ADVANCES IN THE TAKING, VIEWING, AND PROJECTION OF THE LIPPMANN COLOUR PHOTOGRAPHS.

[Some months ago Dr. Hans Lehmann demonstrated to us in the laboratory of the Physikalisches Institut in Jena the method and apparatus employed by him in working the Lippmann process. The dark-slide, viewing case, and projection attachment which have been worked out by him in conjunction with the Zeiss Optical Factory are illustrated in a recent paper read before the Dresden conference of the German "Naturforscher und Aerzte," for the text of which, giving certain technical particulars, we have to thank Dr. Lehmann.—Eds. "Colour Photography Supplement."]

Dr. Lehmann's work has been devoted to devising a convenient form of dark-slide in which the Lippmann plate may be exposed, to working out a viewing frame in which surface reflections may be avoided, and to designing an instrument for projecting the Lippmann heliochrome by reflected light after the manner of the little-used aphengescope. He has also prepared a gelatine dry plate of a kind ready for use in the Lippmann process, and plates made according to his formula were, we believe, formerly obtainable from the works of Kranseder, of Munich. Since the death of Herr Kranseder, however, some months ago, other arrangements have been made as to the commercial manufacture of the Lippmann plates.

The following is a description of the apparatus as made by the Zeiss works:—

Fig. 1 is a diagram of the dark-slide for holding the sensitive plate and the mercury with which it is backed. The plate lies in the frame A, which is closed by the shutter B, and has the

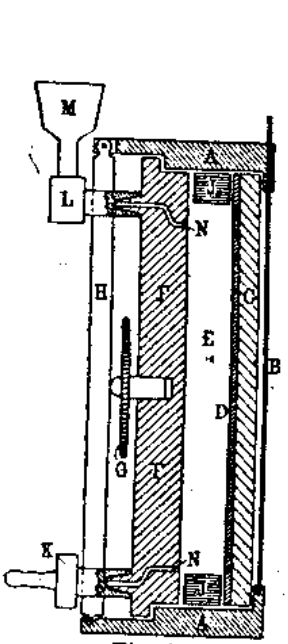


Fig. 1.

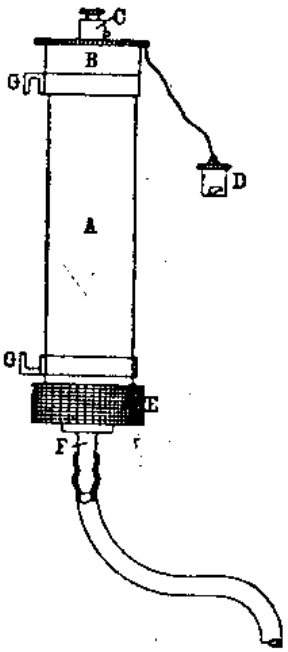


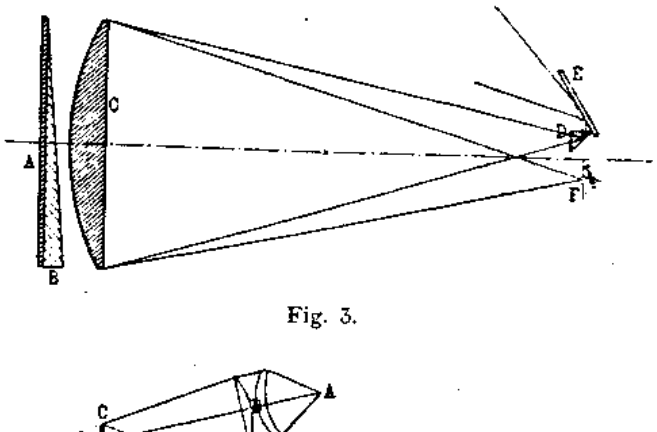
Fig. 2.

glass side D turned away from the lens. On this surface D a rubber frame J is pressed by means of the screw G, the bar H, and the plate F. The space E between the sensitive plate and F is filled with mercury. This is done by means of the tube L, which is removable from the apparatus. The passages N are so arranged that in either position of the plate, upright or horizontal, there is a head of mercury in the chamber: also that the surface of the mercury remains free as the metal enters the chamber, and lastly that the upper edge of the rubber is not touched. This latter is found to be a necessary precaution towards keeping a clean surface in contact with the image.

For holding the mercury, the vessel shown in Fig. 2 is a convenient accessory. It consists of a cylinder A of polished steel. The screw cover B is provided with an air vent C, which can be closed with the cap B. The inlet and outlet of the mercury are controlled by turning the ring E. The outlet tube F is connected with the inlet K (Fig. 1) by means of a flexible rubber tube. The hook G is for hanging the vessel temporarily to the dark-slide during filling. The joint use of the two pieces of apparatus allow of the mercury being used in the cleanest manner.

The Viewing Chamber.

The Lippmann photograph, as is well known, must be viewed by reflected light, best in an apparatus specially constructed for the purpose. The new Zeiss instrument is so designed that disturbing stray light is cut off and the full colour of the Lippmann heliochrome obtained. Fig. 3 is a diagram of the principle on which the apparatus is made. The heliochrome is provided with a glass wedge to avoid surface reflection, as suggested by Professor V. O. Wiener. In front of this latter is fixed a collecting lens C, at the focus of which the pupils D and F of the whole system are placed. The light is thrown upon the lens



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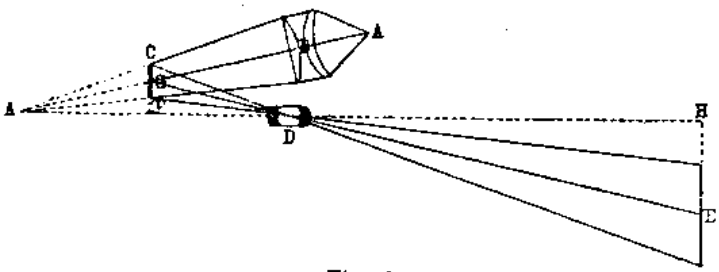

Fig. 4.

C by the total reflecting prism D and the flat mirror E, and transmitted by it in parallel pencils which are reflected perpendicularly by the surface of the image A, and pass for a second time through C to unite at the eye of the observer F. The whole system is placed in a light-tight chamber. It may be arranged for stereoscopic pictures.

The Projection of Lippmann Heliochromes.

A new piece of apparatus has been constructed by the Zeiss works for the projection of Lippmann heliochromes, and can be adapted to the ordinary projection instruments. It permits of the projection of sharp pictures on a larger scale than has previously been possible. Fig. 4 explains the principle of the apparatus. The condenser B throws an image from the crater of the arc lamp A in A^1. This latter, however, is not actually formed here, but