be starched on both sides, or on the back only, in short, whatever may be the means employed for the application of the thickening material.

Under ordinary conditions a cylinder drying machine is composed of a series of cylinders, ranging from 1 to 21 (or less) in number (see B in Fig. 15), they being generally placed so as to alternate, that is to say, that above the first two cylinders, placed in a straight line (1 and 3 in Fig. 15), there is a third cylinder (2 in Fig. 15) which forms an equilateral triangle, with the preceding ones and which constitutes the commencement of the upper series of cylinders.

These cylinders, as shown in connection with the drying machine B in Fig. 15 placed horizontally (in a line), can also be arranged vertically *i. e.* in an upright arrangement, such disposition being preferable when space is limited. B in Fig. 16 shows such an upright drying machine—a single column six cylinder machine—in other words only a small drying machine (but which is all that is there required, since the purpose of this small upright drying machine, in this case, is to only partly dry the cloth under operation previously to it going on the tenter). These upright drying machines, as a rule, are built with 2 or sometimes 3 columns, containing from 18 to 36 cylinders in the complete machine. The cloth after passing through the first column of cylinders, in an upward direction, then passes overhead to the second column and then through this column of cylinders down; and in connection with a 2-column machine then out of the drying machine, whereas if dealing with a 3-column machine, the cloth when coming from column 2, then passes over to column 3, and then upwards through said column of cylinders—leaving this 3-column upright drying machine then overhead.

In some constructions of these upright drying machines the cloth is made to travel from one column to the other—free (not supported), whereas in other makes a special drying cylinder is interposed, to provide a contact for the cloth.

In all the cylinder drying machinery thus described, the cloth in passing over the cylinders will be dried both by the contact of its face and back with the cylinders *i. e.* the first cylinder the cloth comes in contact with, works on one side of the cloth, the next cylinder on the other side of the cloth, and so on, until the cloth leaves the machine. However, in connection with some fabrics like raised face goods—quilts, corduroys, etc., and where contact of the face of the fabric with the cylinders would injure the former, a series of winces, or woodlagged cylinders also called binding rollers, must be used, in this manner bringing one side of the fabric only in contact with the cylinders of the drying machine.

This arrangement refers more particularly to horizontal drying machines, and in order to explain this subject, diagram Fig. 17 has been prepared, showing arranged in one machine the principle for any mode of drying cloth by means of a cylinder drying machine. In said figure Diagram A shows contact of cylinders with both sides of the cloth, viz.: cylinders 1, 3, 5, 7, 9, 11 and 13 drying the cloth on one side, and cylinders 2, 4, 6, 8, 10, 12 and 14 on the other side. Now if placing a series of binding rollers over and below the two series of drying cylinders, as shown in

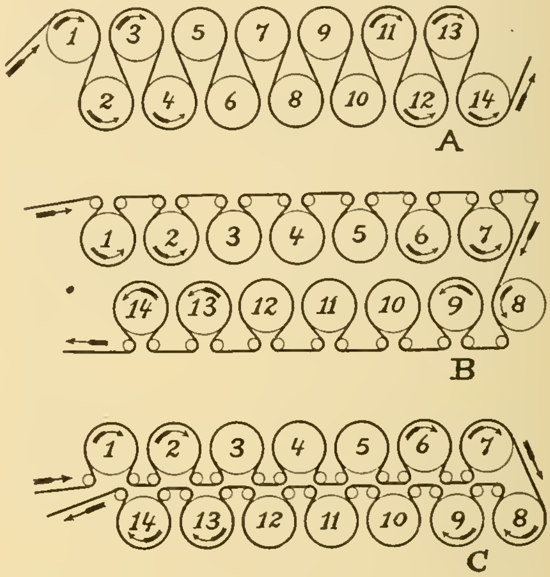


Fig. 17.

connection with Diagram B, the cloth then will have, with the same mode of entrance, contact with the cylinders only on one of its sides. The same result is obtained if placing said binding rolls between the two series of drying cylinders—as shown in Diagram C; the difference between mode B and C being that provided the fabric is fed to the machine in the same way—say for example Face up—then in connection with the arrangement shown in Diagram B, the face of the fabric only will come in contact with the cylinders, whereas in connection with arrangement shown in Diagram C, the back of the fabric only will come in contact with the cylinders. It will thus be seen that with a cylinder drying machine, permitting the insertion of binding rollers as explained we can, with the same mode of entrance of the fabric, get all possible forms of drying, viz.: Face and Back, or Face only, or Back only, a point of advantage when having to dry on one machine a great variety of fabrics requiring drying from one side or the other only, or again such where it is better to dry from both sides. Arrows in Fig. 17 show the run of the fabric through the machine, arrows in circles indicate the rotation of the cylinders and numerals the successive location of rollers as the cloth comes in contact with during its travel through the machine. It will be readily understood that in place of the fourteen drying cylinders as shown in the illustration more or less (as the case may require) can be used.

Butterworth's Vibratory Tentering Machine. This type of tentering machine, as built by the H. W. Butterworth & Sons Co., and of which a perspective view is given in Fig. 18, is particularly adapted to

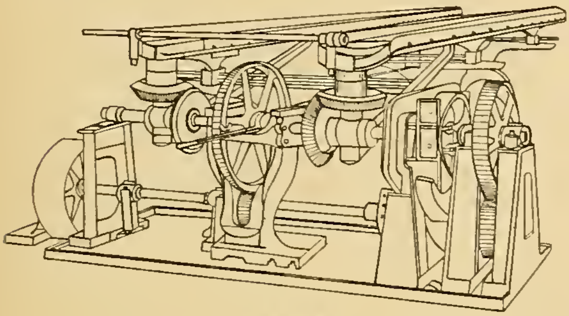


Fig. 18.

tentering and drying all grades of cotton goods, especially where an elastic finish is desired.

Special attention has to be called in the construction of this machine to the patented centre drive, which gives regularity to the swing motion.

The patented automatic clamp, as used in connection with this machine, is shown separately in Fig.

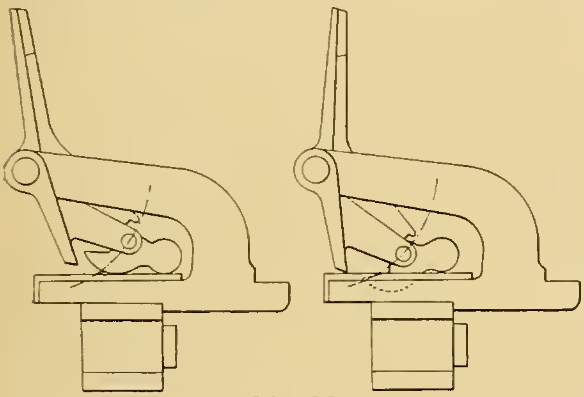


Fig. 19.

19; the same being of simple construction, but at the same time most effective in operation.

Spiral Scoops. It has been in the past almost the universal custom throughout the world wherever cylinder drying machines are used to fit the cylinders with what is known as a bucket scoop for lifting and discharging the exhaust water which accumulates in the cylinder. The live steam enters the cylinder at one end through the hollow journal and this bucket or scoop discharges the water at the opposite end. For a great many reasons, this bucket scoop has never done the work satisfactorily for which it was intended. In the first place, as universally constructed, it does not reach into the cylinder more than 24″ from the head, hence it is evident there must always be a considerable quantity of water which it cannot reach at once, and which flows gradually toward the bucket. As the speed at which the cylinder is revolved increases, the water is acted upon more and more by centrifugal force, which tends to keep the water against the surface of the shell of the cylinder and prevent it discharging by gravity. The efficiency of the bucket scoop is therefore proportionately reduced and at a certain speed the bucket scoop practically ceases to operate. It requires but a very small quantity of water in a cylinder to materially reduce the surface heat and hence the drying capacity of the cylinder. For years many other devices for removing the exhaust water have been tried but all have proved unsatisfactory for many reasons, or altogether too expensive to install or operate, so that until the spiral scoop was introduced upon the market, the old fashioned bucket scoop still remained in almost universal use. It was to overcome the obvious defects of the bucket scoop that the spiral scoop, as shown in section in Fig. 20, was designed and patented by the Textile Finishing Machinery Co. As will be seen from the illustration, this scoop consists of a spiral gutter extending the entire length of the cylinder. It starts shallow at the steam end and gradually increases in depth in order to take care of the increasing volume of water, makes a certain number of revolutions depending on the length and diameter of the cylinder and finally terminates in a lifting pocket or bucket which discharges out through the hollow journal of the cylinder. It will be readily understood that by the use of this spiral scoop, as the cylinder revolves, the water is forced along mechanically and lifted out in a steady uniform stream. There is no rushing of the water back and forth caused by varying steam pressure with consequent danger of damage or collapse of the cylinder, no high steam pressure absolutely necessary to force the water to where the bucket scoop can reach it, and above all no loss of efficiency caused by more and more centrifugal force as the number of revolutions of the cylinder is increased. The truth of the statements just made has been borne out by many practical experiments made either at the works of the Textile Finishing Machinery Co., or at those of some of their customers. It is shown beyond a question that cylinders fitted with the old style bucket scoop operate from 1″ to 1½″ of water in them all the time when running under the most favorable conditions. They never work on a closer margin than this and usually have a much greater amount of water in them most of the time. The spiral scoop, on the other hand, will absolutely remove all water from the cylinder and keep it almost absolutely free from water at all times. It is demonstrated that in a 23″ cylinder, the bucket scoop will commence to refuse to clear the cylinder of water, on account of centrifugal force, when the cylinder revolves to deliver 70 to 80 yards of goods per minute, and at a little higher speed, absolutely ceased to operate. In these tests similar cylinders fitted with spiral scoops were revolved at a speed equivalent to 130 yards surface speed per minute and were kept practically free of water by the spiral scoop.

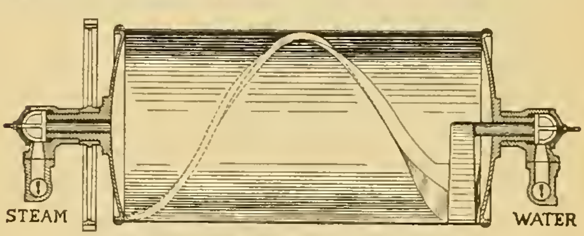


Fig. 20.

By the use of spiral scoops the capacity of a drying machine is not only increased at least 20 to 25%, but the steam pressure and amount of steam necessary to do the drying decreased very materially. In addition to these advantages, the spiral scoop enables goods or yarn to be dried at a lower temperature which leaves them softer and more mellow, as they are not baked by excessive heat. There is very much less or no liability of fugitive colors marking off and of starch sticking to the first few cylinders which is alone of the greatest value in drying many classes of goods. From a mechanical standpoint, it is possible to fasten the spiral scoop in a cylinder far more strongly than the bucket scoop so that the old trouble of scoops becoming loose in the cylinders has been obviated. They can readily be put into cylinders of any face or diameter and are especially advantageous in cylinders of wide face or large diameter.

Since these spiral scoops were first put on the market some four years ago, hundreds of cylinders have been fitted with them, and those mills who have them will now have nothing else, especially manufacturers who have made a study of drying machines and who have come to realize what an inefficient and costly device to operate the old bucket scoop is, and how unsatisfactory and expensive other methods of removing the exhaust water from cylinders are.

Angular Rollers. It is difficult to run cloth, especially when in a moist condition, any distance without it creasing and running in a zigzag manner. To overcome these difficulties, in connection with any kind of machine where such a smooth feeding of the cloth is required, is the object of these Angular Rollers.

Fig. 21 shows such angular rollers, as made by the Arlington Machine Works, in perspective view, the same being applied to a cylinder drying machine, said angular rollers being made up of four brass rollers, which are caused to revolve by the action of the cloth itself. These rollers are secured to a suitable frame, which is pivoted in the middle, and when the cloth runs a little to one side, it causes the device to tilt and thus guide the cloth back to the middle, and cause it to run in its proper path, *i. e.* in a straight line into and through the machine where applied to, the cylinder drying machine in this instance.

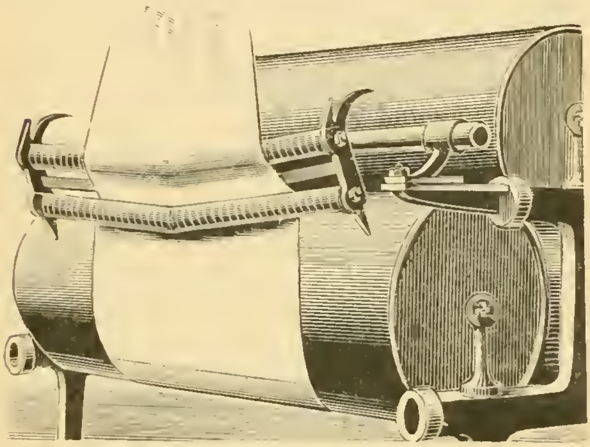


Fig. 21.

The four brass rollers, previously referred to, as will be readily seen from the illustration, are set at an angle, and as the cloth strikes them the opposite sides have a tendency to diverge and to run at right angles to the rollers, hence, any creases in the cloth or doubling of the selvages, are automatically straightened out. The device is composed entirely of brass, and is fitted with patent bushings which do not require any oil, making it safe to run the cloth without fear of oil or rust spots.

STRETCHING OR WIDENING THE CLOTH.

The purpose of this process is to stretch cotton goods in their width before or after finishing, in this way recovering the width to the fabric it lost during bleaching, dyeing, stiffening, etc.

The process as well as its advantages derived at by the fabric thus treated, will be best explained in connection with a standard make of such a machine, selecting for it the Stretcher as built by the Arlington Machine Works. The advantages arising from its use as compared to other styles of machines are: (1) The cloth is under the perfect control of the operator; (2) no pin holes are made in the selvages; (3) the stretching is uniform from the centre of the cloth to the selvages; (4) no damage is done to the edges of the cloth; (5) goods may be stretched on it after they have been stiffened, calendered or beetled, (if such a process is used), with little disturbance to the finish; and (6) uniformity in the width of the cloth after stretching.

The machine is of utility for beetled and for back stiffened goods, as well as for all kinds of cotton fabrics which have been starched and dried. It is also of value in imparting a clothy finish to stiffened goods.

The principle adapted in the construction of the machine is a well known one. The selvages of the cloth, or more strictly the edges of the cloth, for a width of about three inches, are caused to pass over and at the same time are held by the rims of two diverging pulleys. The rims are further apart where the cloth leaves them than where they seize it, hence the stretching is gradually, certainly, and uniformly performed. The cloth is gripped by the pressure of an endless belt acting against the lower half of each pulley, the edges being held between them. The stretching pulleys are covered with rubber to insure a good grip without undue strain on the belts.

In the process of bleaching and dyeing, cotton cloth becomes considerably contracted in the width, in consequence of carrying on the operations when the cloth is in the form of a rope. The effect is that, together with the tension, although slight, and the drying, the filling partly shrinks and partly curls up, the latter, however, being scarcely observable to the naked eye. It may almost be said that, as regards the width, the shrinkage is due to a number of minute crumples, because the cloth is easily stretched again by the fingers almost to its grey width. The main use of a stretching machine, therefore, is not so much to make the cloth more than it is, as to bring it again to its normal or woven width after operations that tend to shrinkage have been performed upon it. The stretching operation, therefore, is especially useful to calico printers, as it enables them to obtain when desired a wide margin of even width, the irregularities due to bleaching being corrected before printing.

In order to be able to more clearly explain the construction and operation of the Arlington Stretcher, the accompanying two illustrations have been prepared, and of which Fig. 22 is a sectional diagram of the machine, Fig. 23 being a view in detail (top plan view) of those parts more particularly connected with the stretching procedure.

The machine consists of two large revolving central wheels 1 and 2, each covered on its face, by an endless rubber belt of best material, expanded sufficiently to bed itself tightly around the surface of its wheel, to prevent it from slipping when in operation. At convenient intervals of each wheel 1 and 2 respectively, are located two endless leather belt guide pulleys 3 and 4, and two endless leather belt adjustable pulleys 5 and 6, to keep the two endless belts (one for each wheel and series of four pulleys) taut.

When the machine is in operation, each endless leather belt covers a frictional surface of about the whole of the lower half of its circumference, of its corresponding rubber belt, which drives its leather belt, traveling to delivery and guide pulley 4 under endless belt adjusting pulleys 5 and 6, and over belt guide pulley 3, a feature which of course establishes a continuous (endless) belt surface.

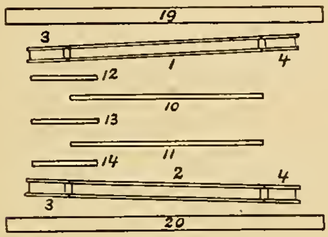


Fig. 23.

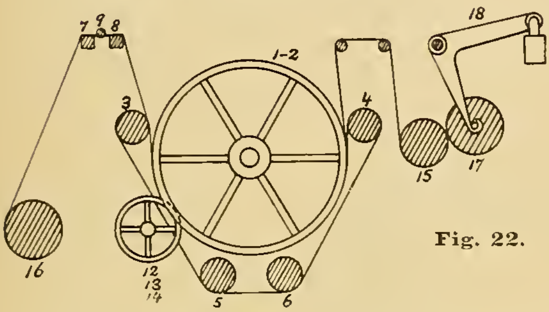


Fig. 22.

The cloth is fed into the machine through tension rails 7 and 8, and round governor tension 9, embedding each selvage between one of the endless leather belts (one on each side) and the rubber belt covering on face of its corresponding large revolving wheel 1 or 2, which conveys it (the cloth under operation) by the strenuousness of its grip to the delivery belt guide pulley 4, where the nip ends and relieves the cloth, which is immediately caught up by wood guide rolls, and quickly transferred over to the surface of wood drum 15, where the stretch in the cloth is maintained.

The large wheels 1 and 2 can be placed at any desired angle, according to amount of stretch required. Arranged between the large wheels and on the same centre are two light revolving tension wheels 10 and 11, about the same diameter as over endless rubber girt on large wheel and below.

In a practical position and on an independent shaft are secured three small tension wheels 12, 13 and 14, regulated by slide and screw, and placed alternately between the large wheels 10 and 11, so that as the cloth passes through, the small wheels are regulated into a position which causes a series of corrugations of the cloth, and which stretches the fibres of the cloth over its entire face. 16 indicates the reel of cloth at entering side of the machine, and 17 the delivery reel of cloth wound by drum 15, and supported by swing arm 18. 19 and 20 indicate the side frames of the machine.

SHEARING.

On all ordinary cotton goods the shear blades are used not for trimming off the nap of the fibres to an even length as on most woolen goods, but rather for cutting off projecting threads and fibres so as to leave the fabric perfectly smooth and free from protruding ends.

Fig. 24 shows in its perspective view the shear as built by the Parks & Woolson Machine Co., the same consisting principally of four shear cylinders (less are used in some machines) placed horizontally in the machine, and two brushes for the face of the goods. The draft rolls on the back of the shear deliver the cloth either to calender rolls, singeing arrangement, or winding rolls, as the case may be. A rolling up attachment, forming a part of the machine, is applied when desired, to wind the goods up on wooden rolls after being sheared, and to be taken in this shape from the machine. The shear cylinders are similar to those of their woolen shear. Each set of blades composing a cylinder is a unit in itself, and can be removed from the machine without affecting other parts. Either ledger blades or shear cylinders can be removed without disturbing each other. The ledger blades are adjusted entirely from above, the screws being all on top and thus do not interfere with the cloth as it passes over, this construction also making it more convenient to regulate when grinding together. The rests, by which the cloth is held to the shearing lines, are adjustable in all directions. They are pivoted and have lifts to raise the cloth when a sewing is passing. A flock exhauster is provided on the machine, which is used to carry away all the dirt and lint made by the operations of the machine. These shears are also built to shear both sides of the cloth at one time. Very often it is of advantage to run, in connection with these cotton shears, rolling machines, either with or without calender rolls, and with or without steam boxes, according to the requirements of the goods to be finished.

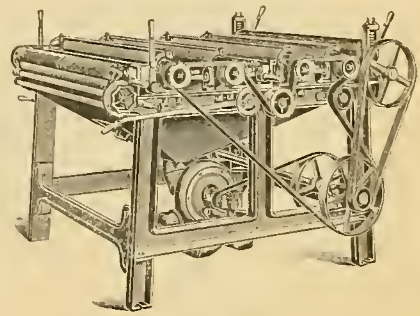


Fig. 24.

Fig. 25 shows the shear as built by the Curtis & Marble Machine Co., in its perspective view, and Fig. 26 is a side elevation with parts in section of this shear, being given to show the location of shear blades, brushes, etc., in the machine, also the run of the cloth through the machine. This shear is made with four sets of shear blades, and three brushes for the face of the goods, and one brush for the back of the goods, which makes a very satisfactory arrangement for printeries, bleacheries, cloth rooms, etc., where but one side of the cloth is to be sheared. The brush for the back of the goods is added, since the face and the back of the cloth come against each other when rolled up, and if dirt or lint is left on the back of the goods, more or less of it is liable to come off on the face when the goods are unrolled, and thus cause trouble in the printing and after processes. Besides the arrangement shown, shears are built with two, three, five or six sets of shear blades for the face, and with any desired number of brushes for both the face and the back of the goods.

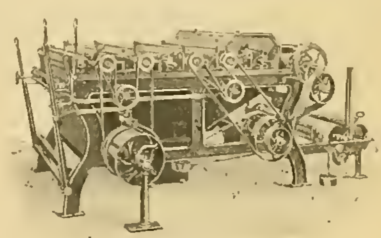


Fig. 25.

These shearing machines are made with swinging cloth rests and stop motion for the revolvers, so that the cloth rests may be raised or the revolvers stopped when seams pass through. The cloth rests, brushes, etc., are held in adjustable boxes so that they can be readily set for any class of goods. On machines for shearing only one side of the goods, a cover is generally placed over the back brush, as shown in the illustration, and the balance of the machine left open, so that the operator may see the work done by the brushes and cutting parts; while on machines for shearing both sides of the goods, the cover usually extends over the entire top of the machine. Underneath the machine is an exhaust fan for taking off dust and lint. Levers are provided at both sides of the machine for starting and stopping the same, as well as for lifting the cloth rests or stopping the revolvers when seams go through. Spreader bars are attached both on the front of the machine where the cloth enters, and at the delivery end just before the cloth is rolled up, for taking out wrinkles and turned edges. The illustrations (Figs. 25 and 26) show a horizontal rolling-up attachment for the goods, having two wooden drums, upright standards, brass slides, cams, weights, etc., to give the required amount of pressure to make a smooth, even roll; however inclined rolling brackets with slides, weights, etc., may be put on (see Fig. 27) or the machines may be run in connection with calender rolling machines, singeing machines, etc.

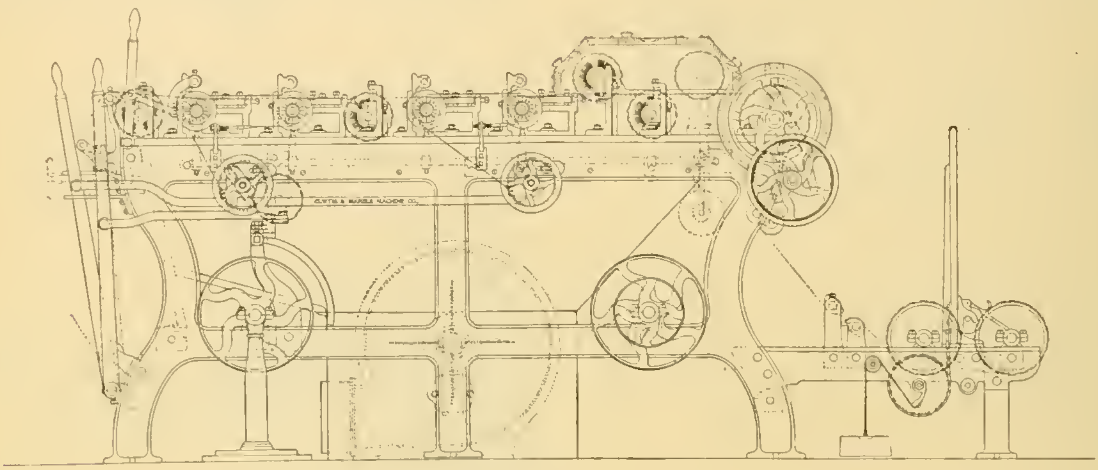


Fig. 26.

Where both sides of the goods are to be sheared, as is the case with most gray goods in cotton mills generally, various cleaning appliances, such as emery rolls, sand rolls, card rolls, beaters, brushes, etc., are used in addition to the shear blades, and since there are usually more threads on the face or thread side of the goods than on the back, there are more shear blades put on the machine for the face than for the back of the goods. The most common styles have either two sets of shear blades for the face and one set of shear blades for the back, or three sets of shear blades for the face and one set for the back, or three sets of shear blades for the face and two sets for the back, in connection, of course, with the cleaning appliances already referred to. Fig. 27 shows such a cotton shearing and brushing machine in its perspective view, the machine being made with one emery roll, one beater, one card roll, two brushes and two sets of shear blades for the face of the goods, and one emery roll, one beater, one card roll, two brushes, and one set of shear blades for the back of the goods. The cover over top and front portion of the machine is shown removed to show the various parts of the machine previously referred to.

On all shearing machines it is advisable to have brushes in front of the shear blades to brush forward the threads and fibres, and have them project from the body of the goods so that the shear blades may trim them off, and also brushes back of the shear blades to remove any loose threads or lint that may cling to the goods after they have passed the cutters.

Where emery rolls, sand rolls or beaters are used, they are commonly put on the front of the machine, where the cloth enters, as shown in Fig. 27. In this way they require but little additional floor space, and are valuable additions for thoroughly cleaning the goods. The emery rolls do good service in removing motes, leaf, chits, etc., and are used especially on the medium and heavier classes of goods, such as sheetings, shirtings, drills, tickings, ducks, etc. For lighter goods they may be covered with finer emery than usual, or with sandpaper, as preferred.

The beaters have steel blades with sharp edges which run against the goods and knock off many of the little knots and nubs which it is difficult to get off in other ways, as well as loosen much of the other dirt so that the card rolls, brushes, etc., which follow, may take it off; they are of great value in connection with the other cleaning appliances and may be used to advantage on quite fine goods as well as on coarse. The card rolls are covered with tempered steel fillet, having less bend to the teeth than usual,

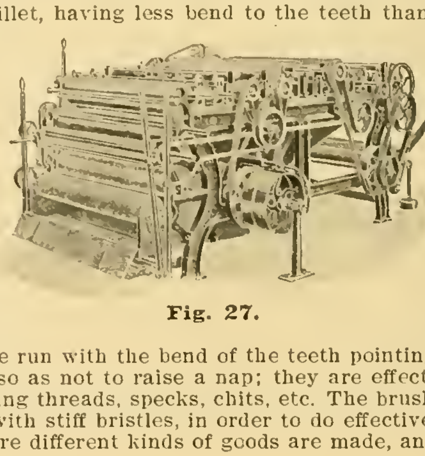


Fig. 27.

and are run with the bend of the teeth pointing backward, so as not to raise a nap; they are effective for removing threads, specks, chits, etc. The brushes are filled with stiff bristles, in order to do effective work.

Where different kinds of goods are made, and some of them do not require as much finishing as others, by changing belts, or taking off some of the belts entirely, either the emery rolls, card rolls, beaters or shear blades may be stopped, and as many parts of the machine used as will best adapt it to each grade and variety of goods.

An exhaust fan is placed underneath the machine, to carry off dust and lint, and covers are placed over the top and around the emery rolls and beaters in front to keep the room free from anything arising from the machine. Swing cloth rests and a stop motion for the revolvers are provided, to prevent cutting the cloth when the seams go through.

The machines are made with rolling brackets at the back side to put the goods on rolls (either an inclined attachment, as shown in the illustration, or a horizontal attachment as had been shown in connection with Figs. 25 and 26), or they are run in connection with calender rolling machines or gas singeing machines, and will finish from 25,000 to 35,000 yards of cloth per day, they being built in different widths, for goods from 27 inches to 64 inches wide.

The Float Thread Shearing Machine, with change speed device, foot lifting arrangement for revolver, spreader roll, enclosed flock box and bonnet back of revolver, swivel frame in front for spot lappets, and rolling head at rear.

Fig. 28 shows this shear as built by the Curtis & Marble Machine Co., in its perspective view, the same being designed especially for cutting float or bridge threads on fancy spot cotton, and other goods, in which the spots are produced either with filling floats, warp floats or are lappet spots. It will be readily understood that such goods cannot be handled on regular shears, for which reason this float shearing machine has various attachments to facilitate the handling of different styles and patterns of these kinds of fancy goods.

On the front of the machine is a brush which acts on the face of the goods for brushing up the fibres so that the shear blades may trim them off. This brush may be run in either direction as desired, and means are provided for throwing the cloth entirely out of contact with the brush when its use is not required. A beater with wooden wings is provided for cleaning the back of the goods.

Another valuable feature in this machine is the change speed device, by which the speed of the cloth may be quickly changed independent of the other parts of the machine, according to the pattern and the amount of material which you have to cut off. This change speed device enables each particular style of goods to be sheared at the highest practical speed of the machine, consequently increasing production.

There is also a lifting device applied for raising the revolver by means of a foot treadle when the seams go through. This device is very convenient, and is appreciated by all shear tenders, as it leaves both hands free for straightening out and guiding the cloth free from wrinkles. From the fact that these spot goods are usually constructed with a comparatively light body or ground texture and oftentimes have open work stripes in them, there is more or less tendency for them to wrinkle or draw in together, especially at the seams; and the shear is therefore arranged so that the operator can lift the revolver with the feet, leaving both hands free for straightening out and guiding in the goods whenever this may be necessary. Previously this lifting of the revolver had to be performed by the attendant taking hold of the cross bar at the front of the frame on which the revolver is mounted, and this usually required him to stand centrally in front of the machine, at the same time requiring, as a rule,

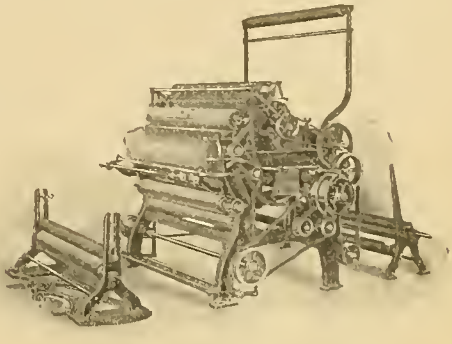


Fig. 28.

the use of both hands to properly effect the lifting of the revolver.

Fig. 29 is a side view of such parts of a float thread shearing machine as will show the nature of this lifting mechanism. Letters of reference in the illustration indicate thus: A the main frame of the machine; B the cloth rest; C the ledger blade; D the revolver or shear cylinder mounted upon the carrying frame F, connected by a hinge to frame A by shaft E; H indicates the draft roll; I the brush; and *a* the various guide rollers for directing the cloth (represented by the dot and dash line K) through the machine in the direction indicated by arrow.

Referring to the lifting device more particularly, we find provided at each side of the machine a lifting connection 3, having an upper end or head 5 operatively engaged with the frame F, as carrying the revolver D, while its lower end is joined by a pivot stud 4 to the rear arm of a rocker lever 6, that is

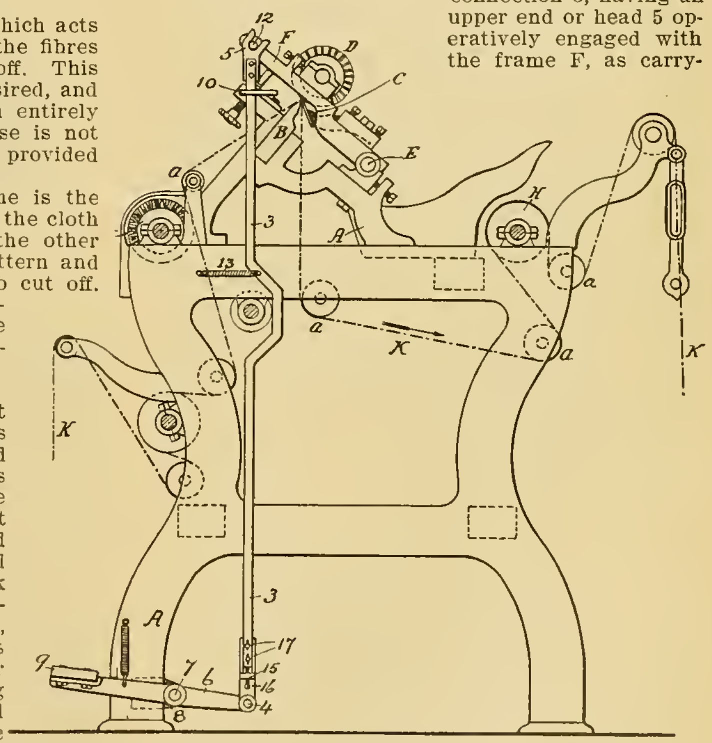


Fig. 29.

mounted on a shaft 7, supported in stationary bearings 8, fixed to the lower part of the frame A; said shaft being movable in its bearings and extending across the frames for uniting the rocker levers at each side of the machine to rock in unison. 9 indicates the foot board supported upon the forwardly projecting arms of the rocker levers 6 and which foot board extends across the front of the machine. The upper part of the connecting bar 3 is supported to slide in a guide 10, attached to the frame of the machine, and the head 5 of the bar is furnished with a jaw adapted to engage with a projection 12, fixed in the end of the revolver carrying frame F. The slot or opening through the guide 10 is elongated to permit limited backward and forward swing of the connecting bar 3 to accommodate the curved line of movement of the hinged frame F, a small spring 13 being attached to the connecting bar 3 to normally draw it to the front end of said slot in guide 10. The jaw of the forked head 5 is open upwardly, but engages beneath the stud 12, so that while the frame F can also be lifted independently by hand, by the hand bar (not shown) as provided in front to the frame F, without reference to the connection 3, the studs 12 then passing by this method of lifting the revolver out of their forks 5, returning again thereinto when the frame F is again dropped to working position. The connecting rods 3 are provided at either their upper or lower ends with adjusting means for varying the length thereof, said means consisting of a grooved bracket 15, embracing the bar 3, and provided with an endwise adjusting screw 16, fitted in a lug thereon, and clamping screw 17, arranged through longitudinal slots in the plate of the member for holding and releasing the adjustment. In the operation of the machine, the attendant by placing his foot upon the foot board 9, effects the lifting of the cutting parts away from the rest whenever necessary or desired, without passing to the central front of the machine.

The cloth K after leaving the shear, is shown to pass through a folder, for laying the goods in even folds on a tilting table, or if the table is tilted and a scray provided underneath, the goods may be run endless. However, as a great many of these goods are handled on rolls, a rolling head, placed back of the machine, as shown, at the left, in Fig. 28, can be provided in place of the folding attachment previously described, in this way keeping the goods cleaner and smoother, besides reversing the direction of shearing at each run of the machine. (This lifting device thus explained, although more particularly designed for these float thread shearing machines has proved of such advantage that the Curtis & Marble Machine Co. have added it to several of their other makes of shears for other goods, more especially to their double cutter woolen and worsted shear for lifting both the front and back revolvers, thus enabling the operator to lift either the front or the back revolver by means of foot treadles in front, at either side of the machine).

A spreader roll, as shown in connection with Fig. 28 is used in many cases in these float shearing machines in front of the cloth rest, so as to hold the goods out in width and remove wrinkles. This spreader roll is made with brass trucks and slides inside, and as the roll is turned by the cloth in passing around it, the slats are drawn outward from the centre toward each end. It is of advantage on almost all goods and will be found especially useful on light goods which tend to draw together, or goods with open work stripes.

The material cut off by the blades may be held in an open flock box and removed from time to time as it accumulates, or the machine may be equipped with an enclosed flock box and bonnet back of the revolver, with inlet and outlet pipes ready for connections to a blower, and an exhauster for sucking off the material as fast as it is cut off. As a large amount of material is cut off on many fancy spot goods, this is a very desirable attachment, and keeps the machine and the room much cleaner than if the flocks are allowed to accumulate. Where an exhauster and blower are used, a current of air from the blower enters at each side of the machine, just back of the revolver, to sweep the flocks away from the back side of the blades toward the centre, whence they are sucked off through a pipe by the exhauster, and are then discharged to any convenient part of the room or mill. The discharge pipe to connect from the machine to the exhauster, may run either up or down, according to the location of the exhauster and blower, which are often placed on a platform underneath or overhead, wherever it is most convenient for parties to drive them.

For shearing spot lappet goods, a swivel frame is used as shown in Fig. 28, in order to give a "skewing effect" to the goods as they pass through the shear. This skewing effect is required for throwing up the bridge threads as they run diagonally from spot to spot. This swivel frame is not required for ordinary spot goods, produced either by means of floating warp or filling.

On spot goods, produced either by means of lappet weaving or floating the filling, all the work of cutting off the float or bridge threads is done on the shear, whereas on spot goods produced by means of warp floats, the bridge threads must be cut open before going to the shear by means of a loop cutting machine, which is also built by the Curtis & Marble Machine Co., and of which Fig. 30 shows a specimen

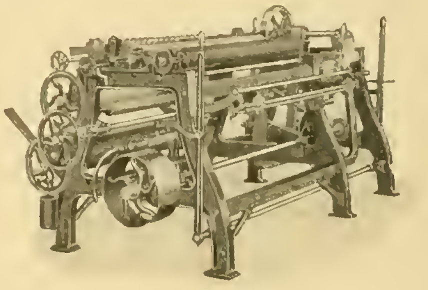


Fig. 30.

in its perspective view. After being cut in this way, the projecting threads are sheared off close on a float thread shearing machine.

The cutting on the loop cutting machine is done by a series of knives attached to a bar which vibrates rapidly across the goods as they pass through. These knives are set so as to cut each way from the centre toward the selvages, and are made with a rounding point, so that they may pass under and cut the loop threads without cutting the goods themselves. Knives with different shaped points may be used, according to the nature of the goods and pattern. The machine is also provided with the necessary tension bars, guide collars and friction roll for drawing the goods out smooth and even, and guiding them straight into the machine.

Before reaching the knives, the goods pass over a spreader roll, which removes wrinkles or creases, and holds the goods out in width. At each side of the knives are nip rolls which hold the goods firmly during the cutting process, and hand wheels are attached to the bottom nip rolls for convenience in threading in the cloth. The rear set of nip rolls are made adjustable so as to bring the cloth closer to or farther away from the knives, and a hand lever is provided to throw the goods entirely out of the way of the knives when seams go through. There is also a stop and start motion provided, governed by a friction clutch, so that the cloth may be readily stopped and started in its travel through the machine while the other parts are in motion. A change speed device is also provided by which the speed of the cloth is quickly changed, according to the pattern of the fabric, which is being cut, since patterns in which there are long float threads between the spots, may be cut at a faster speed than fine patterns, *i. e.* patterns where the bridge threads are comparatively short. After passing through the machine, the goods are rolled up on brackets at the rear, ready for delivery to the float thread shearing machine. To insure good results, *i. e.* clear, defined spots, the threads which form the spots must be tied reasonably tight and firm into the body of the goods, since otherwise some of these threads, as forming the spots, when interlaced only loosely to the fabric, will pull out during the cutting and shearing processes.

SPRINKLING, DAMPENING, OR SPRAYING.

When cotton goods have been starched and dried, they must be dampened before they can be subjected to further operations. This preliminary operation of dampening, *i. e.* conditioning the cloth for calendering, is one to which frequently little importance is attached, and yet upon it the successful final finish of the fabric greatly depends, since if the goods are insufficiently dampened, they will become hard, rough, paper like, taking the pressure of the calender rollers imperfectly, fold badly, do not press nicely, and finally, in the finished state, present an unmarketable appearance. Again if on the other hand, the goods are too much dampened, they will become limp, flabby, without body, in short we also will obtain an unmarketable fabric; from which it will be readily seen that the proper amount of dampening, according to the character of the fabric under operation, is a most important item to the finisher, which under no condition can be slighted. It may be also well to quote here the fact that if the goods are left in a too warm or too damp place, mildew may be formed, in turn destroying not only the colors but the very fabric itself.

From this it will be seen that this sprinkling, dampening or moistening is one of the most important operations of finishing cotton goods, for which reason it is imperative that it is done even, uniform, as well as thorough, *i. e.*, the water must be thrown against the cloth in a very fine spray, and this with such force that it will penetrate into the structure.

Fig. 31 is a diagrammatic side elevation of the latest form of machine for doing this work, built by the Textile-Finishing Machinery Co. The framing of this machine corresponds practically with the one used for the old fashioned brush sprinkler or sprayer, however, the same can be built of any design or style required. The dampening or spraying part is where the secret of the success of this machine lies. By the former method, revolving brushes to throw the spray or moisture on the goods were used, and which were usually made on a wooden core or centre and of bristles, wire or some substitute. From their construction these would wear more or less unevenly, become waterlogged at times and then when run in this condition, throw an uneven as well as an unpenetrating spray, on to the goods, with the result that the goods will be dampened more in one place than in another and consequently make the finish that the goods will take, uneven or blotchy.

The spraying device of the machine under discussion and as manufactured by The Textile-Finishing Machinery Co., consists of a copper box with proper nozzles or atomizers set in, and an air pressure blower for forcing the water through the nozzles and spraying it on to the goods. There are also proper devices for regulating the amount of water in the box so that any degree of coarseness from the finest fog to almost a coarse rain drop can be obtained. The pressure of the air is also such that it will throw the spray or moisture against the cloth with force sufficient to drive it into every part of the structure of the fabric under operation, thus insuring the even dampness required for the finest and best results in calendering.

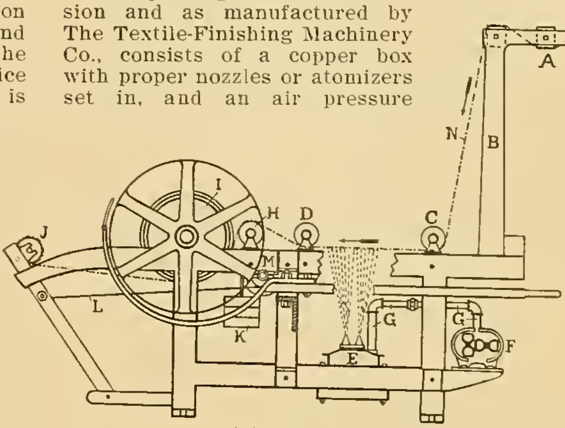


Fig. 31.

The construction and operation of the machine is thus: The cloth is entered in the machine at A, passing over three overhead tension rails held in two uprights B (one on each side frame of machine). C and D are guide rolls for presenting the cloth to the action of the atomizer E, connected by regular pipe connection to the water supply of the mill; the amount of water in the box being regulated by a regular float valve inside. F indicates the air pressure pump driven by means of a pulley on the other end of the shaft, and which forces the air through pipe connections G into the atomizer E.

From guide roll D, the cloth in turn comes into contact with a spiral groove roll H, for smoothing, *i. e.* stretching the cloth widthways, to take out wrinkles, as well as straighten the selvages. After leaving spiral roll H the cloth passes around a portion of the wooden drum I and onto cloth roll J, which consists of an iron centre mounted upon which is a wooden shell; the cloth being wound upon said cloth roll J by means of the latter being held in contact with the wooden drum I, by means of weight K and strap L as fastened to pulleys on shaft M. The run of the cloth through the machine is shown by means of dotted line N.

Fig. 32 is a sectional diagram in outline of the dampening machine as built by the Arlington Machine Works, and which in its main features consists of a wooden box in two parts, one placed within the other; the bottom part 1 to contain water, the top part 2 to confine the spray or dew within its area. The top box 2 is fitted with two adjustable lids 3 and 4, for regulating the area of exit 5 for the spray, and which in turn regulates the quantity of water, spray, or dew diffused on the cloth during its travel over said aperture 5 of top box, the dew or spray being produced by a quickly revolving brush 6, of which the periphery or tips of bristles or copper wire are slightly immersed below the level of the water line 7. This water level 7 is regulated by overflow for heavy or light conditioning, *i. e.* damping, as required by the character of the particular fabric under operation.

The cloth enters the machine through tension rails 8, 9, 10, 11 and 12, then passes under and over guide rollers 13 and 14. The interval of time the cloth takes in traveling between these two rollers 13 and 14 is the time when the damping takes place. The cloth is then reeled by means of frictional contact with surface of wood drum 15. The reel of cloth 16,

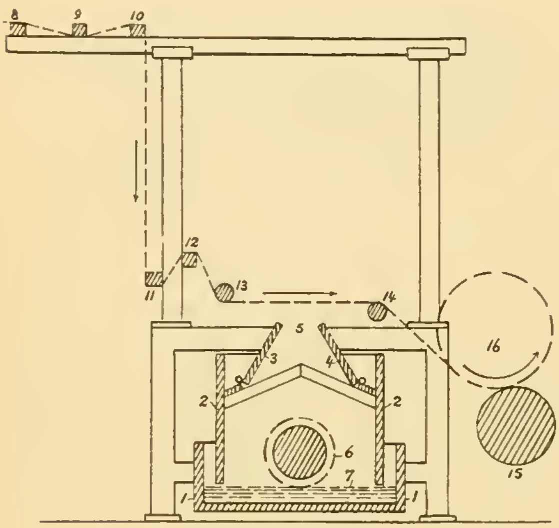


Fig. 32.

thus formed on wood drum 15, is under some pressure, applied by swivel levers weighted at their ends, and which bear on the ends of the rising spear extending through centre of reel, as it gains in diameter by accumulation of cloth. The run of the cloth through the machine is indicated by dotted line.

The revolving brush or sprinkler 6 is made in two different ways, one with ordinary bristles secured to a wooden roll, the other a copper tube with a wood centre forced in, having copper wires tapped on outside surface of copper tube and suitably pitched out. The latter sprinkling device is more advisable to use, since then there is no likelihood of loose wires flying on to the cloth, as is the case with the bristles where they are used, and which loose bristles are then carried away by the cloth, and in turn wound in the reel, and which bristles then in calendering will damage the fabric.

For a description of the construction and operation of the spraying machine as built by the Curtis & Marble Machine Co., see page 350.

Oxidizing machines are also sometimes used for damping, especially where goods are to be only slightly damped. Such machines are composed of an iron chest, furnished inside with metallic rollers over which the cloth is made to pass, a strong jet of steam being let in, which softens the goods, and when it is then easy to regulate the degree of moisture by opening the steam cock more or less. If it is desired to work with very moist steam, the latter is passed through a reservoir of water where it becomes super-saturated with moisture.

The machine operates quickly, for which reason the cloth may be passed twice or three times through the machine. After finally leaving the machine, the cloth is made to wind on a roll so as to keep it in its proper damp state for perfect calendering.

BRUSHING.

This process is practised by cotton manufacturers for the finishing of goods sent to the market in the "brown" *i. e.* goods requiring no other process of finishing.

Fig. 33 shows in its perspective view, the Cotton Brushing Machine (with Calender Rolling Machine attached), as built by the Curtis & Marble Machine Co.; the same being arranged with one pair of emery rolls and beaters in front, and with two card rolls and one stiff brush on top for each side of the goods, to finish them by once running through. This arrangement of card rolls and brushes however may be varied, to suit special makes of fabrics in a mill; all brushes if desired being also supplied by the builders of the machine. The emery rolls and beaters are valuable additions for a more thoroughly cleaning the goods.

The emery rolls do good service in removing motes, leaf, chits, etc., and are used especially for the medium and heavier classes of goods, such as sheeting, drills, shirtings, ducks, etc.; for lighter goods, either brushes, sand rolls, or finer emery rolls may be put on, or only the beaters used in front.

The beaters have steel blades with sharp edges which run against the goods and knock off many of the little knots and nubs which it is almost impossible to get off by any other means, as well as loosen much of the other dirt, so that the card rolls and brushes which follow may take it off.

The brushes are set with very best quality Russian stiff bristles, softer and cheaper bristles, beyond brushing off loose lint and dirt, being of but little service.

The card rolls are covered with tempered steel fillet made expressly for this work, with straighter teeth than usual, and are run with the bend of the teeth pointing backward, making good appliances for removing chits, motes, specks, etc., without raising a nap.

The machine is entirely covered on top and around the emery rolls and beaters (the covers being shown removed in the illustration in order to show the different rolls, etc.), and has a powerful exhaust fan underneath to carry off dust and lint, leaving the room free from anything arising from the machine.

These brushing machines are made either with rolling up brackets attached to the back side of the machine for winding the goods on rolls, or are run in connection with calender rolling machines, as shown in the accompanying illustration, and when the work

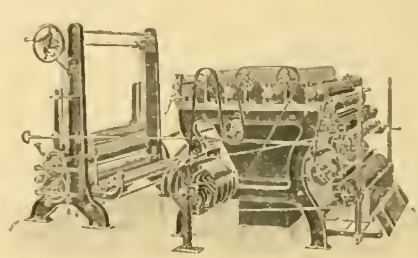


Fig. 33.

of both machines is done in one operation. The iron rolls of the calender head may be made to run either hot or cold, as desired, and with the above arrangement the goods are first thoroughly brushed and cleaned, then passed over a steam vapor cylinder to receive a light vapor of steam, to aid in smoothing out the goods and giving them a softer finish and feel, and then in passing around the iron rolls of the calender head, are freed from wrinkles and puckers and rolled up in firm, hard and even rolls. After being treated in this way and allowed to stand tightly rolled up for a few hours, or over night, when taken off the rolls, the goods then have a much smoother and better finish and feel. The amount of steam is easily regulated, so that the goods may be dampened in this way without giving them the harsh feeling often occasioned by the use of water. A cut off valve is attached to the steamer, to shut off the steam when the machine is stopped, and thus avoid excessive steaming or wetting in one place. A pair of long racks rests on the ends of the wooden roll on which the cloth is wound, and the requisite amonnt of pressure for making as hard a roll as desired, is obtained by a friction strap and cam at the top; the amount of pressure being easily regulated as required for different classes of goods.

An adjustable measuring attachment for giving an accurate measurement of the goods as they are rolled up, and also a revolving stretch roll, as shown in connection with Fig. 35, are added by the builders to the machine if so required.

If shear blades are desired, they are also added, and this for shearing either one or both sides of the goods. This arrangement then is the most complete arrangement presented to manufacturers for finishing goods which are sold in the "brown," or that are not further treated or finished. The machine will finish from 25,000 to 35,000 yards of cloth per day, and is built in different widths, for goods from 27 inches to 120 inches wide.

CALENDERING.

This process of finishing cotton goods is done on machines known as Calenders, and has for its object to impart smoothness (flatness) and lustre to all fabrics passed through it.

The simplest calender consists of two rollers or cylinders, one of which is of metal and permits heating, whereas the other is a solid roll made of paper, husk, cotton, etc. (see special article on Combination Rolls pages 382-383.) By means of screws, levers, etc., a pressure is given to these rolls (sometimes termed bowls) between which the fabric passes and the fibres thus become flattened. The amount of flattening and lustre depends (1) upon the material of which the solid rolls are made; (2) the pressure to which the fabrics are subjected; (3) the amount of friction between the rolls; (4) the temperature of the rolls; and (5) the constituents of the starch or filling as has been previously used in starching the goods.

The variety of ways in which a calender may be used, and the variety of finishes which can be produced is very great, and partly dependent on the conditions specified before, as well as the manner in which the cloths are passed through the calender.

When a piece is passed through once it is said to have had "one nip," when twice "two nips," three times through "three nips," and so on. Calenders are built either with two, three or five rolls.

In constructing these machines it is important to ensure that the centres of the various rolls are in vertical lines so that the nips, given to the cloth as it passes between them, are directly downwards and any deviation from this direction will generally lead to damage of the cloth.

In the case of friction calenders for bright finishes, another source of damage to cloths may arise from said friction being liable to be more than the cloths will stand, for in these calenders the cloth is rubbed, by the speed of the rolls being greater than the rate at which the cloth passes through the machine. With such calenders several sets of gearing wheels should be provided, so that the speed of the friction roll can be varied to suit the strength of the cloth and the amount and character of the starching compound used.

The rolls of friction calenders are liable to be damaged by abrasion if they are run without any cloth passing through them, especially if the speeds be very high, the reason being that in such machines the roll next to the friction roll is usually driven by frictional contact with two other rolls revolving at unequal speeds. This roll, therefore, is acted on by unequal forces, one tending to drive it quicker than the other, with the result that considerable friction ensues at the point of contact, and which friction is liable to cause abrasion of the surface of the middle roll. This is not desirable, and, to avoid it, allow the calender to be driven, only at a low speed, and this only when cloth is between the nips.

The heating of the metal rolls for glazing finishes can be done in three ways.

(1) By bars.—The metal roll is made hollow, and iron bars, from 8 to 12 inches long, and about 1 inch smaller in diameter than the hollow of the bowl, are heated red hot and inserted. In this way the roll becomes very hot. This system however is a very old one and has been practically replaced by either gas or steam heating. The temperature of the roll by means of bar heating could then be raised very high, from 500 to 600° F., and thus very bright glazes were obtained by means of them, on the other hand, the system was troublesome to work, and the high temperature had an injurious influence on the solid rolls —cotton, husk or whatever kind used—of the calender.

(2) By gas.—In this method the roll to be heated is also made hollow. A perforated ¾-inch iron gas pipe traverses its whole length and a mixture of gas and air is forced in. This burns at the perforations in the form of non-luminous flame. By careful regulation of the amount of gas burnt, the temperature of the roll can be regulated with nicety, and every variety of glazing finish can be obtained. The proportion of air and gas requires careful regulation, so that a perfectly smokeless flame is obtained. Too little air and too much gas leads to production of luminous, smoky flames giving comparatively little heat; too great a force of air prevents the gas from burning properly.

(3) By steam.—In this instance the roll is made hollow as before, and is fitted with steam-tight flanges. A supply conveys steam from a boiler and an exit pipe carries away the exhaust steam. This system is the most convenient but can be used only where lower temperatures are required. The solid rolls will last longer where steam is used, the temperature never gets high enough to damage them as it is liable to do with gas or bar heating, and the lower temperature may be counterbalanced any time by higher speed and heavier pressure.

Calenders should be provided with an arrangement so that when out of use the rolls can be separated from one another, since if left in contact, the softer solid rolls, are liable to become flattened somewhat at the nip, and what is rather detrimental to the finish of the cloth. Too much care cannot be taken to keep the rolls of a calender in good condition, because upon the polish of the surface and its smoothness depends the quality of the finish produced by it. Steel and iron rolls require frequent wiping down with dry cloths to keep them free from damp or water which would cause them to rust and pit, in which condition they are useless. The solid rolls, whether cotton, paper or any other combination, are not so sensitive to damp, but still it is advisable to keep them dry, as long exposure to it would injure them by softening their surfaces unevenly in places.

Oil and grease must not be allowed to get on the rolls, for although it will not damage them, it might lead to stains on the cloth, which it is next to impossible to eradicate.

Some of the 2-roll calenders are built with both rolls being hollow metal rolls, both arranged for permitting heating by steam (either one or both or none) and which in turn are more particularly used only as pressure calenders on heavy fabrics.

Fig. 34 shows in its perspection view the 2-roll pressure calender as built by the Curtis & Marble Machine Co., and which is chiefly designed for use on medium and the heavier grades of cotton duck, for flattening down knots and bunches on the surface, so as to give as smooth a finish as possible. This machine has two heavy iron rolls about 12¾" diameter with means for giving increased pressure. On narrow machines, levers with weights, as shown in the illustration, are commonly used, while on wide machines, screws are provided at each end of the rolls. These rolls may be made to run either hot or cold; again a steaming apparatus (steam-box) may be used in front if desired, to slightly moisten the cloth before entering the rolls.

The machine is usually run in connection with brushing and calender rolling machines, when the fabric passes first through the brushing machine, where it is cleaned of chits, specks, and other dirt, then through the pressure calender for pressing down the lumps and knots, and then through the

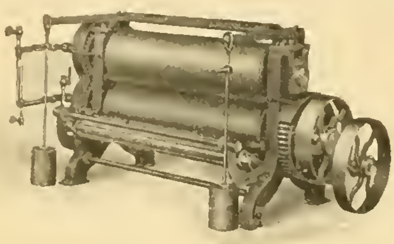


Fig. 34.

calender rolling machine, where it is still further smoothed or ironed, and rolled in firm, hard rolls. This combination of three machines arranged to run in connection with each other, with expansion pulleys to regulate the speed of the cloth, is a most complete and satisfactory arrangement for finishing the heavier grades of duck. The machines are built in widths for handling goods from 30 to 120" wide.

Fig. 35 shows in its perspection view the calender Rolling Machine with Measuring Roll, Steamer and Revolving Stretch Roll, as built by the Curtis & Marble Machine Co. The iron rolls may be made to run either cold or hot, and the process of smoothing out the goods and rolling them up in hard, even rolls, free from wrinkles and puckers, is the same as in the similar machine (Fig. 33) described in connection with the "Cotton Brushing Machine."

The adjustable measuring attachment consists of a measuring roll made one yard in circumference, with an expansion pulley on the end, and attached to the side of the machine is the measuring dial, made to register up to 2600 or 5100 yards, as desired; the expansion pulley may be varied in diameter, and as some goods are more elastic than others, and consequently stretch more in running, the size of the pulley may be so adjusted as to give an accurate measurement of any kind of goods as they are rolled up. The steam vapor cylinder is for slightly moistening the goods before being rolled up, to aid in smoothing them out and giving them a softer and brighter finish than otherwise obtained.

The revolving stretch roll is made with wooden

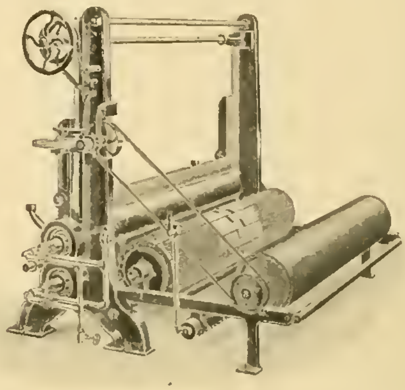


Fig. 35.

slats on the outside and brass trucks and slides on the inside, so as to turn easily; as the cloth passes around this roll it causes it to revolve, and the slats are drawn outward from the centre toward each end, and thus draw out wrinkles in the goods and avoid creases being made when the goods are rolled up. It is especially desirable for extra wide goods, also for all widths of goods where wrinkles must be carefully guarded against, as, for example, where the goods are rolled up and shipped in large rolls, as required for the rubber, enamel cloth and other trades, in which the goods are coated afterwards. The machines are built in varying widths for goods from 27 to 120 inches wide.

Combination Rolls.—Some nine or ten years ago The Textile-Finishing Machinery Co. introduced on the market a patented fibre roll for use in connection with Mangles and Calenders known since then as a "Combination" roll made from cotton and corn husk combined by a special process in such a manner as to obtain a roll with the smooth surface of a cotton roll and still retain the great elasticity and wearing qualities of the husk roll then in common use for water mangles and for calenders used for many classes of finishing.

This roll (shown in Fig. 36 in its perspection view) has proved of the utmost value for general use in water mangles and calenders,but is especially adopted for all water mangles and calenders used to finish

Fig. 36.

goods requiring a soft finish. For water mangles it has come into almost universal use in the United States on account of its splendid wearing qualities and the uniform work which can be done when it is used, and has almost entirely replaced the husk roll for this work. It has, with excellent results, replaced wood rolls in starch mangles for white goods and is also largely used for starching yarn dyed goods. This roll has proved especially valuable for almost all kinds of roller calenders as it combines for this work all the best qualities of the cotton and husk roll without having the objectionable features of either. When cotton rolls are used in a calender it is usually necessary to join the different pieces of goods together by overlapping and pasting their ends, which not only involves considerable labor and trouble but spoils from 10 to 14 inches of goods at each union. With the combination roll, on account of its great elasticity, it is possible and the universal practice to run the goods with the ends of the pieces sewed together, thus saving much labor and injuring but a very small strip of goods.

Cotton rolls very soon lose much of the elasticity or spring which they have when new and are apt to become dead and hard after a few years' wear, while the combination roll can be used with the best results for years. While the husk roll possesses some of the good qualities which a cotton roll lacks, it is impossible to obtain a nice, smooth surface on it and for this and other reasons it is unsuited for calender use in finishing the majority of cotton goods. The Combination roll will outwear the husk roll. For calender work it has proved its superiority over all other rolls for finishing many classes of white and piece dyed cotton goods such as sheeting, shirtings, cambrics, lawns, print goods, window shade goods, sateens, twills and many others and also for almost all classes of yarn dyed goods such as ginghams, madrasses, shirtings, fancy dress goods, tickings, awning goods, denims, etc. Upwards of 1500 of these rolls are in use at the present time in the United States and England.

Calender Roll Grinder.—When calender rolls, as used in the finishing department of cotton mills got out of true, i.e. got bunchy, then the usual way was to take such rolls out of their housings and send them to the shop where they were made, to be reground. Since these rolls are exceptionally heavy, they naturally make this removal from the frame very costly, again the machine will be idle, possibly for weeks, while the rolls are being ground. This disadvantage to mills created a demand for a portable grinder, one which would grind calender rolls true, in their own bearings, i.e. without the necessity of removal from their housings.

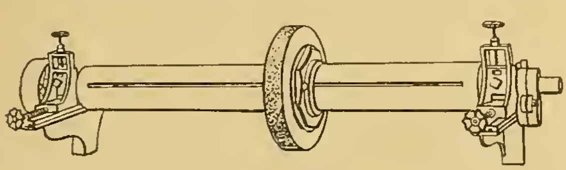


Fig. 37.

The traverse grinder, as shown in its perspective view in Fig. 37, and as built by B. S. Roy & Son, accomplishes this. The same is fitted with a solid emery wheel, and since its installation in any number of cotton finishing plants, has proven a complete success. Not only are the rolls ground without removal from the housings, but at the same time they are ground perfectly true as they are ground in their own bearings. Suitable brackets are fastened to the housings on which are set the adjustable stands and boxes in which the grinder is run. By means of these adjustable stands the grinder can be adjusted horizontally and perpendicularly, while running, to suit. The traverse grinder is fitted with a solid emery wheel, of the proper diameter to reach the rolls from outside the housings, with 2″ face as a rule, and with a special slow, positive, differential motion for slowly traversing the emery wheel, while revolving, until the high places are ground down. The emery wheel should be set very lightly on the roll, just so it can be heard striking the high places. It is not advisable to use a wider emery wheel than 2″. For this work the traverse grinder must be made with an extra strong steel shell, not less than 5″ diameter.

NAPPING.

Regarding this process the reader is referred to pages 326 to 331 explaining the napping of woolens, and which is identical with that for such cotton goods as require this process; the same machines as then explained being used also for the napping of these cotton goods.

CLOTH FOLDING MACHINE.

Fig. 38 shows in perspective view what is known as the cloth folding machine with low back frame and curved apron for feeding-in the cloth to the machine, in order to distinguish it from another style of a similar machine known as the cloth folding machine with high front frame to feed-in the cloth to the machine over the head of the operator, the latter doing away with the low back frame and curved apron, characteristic to the style of machine illustrated; the feeding-in of the cloth to the machine thus being the chief difference between both styles of machines. The machine shown is used both for ordinary gray goods as well as for finished cotton goods; both kinds of machines mentioned being built by the Curtis & Marble Machine Co.

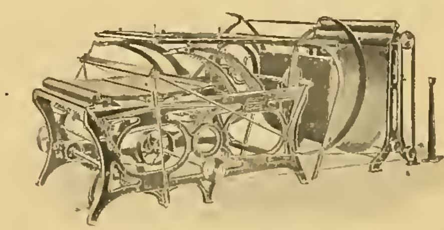


Fig. 38.

In the machine illustrated, as well as in the other style only referred to, the leaves of the table upon which the cloth is folded have a positive opening movement by means of cams and levers in advance of the folding blades, so that the cloth is carried under the jaws without friction on the cloth already folded, and without pulling the cloth from the opposite jaw, or dragging the fold back when the blades are withdrawn from between the table and the jaws. The feeding-in of the cloth and the tension are easily regulated, and accurate measurement may be obtained, whether running at fast or slow speed. The swivel rod for tipping the folding blades is pivoted at the top so that the upper end does not swing upward. This swivel rod works in a hardened steel bushing in the end of the folding blades, and is fitted with an oiling device to keep the rod lubricated and prevent its running dry. Guides are also provided to prevent any motion of the blades sidewise as they move back and forth, and double spiral springs are used on each of the rocker shafts for controlling the bite of the jaws.

For folding extra long cuts, or for heavy or fluffy goods, an automatic drop centre attachment is provided, which lowers the centre of the table in a positive manner, by means of a pawl and ratchet mechanism, as the folds of cloth are laid under the jaws; thus preventing the cloth from rounding up in the middle and lengthening the folds near the last end of the cut. As soon as the piece has been folded and taken out, the whole table is readily raised into position again by the foot lever, the same as on the plain centre machines. The machine is generally made with 4-inch ratchets and jaws, though for goods which require a very large amount of room on the table, longer ratchets and higher jaws can be applied, and which in turn give a greater capacity to the machine.

Referring now to the style of machine illustrated, we find the back frame and zinc apron arranged a few inches above the floor, back of the machine, so as to prevent the operator from stepping in it, giving at the same time the cloth a long run between the apron and the folding blades, so that it has opportunity to be well straightened out when it reaches the table. The small belt which drives the nip rolls runs over carrier pulleys on the back frame, and is generally placed on the opposite side of the machine from that shown on the illustration, so as to be out of the way of the operator in threading in the cloth.

In some cases, where the goods are taken from a high pile on a truck, a high back frame and apron can be supplied in place of the low back frame and apron shown, so as to give a greater lift off from the truck than with the low frame.

These machines, if so desired, can be supplied with dials or indicators to indicate the number of yards folded, the most common style being a dial attached to the right hand side of the machine, at the top of the arch over the table. The dial is then operated by means of a cam on the crank shaft with connecting levers and actuating pawl, and registers each yard. It is provided with a spring and retaining pawl, so that as soon as released, at the end of the piece, it turns back to zero. There is also a rod, with a series of fingers attached, extending across the top of the machine, and turning freely in its bearings. The fingers are held up by the cloth as it is passing into the machine, and as soon as the end of the piece has passed in, the fingers drop, and throw the actuating pawl out of engagement with the dial. The dial therefore can register only when the cloth is passing into the machine, even though the machine is left running. For registering the aggregate number of yards folded per day or week, a counting register may be attached to the machine to register up to 100,000 or 1,000,000 yards.

These machines are also built for different widths of goods, the most common widths being for 40, 44, 50, 54, or 60 inch goods, though either narrower or wider machines than this can be furnished, if required.

Machines are also constructed which can be adjusted in a few moments from one length of fold to another, and where mills have to fold goods in different lengths of folds, and do not have sufficient work for a machine for each length, such a shifting machine can be conveniently used. The most common style of shifting machine built is to fold either 1 yard or 1¼ yard folds, another is to fold either ¾ yard or 1 yard folds, and sometimes such machines are built with as wide a range as 1 yard to 1½ yard folds.

Machines for 1 yard folds only, when running 250 turns, will fold 75 yards of cloth per minute; machines for 1¼ yard folds, when running 200 turns, will fold 75 yards per minute.

For folding pile fabrics like plushes, velveteens, corduroys, etc., which are usually folded in comparatively short folds, ranging from 12 to 24 inches long, a special folder, of a different style from the one explained is built, and which will fold the goods in short folds, and is capable of folding a pile of cloth 18 inches high on the table. An adjustable measuring attachment is commonly put onto folders of this type, to give an accurate measurement of the goods, in whatever length of folds they may be folded.

DOUBLE-DOUBLING.

This process is used in connection with wide sheetings and similar goods to fold the selvages together twice, making them thus a four-ply fold.

Fig. 39 shows in its perspective view the double-doubling machine as built by the Curtis & Marble Machine Co., the operation of which is thus: The roll of goods as it comes to the machine, is placed in adjustable brackets, with lever handle attached, by

Fig. 39.

which the operator can shift the roll from side to side so as to guide the cloth into the machine as straight and even as possible. After passing over tension and guide bars at the top, the goods pass down the first triangle, where they are folded to one-half their original width, making them two-ply. They next pass through draft rolls and over the second triangle, which folds them to one-quarter their original width, making them thus four-ply. The goods then in this condition pass through a second pair of draft rolls and over a large drum to the floor ready to be folded for the market, either by hand or with a machine. The position of the triangles is easily adjusted by means of hand wheels to suit different widths and varieties of goods, so as to bring the selvages even with each other. The machine is built in different widths to suit the style of goods made in a mill.

WINDING AND MEASURING.

The machine for doing this work, and of which a perspective view is given in Fig. 40 is designed for winding goods on boards for the market, and is largely used by mills, bleacheries, printeries, dyeing and finishing establishments, etc., for almost all classes of goods; the same being built by the Curtis & Marble Machine Co.

The machine is provided with tension rods, by which any desired amount of tension may be obtained to wind the goods hard or soft; there being also guide collars to aid in guiding the cloth in straight and even, so as to make a neat looking roll with square ends. The machine is readily stopped and started by the foot of the operator on the treadle bar at the bottom, and the boards on which the goods are wound are quickly clamped and unclamped in the sockets by a hand lever, held in position by a weight, so that any slight variation in the length of the boards is immediately taken up. The cloth is quickly threaded into the machine, and the work of rolling the goods may be done very rapidly.

The machine is built either with or without measuring attachment. In the first instance the measuring roll is one yard in circumference, with nickel plated dial on the end to register up to 60 yards. On top of the measuring roll is a nip roll, so that the cloth must turn the measuring roll as it passes around it, giving an accurate measurement, without danger of slipping. Jaws of any width, from 4 to

9 inches, to suit the width of board used are provided, or if the goods are to be wound on square bars or flat plates, which are drawn out after the goods are rolled up, suitable jaws can be provided. The machines may also be arranged to roll the goods on flat cardboards, paper tubes, wooden sticks, or other devices. These machines are generally built either 3/4 wide for goods up to 28″ wide, or 4/4 wide for goods up to 37″; since however, a 4/4 machine will wind either 3/4 or 4/4 goods, this is the width most commonly used; however wider and heavier machines for 40″, 45″, 50″, 60″ or 72″ wide goods are also built.

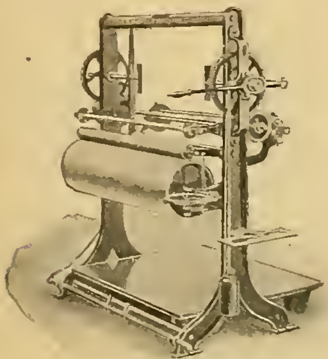


Fig. 40.

Where the cloth comes to the machine in large rolls, an Unrolling Frame is sometimes used in connection with the winding machine, to unwind the cloth from the large roll and deliver it in loose folds into an apron, from which it is taken by the winding machine. The usual speed of these machines is from 175 to 250 turns, according to the style of goods, width of boards, etc.

HOW TO TEST THE VARIOUS FINISHES OF COTTON GOODS.

When required to ascertain how a fabric, of which a sample has been submitted, had been originally finished, examine its external or physical properties, since a practical eye can detect at once if the fabric in question has been only calendered, or if starched on the back only or through the structure, etc.

Examining the fabric against the light it will show whether it has been starched or not. A heavily weighted cloth will lose much of its stiffness by rubbing it between the fingers. If, in tearing the sample, a lot of dust flies off, this indicates a weighted finish, (the more dust the heavier the weighting), and by the aid of the microscope we then may be able to detect whether the starching has been done only superficially or whether it has penetrated into the body of the structure, also if the same contains weighting substances.

The next point of value is to ascertain the amount of moisture in the sample, and which is done by carefully weighing a sample of a known size on a pair of fine scales and after recording this weight then drying the sample in a stove for some time, until there can be no further loss of weight, and when the sample is weighed again, and this weight subtracted from the first weight, the difference then indicating the amount of moisture in sample before it was tested, and from which answer it then will be easy to ascertain by means of proportion the percentage of moisture.

For example:

First weighing to be 6 grains.
Second weighing to be 5½ grains.

Loss: ½ grain.

and 6 : 5½ :: 100 : x; $\frac{5\frac{1}{2}\times100}{6}=91\frac{2}{3}$

and $100-91\frac{2}{3}=8\frac{1}{3}=8\frac{1}{3}\%$ amount of moisture in sample. Although this test and calculation will not show us the kind of finish, yet it is better to make it, since cellulose by itself is less hygrometric than starches, thus if there is a great percentage of moisture present it is a sure sign of the cloth being heavily starched. To ascertain exactly how much foreign matter a fabric contains, treat as large a sample of the fabric under discussion, as can be conveniently handled, after first weighing it with distilled water, containing malt; let it diaggregate, then wash, dry and weigh it. With this experiment the difference in the two weighings indicates the quantity of foreign substances deposited on the fabric; however there may be certain insoluble soaps (softeners) still in the fabric, and for which reason the sample must then be boiled in a weak acid solution in order to remove any fatty substances still adhering to the structure. After this boil, dry sample, weigh again and subtract this weight from the first weighing, the difference between both weighings being the amount of dry finishing matter in the sample and from which, by following calculation given before, it will be easy to ascertain the percentage. However we must also remember that when testing printed or dyed goods, that all colors are more or less attacked by acids.

The next procedure will be to ascertain the constituents used for starching, weighting or finishing and for which treat with boiling water for a few hours, which will remove the feculæ, starches, thickenings, gums, soluble salts, alum, sulphates, chlorides, etc., as well as all mineral or earthy matters, after which, by means of filtering, separate the soluble from the insoluble substances. In order to ascertain the nature of those soluble substances, evaporate part of the liquid, treat a few drops with tincture of iodine, which will reveal starchy substances by turning blue. If no starch present, concentrate the whole solution adding two or three times its volume of alcohol and when glue, dextrine and gum are precipitated. A tannin solution in turn will reveal the presence of gelatin by precipitating the same.

In order to distinguish gum from dextrine use the polariscope, and when dextrine is diverted to the right, gum to the left. The mixture of the two can be sufficiently indicated by basic acetate of lead, which when cold will precipitate gum but not dextrine, whereas when warm, both. If no precipitation is obtained, but an organic substance still shown by the incineration on the platinum blade, then this indicates the presence of mosses, lichens, etc. Sugar is found by Fehling's liquor, before and after interversion; add to the tolerably concentrated aqueous liquor, a few cubic centimetres of pure hydrochloric acid, ordinary concentration, warm in water bath in an apparatus with reflux refrigerator and treat with copper solution. If desired to more closely examine the soluble mineral substances, employ the usual methods of analytical chemistry.

China clay or any other matter as was used for weighting purposes in the sample will be found in the residue insoluble in water, alabaster, gypsum and talc or French chalk, provided such should have been used, in the weighting compound, being also found in this residue.

Resin is detected by boiling the sample of cloth with carbonate of soda, which will dissolve it, its presence then being shown by the precipitate of sylvic acid as is obtained from the liquor when treated by an acid. Other fatty substances do not give any precipitate, but an oily fluid which swims on the surface of the liquor.

Glycerine, if present will be also found in the watery solution and is detected, after evaporation by treating with sulphate of potash.

To ascertain the quantity of fatty matters used in a finishing compound dissolve the latter by means of ether, and when after evaporation the weight of the residue expresses the quantity of fatty matter. By treating this residue with boiling water we then can ascertain if any soluble substances are in the water.

It certainly will be next to impossible to ascertain the exact proportions of the various substances as have been used in finishing a certain fabric submitted for analysis, however having obtained the nature of the substances used, and obtained a fair idea of about the proportions of each used, it then will be an easy matter for the practical finisher to judge on what substances to use on his part and the proper proportions of each, in order to duplicate said finish.

SILK FINISHING MACHINERY FOR YARNS AND FABRICS.

SILK LUSTRING.

The silk, during boiling off or dyeing, as the case may be, has a tendency to contract, which action causes it to lose its smoothness and lustre. In order to give back to the silk these lost properties, the operation of lustring is made use of, and which consists in stretching the silk, in the shape of skeins, while damp, either to its original length, or slightly longer, maintaining said skeins in a stretched condition from one to three minutes and causing them to be rotated or turned gradually while so stretched; together with the action of steam under pressure upon it during the operation, which in turn aids in making the lustre permanent, *i. e.*, setting it. By this process the silk is prevented from shrinking while drying, every portion of the skein of silk during the revolution of the skein being acted upon and a uniformity in the lustre produced throughout the whole skein. Lustring is of special advantage when applied to black dyed silk, and in all instances dry steam should be used.

Fig. 1 shows the silk lustring machine as built by the Webendorfer Machine Company, in its perspective view, showing also the arrangement of its interior. Referring to the illustration, A indicates the hooks on which the skeins to be lustred are hung, said hooks being made of forged steel and covered with brass, the lower hook being secured to a piston of a small engine at the bottom, the pull of which stretches the skein to effect the lustring. The piston is capable of exerting a pull of 19,000 pounds, but as the length of the stroke of the piston is under control of the operator, through the lever F, the tension on the silk can be exactly regulated to suit the requirements.

The hooks work in slides, the upper hook being made adjustable, through a hand wheel E at the top of the machine, so that the same can be set to operate on skeins of different lengths up to 54 inches; or by special construction, 60 inch skeins can be treated in the machine. The chamber B is made of cast iron, and has a double back and sides, the spaces between these inner and outer walls forming a steam chamber. The object of this arrangement is to keep the interior chamber continually hot while the process is in operation, which does away with the necessity of suspending operations from time to time to heat up the interior, as must be done in some of the older types of machines.

An inlet arrangement at C, into the box, is provided, so that the skeins can be moistened by steam, when required, *i.e.* when taken to the machine in a dry condition.

When in operation, the door of the machine is closed, being equipped with a powerful locking device D, operated by a single movement, said door

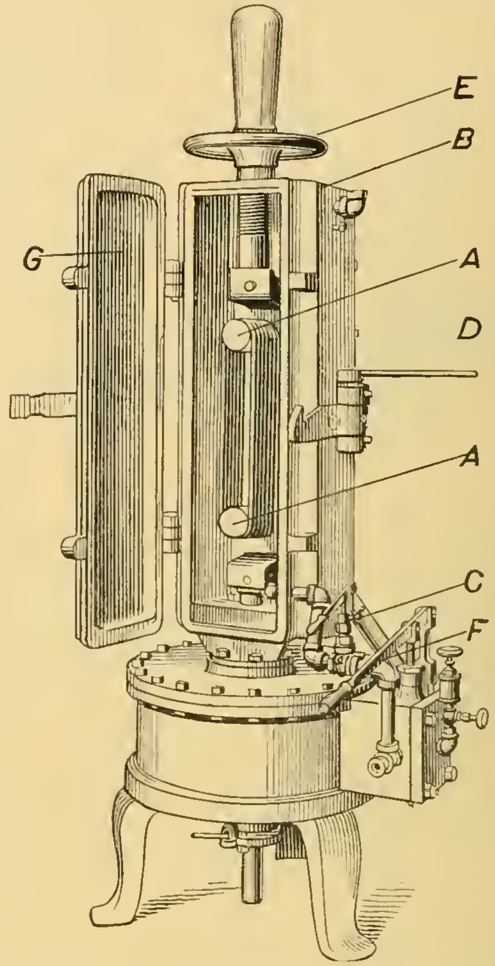


Fig. 1.

being packed around the edges with rubber gaskets, so that it is practically steam tight when closed. A safety valve in the door at G obviates all danger from accident, should the steam pressure in the chamber exceed the set limit for the safety of the compartment. Care should be taken not to overstretch the material in the operation.

The process of lustring takes from one to three minutes, and one person can lustre, with this machine, upwards of 500 pounds of silk in ten hours.

Fig. 2 is a sectional view, partly in perspective, of another make of silk lustring machine; clearly showing the method of stretching the skeins of damp silk spread out on and around a pair of hollow metallic nickel plated rollers 1 and 2 adapted to turn in their respective bearings, the silk while being maintained in said stretched condition and rotated, being at the same time subjected to a dry air temperature of about 120°F.

The upper roller 2 is mounted in bearings 3 and 4, which are secured to the upper part of the I-shaped beams 5 and 6, while the lower roller 1 is mounted in bearings or journals 7 and 8 in the downwardly projecting portions of the inverted U-shaped bridge 9, which is adapted to slide vertically between the legs 10. The bearings 7 and 8 of the lower roller 1 are raised or lowered by means of the screw 14, which passes through a worm gear wheel 13. The screw 14 has a head 15 secured by means of screw 16a to the bridge 9, and when the worm gear wheel 13 is rotated

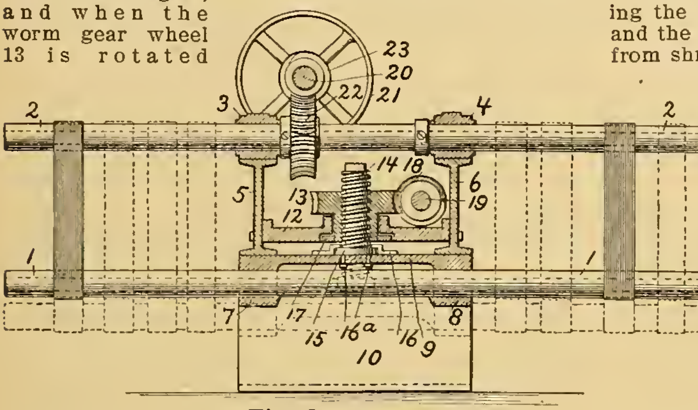


Fig. 2.

by means of the worm 18 on the driving shaft 19 the screw 14 is raised or lowered, and with it the bridge 9 and the bearings 7 and 8, according to the direction in which the worm gear wheel 13 is turned. The worm gear wheel 13 is provided at its lower end with a lock nut 17, which prevents it from rising, but permits it to turn in the support 12, which is secured to the beams 5 and 6. In addition to the head 15 on the lower end of the screw 14 being secured by the screw 16a, it is secured also by means of clamps 16 on the upper part of the bridge 9.

When the skeins of silk have been placed around and spread out on the upper and lower rollers, and the stretching mechanism has been put into operation, forcing the lower roller down until the skeins are stretched to the desired extent (shown in dotted lines), they are left in that position, thereby being prevented from shrinking, and the upper roller 2 is caused to rotate. Power being communicated to the driving shaft 20 by pulley 21, a rotary motion is communicated through the worm 23 to the worm gear wheel 22, thereby causing the roller 2 to turn in its bearings. Owing to the stretched condition of the silk around the two rollers, both are caused to turn in the same direction, thereby giving the skeins of silk a continued revolution around both rollers, so that during the successive revolutions of the silk every portion of the skein is brought in contact with the smooth heated surface of the rollers.

Fig. 3 shows another make of silk lustring machine, the same being a frame, erected in drying room and upon which frame the damp silk skeins are stretched for three or four hours, being at the same time subjected to a drying heat of about 120° F., thus preventing contraction or shrinkage of the fibre while being dried. The heated air of the drying room gradually dries the moist fibre, and owing to their inability to shrink, on account of the stretching machine, they are given an intensified lustre.

The illustration is a side view of the frame, showing the arrangement of the wet skeins of silk fibre and the stretching mechanism which prevents the fibre from shrinking while being dried or after it is dried.

Said frame comprises uprights A, braces *a*, cross beams B, long beams C, and receiving strips *c*. On each side, and near the bottom of the uprights A, a metallic side plate D is secured by screws *d* and which in turn is reinforced by an inner plate, which rests on shoulders cut in the uprights to receive it. A series of shafts I (shown in dotted lines) are journaled in bearings in the side pieces D, one end of each of said shafts having a reduced portion, forming a shoulder which rests in one of the side pieces D, while the other end *i* of each of said shafts I is squared to fit a crank lever O or a ratchet lever O1. On the operating end of each of said shafts I is secured a ratchet wheel G, and a pawl H is secured to the outer side plate D, one for each of said ratchet wheels G. The top receiving strips *c* are provided with segmental notches *c'*, adapted to receive and hold the uppermost rods E, each of which is capable of holding a number of skeins of silk. Each of the said rods is provided with circumferential grooves, one near each end thereof and one midway between the ends thereof, to prevent the displacement of the links *e* and the S-shaped links *e'*, which connect the upper and lower rods in vertical series, (three of which are shown, but more or less can be used) when

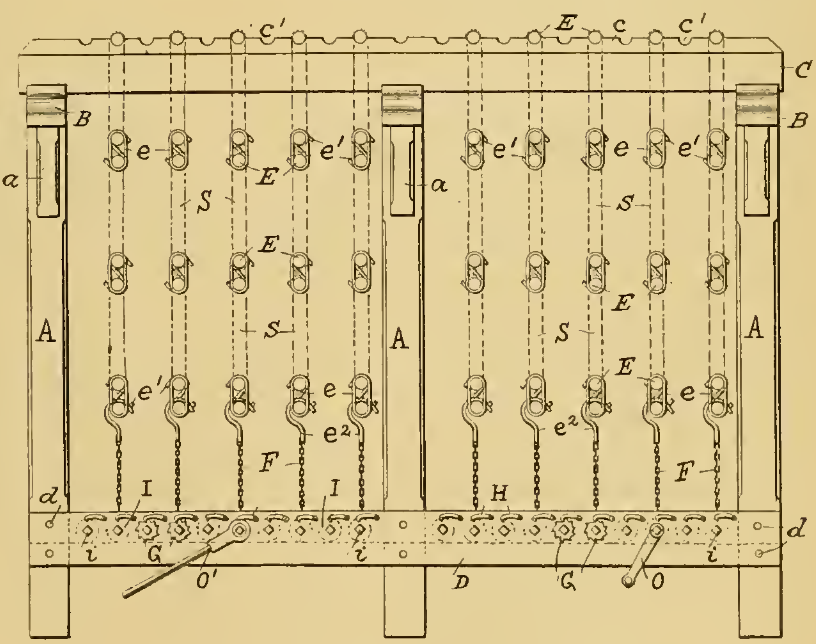


Fig. 3.

they are filled with skeins of silk S. A chain F is secured to each of the shafts I by a hook, and is provided at its other end with a double S-shaped hook e^2, which engages the lowermost of the vertical series of horizontal rods E.

After the damp silk is taken from the hydroextractor the skeins are placed on the rods E, as many skeins as the rods will hold, and are then stretched by the manipulation of the crank and ratchet levers, the temperature of the room being kept of from 90° up to about 120° F., and the skeins left there for three or four hours in that stretched condition.

TENTERING AND DRYING MACHINE FOR SILK FABRICS.

This machine as built by D. R. Kenyon & Son, sizes, dries and tenters silk or silk mixed goods all in one process, and is so constructed that it can be easily and quickly changed to take in different widths of goods to be operated upon. The principle of construction of this machine is the same as the celebrated French machines of this character, although the improvements added to this machine have greatly increased its working qualities.

The roll of goods to be treated, is first placed on slotted pieces attached to rods, directly in front of machine, and which are adjustable for different widths of goods to be treated. The goods, thus placed, then pass over a wood roll, around a lower brass roll and between upper and lower brass rolls, the lower one of which runs in the sizing liquid contained in a copper tank, which tank can be raised and lowered and thus bring the sizing liquid up around the lower roll, and take it away when required. The liquid can be heated by means of a coil of copper piping in the bottom of the tank.

After passing between these two brass rolls, the goods pass over a table, covered with oil cloth, and a brass knife edge scrapes off the surplus size from the goods, which then pass under a small wood roll, and over a roll which is movable up and down in slots of two upright frames, placed opposite to each other on the two sides of the machine.

From this tension roll, the cloth passes under another wood roll to the point where it is fed onto the clamp chain by the operator. Weights are connected to this roll by means of a wire rope, on each side and thus tension can be given to the goods at this point by the tendency of the roll to move upwardly due to the pull by the weights. The tension of course can be varied by varying the amount of weights used.

The goods are thus held by the clamp chain, which tenters them, and at the same time passes them over a charcoal or gas fire which dries them. If charcoal is used to generate the heat, it is done by igniting the same in a large iron pan which travels in and out on a track under the machine. The amount of fire exposed to the goods can be regulated by means of a lid which slides over the pan in the direction of the motion of the goods, thus exposing as little or as much of the fire as is wanted. If the cloth or machine stops, there is a mechanism by means of which the pan can be quickly thrown out of the machine, thus preventing the burning of the goods. It is claimed that charcoal fire gives a lustre and finish to silk goods that cannot be equalled by steam, gas or any other known process of producing heat. A hood is provided over the fire, with an exhaust fan to carry off any fumes.

After being dried by the charcoal, the goods pass around a steam drum which dries the edges as were held by the clamps. After leaving the steam drum, the goods pass under another wood roll and then to the winding attachment which rolls them up.

SINGEING.

This process of cleaning silk fabrics from any loose fibres on the face and back of the structure is identical with this process as practised with cotton and worsted fabrics as previously explained, the same machines being used for this process, and for which reason the reader is referred to page 346 with reference to a description and illustration of the gas singeing machine as built by the H. W. Butterworth & Sons Co. and to pages 366-367 with reference to this machine as built by the Curtis & Marble Machine Co.

FINISHING MACHINE FOR SILK FABRICS.

This machine, shown in its side elevation in Fig. 4, refers to that class of silk finishing machinery which does the ironing and lustring of the fabric as previously impregnated with size, the object being to provide means whereby the size is "set" in the fabric previous to the ironing of the latter.

The frame of this machine consists of two side standards 1, connected together by cross girths (not to be seen in the illustration). On each standard is mounted an upright 2, to which is bolted on the front of the machine a support 3, provided with a brace 4. The uprights 2 are also provided with slots adapted to receive a series of bolts 5, carrying blocks 6, which constitute bearing brackets for a corresponding series of hollow cylindrical rollers 7. Each roller 7 is provided with a pinion 8, the pinion of the lower one only being shown for sake of clearness of illustration, said pinions intermeshing with each other, and all receiving motion through the pinion of the lower roller meshing with a gear 9, which is driven from a gear wheel 10, secured on the main drum 11 of the machine.

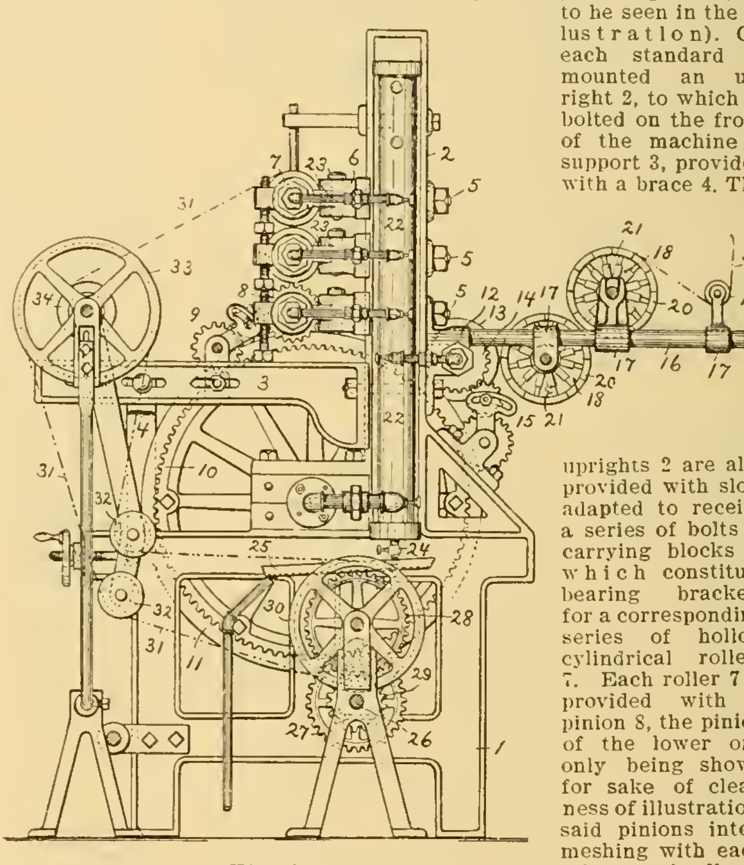


Fig. 4.

From the rear faces of the uprights 2 project brackets 12, which provide bearings for a roller 13, provided with the pinion 14, which is driven from the gear wheel 10 through the intermediate gear 15. A pair of arms 16 project from the brackets 12, and carry supports 17 for the rollers 18 and 19. Each roller 18 consists of a series of sections 20, carried by spring actuated spokes 21, which serve to exert a tension on the fabric as it passes over them, the roller 19 being simply a guide roller.

In each upright 2 is secured a steam cylinder 22, being connected with the series of hollow rollers 7 and roller 13 through a series of pipes 23. For the purpose of drawing off any condensed steam as contained in the cylinders 22, they are provided at their lower end with a pet-cock 24, beneath which is placed a drip pan 25.

The machine is driven by friction devices fastened to one end of shaft 26 (the end not shown in the illustration), the other end of said shaft carrying a gear wheel 27, which drives the drum 11, at the same time also driving the gear wheel 28 through pinion 29. The gear wheel 28 carries a pulley 30, over which is passed a belt 31, said belt running over two small pulleys 32, mounted on one of the side frames of the machine previous to its passing around pulley 33, for driving winding roll 34.

The fabric to be finished is first impregnated with its sizing compound, and then guided under the roll 19, over and under tension rollers 18, to the roller 13, which in turn evenly distributes the sizing compound all over the fabric. On account of said roller being heated, the fabric leaves it with the sizing "set" evenly on the fabric, and this in a partially dried state, with most of said size pressed through the body of the fabric onto its face, whereupon, as the fabric passes around the drum 11, its face being brought into contact with a band of absorbent material placed on said drum 11. This absorbent material completely dries the size in the fabric, at the same time evenly distributing said size all over the face, back and body of the fabric under operation.

The fabric being now thoroughly dry and impregnated with size, next passes to and between the series of heated ironing rollers 7, which, besides calendering the fabric, also, through their ironing action, impart to the fabric the desired lustre. This completes the finishing process, and the finished fabric passes to the roll 34, upon which it is wound, and from which it is subsequently removed.

CRINKLED EFFECTS ON SILK.

Silk filaments, whether in the form of threads, hanks, or fabrics, when subjected to the action of acids under certain conditions, become shortened, the effect depending upon the degree of concentration of the acid employed, the temperature of the bath, and the duration of the immersion or impregnation. It is by suitably regulating these several factors—viz., concentration, temperature, and time—that the desired result, *i. e.* crinkled effect on silk, is attained.

According to a French process, the silk threads or fabrics, in any condition, whether raw, ungummed, or boiled-off, are immersed in an acid bath until the desired shortening effect is obtained, and then washed. The density of the acid, the temperature of the bath, and the time of immersion, are determined according to the magnitude of the effect it is desired to produce, these conditions varying according to the nature of the acid employed.

The degree of concentration of the acid proper to produce the required effect upon the silk must be carefully determined for each acid, as it is only susceptible of variation within very narrow limits. Thus, for example, an active acid will not produce a useful effect if of too low a density, whatever may be the temperature and period of immersion. On the other hand, an acid of too high a density would either burn the silk or fail to produce any useful effect, according as the temperature is too high or too low.

As examples of the extreme limits of deviation allowable in the case of sulphuric, hydrochloric, nitric, and ortho-phosphoric acids, the following directions are given:

SULPHURIC ACID.

Density at 15°=1375 to 1400.
Temperature of the bath=60 to 100° F.
Period of immersion=5 to 15 minutes.

HYDROCHLORIC ACID.

Density at 15°=1130 to 1145.
Temperature of the bath=40 to 95° F.
Period of immersion=1 to 15 minutes.

NITRIC ACID.

Density at 15°=1270 to 1330.
Temperature of the bath=40 to 110° F.
Period of immersion=½ to 15 minutes.

ORTHO-PHOSPHORIC ACID.

Density at 15°=1450 to 1500.
Temperature of the bath=75 to 110° F.
Period of immersion=2 to 15 minutes.

The process may, as before mentioned, be applied to silk whether in the form of threads or fabrics. In the first case, the crinkled thread which results from the action of the acids may be used in the manufacture of fabrics either alone or mixed with other textile fibres. In the case of fabrics the contraction of the silk threads interwoven enables varied effects to be obtained, according to the mode of combination of the silk and other threads in the warp and filling, whilst in the case of fabrics made wholly of silk the effect produced on the fabric, and consequently its final aspect, may be varied by the application of reserves upon the fabric either by printing or otherwise. For fabrics of mixed silk and other threads, the effect varies according to their relative disposition in the fabric, but in any case it is the silk threads only which are shortened by the process herein described, the other threads (such as cotton, wool, etc.) preserving their original length and forming a crinkled surface.

Instead of steeping or immersing the fibres or fabrics in an acid bath, the acid may be applied by printing the pattern upon the fibre, thread, or fabric, with an acid mixed with suitable thickening material, the impression being applied upon those parts which are to be contracted. The printed fibres or fabrics are thereupon immediately subjected to the action of heat until the desired contraction is obtained, after which they are washed and dried. The temperature and period of heating, as well as the strength of the acid employed in the mixture, is to be varied according to the nature and the quantity of the thickener employed and the strength and composition of the fabric. To the printing mixture may be added metallic salts or coloring matters, for example, in the following proportions:—A printing mixture containing 5 per cent. of gum tragacanth and 45 per cent. of real ortho-phosphoric acid printed on silk tulle and afterwards subjected to a temperature of 100°F., for from three to seven minutes, gives good results. With the same composition a good effect may be obtained on foulards, when exposed to a temperature of 110°F., for from five to twelve minutes. With a composition containing 30 per cent. of gommelin, 60 per cent. of real ortho-phosphoric acid, silk tulle should be subjected for from five to ten minutes to a temperature of 105°F., and foulard for from seven to twelve minutes to a temperature of 110°F.

HEAT, POWER, TRANSMISSION AND ACCESSORIES TO MILL CONSTRUCTION.

Heat requires for its production mechanical energy in the proportion of 772 foot lbs. for each unit of heat, which is the amount of heat required to raise the temperature of 1 lb. of water, at or near its temperature of greatest density (39.1°F.) through 1° F.

The ratio of the quantity of heat required to raise the temperature of a given weight of any liquid substance through 1° F., is known as its specific heat, and as compared to the quantity of heat required to raise the temperature of an equal weight of water, at 39.1° F., *i.e.* its temperature of greatest density, through 1° F.

POINTS REGARDING HEAT, BOILERS AND POWER.

Heat of common fire	1140°	F.
Heat of blood	98	"
Water boils at	212	"
Lead melts at	594	"
Brass melts at	2233	"
Iron melts at	3479	"

For each nominal horse power a boiler should have: One cubic foot of water per hour (at least); One square yard of heating surface; One square foot firegrate area; One cubic yard of capacity; Twenty-eight square inches flue area.

One pint of water evaporates into 206 gallons of steam.

Mechanical Stokers will keep the steam pressure more regular, effect a considerable saving in fuel, prevent the emission of black smoke, and besides by means of them, one man will be able to do the work of two or three hand-stokers.

To ascertain proper size of Injector needed for a boiler, multiply the nominal horse power of the latter by 10, the result being the gallons of water needed per hour.

To find the number of cubic feet of exhaust steam that the cylinder emits per minute, multiply the area of the piston expressed in square feet by the speed of the piston expressed in feet per minute.

A horse power (technically expressed H.P. or h. p.) equals 33,000 lbs. lifted one foot in one minute, or its equivalent motion against resistance.

To ascertain the indicated horse power of an engine: Multiply the mean pressure, expressed in lbs. per square inch on piston, by the area of the piston in square inches, and the piston speed in feet per minute, the result being the number of lbs. the engine will raise one foot per minute. Dividing this result then by 33,000, will give the indicated horse power, from which then deduct $\frac{1}{5}$ for friction, in order to ascertain the effective horse power of the engine.

To prevent incrustation to the boiler: Every day throw into the feed water of the boiler, 1½ lbs. of Wyandotte Textile Soda to each 100 gallons of water used. For ordinary hard water this is amply sufficient. For very hard water, 2 lbs. should be used to each 100 gallons of water. Use the blow-off tap freely. The detrimental effect of boiler scales is shown by the following: A scale of ⅛ of an inch in thickness causes 16% increase in the consumption of coal, ¼ of an inch thickness of scale an increase of 50%, and a scale of ½ inch in thickness increases the consumption of fuel 150%. The lime which causes the hardness of the water is precipitated as a muddy sediment by the Wyandotte Textile Soda, which is thus easily removed, instead of forming on the plates and tubes of the boiler as a scale. Wyandotte Textile Soda is absolutely harmless, and will not rust or pit the metal parts nor injure the fittings, and readily dissolves in cold or hot water.

FUEL ECONOMIZERS.

The best known Fuel Economizer is the one built by The Green Fuel Economizer Co., the object of which is to utilize the waste heat in the gases passing off from the boiler furnace, and in the main consists of a stack of tubes arranged vertically in the flue leading from the boiler to the chimney. The

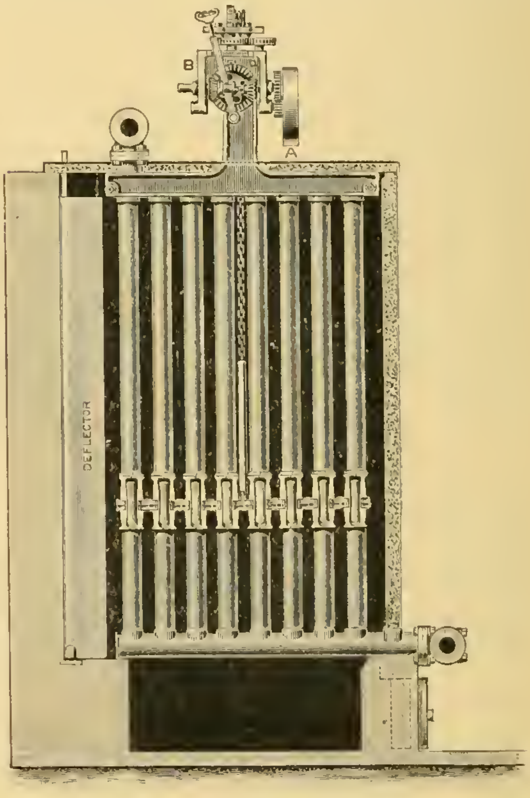


Fig. 5.

utilization of the waste heat is accomplished by heating the feed water for the boiler with the low temperature heat of the gases passing from the furnace to the chimney, said heating taking place by absorbtion of the heat by the water, which is first pumped through the economizer, before its entry to the boiler.

It is a fundamental principal of heating the feed water in a separate vessel quite apart from the boiler, and thereby utilizing the waste gases passing to the chimney, which constitutes the distinctive feature of the first invention of the fuel economizer.

It is well known to every one acquainted with the working of steam boilers that in all cases there is a large amount of surplus heat escaping up the chimney, which should not be allowed to go to waste, but be used for heating the feed water for the boilers. It is a recognized fact that the most economical boilers are those which have the most rapid circulation, and to obtain this circulation the temperature of the escaping gases must leave the boiler considerably above the temperature of the steam. What this ratio should be to obtain the highest economical results, is a subject on which engineers differ very widely. With the high pressures now in use, and gradually increasing, the temperature of the escaping gases increases in proportion to the temperature of the steam generated, and thus the necessity of economizers becomes greater in order to utilize this heat, which is otherwise wasted.

The construction and operation of the economizer is best shown by means of the accompanying illustration, which is a cross sectional view through the economizer chamber.

The economizer consists of a series of sets of cast iron tubes about 4 inches in diameter and 9 feet in length, made in sections (of various widths) and connected by "top" and "bottom headers," so as to have a continuous circulation of water through the pipes, these again being coupled by "top" and "bottom branch pipes" running lengthwise, one at the top and the other at the bottom, on opposite sides and outside the brick chamber which encloses the apparatus. The waste gases are led to the Economizer, that is, to the outside of pipes, by the ordinary flue from the boilers to the chimney, and the heat is thus absorbed by the water in the pipes.

The feed water is forced into the Economizer by the boiler pump or injector, at the lower branch pipe nearest the point of exit of gases, and emerges from the economizer at the upper branch pipe nearest the point where the gases enter between the pipes.

The tubes are made from a mixture of the best American pig, cast vertically in dry sand moulds, and are of equal thickness and free from blow holes throughout. The tubes are tested up to a pressure of 500 pounds on the square inch before being sent out. The joints of the tubes and headers are all conical, turned and bored metal to metal, and forced together by powerful hydraulic pressing machinery expressly designed for the purpose. The lids to each tube are turned conical with a taper joint, made metal to metal. The internal lid to use for high pressures has the large diameter inside the header, so that the pressure of water is all the time tending to tighten it. The external lid as used for low pressures, is held in place by a bolt and cross bar.

Each tube is provided with a geared scraper shown near the bottom of the tubes, and which travels continuously up and down the tubes at a slow rate of speed, the object being to keep the external surface of the tubes clean and free from soot which is a nonconductor of heat, and thus otherwise prevents the proper absorbtion of heat by the feed water in the tubes. The mechanism for working the scrapers is placed on the top of the economizer, outside the chamber, as shown, and the motive power is supplied either by a belt from some convenient shaft or small independent engine or motor.

The gearing for operating and reversing the scrapers is fitted with an improved clutch box and reversing lever with rolling weight which never fails to reverse at the right moment, and change the direction of travel of the scrapers on the tubes. The power required for operating the gearing is very small. The apparatus is fitted with blow-off and safety valves, and a space is provided at the bottom of the chamber for the collection of the soot, which is removed by the scrapers.

The illustration also shows a sheet iron sectional covering for the front side of the economizer, where it is desired to use it in place of usual brick walls. Although this covering is more expensive than brick walls, it is lighter, air tight, and facilitates the cleaning and examination of the economizers. It consists of a wrought iron or steel casing, lined with asbestos or any good non-conducting material.

Under conditions where a forced circulation of the feed water may be an advantage over natural circulation, an improved circulating blow off manifold is provided. By means of these manifolds any portion, or the whole of the economizer, can be made to circulate the water, and at the same time every section can be thoroughly blown off. As the economizer should be blown off for a few moments at least once a day, the valves are connected together by a long lever, which makes the operation very simple and takes the least possible time to operate. The arrangement consists of a series of wing valves placed in the manifold, worked by short levers connected by means of a long bar of iron. The valves having equal pressure on both sides, there is practically only the friction of the packing to overcome in opening. It will thus be seen that the arrangement is very simple and can not get out of order.

Where impure water is used for the boiler, the tubes require internal cleaning. An improved method of flushing the economizer by means of a patent access pipe obviates the necessity of taking off the branch pipe, and so simplifies the operation of cleansing the tubes and bottom boxes that an economizer may be thoroughly washed out and be again made ready for work in a few hours without skilled labor.

By means of an economizer, the temperature of the escaping gases is reduced on an average from 550° F. on the boiler end of the economizer to 300° F. on the chimney end, while the temperature of the feed water is increased on an average about 150° F. This rise of temperature on the part of the feed water represents so much pure gain, since it is effected by heat which would otherwise be wasted. The percentage of gain resulting from the increase of temperature of the feed water in any particular case can be easily calculated by the following formula:

$$\text{Gain Per Cent} = \frac{100\ (T-t)}{H-t}$$

where H = Total heat of steam at boiler pressure reckoned from 0°F.

T = Temperature of feed water after heating.

t = Temperature of feed water before heating.

Among the advantages claimed for the economizer are a saving of from 10 to 20 per cent. in fuel; heating the feed water economically to high temperatures, considerably above what can be obtained by other means; a great volume of water always in reserve at the evaporative point, ready for immediate delivery to the boilers; utilizing in a practical way heat from the escaping gases which otherwise goes to waste; prolonging the life of boilers by having the high temperature of feed water, thus preventing the usual expansion and contraction, due to feeding cold water; considerable sediment in the feed water being deposited in the economizer (where it can be easily blown off) by reason of slow circulation and the high temperature obtained; and increasing the boiler efficiency by adding to its heating surface.

THE CONSTRUCTION OF CHIMNEYS FOR POWER PLANTS.

The sizes and proportions of chimneys vary considerably according to different requirements. Every chimney should be large enough in cross section to carry off the gases from the furnace, and high enough to produce sufficient draft to cause a rapid combustion of the fuel in the furnace. The object of a chimney being to carry off the waste gases, it naturally determines the amount of fuel that can be burnt per hour, and it is advisable to have always a good draft, as it can then always be regulated by a damper.

Draft pressure is caused by the difference in weight between a column of hot gases in the chimney and a column of air of equal height and area outside the chimney.

The formula for finding the force of draft in inches of water of any given chimney is as follows:

$$F = H\left(\frac{7.64}{T_2} - \frac{7.95}{T_1}\right)$$

Where F = Force of draft in inches of water.
H = Height of chimney in feet.
T_1 = Absolute temperature of chimney gases $(t+460)$.
T_2 = Absolute temperature of the external air (t_1+460).
t = Temperature of chimney gases.
t_1 = Temperature of external air.

Formula for finding the height of a chimney in feet for a given force of draft:

$$H = \frac{F}{\left(\frac{7.64}{T_2} - \frac{7.95}{T_1}\right)}$$

To find the maximum force of draft for any given chimney, the external air being 60° F., and the heated column of gas being 600° F., multiply the height of the chimney above the grate, in feet, by .0073, and the product is the force of draft expressed in inches of water.

The draft power of a chimney varies as the square root of its height.

The retarding of the ascending gases by friction may be considered as equivalent to a diminution of the area of the chimney, or to a lining of the chimney by a layer of gas which has no velocity. The thickness of this lining is assumed to be 2 inches for all chimneys, or the diminution of area equal to the perimeter × 2 inches (neglecting the overlapping of the corners of the lining). Let D = diameter in feet, A = area, and E = effective area in square feet.

For square chimneys, $E = D^2 - \frac{8D}{12} = A - \frac{2}{3}\sqrt{A}$.

For round chimneys, $E = \frac{\pi}{4}\left(D^2 - \frac{8D}{12}\right) = A - 0.591\sqrt{A}$.

For simplifying these calculations, the coefficient of $\sqrt{A}$ may be taken as 0.6 for both square and round chimneys, and the formulæ become:

$$E = A - 0.6\sqrt{A}.$$

The power varies directly as this effective area E.

A chimney should be proportioned so as to be capable of giving sufficient draft to cause the boiler to develop much more than its rated power, in case of emergencies, or to cause the combustion of 5 lbs. of fuel per rated horse-power of boiler per hour.

The power of the chimney varying directly as the effective area E, and as the square root of the height H, the formula for horse power of a boiler for a given size of chimney will take the form:

$$H.P. = C\,E\,\sqrt{H},$$

in which C is a constant, the average value of which, obtained by putting the results obtained from numerous examples in practice is 3.33.

The formula for horse-power then is

$H.P. = 3.33\,E\sqrt{H}$, or substituting the value of E

$$H.P. = 3.33\,(A - .6\sqrt{A})\sqrt{H}.$$

If the horse-power of boiler is given, to find the size of chimney, the height being assumed,

$$E = \frac{0.3\ H.P.}{\sqrt{H}}; = A - 0.6\sqrt{A}.$$

Then for round chimneys, diameter of chimney = diam. of E + 4".

For square chimneys, side of chimney $= \sqrt{E} + 4''$.

If the effective area E is taken in square feet, the diameter of the chimney in inches is $d = 13.54\sqrt{E} + 4''$, and the side of a square chimney in inches is $s = 12\sqrt{E} + 4''$.

If horse power is given, and area assumed, the height $H = \left(\frac{0.3\ H.P.}{E}\right)^2$

In proportioning chimneys, the height is generally first assumed, with due consideration to the heights of surrounding buildings or hills near to the proposed chimney, the length of horizontal flues, the character of coal to be used, etc., and then the diameter required for the assumed height and horse power is calculated by the formula or taken from the table.

TRANSMISSION OF POWER.

There are three systems by which power may be conveyed from its source, whether steam or water power, to the shafting of the mill, viz, wheel, rope and belt driving.

Wheel Driving or Gearing, is the oldest of these three systems, but is what we might call out-of-date, for the fact that it is an expensive system on account of the necessary massive foundations of engine, etc., bed and thick gearing walls which support the shaftings and this in complicated wall boxes and fixings. As a rule it consists of a large spur segment wheel on crank shaft, driving a pinion on a second motion shaft, which in turn communicates this motion by means of bevel wheels to a vertical shaft in the gearing room, driving in turn also the shafting in the various rooms of the mill by similar wheels.

When calculating by wheel gearing, take the pitch diameter as the effective diameter, the pitch circles touching or rolling upon each other when wheels are properly geared.

Rule for calculating the horse power transmitted by cast iron wheel gearing: $(\text{Pitch})^2 \times$ breadth of tooth × speed in feet per minute ÷ 1,000 = H.P. safely transmitted.

Example.—Consider a cast iron spur wheel 7' in diameter, having 66 cogs of 4" pitch and 10" broad. The shaft on which the wheel is keyed to run 110 revolutions per minute. Ascertain H.P. which by means of this gearing can be transmitted safely:

Circumference of pitch circle $= (3\frac{1}{7} \times 7) = 22$ feet.

Speed of pitch circle in feet per minute $= (22 \times 110) = 2420$ feet, speed per minute, and

$$\frac{4 \times 4 \times 10 \times 2420}{1000} = 387\ \text{H.P. Ans.}$$

If applying this rule to bevel wheels consider the average pitch. Never run cast iron wheels over 2,500 feet per minute, whereas steel wheels can be run about 3,500 feet per minute.

The only advantage of this system of transmission of power is that slipping when the wheel teeth are in gear cannot take place. When wheels work with little noise and a minimum of friction, it is then a sign that the teeth are correctly formed and geared; however this is only seldom met with as a rule, a great amount of noise and vibration being the experience with gearing in motion.

Wheel gearing as a drive for a mill is also frequently the cause of breakdowns caused by the back lash in many wheel teeth, which is set up when a load is suddenly thrown off the machinery, which causes the driven wheels to run back upon the drivers, and when this pounding action will frequently be the cause of mutilating or breaking out teeth.

When the axes of driving and driven shaft are parallel, spur gearing is used, whereas when the axes of driving shaft and driven shaft are at right angles, bevel gearing is employed. When a shaft is at any angle with the one from which it is driven, angle wheels are used.

Mitre wheels are bevel wheels of exactly the same number of teeth of an angle of 45 degrees.

Mortice wheels are such as have teeth of hard wood inserted into spaces cored in the rim, and are rather noiseless and consequently can be run at a higher speed.

How to Compute the Velocities, etc., of toothed gears. The relative velocities of gears is as the number of their teeth.

Where idle or intermediate gears intervene they are not reckoned.

The Pitch of a Gear is the distance apart of the teeth from each other, and gears of unequal pitch cannot run together.

The Pitch Line of a gear is a circle struck from the centre, and passing through the middle of the teeth. It defines the diameter of a gear, which is not, as many suppose, the whole distance across from point to point of teeth, but half way from bottom to top of teeth.

To Measure the Diameter of a Gear it is only necessary to take the distance from the bottom of the teeth on one side to the top of the teeth on the opposite side of the gear.

To Ascertain the Pitch of a Gear.—Find the diameter as above, then count the teeth, and divide their number by the diameter.

Example.—If a gear of 21 teeth measures 3 inches diameter on the pitch line, then the gear is 7 pitch.

How to Distinguish the Driver from the Driven Gear.—If the gearing is in motion a glance will usually suffice to show this, since if a wheel is bright or worn on the front of the tooth, *i. e.*, on the side in the direction of which the wheel is moving, it is the driver; whereas the driven wheel is worn on the side of the tooth further from the direction of motion. With reference to bands or straps, one side of the band or strap is always tighter than the other since the driver is doing the pulling.

Worm Wheels.—As drivers only are usually single threaded and are equal to one tooth as a multiplier of speed, worm wheels are used to rapidly diminish speed.

Example.—A worm wheel revolving 750 times per minute, drives a 150-tooth wheel. What is the speed of the latter?

Answer.—$750 \times 1 \div 150 = 5$ revolutions per minute.

If the worm wheel had been double-threaded it would have taken two teeth at one revolution, and the result would have been 10, obtained thus:

$$750 \times 2 \div 150 = 10.$$

A Mangle Wheel is a driven wheel only, and is used to reverse its own direction of motion. The speed for it is calculated as for an ordinary wheel, but since the tooth at each end is used only once in a double revolution (all the others being used twice) its size is taken as one tooth less than it actually is.

Example.—A 12 pinion revolving 350 times in a minute drives a mangle wheel of 140 teeth. How many times will the mangle revolve in a minute?

$350 \times 12 \div 140 = 30$ revolutions (equalling 15 in each direction). Ans.

How to Ascertain the Number of Revolutions of the Last Wheel at the End of a Train of Spur Wheels, all of which are in a line and mesh into one another: Multiply the revolutions of the first wheel by its number of teeth, and divide the product by the number of teeth of the last wheel; the result is its number of revolutions.

How to Ascertain the Number of Teeth in Each Wheel for a Train of Spur-Wheels; each to have a given velocity: Multiply the number of revolutions of the driving wheel by its number of teeth, and divide the product by the number of revolutions each wheel is to make, to ascertain the number of teeth required for each.

How to Find the Number of Revolutions of the Last Wheel of a Train of Wheels, and pinions, spurs, or bevels, when the revolutions of the first, or driver, and the diameter, or the number of teeth, or circumference of all the drivers and pinions, are given: Multiply the diameter, the circumference, or the number of the teeth of all the driving wheels together, and this continued product by the number of revolutions of the first wheel, and divide this product by the continued product of the diameter, the circumference, or the number of teeth of all the pinions, and the quotient will be the number of revolutions of the last wheel.

Rope Driving was introduced on a large scale not until 1860, and in its principle consists in a fly rope pulley, being made up in segments, is keyed on the crank shaft of the engine, driving in turn the other pulleys on the various line shaftings in the mill by means of ropes working in grooves turned in the outer rim of the pulleys.

The angle of groove varies from 40° to 45°, and the ropes (as are made either of hemp or cotton) do not rest at the bottom of groove, but are wedged in on the sides, so that slipping is reduced to a minimum.

The average life of a rope is about ten years, and the limit of speed for maximum efficiency about 5,000 feet a minute. Beyond this speed there is loss of driving power, caused by the resistance of the air and the centrifugal force, which tends to throw the rope out of the groove and decrease the grip of the rope in the groove. Place the slack side of the rope on the top, and the tight, or driving side on the bottom, so that as great an arc of contact as possible is obtained. The diameter of a rope pulley is always measured to centre of rope, and should not be less than 30 times the diameter of rope itself in order to equalize as much as possible to permit the alternate bending and straightening action the rope is subjected to during its travel.

Belt Driving. To obtain the full power and longest service from belting, care must be taken in laying out shafting and pulleys.

All shafting should be made to run perfectly true at the first, for a slight negligence in this matter at the outset becomes constantly more serious the longer it is allowed to go uncorrected, causing loss of power and the rapid destruction of belts and machinery. The pulleys should be perfectly balanced and centered, and the circumference of both outer edges of the same pulley must be exactly alike. The highest part or crown of the pulley face being exactly in the centre, the crown of the pulley face should not exceed ⅛ of an inch in length above that at the edges, to every 12 inches in width, and experience has demonstrated that these are about the best proportionate dimensions to secure the best running and the greatest endurance of the belts; with the crown of the pulley face higher than this, the belt is liable to be strained in the middle and lift off on its two edges, especially with light belts. Pulleys for shafting belts should not be higher in the middle, but have a straight face, and pulleys and belting alike should be ample size for the work to be done. Always try and use pulleys as large as circumstances will permit, and the diameter of the pulleys should be increased as the thickness of the belt is increased, for the reason that in order to bend around one-half of the pulley, the outside of the belt must stretch and the inside compress, and the larger the pulley the less the stretch or compression for a foot of belt, and consequently the less the wear to the belt.

Increasing the diameter of the pulley, the number of revolutions remaining the same, will increase the power, for which reason a light belt on a large pulley is more economical than a thick belt on a small pulley. When more power is wanted, and the diameter of the pulley cannot be increased, increase the face of the pulley and the width of the belt.

Single belts may be used, with economy, as wide as 12 inches, but where greater width is required they should be of double thickness. All belts, 8 inches wide and more, are cut on the hide lengthwise of the back. This is necessary to insure their running straight. A wide belt made of leather cut from the side, cannot, with the greatest care, be made to run evenly, on account of the differences in the tensile strength of the different portions of the hide; but a wide belt, made from the centre of the back, has the same thickness and quality of leather on each side and must necessarily run evenly, the lightest and weakest parts of the leather being in the middle, and the strongest and heaviest on the sides, the difference in thickness amounting, in some cases, to as much as one-fourth of an inch; for this reason, when a wide, single belt is placed under a heavy strain, the thick heavy edge crowds up toward the centre, or lighter part, running on the crown of the pulley, and this prevents the even, uniform hug, so essential where the best results are desired.

Double belts are stiffer and better able to resist the tendency to cup in the middle, to crowd up from the edges, as they generally hug the pulley closely along the whole width. There are those who hold that the single belt, being more flexible, adheres better to the pulley, but this is correct only in cases where they are subjected to but a moderate strain. Where an inch single belt has to do extra heavy work, it will be almost certain to stretch, lift up from the pulley in the middle, or the fastenings give way, therefore, where a single belt must be used, it should be of ample width for the labor to be performed, and not run too tight on the pulleys, so that the fastenings need not be strained. When the fastenings frequently give out, it is a sure sign that too much work is being done by the belt, and either a wider single belt or a double belt should be substituted. For machinery which is run at a high rate of speed, and where fine work is done, light even belts with joints only cemented should be used. Such joints will pass over the pulleys smoothly, causing no jar or vibration to either pulleys or shafting.

Double belting should always be used when a slow motion, great strain and hard labor are required; also when a belt is to be run at one-quarter turn, so as to give the proper angular motion, the principal strain in these cases being on the sides. Belts which have to be constantly shifted, or those which are run on upright shafts with flanged pulleys, should also be double. Where wide belts are made double, they may be subjected to severe strain without injury, for there must always be one strong solid part to the leather to cover every point of possible weakness or where the ends are lapped in breaking joints. It should not be forgotten in ordering belts, that one wide belt is better than two narrow ones, even if the two narrow belts would, together, cover more surface than the one wide one.

Double belts transmit about 50 per cent more power than single belts.

Vertical belts require special tension to obtain sufficient friction on the lower pulley.

Excessive tension on a belt is injurious.

Horizontal belts and belts running at an angle of 45° or less should have the lower side, the tight or pulling side of the belt wherever possible.

Avoid quarter turn belts wherever possible, and if run in this way, they should be turned end for end often until the stretch is entirely taken out.

It is reckoned that leather belts, grain or hair side to the pulley, will drive 34 per cent. more than with flesh side to the pulley; 48 per cent more than rubber; 121 per cent. more than gutta percha; and 180 per cent. more than canvas.

The slack side on top, with large pulleys at high speed, is undoubtedly the true philosophy of transmitting power by belts.

Not speed alone, but adhesive force must be gained to do work without destructive tightness or slippage of the belt, therefore, there should be a proper proportion of pulley diameter and belt contact.

Long belts are preferred to short ones, but care must be taken that the length be not too great.

To Find the Length of a Belt: Add the diameters of the two pulleys and multiply sum by 1.57, and to this add double the distance between the centres and the two shafts; then, (when dealing with pulleys of different diameters, in order to compensate for oblique direction of running belt) subtract separately the diameter of the smaller pulley from the diameter of the larger and multiply the remainder by itself, divide product by four times the distance between centres of the two shafts, and add this result (which naturally would be 0 if pulleys of equal diameter) to that of the first part of the calculation, the answer being the exact length of belting required (less tension). It will be readily understood that in connection with the calculation, all dimensions must be expressed in either feet or inches.

Example: Pulleys to he 6 feet and 3 feet, and distance between centres of shafts 30 feet.

$6+3=9\times1.57=14.13+60=74.13$

and $6-3=3\times3=9\div120=\ \ 0.133$

$\overline{\qquad 74.263}$

Answer. $74.263'=74',\ 3\frac{156}{1000}''$, practically $74'\ 3\frac{1}{6}''$.

To Measure Belts in Coil. In order to calculate the length of a belt in coil, we may consider the coil as composed of a series of concentric circles, and then calculate the sum of their circumferences for the total length of the coil; but this would be tedious, and a simple method should be devised.

To obtain this, first, find the mean diameter of the extreme coil diameters by taking half the sum of the diameters of the outer and inner coils, multiply this number by 3.1416, and then by the number of coils, this will give the total length of the coil in inches if the diameters of the coils were taken in inches.

A formula expressing this rule will be:

$$L=3.1416\ n\left(\frac{D+d}{2}\right)$$

and may be simplified thus:

$$L=1.5708\ n\ (D+d).$$

In both of which L D and d must represent like units of measurement.

To simplify calculations still further by getting the length L in feet, and the diameters D and d in inches, the rule may be put into this form, which is probably the best for use:

$$L=.1309\ n\ (D+d).$$

Method of Calculating Horse Power of Belting. A single belt 1″ wide running at 1,000 feet surface speed a minute, will safely transmit 1.7 H.P., and a double belt 1½ times the amount. Hence the rule:

$\frac{\text{Breadth of belt} \times \text{speed of belt in ft. per minute} \times 1.7}{1000}$

Example.—Find the H.P. which may be transmitted by a pulley 3′ diameter, 4″ broad, when running 300 revolutions per minute.

3′ diameter=(3.1416×3)=9.4248 feet circumference, 9.4248×300=2827.4 feet=speed per minute, and $\frac{2827.4 \times 1.7 \times 4}{1000} = 19.2$ H.P. Ans.

Miscellaneous Calculations, Etc.

How to Find the Circumference of a Circle, or of a Pulley: Multiply the diameter by 3.1416; or as 7 is to 22 so is the diameter to the circumference.

How to Compute the Diameter of a Circle, or of a Pulley: Divide the circumference by 3.1416; or multiply the circumference by .3183; or as 22 is to 7 so is the circumference to the diameter.

How to Compute the Area of a Circle: Multiply the circumference by one-quarter of the diameter; or multiply the square of the diameter by .7854; or multiply the square of the circumference by .07958; or multiply half the circumference by half the diameter; or multiply the square of half the diameter by 3.1416.

How to Ascertain the Circumferential Velocity of a Wheel, Driver or Cylinder: Multiply the circumference in feet by the number of revolutions per minute.

Example.—A roller has a circumference of 4 feet and makes 12 revolutions per minute. Ascertain its circumferential velocity:

4×12=48 feet. Ans.

How to Find the Speed of Last Shaft where several shafts and pulleys or wheels intervene: Multiply all the drivers into each other and the product by the speed of the first shaft, divide this product by the product of all the driven pulleys or wheels, multiplied into each other. In connection with pulleys consider circumference, in connection with wheels consider the number of teeth.

Example.—A line shaft in a weave room revolves 120 times per minute, and carries pulley 12 inches in diameter. The looms driven by them carry pulleys 10 inches in diameter. Find the speed of the looms.

$\frac{120 \times 12}{10} = 144$ revolutions. Ans.

Driving-Driven: The manner of describing the driving wheel must also be applied to the driven. If the diameter of the driving wheel be taken, we must also use the diameter for the driven wheel, and neither the radius or circumference.

Example 1.—An engine has a driving wheel 20 feet in diameter, revolving 40 times per minute, which drives, by means of ropes, a pulley on the second motion shaft 2 feet in radius (semi-diameter). Ascertain speed of the second motion shaft:

Two feet radius=4 feet diameter, thus 40×20 feet ÷4=200=revolutions speed of the second motion shaft per minute. Ans.

Example 2.—Speed of under shaft of a loom 80, the same carries a 10-teeth bevel, which gears with a 10 on an upright shaft, at the top of which a 32-teeth wheel on a block of tappet wheels, is driven by an 8. Find the speed at which they revolve:

80 × first driver 10, × second driver 8÷ first driven 10 and second driven 32.

80×10=800×8=6400÷10=640÷32 = 20 revolutions per minute. Ans.

How to Find the Speed of the Driving Wheel, when the speed of the last driven wheel and the size of the gearing are known: Multiply the speed of the last driven wheel by the size of the driven wheels and divide by the size of the drivers.

Example.—A spindle revolving 1,500 times per minute, is driven from a line shaft by a 30 inch drum to a 10 inch pulley, which is fixed to a 10 inch tin roller driving the 1¼ inch wharve of the spindle. Ascertain speed at which the line shaft will revolve:

The drivers being 30 and 10, and the driven 10 and 1¼.

1500×10×1¼=18750.

18750 ÷ 30 = 625 ÷ 10 = 62.5=62½ revolutions per minute speed of line shaft. Ans.

How to Obtain the Size of the Driving Wheel the speed of the driven and driving shaft and the size of the driven wheel or pulley being given: Multiply the speed of the driven shaft by the teeth in the wheel or the size of the driven pulley, and divide by the speed of the driver.

Example.—A shaft having a speed of 125 r. p. m., drives another shaft at 100 r. p. m., on which is a 40-tooth bevel wheel. Ascertain the size (teeth) of bevel wheel on the driving shaft:

100×40=4000÷125=32 teeth. Ans.

How to Obtain the Size of the Driven Wheel if the speeds of the driver and driven wheel or wheels are given and also the size of the driver: Multiply the size of the drivers by the speed of the first driver, and divide by the speed of the driven, and by the driven pulleys given, if any.

Example.—A shaft making 17 revolutions per minute, carries a 15-tooth wheel, which drives a second shaft by means of a wheel, the number of teeth in which it is desired to find. On this shaft is a 120-tooth wheel driving one of 64-teeth, which latter revolves at $15\frac{15}{16}$ revolutions per minute. Required the size of the first driven wheel:

Drivers 15 and 120. Driven 64 and $15\frac{15}{16}$.

17×15×120÷64÷$15\frac{15}{16}$=30 teeth required in wheel. Ans.

How to Change the Speed of a Driven Pulley, Shaft or Wheel: Increase the size of the driver or decrease the size of the driven pulley in exact proportion to the increase of speed required; or vice versa if a decrease is required.

How to Cool a Hot Shaft: Make a belt of something of a loose, water-absorbing nature, and hang it over the shaft as near the hot journal as possible, allowing it to hang down and run loose on the shaft. A pail of water may now be fixed so the lower part of the belt will run in it, and in this simple way the shaft may be cooled while running.

Another method consists in the use of black antimony and best castor oil; you may, if you like, add a little black lead. Work it up nicely together and lay it on the shaft, first thick, and then taper down to nothing but the oil.

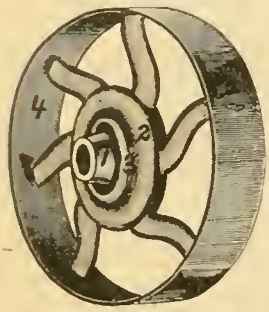
Cooling Compound for Hot Bearings: Mercurial Ointment mixed with black cylinder oil and applied every quarter of an hour, or as often as expedient. The following is also recommended as a good cooling compound for heavy bearings: Tallow 2 pounds, plumbago 6 ounces, sugar of lead 4 ounces. Melt the tallow with a gentle heat, and add the other ingredients, stirring until cold. For lubricating gearing, wooden cogs, etc., nothing better need be used than a thin mixture of soft soap and black lead.

Steel and Iron: To distinguish steel from iron pour on the object to be tested a drop of nitric acid; let it act for one minute, then rinse with water. On iron the acid will cause a greyish-white, on steel a black stain.

In case of wire, heat in the gas and dip in water; if hard and brittle it is steel.

McCAFFREY'S SELF OILING LOOSE PULLEY.

The advantages of this pulley are: (1) that it will run for weeks with a single oiling, (2) that oil can be applied in quantity to the pulley while the machine is running at high speed, and this without a waste of oil, (3) that by oiling these pulleys while running the danger of a machine suddenly starting up while oiling and maiming the oiler is avoided, (4) that the throwing off of any surplus oil onto the machine, the yarn, the fabric, etc., when starting up, is avoided.



With reference to the accompanying illustration, which is a perspective view of this pulley, the oil is applied to the surface of the cone shaped journal 1; the surplus oil travels up the cone and disappears in the interior 2 of the pulley, in turn feeding (oiling) the shaft surface from within the pulley. The surplus oil then travels between the shaft and the bearing of the pulley to the outer end of the cone 1, and from where it is again drawn up on the outer surface of the latter and the procedure as before explained repeated.

When the pulley is idle, the oil drops below the level of the shaft, and any oil on the cone surface will then run down the lower side of the cone to the interior of pulley 2, and from where in turn it is also re-used. A flange 3 protects the oil when on the cone surface 1 from dropping onto the inside 4 of the pulley belt surface.

Sticking of this pulley, caused by lack of oil, is prevented, for the fact that no oil is wasted, the latter being continually conducted into the inside of the pulley, and re-used, thus accomplishing a saving in time, lost otherwise by having to stop the machine to loosen the pulley provided the latter has run dry, in turn preventing any possible injury thus caused to the shaft and journal surfaces, prolonging also the life of the belt.

Directions to oil the pulley: Fill the chamber until the oil can be seen in the ring, turn the pulley around a few times, then put on the belt. To oil the pulley while running, place the oil-can on the hub, just inside the ring and the hub will carry the oil to the chamber. To keep the oil clean in the chamber, wipe off the hub occasionally and put in fresh oil. (John McCaffrey, Lawrence, Mass.)

THE AMERICAN PIONEER PRESSED STEEL SHAFT HANGER.

As a substitute for the common cast iron hanger a new form of pressed steel has recently been produced. Cast iron, from the nature of its structure, is a poor material to use where bending or torsional strains are present. Steel and wrought iron have higher tensile strengths and greater elasticity, making a lighter construction possible to withstand a given strain. In a cast iron member it is necessary to allow a greater factor of safety on account of possible blow holes or imperfections, while with steel and wrought iron the close grained, uniform structure makes this unnecessary, which means a still greater saving in weight.

The accompanying illustration Fig. 1 gives a perspective view of this hanger assembled, and which is made of rolled open hearth steel, a material very much stronger than the very best cast iron, more homogeneous, and one that may be worked in dies and pressed to shape. The pattern shown is known as the American Pioneer four-way adjustment hanger, and consists of two pressed steel legs each strongly ribbed and flanged to give rigidity and lightness. At the upper ends these are shaped into broad feet to form a solid base, where the hanger bolts to the footing piece, while the lower ends are narrowed down to fit the lower cross piece or clamp.

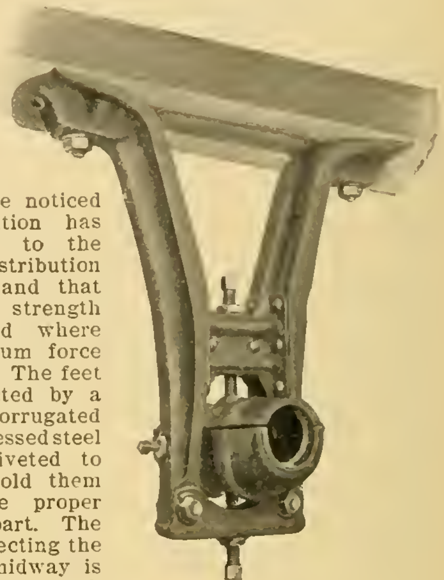


Fig. 1.

It will be noticed that attention has been paid to the proper distribution of metal, and that maximum strength is provided where the maximum force is applied. The feet are connected by a flanged corrugated plate of pressed steel securely riveted to them to hold them rigidly the proper distance apart. The brace connecting the two legs midway is also pressed steel, strongly ribbed, and being riveted to each leg by six rivets is practically one piece with them. Besides acting as a transverse or lateral brace, this part also takes the thrust transmitted through the upper vertical adjusting screw. The arched clamp connecting the ends under the bearings is of U section so as to resist the bending moment due to the thrust on the other vertical adjusting screw. It fits outside the narrow ends of the legs, and is secured to them by two fitted bolts, so that it ties the narrow ends of the legs together, strengthening the whole construction. By removing one of the bolts which secure the cap, the latter, as shown in connection with Fig. 2, can be swung upon the other bolt as a hinge when removing or inserting the bearing blocks—a convenient feature which is not found in the ordinary cast iron hanger. The bearing consists of three parts, all cast iron; an upper and lower half bearing, and an oil pan. The top of the upper half

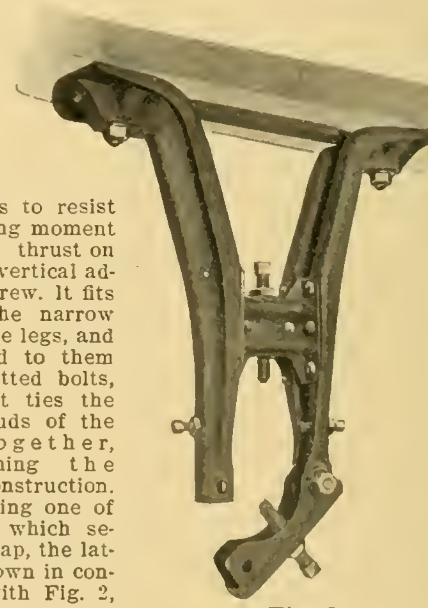


Fig. 2.

bearing and the bottom of the lower one are formed to fit sockets having their common center in the axis of the bearing. The lower socket is cast in the oil pan, which is made large enough to accommodate the lower half bearing, with space between to hold lubricating oil. The bottom adjusting screw engages a recess located centrally on the under side of the oil pan. When the bearing is assembled and the vertical and lateral screws adjusted the half bearings rest on each other their full length and are supported in the socket of the oil pan. While the pan is stationary, being firmly held by the set screws, the bearings are free to adjust themselves to fit the shaft. The bearings are provided for ring oiling, as shown in the sectional view in Fig. 3, and to prevent dripping of oil, are fitted with automatic wipers.

Fig. 3.

The pressed hanger complete with cast iron boxes is claimed to weigh but one-half of an all cast iron hanger designed for the same work. Being lighter, the hanger is much easier to install, especially in locations difficult of access, and may be shipped in quantities at a considerable saving of freight charges. (Standard Pressed Steel Co., Philadelphia, Pa.)

MINERAL TANNED LEATHER BELTING.

The old saying, "there is nothing like leather" as far as belting is concerned, at least, still holds true. Rubber, Canvas, and other kinds of belting are being used mainly for the reason that a belt is required that will stand steam or moisture. But this class of belting is short lived, as a rule, and cannot be run successfully as cross belts or when subjected to constant shipping; oil or grease tends to rot rubber. Again this class of belting practically cannot be repaired.

The Barnes Mineral Tanned Leather Belting has solved the problem of a leather belt that will run successfully in wet and steamy places. Not only is the cement used in this belt, proof against steam or water, but the leather as well; it can even be boiled in hot water without any apparent effect. This belting is now used in a large number of bleacheries, dye houses, etc., and will also run in places where exposed to intense heat or gases, remaining at the same time pliable under such conditions. There is practically no stretch to this belt. (Henry K. Barnes, Boston, Mass.)

THE JACKSON BELT LACING MACHINE.

The object of lacing belts by this machine is to overcome the disadvantages characteristic to hand lacing, producing a smoother connection, doing the work quicker and at the same time more economically, both with reference to material used for the lacing as well as saving in length of belting needed.

The smooth connection is the direct result of the ingenious construction and operation of the machine, and is equal in every respect to a joint in an endless belt made by skiving and gluing. Necessarily as the joint is a perfect hinge, it passes over the pulleys noiselessly, without slippage and without friction, thus reducing to the lowest possible percentage the vibrations and the wear upon the bearings and shafting, a feature impossible for a handlaced belt, whether lacing-leather or studs, clamps or hooks are used, and which cannot help but produce an uneven surface in that portion of the belt; whereas in belts laced by means of the Jackson machine, the lace is the same on both sides of the belt and is even with the surface in every instance. This certainly is the most important item to be considered by the management of any mill, since in the transmission of power, it is important that the ends of the belt be joined in such manner as to secure the greatest strength, combined with a flexible joint and an even surface on its face, a feature the Jackson machine does to perfection.

With reference to cost, lacing by this machine is in the first instance only about one-quarter that of the old methods employed, and at the same time will last about three times as long. Computing these two claims for the Jackson machine vice versa old methods will give us ($4\times3=$) 12 points in favor of the machine, by which we mean that besides the belt running smoother, and its consequent advantages to transmission and machinery in a mill, the actual lacing of the belt by the machine will be only about $\frac{1}{12}$ the cost of that by the old methods, in turn readily explaining such claims as: One cent laces a 5-inch belt, two cents a 10-inch belt, or three minutes required to lace a 6-inch belt, four minutes an 8-inch belt, etc., indicating that the lacing is an indispensable adjunct to every factory in which belting is used, the Jackson Belt Lacing Machine having solved, through the wire coil clasp lacing, a vexing problem. The saving to the manufacturer of time and money in these days of keen competition, when slight advantages are so often attended by the most important results, occupies the best thought of business men the world over, and when consequently any textile manufacturer must pay the closest attention to belting, no doubt one of the most important items with reference to Supplies in every mill. If then he is still using the primitive method of lacing belts by hand in his mill, the great utility of the Jackson Belt Lacing Machine will readily be seen in a brief investigation of its capabilities.

First and foremost, the Jackson Lacer will not only save money in the cost of lacing 12 : 1 as previously referred to, and besides this better work, but it will at the same time reduce to the minimum loss in production (=$) caused by the stoppage of machinery for the sake of relacing belting.

The Jackson Belt Lacing Machine, and of which a perspective view is given in Fig. 1, is most simple in construction, and is made of the very best material. The rolls and gears are of hard tool steel, and furthermore, all the parts of the machine are interchangeable and can be easily replaced, should necessity require, without the return of the machine to the factory. They are built in four sizes, known respectively as 6-12-18 and 24 inch machines, the numerals quoted indicating the maximum width of a belt, one or the other machine is capable of lacing. Although as a rule the machines are operated by hand, yet if required, the #18 and #24 machine can be equipped for power. It certainly might be useless to mention that the machines will lace belts made of any material, up to 24 inches wide and ⅝ of an inch thick. The simplicity, construction and operation of the machine will certainly alone recommend it, but in this connection the factor of strength and durability of the lacing is also an additional (and certainly most important) factor in favor of this machine, tests of two and a half inch belting having shown that the wire coil as was used in connection with a #6 machine, has stood a tensile strain of 1900 pounds without breaking or pulling apart.

The operation of lacing consists first in squaring the end of the belt by means of the cutter bar seen on top of the machine (see Fig. 1) and a specially constructed knife furnished with the machine. The end of the belt being square, the belt is clamped firmly between the jaws by means of the levers and the end punctured by a spiral needle. The needle is driven ahead by three grooved rollers which are revolved by means of the crank. Following the needle the coiled wire is inserted and enters the holes punctured in the belt by the needle. The lacing being in the belt, it is removed and the surplus wire cut off with pliers. The wire is then flattened between the jaws of the machine until it is flush with the surface of the belt (see *a* in Fig. 2). The other end of the belt being laced in a similar manner, the two ends being brought together (see b in Fig. 2), they are held by means of twine, lace leather, rawhide or metallic pins inserted between the wire meshes of both ends of the belt (see c in Fig. 2). The joints thus made are fully twice as strong as those made by lace leather (hand lacing) to a similar belt, since considerable less of the cross section of the belt has to be removed for the insertion of the wire, at the same time a larger number of loops per inch are made than with hand lacing, and consequently each loop in proportion exerts less strain upon the belt, when the latter is under tension. For belts subject to steam or acid fumes, brass lace wire is used. The size of the wire used varies with the width and thickness of the belt, as will be readily understood.

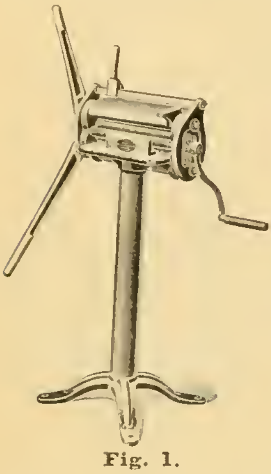


Fig. 1.

Another advantage that should not be lost sight of in connection with this modern system of belt lacing, is that by simply pulling out the pin c, the belt can

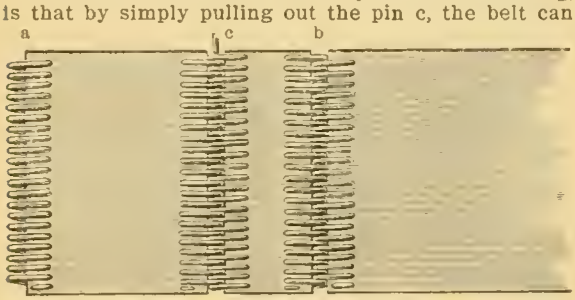


Fig. 2.

be disconnected in a moment, a feature which is a great convenience in mills where belts of varying length are required or where it is desirable to have a reserve belt in readiness for a machine when required.

Rule for ascertaining the length of a new double belt: Draw a tape line around the two pulleys in the manner the belt would be when working; then deduct from this length obtained ⅛ inch per foot to give the required tension to the belt to start with. This now would give you the length of belting required if dealing with hand lacing. However, if dealing with the Jackson Machine, deduct an additional ¼ inch per foot to allow for the final elongation of the belt which will in time permit the ends to come together, and which latter item (¼ inch for each foot of belting ever used in your mill) is a clear saving in your pocket, since with hand lacing when in time tightening the belt, this means waste of belting, thrown away, but which is not the case with machine lacing, a feature readily explained by a practical test.

Example: Instead of cutting a belt the right length to reach around pulleys, and allowing for proper initial tension, a new two-ply belt, say, 20 feet long by 4 inches wide, is cut 7½ inches shorter and an extra (a spare piece and of which different lengths are kept on hand) piece 5 inches long is inserted to make up the deficiency minus (2½″ see rule =⅛″ per ′ as given before) tension. The 5 inches belting are a clear saving to you on this belt and similarly on another. The person in charge of the belting in the mill, as indicated before has several sets of pieces of 4-inch belt in lengths of 1, 2, 3, 4 and 5 inches, with wire lacing in their ends ready for use. After the new belt has been run a few hours and requires tightening, he then takes the two rawhide pins (see c Fig. 2) out, removes the 5-inch piece and inserts a 4-inch piece, repeating the operation at intervals when occasion demands; using in turn the 3-, 2- and 1-inch spare pieces of belting until the two ends of the initial belt come together. We then have a belt that has been taken up five times and has been laced only once. It will be readily understood that these spare pieces of belting are carefully saved for future use in connection with any other 4 inch wide belt. In the same manner the spare pieces for other widths of belting are saved for ready use when required. In the small mills and where it would not pay to regularly employ a man to look after the belts, the several sets of different width belting can be placed in the tool room and the operator of the machine can at any time exchange a long piece for a shorter one, and thus save the time of re-lacing. Besides technical points quoted thus far in favor of the machine, there is one more point which came to our notice, but which more correctly speaking, does not belong here, the same being the fact that six thousand inches of coil lacing (or enough for 500 belts 6″ wide) belong to the outfit with each machine, and since this quantity of lacing will serve for as much belting as $35.00 worth of lace leather, a #6 or #12 machine will practically half repay itself at once by means of this single item.

The advantages of this belt fastener are as follows: The belt remains of the same thickness all through, even at the place of joint. This is a great advantage, especially in electric light installations. The fastener is very elastic and strong, and is quickly and cheaply made (the heaviest and widest belts can be joined inside of half an hour). Further there is no waste of belt material. It is easy to take a joint apart when the belt has to be shortened. It can be made at any place, and can be used immediately. With the exception of one case, the belts can be placed on the pulleys without the use of belt clamps. Only when both pulleys have flanges, is a belt clamp necessary. This belt fastener can be used in connection with tight and loose pulleys. The belt does not suffer on account of the lateral strain when shifting. The joint further has sufficient elasticity crosswise to allow of its being used on crown pulleys. (Diamond Drill & Machine Co., Birdsboro, Pa.)

CLING-SURFACE AND ITS NEW METHOD OF BELT TRANSMISSION.

In taking up the consideration of improved methods of belt management, it may not be inadvisable to rehearse the general form of procedure followed in the past and in many plants at the present.

The keystone of this whole method of transmission of power by belts or rope has been the necessary ruling that "you must have a belt more or less tight in order to transmit any power." Initial tension (the tightening strain put on the belt before it begins to work) has been the great necessary element which has made such method of transmission possible, and which has also been the seat of all attending trouble and operative waste.

What does a tight belt mean? The usual rule is to run single belts under about 50 pounds initial tension per inch of width, and double belts under about 65 pounds per inch of width. The actual conditions are apt to be over than under this. On a 6-inch single belt, then, we have 300 pounds tension, and for, say a 20-inch double, we have 1300 pounds tension on belt, bearings and shafting *before any working load is put on at all.* This strain is actually extra friction added to the necessary friction from the working load, and the whole sum of this portion of the friction load, of course, is that of the tightening strains on every belt in the plant. It foots up to an enormous amount and it must be dragged along all day by the transmission machinery (belts, bearing and shafting), while it all concentrates at the engine. The engine and coal pile have to meet this enormous extra friction load every hour of the working day, in addition to its legitimate manufacturing work.

It produces high friction in bearings, as frequent hot boxes testify, and excessive lubrication is necessary. It is a continual strain on the shafting.

The belts being merely animal or vegetable fibre, show it excessively. Imagine such a belt to be a 20-inch double belt on say 2,000 feet speed. Its estimated output would be 100 H.P. But to get this output it would have to drag along 1300 pounds of initial tension. This is on day and night. In the day it is under this plus the 100 H.P.; at night it is still kept tight by the 1300 pounds. Its fibres are always on the stretch, they can never regain their natural position, and as the belt stretches and loosens it is again taken up and the stretching is renewed until all its elasticity is destroyed and it becomes "dead"—like an old rubber band about a package. There is waste every minute, waste in coal, in wear on engine, shafting and bearings, in oil for engine and bearings, in the belt itself, in men's time who work over this belt, in the time of other operatives.

All this results from the necessity of keeping the belt tight in order to stop slipping.

F. W. Taylor, in his paper, "Notes on Belts", read before the A. S. M. E. at Germantown, 1893, related that one of his mills was belted, half on a basis of 65 pounds tension per inch of width for double belts at 5000 to 6000 feet per minute: the other half on a basis of 30 pounds at 4000 to 4500 feet per minute. And then says:

"It is safe to say that the belting of the first half of this mill gave 100 times as much trouble as that of the second half. In fact, the belting proved to be the chief source of trouble and expense in running the first half of the mill, owing to frequent interruption of manufacture caused by it; while that of the second half ran from the start with hardly any trouble."

If half-tight belts make "hardly any trouble" how much will slack and easy ones make?

In an extract from a book published by Jones & Laughlin, Ltd., an eminent cotton-mill engineer is quoted as saying that the power necessary to drive shafting alone in eight of the best textile mills in New England was as follows:

Mill.	Whole Load in H. P.	Shafting alone in H. P.	Per cent. of whole.
No. 1.	199	51	25.6
No. 2.	472	111.5	23.6
No. 3.	486	134	27.5
No. 4.	677	190	28.1
No. 5.	759	172.6	22.7
No. 6.	235	84.8	36.1
No. 7.	670	262.9	39.2
No. 8.	677	182	26.8

z

He also says "Taking the cost of a horse power at 35 pounds coal per day and allowing 15% of the whole as a reasonable loss from friction, one can see that the cost of running tight belts is no inconsiderable one—to say nothing from shortened life of the entire equipment."

A mill having, say 100 looms, might easily on certain grades of cloth turn out 50 cuts per day. The cut averages 35 yds. and sells for say $1.25 per yard. This totals $2,187.50 daily and $682,500.00 yearly. Put belt slippage at 5% which is common enough (2% is minimum average in all plants) and it means a loss of $34,125.00 worth of product per year. And the fact that the slip is never constant injures the general average of quality. This loss is from slippage only, and the profit on it above would more than pay for all the Cling-Surface needed.

Tight belts have long been recognized as an evil, but there has been no satisfactory mode of cure previous to 1897.

Belt dressings have been sold for relief of the slipping, but with little satisfaction, for they were either rosin preparations which operated by adhering the belt to the pulley, and forcing it to be ripped off at much expense of power and belt, while the preparation itself was harmful, or else simply preservative oils like neatsfoot, which kept the belt pliable and helped a little, but belts still had to be run tight.

In 1897, after a long series of experiments, Cling-Surface was perfected. It was designed to be, first, a real and perfect preservative for all fibre, leather, cotton and hemp, and, second, to eliminate slipping without causing any adhesion or sticking of belt to pulley. It was made in solid form like a grease, rather than liquid, to keep the belt pliable yet not soft and flabby. For a year it was placed in the hands of one-hundred manufacturers of all kinds, for trial, and proved to be even better than expected.

Cling-Surface is applied hot (liquid) in small quantities and gradually penetrates into the belt, surrounding every fibre with a preservative lubricant. This keeps them pliable, elastic and water-proof. It becomes simply impossible to make a belt so filled, hard or dry. We thus have a belt not only preserved, but pliable, and obtaining the best possible grip on the pulleys. But in addition, Cling-Surface has the property (as it penetrates) of leaving the surface clinging. This is very different from adhesion. There is no stickiness, but only a smooth, clean, velvety condition that grips the pulley with a slipless grip and then releases it with perfect freedom. In theory it acts as a moist hand grips a tool handle better than a dry one—there is no necessity of adhesion, simply a cling, and the belt leaves the pulley as readily as it meets it.

This eliminates slipping. As a result we have removed the foundation of the whole tight-belt method and rendered a tight belt unnecessary. And the rule of cause and effect has carried it further: it will be granted that providing there is no slip, there is no necessity of running a belt tight, but it can be run easy. Then if a belt will run one inch easy, it will as readily run 12 inches slack, run slack until the top touches the bottom. This is exactly what practice has proved and as a result we not only have an entire removal of that part of a plant's friction load due to tight belts, but we find that as the belts run slacker they gain a larger and larger arc of contact on pulleys and the slacker they run the more power they transmit.

Mr. H. E. Collins of New York City an expert engineer, was called to a silk mill, where power was short. He decided tight belts was the cause. He bought Cling-Surface and in 47 days decreased the friction load over 18% by running slack and easy belts, giving an ample margin of power from the old equipment.

Professor R. C. Carpenter of Sibley College, Cornell, has made a series of tests of Cling-Surface, from which the following diagram was used.

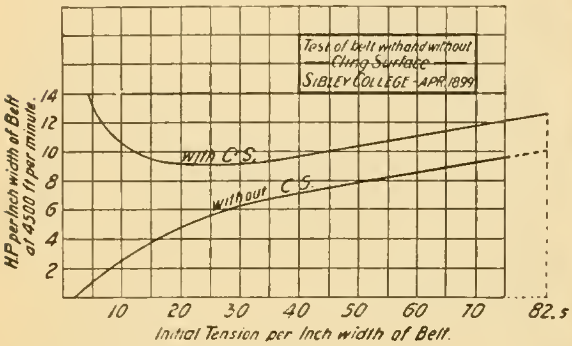


Fig. 1.

He used two 4-inch belts, run under exactly similar conditions, one treated and one untreated. He started them both at 82.5 pounds initial tension and gradually reduced this tension to zero. At 82.5 pounds the Cling-Surface belt transmitted 13 H.P., while the untreated transmitted only 10 H.P. As they were slackened, both did less, in the same proportion, the untreated belt doing less and less until at 5 pounds it would not deliver 1 H.P. The Cling-Surface belt however, decreased to the 25-pound mark and then, as it began to wrap the pulleys, did more, until at 5 pounds initial tension—the slackest, it was doing 14 H.P.—4 H.P more than the untreated *and about two H.P. more than it did itself at its tightest.* Professor Carpenter said in his report, "The general effect of Cling-Surface appears to enable the full capacity of the belt to be obtained for transmitting power when the belt is so loose that the sides nearly touch."

In Fig. 2 there is shown four 12-inch belts in the Homestead Works, of the Carnegie Steel Company.

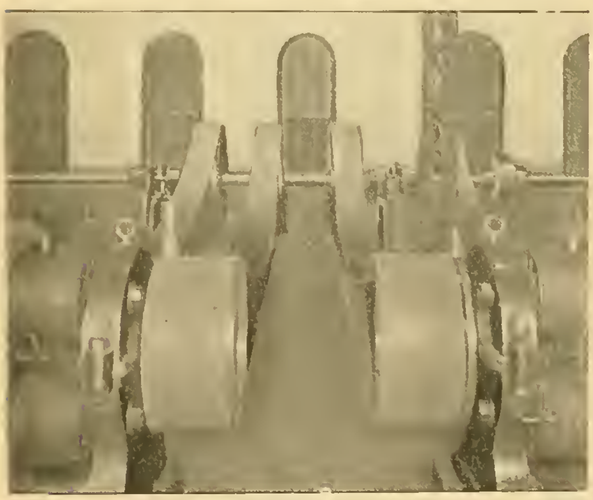


Fig. 2.

In 1900 they were as tight as it was possible to pull them. They probably added a ton and a half to the friction load of the plant and yet gave trouble. Cling-Surface stopped the slipping. The dynamos were set at the other end of the slide and ever since they got more power than before, with no troubles.

The belt at 45 degrees angle, shown in Fig. 3 was

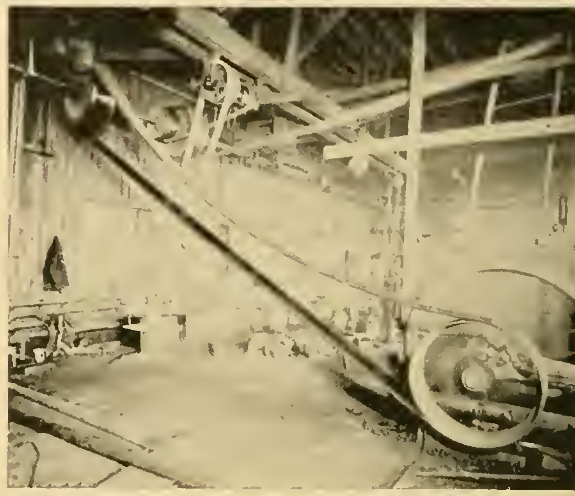


Fig. 3.

twelve years old, was tight and delivering power to a line of machines—short power at that. It was treated with Cling-Surface. A further piece (18 inches long) was put in the belt and it was run slack and two more machines were added to the row—the gain in power to all the machines being 24 per cent.

The main belts of the Broadhead Mills at Jamestown, N. Y. (Fig. 4) are 40-inches face, on 45 and 34

Fig. 4.

feet centers, doing 500 H.P. easily when photographed, and running 4-feet and 22-inches slack respectively, in perfect condition, after five years use of Cling-Surface.

The vertical belt (Fig. 5) is a 12-inch belt, 9 feet centers and has done 55 H.P. in this way for nearly four years. It shows the possibilities of the slack belt.

Vertical belts cannot usually run slack—simply easy. Over-drives the same. If a belt can run slack, every inch is a direct gain. If it cannot, still tightening strain is removed and full power is obtained with low friction load. The slacker the better, as conditions permit.

Equally good results are obtained with rope drives —preservation of the rope, no fraying from internal friction, pliable, water and weatherproof rope, lasting

Fig. 5.

much longer than under ordinary conditions, and doing more work.

There is no part of a plant where economy can be more easily put in operation and where direct returns are so quickly obtained. (Cling-Surface Co. Buffalo, N. Y.)

THE BARNEY COMPOUND FAN.

The same is an apparatus for moving large volumes of air with whatever floats therein, and is used for the removal of

Steam from Dye-Houses, Bleacheries, Slasher Rooms, Wash Rooms, Drying Plants (Barney System);

Heat from Dynamo and Boiler Rooms, Press Rooms in Woolen Mills, Spinning Rooms in Cotton Mills;

Moisture from Dry Rooms where the wet goods are constantly surrounded by a current of dry air, Wool-Dryers, etc.; as well as for ventilation of all kinds, under varying conditions, and whatever a volume fan can do.

The purpose accomplished by this fan is to increase the volume and velocity of columns of air and to deliver them freely through the fan in such a manner as to meet with a minimum of atmospheric resistance at the discharge face of the fan. The fan is so constructed, that while the rear blades suck in the air, the outer blades beat away the surrounding air and draw out that taken in on the other side of the fan. The unchangeable shape and angle of the blades (all scientifically determined) being such that the proportionate maximum of work is accomplished whatever the speed employed. Amount of air passing through the fan in a given time is then easily decided by the speed at which the fan is run, it being directly in proportion to that speed.

A Blower moves small volumes of air at great velocity, requiring large horse power on account of small air inlet, and is unequalled for blowing fires, moving materials that require a powerful and rapid current of air of small volume, whereas:

A Barney Compound Fan moves large volumes of air at low pressure, requiring small horse power on account of large inlet for air, and is unequalled for moving air, dust, smoke, steam, heat, gases. The fan is so constructed as to admit of being run either way, and will blow or exhaust an equal current of air in either direction. This feature is often a valuable one where it is desirable to sometimes exhaust and at other times force in a volume of air. Size of fan required and speed to run are best left to the decision of the fan engineer, since in most cases the consumer has little, if any, experience in that matter. Where pipes are necessary the size should equal diameter of fan revolving portion. All air inlets near the fan should be closed, but air must be allowed to take the place of that expelled, for which reason the point of air inlet should be in such relation to the fan, that the air will flow across the dusty, steamy or heated portion.

Fig. 1 shows a face view and Fig. 2 an edge view of the Barney compound fan. The blades of the fan are in two sections A and B respectively, each section consisting of a series of four blades mounted upon hubs at an angle to the axis of the hub, with the inner straight edge of each blade lying in the plane of the rear face of the section and the outer curved edges forming the front face of the section. These two sections are united upon a common shaft, with the planes of their inner faces abutting and the outer ends of each blade secured to a common peripheral central ring, the concave inner surfaces of each two alternate opposite front and rear blades forming channels for the passage of air through the fan at an angle to the axis of the fan, corresponding in degree with the angle at which the blades cross the shaft. The compound fan in its central cross section shows an elliptical outline.

Facing the fan on the pulley side, it usually revolves to the right, and when the blades marked A scoop in the surrounding air, while those on the

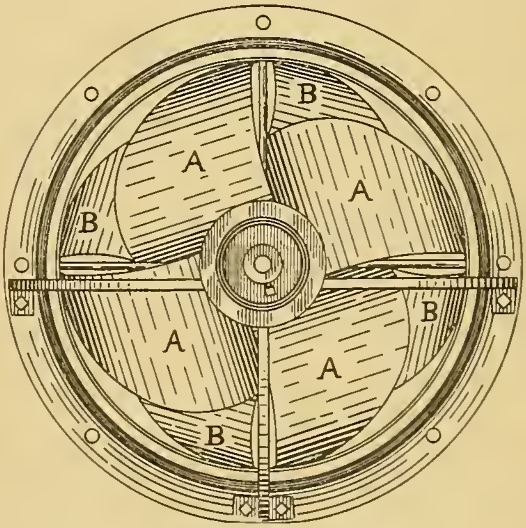


Fig. 1.

other side, marked B beat away the air outside, thus forming a vacuum in advance of the column of air which is being scooped in on the feed side, and when consequently a solid column of air is discharged. In other words, the concave inner face of the front blades, acting as suction, in unison with the convex outer face of the rear blades, acting as "plenum," produces a practical vacuum at the rear of the wheel and in advance of the discharged column of air, thereby increasing both the volume and velocity of the column of air moved through the wheel.

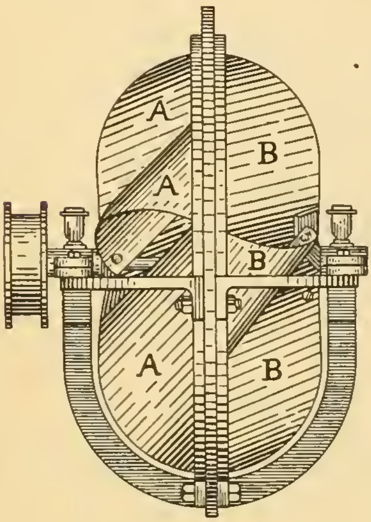


Fig. 2.

The shape of the blades, as is clearly shown in Fig. 1, *i. e.* wide near the hub and narrow at the periphery, is the correct shape, for if the blades were narrow at the hub where the circle described in revolving is small, and wide at the periphery where the circle described in revolving is large, then the air would be drawn through at the periphery with much greater velocity than at the centre, resulting in partial vacuum near the centre and a consequent back flow of the air, being forced out at the periphery, back into the fau again. This is the cause of back draft which materially cuts down efficiency of most fans.

The shape of the blades of the fan as shown, together with the action of the rear set of blades, assure an equal velocity of air through all parts of the fan, and thus make back draft impossible. (Barney Ventilating Fan Works, Boston, Mass.)

WING'S DISC FAN.

This fan is characterized chiefly by its efficiency in circulating air for ventilation, heating, drying, etc., and the ease with which it can be adjusted to circulate more or less air as may be required at different times. They are used in all kinds of textile plants, for ventilating purposes, removing heat, dust, steam, etc., and in bleacheries, print works, dye houses, etc., for removing steam, heat, vapors, and for drying purposes. They may be driven in three ways, according to the different requirements, viz: by belt and pulley, by a small steam engine attached to the fan, the engine shaft also acting as the fan shaft, or by an electric motor attached to the frame of the fan, the armature shaft carrying said fan.

A perspective view of a disc fan is given in the accompanying illustration, showing it complete in its casing. The fan consists of six blades, equally spaced from each other, as it has been found by tests that a fan with six blades will either propel or exhaust more air than one with any greater number, and that if the number of blades be increased beyond six, the amount of air propelled or exhausted is in inverse ratio to the number of blades employed. The blades are made adjustable as to the angle they are to work at, and can thus be set to suit the conditions under which the fan is to operate. Each fan is, therefore, available for efficient use under widely varying conditions, since the current of air can be reduced, increased or turned without having to replace the fan with one of another size, or change any pipe or belt used in connection with it.

Standing on the pulley side of the fan, as shown in illustration, the direction of running is similar to that of the hands of a clock, and the current of air is moved from the pulley side through the fan when the latter is running. For open ventilation the blades of the fan are set at an angle of 35°, which angle has been found to be the best for exhausting air from mill rooms, etc. For forcing air through long pipes, or a series of rooms or drying chambers for cooling or drying purposes, the blades of the fan should be set at a different angle from the one just given, and in accordance with the conditions under which the fan is to operate.

The speed of the fan is also an important item, and depends on the use to which it is put. For heating and ventilating purposes, a comparatively low speed will give excellent results, while with higher speeds, pressure is obtained for forcing air through pipes, etc. When using these higher speeds, the usual angle of the blades is altered.

Two other characteristics of this fan are that it is practically noiseless, and does not obstruct the light, when placed in a window. In all cases where these fans are to be used, two things must be attended to; viz: the proper size or sizes of fans must be ascertained, and an ample supply of air must be admitted for the fans to exhaust; or if the air is forced in, there must be plenty of avenues for the escape of the air thus driven in, as well as a sufficient supply for the fan. If this is neglected the efficiency of the fan will be reduced.

The following table of speeds, horse power used, and amount of air exhausted will assist in ascertaiuing fan or fans required for certain results.

Size.	Rev. Per Minute.	Horse Power Used.	Exhaust Cubic Feet of Air Per Minute.
12 in.	1,000 to 1,500	1/16 to 1/4	1,500 to 2,200
18 in.	700 to 1,200	1/8 to 1/2	3,000 to 5,200
24 in.	600 to 1,000	1/4 to 3/4	4,500 to 7,500
30 in.	500 to 900	1/3 to 1	7,500 to 13,500
36 in.	400 to 800	3/4 to 2½	12,500 to 24,000
42 in.	400 to 700	1 to 3	18,000 to 31,500
48 in.	400 to 500	2 to 5	24,000 to 36,000

To decide on size, or size and number of fans, needed for any room or building that is to be heated, ventilated, cleared from steam, etc., find out how much steam, dust, etc., is to be removed, or how much material to be dried. When these facts have been ascertained you must decide upon how often the air in the room or machine should be changed to keep the air in the proper condition, and when then this most important point has been determined, you then can figure what fan or fans you want.

For example, say we wish to ventilate a room that is 60 ft.×200 ft.×25 ft., which thus contains 300,000 cubic feet of air, and the air should be changed, say, every 20 minutes to keep it pure and healthful.

To find the proper size of fan to use, we have

$$300{,}000 \div 20 = 15{,}000 \text{ cubic feet per minute.}$$

Then from the table given, it will be found that a 36 inch fan is required, the same to run at about 480 revolutions per minute, in order to exhaust the required amount of air in the time specified. The same principle of calculating is followed for ascertaining the proper fan or fans to use for drying, heating, cooling, etc. purposes.

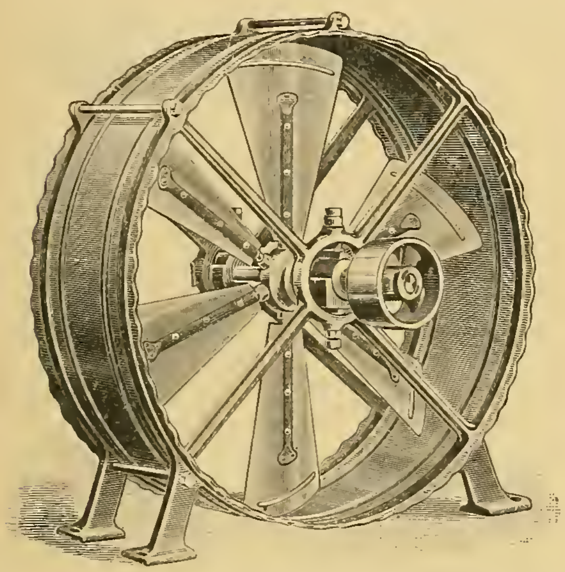
In ventilation, the air usually needs changing in from 15 to 30 minutes, while for drying, taking out vapors, dust, etc., it varies from once an hour to once a minute.

In heating and ventilating, the best results are obtained by both forcing and exhausting the air. The openings for the exhaust (when flues are used) should be distributed, having one-half of them near the floor, and the other half near the ceiling, as this assists in keeping an even temperature and makes heating more economical.

Special attention must also be given to the location of the fans and the admission of fresh air. For heating, ventilating and drying, the fan or the pipes and ducts leading to the fan must be located as nearly as possible on the opposite side of the room from inlets of fresh air.

For taking away dust, vapors, etc., the fan must be placed as nearly as possible to where the same are generated and the air admitted from the opposite side or end of the room. When this cannot be done, place the fan where convenient and run pipes or ducts to those parts of the room where the dust, etc., is made.

In dye houses, boiler rooms, etc., where the fans are placed in the walls or windows, it is absolutely necessary to keep the doors, windows and other openings near the fan closed, since the fan will draw



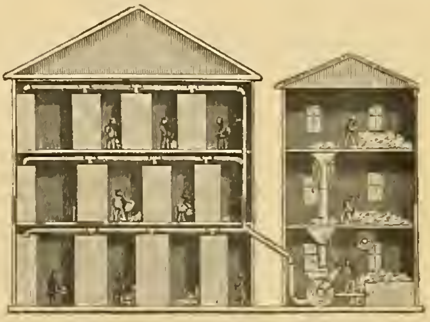
air from these nearest openings, whereas the air should come from the other side of the room to give proper results.

Where pipes, ducts or flues are used to exhaust from a number of machines or places, the sum of the area of all the pipes, etc., should not exceed the area of the fan.

The pipe or pipes on the force side of the fan must be of same area as the fan to move the largest quantity of air. Fans put in walls, windows, etc., should always have openings the full size of the fan. (L. J. Wing Mfg. Co., 251 and 253 West Broadway, New York.)

SCHNITZLER'S PNEUMATIC CONVEYOR SYSTEM.

This system consists principally of a blower, especially constructed for the rapid handling of all kinds of fibrous material, and a system of galvanized iron piping with special transfer valves, by which means all kinds of fibrous material, such as wool and cotton stock, hair, rags, jute, etc., wet or dry, can be taken from Pickers and Dryers or other machinery, or, in connection with hand feeding, from Hoppers as fitted to the blower, and conveyed to one or more buildings or departments of a mill, and, by



an arrangement of a system of bins, to any one of the latter which may be desired, either in the lower or the upper stories of the mill, or any building, as shown in the accompanying illustration, and the same can be conveyed to any particular place without any possibility of mixing or exchanging stock, as nothing is left in the pipes or against the valves.

The system is also adapted for plants where several parties are manufacturing in the same mill and when one or the other needs to use the conveyor, the signal is given, transfers made to party using, and then stock can be passed through the telescope feeder, pipes connecting from the first, second or third floor, as the case may be, to blower, and thence to the desired departments of the mill. It saves 25% in handling stock, such as wool, cotton, etc.; it opens up the material under operation and makes it light and flaky. This system of conveying will handle material at the rate of 100 to 150 pounds per minute. Another feature of the system is the economy of space required, since stock can remain in the picker room until needed, and then be immediately sent to the department where it is needed to be worked. No stock need be put up in sacks or sheets, pressed, and thus in turn made bunchy and unsuitable for perfect work at the card. The latter department thus can be kept neat and clean, a feature much desired by manufacturers.

This system is being placed in Wool, Cotton and Carpet Mills, Dyehouses, etc., with great success. (Chas. H. Schnitzler, Philadelphia, Pa.)

THE BELL SYSTEM OF HUMIDIFICATION.

The Bell system of Humidification is based on strictly scientific principles and carries them out in a practical, economical and efficient manner, reproducing and automatically maintaining in the mill the best climatic conditions required for perfect work, thus ensuring to the mill, product through all seasons and all weather conditions, quantity as well as quality.

The Bell Humidifier takes up water by rapid evaporation, produced by the forcing of air at constant speed over large, ingeniously arranged wet surfaces, producing moisture as aqueous vapor, just as it is found in nature but always below the dew point, maintaining the air in the room at the point below saturation that is most suitable for any class of textile working. It treats all the air in the room, separating from it the static electricity, dust and impurities, and keeping down the fine fuzz.

This Humidifier is self-regulating and does not keep on moistening when further moistening is useless. When once set to produce a given humidity no further regulation is needed under ordinary variations in the external conditions. When the general humidity of the room has been brought up to the pre-determined point the Humidifier automatically ceases raising it further, thereafter merely supplying the deficit produced by absorption and condensation. If by sudden temporary changes, such as the opening of doors and windows, the humidity falls, the air receives more moisture automatically in the machine. In wet weather the humidity in the room is not affected materially unless the windows are kept open; if damp air comes in and raises the humidity temporarily the machines do less moistening until absorption has taken care of the surplus, when things settle down to an equilibrium as before. The apparatus, by keeping the air moving, tends to produce rapid absorption by the yarns, etc., which also tends to hold conditions uniform. About the only effect of changes outside is that the machines do not have to do quite so much work in wet weather as in dry; the absorption in the room is far more than enough to take care of the little moisture that may creep into the room, so that the machines are still kept busy.

The humidifying apparatus by itself requires no outside connections, being arranged for suspension it takes up no floor space, and requires only H.P. to operate.

Details concerning the application of the Bell system can be obtained from the BELL PURE AIR AND COOLING COMPANY, New York.

POWER PRESSES FOR BALING AND FINISHING PROCESSES.

A most important adjunct to any mill is satisfactory baling presses, may it be for yarns, knit or woven goods, in order to bring them in proper shape for shipping purposes; again in some instances certain styles of these presses are needed in the finishing department of cotton and woolen mills.

Fig. 1 shows what is known as a *Yarn Baling Screw Press*, which as its name indicates, is operated upon the double screw principle, being mainly used for the baling of yarn, or knit goods, etc., and when no extra heavy pressure nor great speed is an object. The frame of this press is made of steel channel beams securely riveted together. The standard size of this press has its screws of steel, 3″ in diameter, and with a movement of 44″. The gearing is heavy and the screw nut seats self-oiling and self-adjusting. The pulleys are 24″ diameter, to be used in connection with 4″ belts. The baling box is 24″ x 36″ x 52″ deep, the sides of the upper part being arranged to lift off for convenience of filling. The lower part of the box is hung on hinges and opens downward for tying and removing the bale. The entire box can be readily removed and the press used for baling knit goods or cloth if so desired. A safety device is provided for shifting the belt at the extreme upward movement. As the press is all iron and steel except the baling box, its durability is beyond question. It will be readily understood that this press is built in any size required, as regulated by the requirements of a mill, the dimensions quoted having been simply given to illustrate the general construction of a certain standard make, of advantage to be used by the average mill. As will be readily seen from our illustration, this press bales or presses downward, and which as a rule is the system of pressing mostly preferred for the class of work these presses are designed for; however in some cases it may not be convenient to have the press in a room where power can be easily applied, and in which instance the gearing of this double screw press is then placed below the floor, raising the platen and baling box upward, a plunger being attached to the head beams of proper size to enter the box. In connection with this construction, arrangements are sometimes provided to permit the box to be put on wheels and run to any part of the room for convenient loading or unloading purposes.

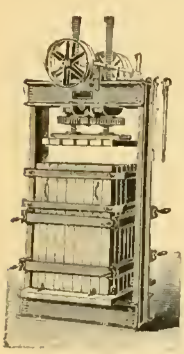


Fig. 1.

Fig. 2 shows a specimen of a *screw and lever press* designed for the finishing departments of cotton and woolen mills in connection with (pressing) ginghams, calicoes, bleached goods, woolen goods, as well as for baling cotton, woolen and worsted goods of every description. It will be readily understood by anybody only somewhat versed in mathematics, that by means of the power principle, the action of this press is based upon, *i. e.* the double lever, and screw arrangement, an immense power can be exerted by this press, which is built in various sizes—from a pressure of 60 tons to 500 tons—to suit the demands of a certain mill as to kind of work or production required. The press itself—no matter what size of press under consideration—as will be readily grasped, to withstand the immense pressure exerted by the press, is all iron and steel. An automatic shifting device is provided to the press, which stops the latter at any point desired for either upward or downward motions, an indicator showing at all times the amount of pressure being applied on the goods. This kind of a press is also, where so desired, built to have its pulleys and attachments placed on the floor beneath that in which the baling is done, and in which case the platen rises similarly as in an ordinary hydraulic press.

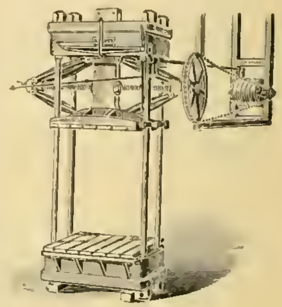


Fig. 2.

The Indicator for these presses consists of two levers arranged to accurately indicate the spring of the head beam of the press, enabling the operator to see at a glance the amount of pressure being transmitted to the material under pressure. The advantages of this are that this attachment (as is supplied to all presses) greatly reduces the possibilities of breakage and enables the operator to determine when the material under operation is sufficiently pressed, *i. e.* to put more or less pressure upon the material in the press as desired, the Indicator being for this work as accurate as a pair of steel scales.

Fig. 3 shows us a specimen of a *Hydraulic Press*, as used in connection with finishing cotton and woolen cloth as well as baling material.

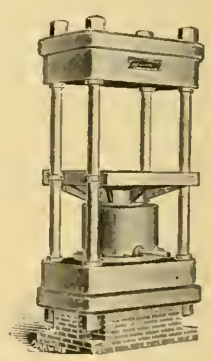


Fig. 3.

As the action of the hydraulic press does not seem to be understood by all, a short sketch, explaining the principle underlying this system of pressing, will not be amiss. Hydraulic power depends upon the principle that liquids press equally in all directions, and that if the power applied to the plunger of a force pump be multiplied by the ratio existing between the area of the pump plunger and the ram of the press, the product will be the power of the press; thus if the diameter of the pump plunger be $\frac{7}{10}$ of an inch, the area would be ½ square inch, and if the ram were 12 inches in diameter, the area being 113 square inches, the ratio between pump and ram would be as 1 to 226, or the area of the ram would be 226 times larger than the pump plunger. Now if one thousand pounds weight were laid on the pump plunger, the pressure transmitted through the water to the press ram would be $226 \times 1000 = 226{,}000$ pounds, or 113 tons and the water pressure would be 2,000 pounds per square inch of surface, both in pump, pipes, valves and cylinder. In other words the power of the press would be 226 times the pressure or weight applied to the pump plunger. Increasing the size of the ram, or decreasing the size of the plunger, would increase the ratio and hence would give increased power to the press.

In use, the foundation for this press is made of such a height as to bring the platen on a level with the floor when cars are used for loading and unloading the material to and from the press, or a little above the floor (as shown in the illustration), when goods are laid up in the press. Wooden baling strips are attached to head and platen when the press is used for baling purposes. As will be readily understood these hydraulic presses are also built in all sizes, *i. e.* dimensions and pressures to suit the amount of work to be handled by it in the mill.

Hydraulic Pumps. In connection with a hydraulic press it is necessary to bestow care to the selection of the proper hydraulic pump and of which there are several styles of construction and which can be divided into belt and steam pumps.

The first kind again may be a common double plunger pump, or a double plunger pump of different size plungers and which gives a very great advantage in point of time over those of ordinary manufacture. Again there are triplex pumps which give a smooth and continuous flow of water and will be found very satisfactory. The plungers in this pump are all of the same size and driven by eccentrics, the diameter of the plungers depending upon the pressure and capacity required to do the work in the best manner. In many cases when the material is soft like waste, wool, etc., it is desirable to get the material condensed quickly, and for such work a pump having two larger plungers to give a quick movement and two smaller ones to give the final and heavy pressure, are used; each set of plungers being provided with safety and relief valves. For very large presses requiring extreme high water pressure, geared pumps are used, the same having machine cut gears, steel barrels, plungers, and crank shaft.

When the greatest efficiency is desired the steam hydraulic pump may be used to advantage. Its first cost is more than a first class belt pump, but it uses no steam that is not required for effective work, can be run without running the engine, and "follow up" without the loss of any power, whereas in a belt pump the surplus water must overflow through the safety valve, consuming power and wearing the valve rapidly. (Boomer & Boschert Press Co., Syracuse, N. Y.)

RIVER WATER AND ITS FILTRATION FOR TEXTILE PURPOSES.

One of the most important supplies for any Textile plant, more especially with reference to scouring, bleaching, dyeing and finishing, is a plentiful supply of good water. With reference to judging the suitability of any source of water for textile purposes we must be guided by different considerations, for the fact that some impurities which may be very injurious in one instance may be harmless in another, and in some instances even of benefit to the process. There is no doubt that the use of an absolutely pure water would be of immense advantage for textile manufacturing purposes, but it is equally well known that such a water in sufficient quantities could never be obtained, hence we must set ourselves thinking how to make the best of the supply of water at our command.

The impurities existing in water as we have to use, vary considerably, both in quantity and kind, and it is very important that the chemist or overseer of any of the various departments of a textile mill as quoted before, should know what impurities in connection with a certain water he has to deal with, since these impurities cannot help but exert an influence to the process under operation; again he must inquire how these impurities, if injurious to the process, can be removed, or at least their effect counteracted.

Aqueous vapor condensed forms pure water, and for which reason, rain water if collected before reaching the ground, would constitute the most pure natural form of water, since it only will contain such impurities as absorbed by it during its passage through the air; however in its usual course, rain or dew falls on the ground, in which case a portion of the water simply drains over the surface, flowing to lower levels, and in turn forming and feeding streams and rivers, whereas other portions of the rain or dew will sink in the ground, etc., etc., in turn either forming the supply of water known as spring or well water respectively. Of these three water supplies, no doubt the first mentioned one is the most important supply to textile mills, hence will be only treated by us, the other two supplies belonging more particular under the special care of the chemist of the mill.

River water has for the most part simply run over the surface of the ground, and consequently has been in contact with the latter only for a short time, thus, as a rule, does not contain so much dissolved impurities as spring or well water; however, on the other hand, it is frequently muddy by reason of solid vegetation or mineral matter held by it in suspension. As will be readily understood, river water is much more quickly and extensively polluted by heavy rains or continued drought than springs or wells.

After heavy rains, many water supplies are made practically useless for scouring, bleaching, finishing or dyeing purposes, owing to the large quantities of suspended matter, mud and sand, organic matter from the banks of the stream or the gathering ground, and solid matter turned into the river by works or towns situated higher up the stream, and which remain in suspension for a long time. The composition and amount of these is very variable, not only in different places but also at any given place at different times. The only remedy for this trouble is ample storage and subsiding reservoirs or efficient filters, since no chemical treatment will meet this case. The first plan in most cases is a rather expensive affair to mills, again in most instances the space necessary for such a plant is not available, hence filtering the water by means of a reliable filter is the most advisable adjunct to use.

The Roberts System of Filtration. The chief features of this filter are its simplicity of construction and operation, and this in connection with perfect filtering. The filter as will be readily understood is built in various sizes, in order to suit the various demands of a mill; again any number of these filters may in turn be connected to one main supply of filtered water to the mill. The filter in itself consists of a large tank of cast iron or steel shells, supplied in its interior at the bottom with special brass strainers on 6 inch centres, all over the bottom to prevent passage of sand with the filtered water from the filter.

The accompanying illustration shows one of these strainers or sand valves as they are called, in its

perspective view, the same being made of first quality brass or valve metal, being designed to permit the escape of the filtered water from the filter when filtering, and at the same time to admit the wash water when washing the gravel and sand, *i. e.* the interior of the filter. These sand valves or strainers are of a superior construction compared to other strainers used in connection with other makes of filters, and have by practical application proved not to clog or channel the sand bed, and to positively prevent the escape of sand with the filtered water. These strainers consist of two metal plates, riveted on their bottom plate of the strainer, leaving a small aperture, produced by means of small washers on the rivets between the metal plates. The bottom plate connects to the outlet or inlet as the case may be of the strainer. The two apertures between the three metal plates are about $\frac{1}{32}$ of an inch, and for the fact that they are on the side of the strainer—around its circumference—they naturally will successfully prevent this strainer from carrying off sand in connection with the filtering water; whereas, in other strainers as used in connection with other makes of filters, plugging up of the inlet holes of such strainers —then in the shape of a screen on top and around its sides—is a frequent occurrence, on account of the sand embedding itself into the holes of these strainers, these holes in most cases being in direct contact, more or less, with the sand, which in such filters generally is used without gravel.

Coming back to the Roberts Filter, we find placed on top of the strainers 8 inches of gravel. Here we must state that the right kind of gravel is used, since there are many kinds of gravel which will mix with the sand, and thus make filtering more cumbersome. On top of the gravel 3 feet of pure silicate sand, sterilized and graded is placed, in this way finishing the interior arrangements of this filter.

Another important feature of this filter is its single controlling valve, by means of which every operation of the filter is controlled. This controlling valve is so simple that the filter can be successfully operated by the most ignorant workman, it abolishing the old style complication of valves generally found in other makes of filters. The controlling valve is operated by a simple lever from the outside of the filter, said lever pointing against a dial, carrying 5 different readings, thus at once indicating the acting of the filter, viz: (1) cleaning filter; (2) filtering purpose; (3) by passes—cut out filter for passage of water, when for example no filtering is needed for a short time; (4) setting valve so that the first filtered water which naturally is dirty will run in the sewer in place of the supply pipes for the mill; (5) closed —everything closed up, filter completely placed out of use, *i. e.* temporarily not needed for some time.

By the use of an ingenious device, a solution made from commercial crystal potash alum is fed, drop by drop, into the unfiltered water before it enters the filter. The alum coagulates the impurities in the water and gathers together the exceedingly fine particles of clay and suspended matter, as well as the bacteria. The alum, with its enveloped and entangled impurities, is precipitated in the form of large gelatinous flakes. These flakes, being much larger than the voids between the sand grains, are easily arrested and retained by the filtering material, and, during the cleansing or washing of the filter, are completely eliminated from the sand bed and thrown into the drain or sewer. Absolutely no trace of the Alum remains in the filtered water.

GRAPHITE AS A LUBRICANT.

The object of all kinds of mechanism is the application of energy for the purpose of doing useful work. Owing to inherent imperfections in materials and construction of machinery, which cannot be avoided, a large part of the energy or force applied is wasted in overcoming the resistance to motion, offered by surfaces in contact with each other. This resistance is called friction, and is due to minute roughness and unevenness of the surfaces in contact. It is not possible to produce an absolutely smooth surface, and no matter how smooth the surface may appear to the naked eye, it will always prove to be rough and full of inequalities (as compared to absolute smoothness) when examined under the microscope. These minute elevations and depressions (of the two surfaces) interlock when said surfaces are in contact, and consequently resist free motion. Therefore, when force is applied, the irregularities of the different surfaces must either ride over on another, or the minute projections on the surfaces be broken off. When this occurs we have a continual abrasion and wearing, and all of the energy absorbed is converted into heat.

Lubrication has a threefold object, viz.: reducing frictional resistance, reducing wear of the parts in contact, and lessening the amount of power or energy wasted. Lubrication is accomplished by introducing, between the moving surfaces, a layer or film of some other substance which will keep the minute projections from interlocking or even touching, if the best results are to be obtained.

When the friction surfaces of a bearing are lubricated with oil, that part of the oil-layer or film nearest the box will be largely at rest, while that next to the journal will tend to move with the latter. Thus there is a constant movement of the particles of oil one upon the other, technically called "internal friction between the different particles or layers of the lubricant itself." The amount of this internal friction varies directly with the "viscosity" or "body" of the lubricant. The more viscous the lubricant, the greater the internal friction, and vice versa.

A good and efficient lubricant must possess the following characteristics:

(1). Sufficient body or viscosity to keep the friction surfaces apart, but at the same time with the greatest possible fluidity, consistent with this condition.

(2). A minimum coefficient of friction in actual service.

(3). Must not thicken or "gum" when in use, and must not contain acids or other injurious ingredients.

(4). Must not be easily thinned or vaporized by heat, or thickened by cold.

(5). Must be wholly free from all gritty or other foreign substances.

Petroleum or mineral oils have now come into almost universal use as lubricants, and in certain cases they are mixed with animal oils, especially in the case of those for cylinder lubrication of engines.

Animal oils will decompose quite readily, especially in the presence of heat, setting free their fatty acids, which in turn will cause serious corrosion of metals, although they retain their viscosity at high temperature. This makes them very suitable for adding to mineral oils for special purposes, but as a general rule, it is much better to use a "straight" mineral oil, if it will do the work, because mineral oils will never cause corrosion, and are more easily separated.

Graphite is also a lubricant. It is one of the purest forms in which carbon occurs in nature, possessing a bright lustre and a remarkable degree of smoothness and softness. It is unaffected by heat or cold, is not acted upon by acids or alkalies, and has a strong attraction for metal surfaces. When rubbed upon other substances it imparts to them a sort of greasy coating of great smoothness. Graphite occurs naturally in two forms, the crystalline or flake, and amorphous, but the latter is usually closely associated with clay and other impurities, and is therefore not at all fit for lubricating purposes. Both theory and practice clearly indicate the flake form of graphite for all purposes of lubrication.

The ideal lubricant should get at the cause of friction, that is, the minute roughness of the metal surfaces, and permanently fill up all these irregularities. Furthermore, it should have a low coefficient of friction, should be solid enough to resist being crushed out by great pressures, *and should wholly prevent cutting and abrasion.* It should be unaffected by any degree of heat attained in a cylinder or bearing, and not decomposed in any manner, to attack metals in contact with it.

The action of flake graphite is to fill up the minute depressions, roughnesses and pores in metal surfaces, bringing them much nearer to a condition of perfect smoothness, which brings about a very great reduction in the "solid friction" between those surfaces. Graphite has a strong tendency to attach itself to metallic surfaces, and imparts a veneer of great smoothness and endurance that materially reduces the necessity of a thick oil film. Its use therefore brings about a double reduction in friction. The best results for lubrication are probably obtained when flake graphite is used with oils or greases rather than with flake graphite alone and the gain in efficiency and reduction in friction is very evident.

With graphite, a thinner and probably cheaper oil may be used. Flake graphite is an accessory lubricant that makes oils more efficient, and supplies, with oils, an almost perfect system of lubrication. To reduce friction losses to their lowest, the lubricating film must be composed of an oil with the least possible internal friction. The thinner the oil that will suffice for a given bearing, the less the friction losses will be at that point. It is not enough appreciated among engineers that too viscous a lubricant can cause overheating just as surely as one that has not enough body. Very small percentages of flake graphite are sufficient to enable oils to have the best lubricating action. When first beginning to use graphite, use only enough to thoroughly coat the bearing surfaces, and after that only enough to maintain that thin layer against natural wear. The action of the graphite is to coat, with a smooth, hard coating, the metal surfaces in contact, and by so doing to relieve the liquid oil from some of the service which it would otherwise have to perform. In this manner the whole process of lubrication is made more effective, and, also the wearing qualities of the oil are preserved. In the case of very light bearings or sliding surfaces flake graphite alone is often sufficient to keep the surfaces bright, clean and smooth, and to furnish ample lubrication.

Graphite will not build up on itself to the extent of causing the moving parts to bind, because graphite is the softest of all minerals, being worn down easily by rubbing with the fingers, so that any tendency to build up is at once overcome by the wearing of the moving surfaces.

Graphite does not behave like oil, but associates itself with one or the other of the rubbing surfaces. It enters every crack and pit in the surfaces and fills them, and if the surfaces are ill-shaped or irregularly worn, the graphite fills in and overlays until a new surface of more regular outline is produced. When applied to a well-fitted journal the rubbing surfaces are coated with a layer so thin as to appear hardly more than a slight discoloration. If, on the other hand, the parts are poorly fitted, a veneering of graphite of varying thickness, which in the case of a certain experiment was found as great as $\frac{1}{16}$ inch, will result. The character of this veneering is always the same, dense in structure, capable of resisting enormous pressure, continuous in service without apparent pore or crack, and presenting a superficial finish that is wonderfully smooth and delicate to the touch.

The best percentage of graphite to use with each oil has never been scientifically and accurately determined, but from 2% to 8% by weight of flake graphite is advised, according to the work to be done and the character of the oil used.

The use of graphite in textile mills as a lubricant, both for shafting as well as machinery, is worthy of consideration. It makes possible clean systems of lubrication, thus minimizing the danger of oil stains upon goods in process of manufacture. Lubricating oil stains upon woven goods are almost impossible to remove without damage to the fabrics, and especially is this true of mineral oils. Again the consumption of power in a textile mill is not a case of a comparatively few machines, but of many thousand small spindles, great lengths of shafting, many looms, etc. The unit of friction may be small, but it occurs thousands of times, and the cost of power is a heavy fixed expense that must be reduced to the lowest possible figures.

It is also important that wear of spindles, looms, and machinery be made as low as possible, if uniformly good work is to be turned out, and all bearings be kept from overheating. More than one textile mill fire has been traced to the overheating of a bearing causing ignition of the oil which should have lubricated it. The use of pure flake graphite occasionally will glaze the small friction surfaces of each spindle, lowering their friction, keeping them cool, and preventing wear. In this instance it conspicuously aids the regular lubricating oil. The use of flake graphite almost wholly guarantees freedom from the danger of shut-downs due to hot bearings.

All bearings that are not siphon-fed may be regularly treated to a little flake graphite, with marked benefit, in the shape of lower friction, less wear, and the impossibility of abrasion and overheating. If flake graphite be used, less oil will suffice to give good results, and there will be a corresponding decrease in the likelihood of a pulley or gear to "sling oil" and stain a fabric.

From experiments with flake graphite as a lubricant, the following conclusions were obtained:

(1). The addition of graphite to oil results in a lower frictional resistance of the journal than would be obtained by the use of oil alone.

(2). When graphite is used with oil, the amount of oil required for a given service is reduced.

(3). By the use of graphite a light or an inferior quality of oil may be employed for a given service.

(4). By the use of graphite, water under favorable conditions may serve as a sufficient lubricant, as in the case of engine cylinders.

(5). A small amount of graphite only is required, since too much graphite unduly thickens the oil and correspondingly increases its internal friction due to viscosity. The supply, however, should be constant, though small, for the best results.

MENSURATION OF SURFACES, SOLIDS, ETC.

Diameter of a circle×3.1416=the circumference.

Circumference of a circle×0.31831=the diameter.

Diameter of a circle×0.8862=the side of an equal square.

Side of a square×1.128=the diameter of an equal circle.

Square of diameter×0.7854=the area of a circle.

Square root of area×1.12837=the diameter of equal circle.

Square of the diameter of a sphere×3.1416=surface area.

Cube of the diameter of a sphere×0.5236=solidity.

Diameter of a sphere=0.806=dimensions of equal cube.

Diameter of a sphere×0.6667=length of equal cylinder.

Square inches×0.00695=square feet.

Cubic inches×0.000578=cubic feet.

Cylindrical inches×0.0004546=cubic feet.

Cylindrical feet×0.0290946=cubic yards.

183.346 circular inches=1 square foot.

2200 cylindrical inches=1 cubic foot.

Area of triangle=base×half the perpendicular height.

Surface of cylinder=area of both ends+length× circumference.

Surface of cone=area of base×½ (slant height× circumference of base).

Surface of sphere=diameter squared×3.14159.

Solidity of sphere=diameter cubed×0.5236.

Solidity of cylinder=area of one end×length.

AREA OF CIRCLES IN SQUARE FEET.

Diameter in Inches.	Area in Square Feet.	Diameter in Inches.	Area in Square Feet.	Diameter in Inches.	Area in Square Feet.	Diameter in Inches.	Area in Square Feet.
5	0.136	12	0.783	25	3.408	38	7.87
5½	0.164	13	0.921	26	3.687	39	8.29
6	0.196	14	1.069	27	3.976	40	8.72
6½	0.230	15	1.227	28	4.276	41	9.16
7	0.267	16	1.396	29	4.586	42	9.62
7½	0.306	17	1.576	30	4.908	43	10.08
8	0.349	18	1.767	31	5.24	44	10.55
8½	0.394	19	1.968	32	5.58	45	11.04
9	0.441	20	2.181	33	5.93	46	11.54
9½	0.492	21	2.405	34	6.30	47	12.04
10	0.545	22	2.639	35	6.68	48	12.55
10½	0.601	23	2.885	36	7.06	49	13.09
11	0.659	24	3.141	37	7.46	50	13.63

U. S. MEASURES.

Measures of Length.

12 inches (in.)	=1 foot (ft.)
3 feet	=1 yard (yd.).
5½ yards	=1 rod (rd.).
40 rods	=1 furlong (fur.).
8 furlongs	=1 mile (mi.).
3 miles	=1 league (lea.).
1760 yards	=1 mile.
6 feet	=1 fathom.

Measure of Capacity.

60 minims	=1 fluid drachm (fl. dr.).
8 fluid drachms	=1 fluid ounce (fl. oz.).
20 fluid ounces	=1 pint (pt.).
2 pints	=1 quart (qt.).
4 quarts	=1 gallon (gall.).
8 quarts	=1 peck (pk.).
4 pecks	=1 bushel (bus.).
8 bushels	=1 quarter (qr.).

1 minim equals 0.91 grain of water.

Avoirdupois Weight.

16 drachms (dr.)	=1 ounce (oz.).
16 ounces	=1 pound (lb.).
28 pounds	=1 quarter (qr.).
4 quarters	=1 hundredweight (cwt.).
20 hundredweight	=1 ton.
1 pound Avoirdupois	=7.000 grains, Troy.
1 ounce "	=437½ " "

Troy Weight.

24 grains (gr.)	=1 pennyweight.
20 pennyweights	=1 ounce.
12 ounces	=1 pound.

Apothecaries' Weight.

20 grains	=1 scruple.
3 scruples	=1 dram.
8 drams	=1 ounce.
12 ounces	=1 pound.

Surface Measure.

144 square inches (sq.in.)	=1 square foot (sq. ft.).
9 " feet.	=1 " yard (sq. yd.).
30¼ " yards	=1 " rod (sq. rd.).
40 " rods	=1 rood (ro.).
4 roods	=1 acre (ac.).
4840 square yards	=1 acre.
640 acres	=1 square mile

Cubic Measure.

1728 cubic inches (cu. in.)	=1 cubic foot (cu. ft.).
27 cubic feet	=1 cubic yard (cu. yd.).

Angle Measure.

60 seconds (″)	are 1 minute (′).
60 minutes	" 1 degree (°).
360 degrees	" 1 circumference (C).

Counting.

12 units	=1 dozen (doz.).
12 dozen	=1 gross (gr.).
12 gross	=1 great gross (gr. grs.).
20 units	=1 score.

Paper.

24 sheets	=1 quire.
20 quires	=1 ream.
2 reams	=1 bundle.
5 bundles	=1 bale.

METRIC SYSTEM.

The Metric System, of weights and measures, is formed upon the decimal scale, and has for its base a unit called a metre.

Units.—The following are the different units with their English pronunciation:

The Metre (meter).—The unit of the Metric Measure is (very nearly) the ten millionths part of a line drawn from the pole to the equator.

The Litre (leeter).—The unit for all metric measures of capacity, dry or liquid, is a cube whose edge is the tenth of a metre (or one cubic decimetre).

The Gram (gram).—The unit of the Metric Weights, is the weight of a cubic centimetre of distilled water at 4° centigrade.

The Are (air).—is the unit for land measure. (It is a square whose sides are ten (10) metres.)

The Stere (stair).—is the unit for solid or cubic measure. (It is a cube whose edge is one (1) metre.)

Measure of Length.

Metric Denominations and Values.		Meters.		Equivalent in Denominations used in the United States. Inches.		
Myriametre (Mm.)	or	10000	equals	393707.904	=	6.21 miles.
Kilometre (Km.)	"	1000	"	39370.7904	=	3.280 ft. 10 in.
Hectometre (Hm.)	"	100	"	3937.07904	=	328 ft. 1 in.
Decametre (Dm.)	"	10	"	393.707904	=	32.8 ft.
Metre (M.)	"	1	"	39.3707904	=	3.28 ft. almost 40 in.
Decimetre (dm.)	"	0.1	"	3.9370790	=	almost 4 in.
Centimetre (cm.)	"	0.01	"	0.3937079		
Millimetre (mm.)	"	0.001	"	0.0393707		

U. S. Measures.	Metric Measure.	U. S. Measures	Metric Measures.
1 Inch =	2.5399 Centimeters.	1 Foot =	3 0479 Decimetres.
1 Yard =	0.9143 Metre.	1 Mile =	1609.32 Metres.

Measure of Capacity.

Metric Denominations and Values.								Equivalent in United States Denominations.	
Myrialitre (Ml.)	=	10000	litres	=	10 cubic	meters	=	2200.9670	gallons
Kilolitre (Kl.)	=	1000	"	=	1 "	metre	=	220.0967	"
Hectolitre (Hl.)	=	100	"	=	100 "	decimetres	=	22.0097	"
Decalitre (Dl.)	=	10	"	=	10 "	decimetres	=	2.2009	"
Litre (L.)	=	1	"	=	1 "	decimetre	=	1.7608	pints
Decilitre (dl.)	=	0.1	"	=	100 "	centimetres	=	6.1027	cubic inches
Centilitre (cl.)	=	0.01	"	=	10 "	centimetres	=	0.61027	" "
Millilitre (ml.)	=	0.001	"	=	1 "	centimetre	=	0.061	" "

Measure of Weight.

Metric Denominations and Values.						Equivalent in United States Denominations.	
Myriagram (Mg.)	=	10000	grams.	=	10 cu. decimetres of water	22 046	lbs., Avoir.
Kilogram (Kg.)	=	1000	"	=	1 " " " "	2.204	" "
Hectogram (Hg.)	=	100	"	=	100 " centimetres " "	3.527	oz., "
Decagram (Dg.)	=	10	"	=	10 " " " "	154.323	grams.
Gram (G.)	=	1	"	=	1 " " " "	15 432	"
Decigram (dg.)	=	0.1	"	=	100 " millimetres " "	1.543	"
Centigram (cg.)	=	0.01	"	=	10 " " " "	0 154	"
Miligram (mg.)	=	0.001	"	=	1 " " " "	0.015	"

CLASSIFIED BUYERS' INDEX.

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FOR ALPHABETICAL LIST OF ADVERTISERS, SEE PAGES 413 AND 414.

FOR ALPHABETICAL LIST OF ADVERTISERS, SEE PAGES 413 AND 414.

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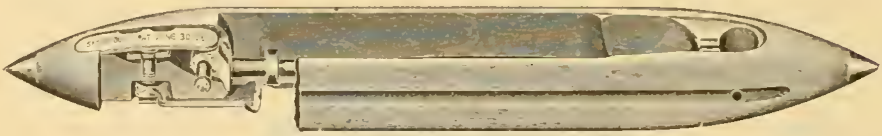

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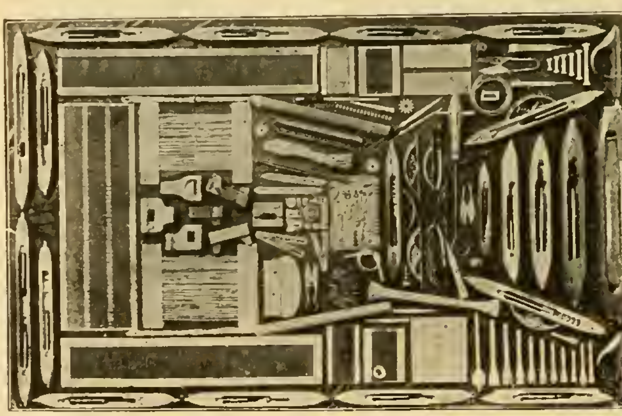

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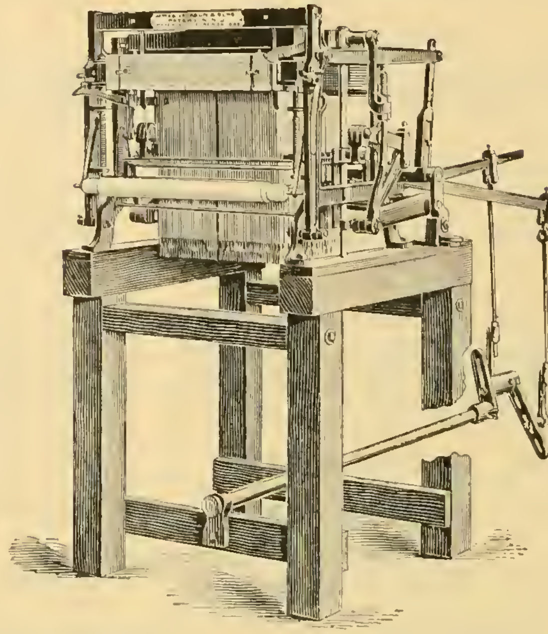

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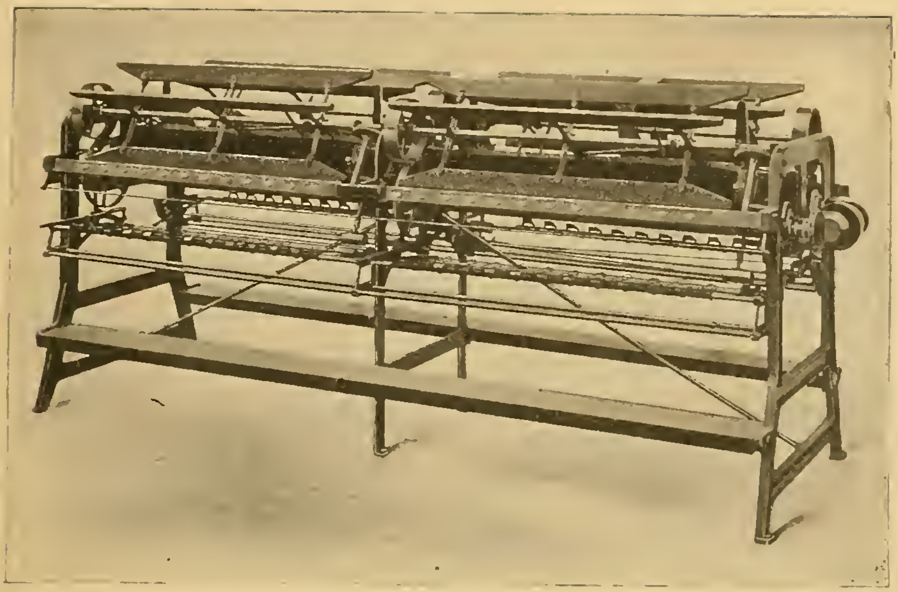
For description of these machines see pages 260, 261 and 386.



The Sipp Automatic Power Reel, made one, two or three flies long. Patented March 24, 1903.

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We also make winders, all styles, as well as quillers, measuring devices for looms, testing machinery, etc.

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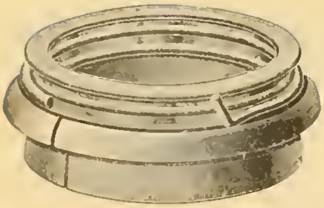

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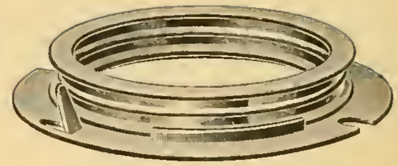

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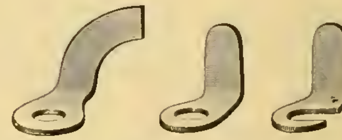
The Lightest Running and Most Durable Rings ever Produced.



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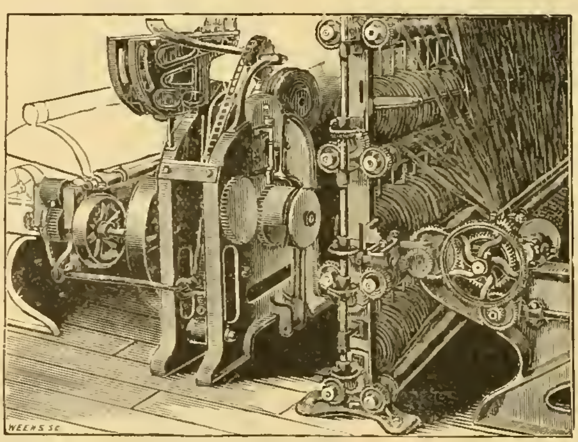


SAVES Labor Waste Room

Increased doublings, insuring perfect blend of stock and even yarn. Dispenses with the old creel and lap systems. Positive unwinding motion on creels. Makes any size ball by simply adjusting a screw.

CHOQUETTE WASTE SAVER.—Saves card fly, reducing the card waste to a minimum. SAMPLING CARD.—For matching colors and making mixes. KEARSLEY'S FEED BACK.—For self feeds, insures even weighings. AUTOMATIC BALLER for WORSTED CARDS.—Doffs the sliver from morning to night without attention of operative.

For a description of Horrocks' Patent Stop-Motion, see page 122.

TO THE KNIT GOODS MANUFACTURERS.

YOU WILL certainly do your best to give **entire satisfaction to your customers**, that **they might keep you busy for the following years.** You want to manufacture **high-grade goods,** produce in **large quantities** and at **cheap rates,** that you might get good benefit out of same, without raising your prices to a forbidding point.

All this is only possible if you have **an up-to-date plant**; you can do it only on **first-class** and **improved machinery.**

Are you better off than your competitor, is your plant fitted to do the work well? If not you have to consider and make **at once** the necessary improvements. The longer you wait, the harder it will be. Your competitors will find out the weak points of **your** manufacturing system, will attack and beat you there, and have **the best of you** in the struggle for orders. **This concerns you.**

If you intend to enlarge and improve your plant, to invest new capital in machinery, do not waste it, **invest.** To enable you to do so you will have to buy the **best machines** in the market, as the best only is the cheapest; you will have to get the **most improved** machines and from a manufacturer who has a reputation in the country and takes care to keep the same. He will **give** you the advantages of a **long and expensive experience free** to you in providing you with machines for most regular goods, with **largest production** for first-class work.

Now-a-days the mechanical work spares capital, spares wages; give the engineer a chance to put **you** in position to save **your** capital in **reducing your manufacturing expenses.**

Consider carefully all the necessities of your plant and your line of business; if your order is ready, see that the machines you are going to buy will respond to the following capital points:

I. Are they **built well, strong enough** and of **selected materials**; will they not be subject to **rapid** wearing out and **expensive repairs?**

II. Are all your needs **considered,** can the machines be operated by workmen without special training

III. Can the machines be used **with advantage** for other articles, if the selling of the goods you actually make will **drop,** and the market opens for new styles?

IV. Are the movements of the machines so **independent** that **any combination** of same for various patterns, etc., **will be possible?**

V. Are the parts, cams, etc , **interchangeable,** and can you get same at once if you need any, or will you be compelled to **stop** your machines **for weeks** until they can undergo repairs?

VI. Will there be an experienced man to help you out of trouble if your own employee cannot go further?

VII. Will the factory building the machines be able to deliver same in time for the season?

Before ordering the machines, let them undergo **this examination.**

In buying a **"GROSSER" Machine,** you are sure **not** to be disappointed; it **will be** what it is **sold** for, **make** what it is **claimed to do.**

Different machines can be seen **in operation,** in factories and show-rooms. **Large stock in hand** and **full automatic power machines. All parts, needles, etc., always kept on hand.** Engineers and machinists at the disposition of the buyer.

See advertisement on next page.

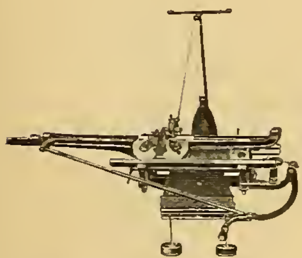
The Grosser Knitting Machine Co.

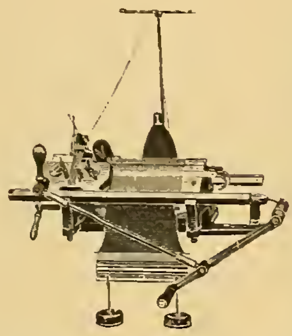
WOOL EXCHANGE BUILDING.
Room 400.
Telephone Franklin 4200.

MAX NYDEGGER

260 WEST BROADWAY
NEW YORK

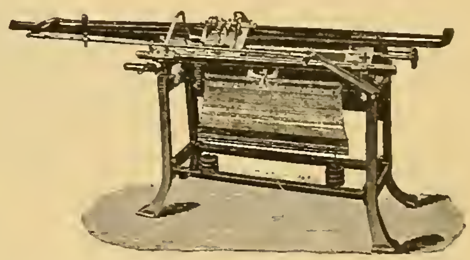
The "**Grosser**" **Patent Flat Knitting** Machines for hand power.





The speediest machines producing the best and nicest work. Easy to operate.

The "**Grosser**" **Fancy Jacquard** Machines for hand power.

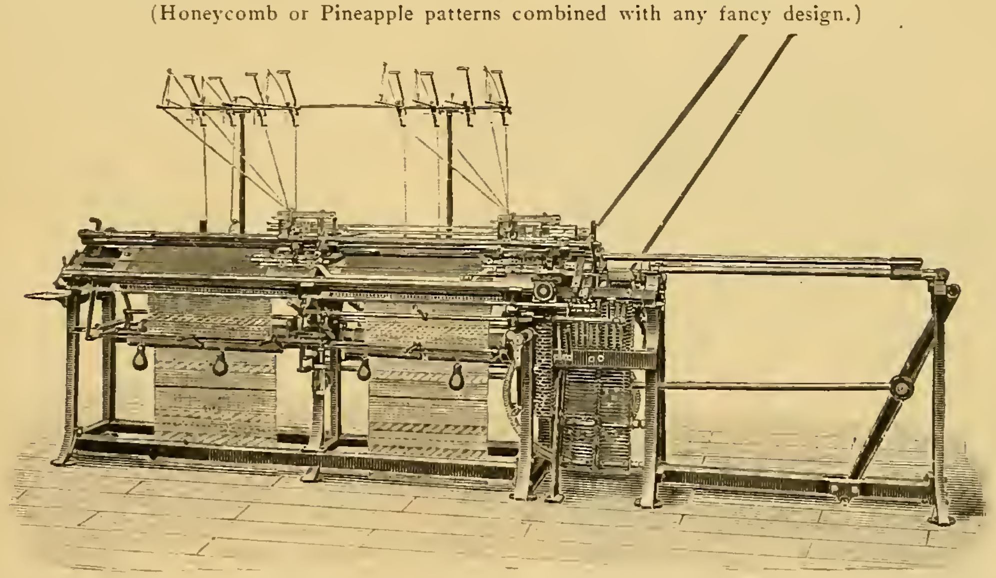


The best for fancy work. Pineapple and Honeycomb, color effects. Unlimited variety in pattern.

The "Grosser" Machines will help you more than any other to make a real success in the knit goods line. **Large production, irreproachable work and high grade goods** recommend these latch needle flat knitting machines. Special constructions for all purposes in flat and circular work for plain and fancy goods. Machines to be operated by hand power or steam.

The "Grosser" **Jacquard Power Machine M. M. G.**, 2 sections.
(Honeycomb or Pineapple patterns combined with any fancy design.)

Absolutely automatic in all movements.
Reliable in its work and regularity.



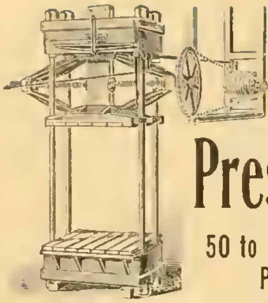
Dependent or independent heads.
Latest improvements, largest production.

Practically **unlimited** in variety of patterns.

All kinds of **full automatic flat knitting machines operated by power** for plain and circular work, (Sweaters, Jackets, Ladies' Blouses, Sporting and Athletic Goods, Union Suits, Rib Caps, Gloves, Stockings, etc., etc.). **Full fashioning machines** (automatic widening) for pants, sleeves, etc., in **flat** and **circular work. Absolutely independent heads**, latest improvements. Selected materials, best construction, long experience, skilled workmen. **Interchangeable parts.**

Largest and best assorted Stock in **all special machines, needles, parts and supplies.** Lowest prices, easy terms, prompt delivery. Write for catalogue and all particulars.

Large show room. Machines to be seen in operation. Samples at your disposition.

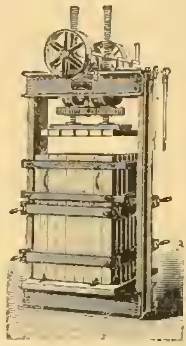


Hydraulic
Power Screw and
Knuckle Joint

Presses.

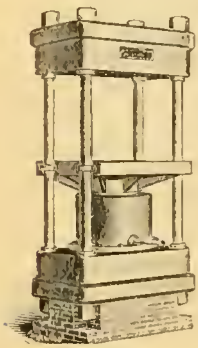
50 to 500 Tons
Power

Knuckle Joint.



Screw Yarn Press.

FOR
COTTON MILLS,
WOOLEN MILLS, ETC.



Hydraulic.

SEND FOR
CATALOGUE.

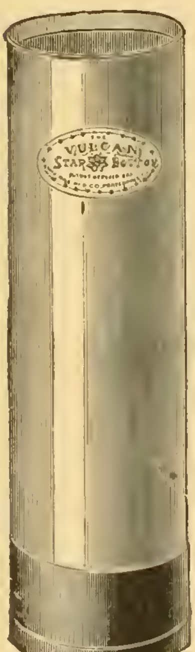
**Boomer & Boschert
Press Company,**

**380 West Water Street,
SYRACUSE, N. Y.**

A. H. WASHBURN,
Southern Agt., Charlotte, N. C.

James Hill Manufacturing Co.

Providence, R. I.



MANUFACTURERS
OF

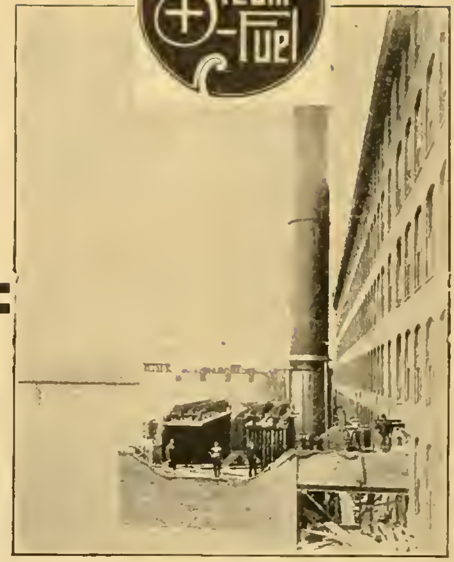
Fibre Roving Cans.
Vulcan and Hercules

Tin Cans.
Hill's Improved Roving
Can
Gill Box Cans
Braider Cans.

Galvanized Iron Dye-
House Cans.
Comber Cans, Fire Pails,
Waste Cans.

Roving Can Springs.
Oil Storage Tanks, etc.

Steam + Fuel



GREEN'S ECONOMIZER

has fulfilled the above emblem in the power house of every textile mill, bleachery or dye house wherein it has been installed. We can do this for you—

Save 10 to 20 per cent. in fuel.
Increase steaming capacity of present plant 10 to 15 per cent.
Save cost of labor in handling 10 to 15 per cent. of present fuel supply —cost of handling ashes also.
Prevent expansion and contraction of boilers, thus prolonging their life.
Give you a large volume of water above the boiling point always ready for sudden demands for extra power, heating the mill in winter, or other purposes.

What we claim to do here has been demonstrated in hundreds of textile mills.

We will be pleased to forward our catalog, which explains other advantages.

The Green Fuel Economizer Co.

MATTEAWAN, N. Y.
Sole Manufacturers in the U. S. A.

(See Preceding Page)

SOME SCIENTIFIC FACTS

OF INTEREST TO TEXTILE MANUFACTURERS.

Textile Manufacturing Goes More Smoothly and Successfully in Certain Climates than in Others.

THE BELL SYSTEM

VENTILATION & HUMIDIFICATION
BELL PURE AIR AND COOLING CO.
TRADE MARK.

Reproduces in the Mill any climatic conditions required. It automatically preserves throughout the year the best conditions of the best climates for textile working.

THE BELL MACHINE delivers air carrying moisture as aqueous vapor, just as it is found in nature, which moistens thoroughly and uniformly. Being SELF-REGULATING it does not keep on moistening when further moistening is useless.

Water delivered as a mist wets rather than moistens; settles on the surface in fine globules instead of being absorbed at once into the fibres. For further particulars address

BELL PURE AIR & COOLING CO.

97 CEDAR STREET, ... NEW YORK, N. Y., U. S. A.

JAMESTOWN, N. Y., Oct. 27, 1904.

CLING-SURFACE Co., Buffalo, N. Y.

GENTLEMEN:—The data herewith explains the conditions of the belts you have photographs of.

Our engine is 1000 H. P. The belts run from two 20 ft. pulleys (62 R. P. M.) to two 31" pulleys (450 R. P. M.) The large belt is 40" face, double leather, on 45 ft. centers. The shorter belt is 40" face, also double leather, and on 35 ft. centers. The two belts were doing 500 H. P. when photographed and could do much more.

I have used Cling-Surface here for five years, and am entirely satisfied with it. These belts are clean, not sticky, pliable and in fine condition and the larger is running with a sag of 4 ft., while the smaller is 22" slack. I believe in slack belts and Cling-Surface permits me to run them so.

Yours very truly,
W. H. COBB, Chief Engr.
Broadhead Worsted Mills.

Five Years' Use in the Broadhead Mills

THESE big belts are a good example of what Cling-Surface is doing. Don't think of Cling-Surface merely as a material for belts. It is that, but its far-reaching results make it a means to a new method of belt management—the easy or slack method, and that means low friction load, economy of oil, babbitt, belts, fuel, power, time and trouble.

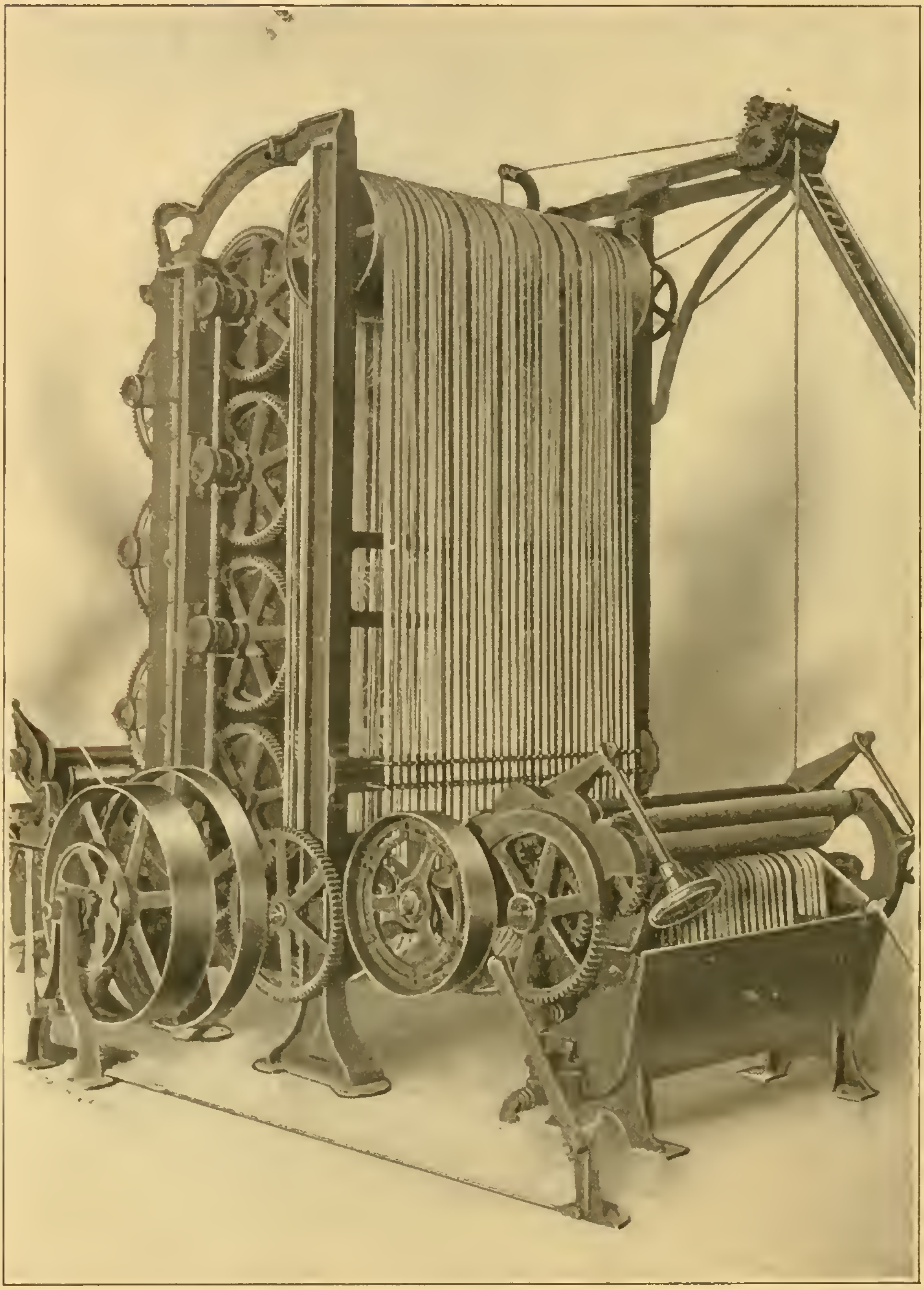
Get a package therefore and test it—severely.

CLING-SURFACE CO., 146-152 Virginia St. Buffalo N Y

BOSTON, 170 Summer Street — CHICAGO — NEW YORK, 39 Cortlandt Street — ST. LOUIS — PHILADELPHIA, The Bourse

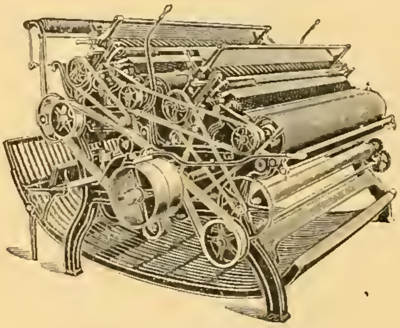
SEE PAGES 263, 264 and 265.

Indigo Warp Dyeing Machine.

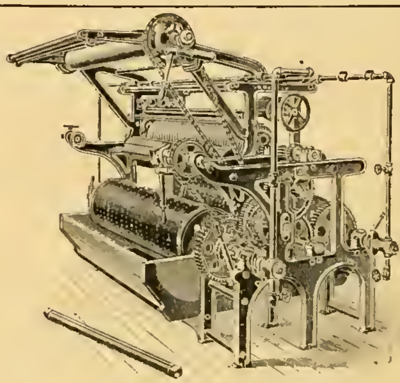


See Pages 402-403 for description of Wing's Disc Fan

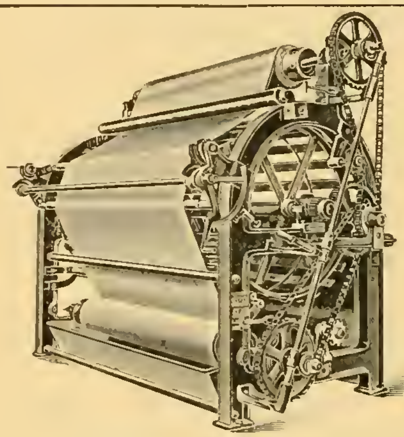
PARKS & WOOLSON
MACHINE COMPANY
SPRINGFIELD
VERMONT



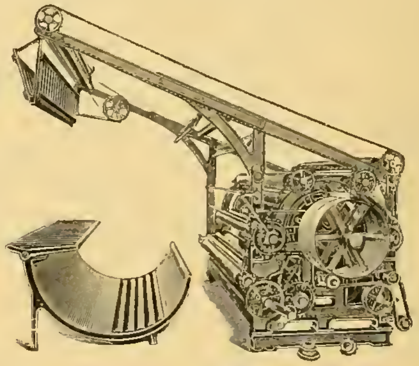
DOUBLE SHEAR
All Kinds of Shears



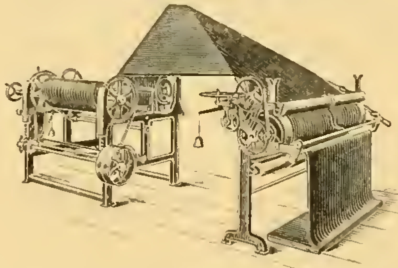
STEAM LUSTERING MACHINE



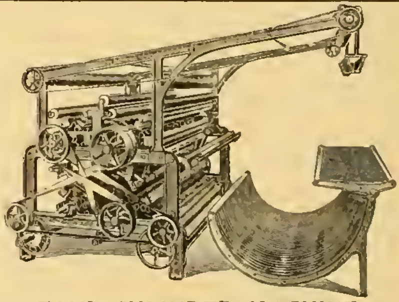
UP AND DOWN TWO-CONTACT GIG
All Kinds of Gigs



SIXTEEN-WORKER NAPPER
COTTON, WOOLEN OR KNIT GOODS



MEASURING, DOUBLING AND ROLLING
MACHINE



FOUR-CYLINDER MACHINE
FOR BRUSHING OR POLISHING

CLOTH-FINISHING MACHINERY

WORKS ON BOSTON & MAINE R.R.
TELEPHONE-ARLINGTON
TELEGRAMS-WESTERN UNION
CABLE ADDRESS ARBIRCH-BOSTON

Arlington Machine Works

BLEACHING
DYEING
DRYING
AND
FINISHING
MACHINERY

ARTHUR BIRCH

Textile Finishing Machinery

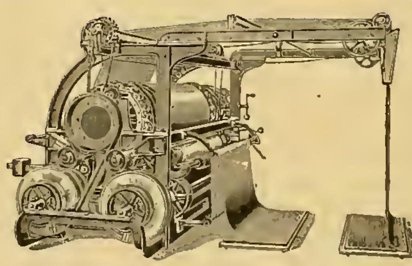
ARLINGTON HEIGHTS, MASS.

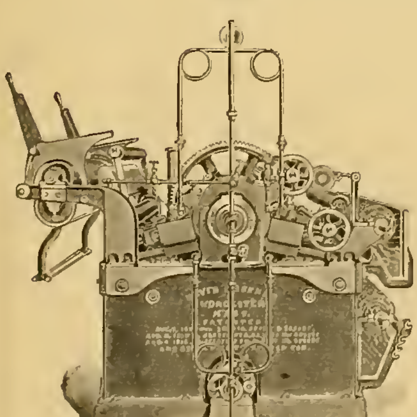
WOOLEN
AND
WORSTED
FINISHING
MACHINERY
SEWING
MACHINES

David Gessner

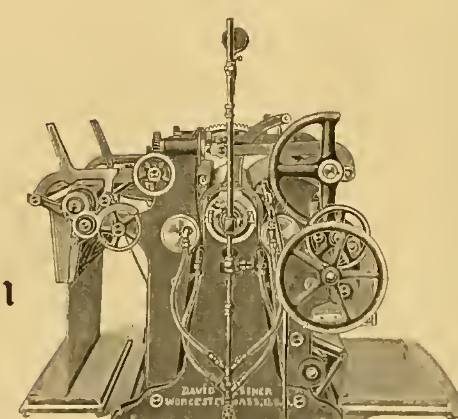
Worcester, Mass.

Latest Improved Cloth Finishing Machinery





Napping Machines and Rotary Steam Presses a Specialty

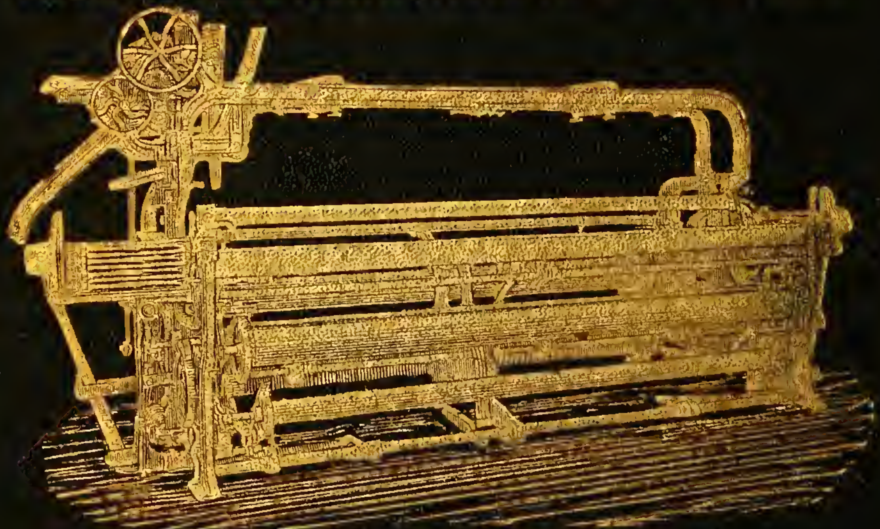


"Printed in the U. S. A."

CROMPTON & KNOWLES LOOM WORKS

WORCESTER, MASS.

WORKS: WORCESTER. PROVIDENCE. PHILADELPIHA.



BUILDERS OF EVERY VARIETY OF

WEAVING MACHINERY

SEE INSIDE PAGE 2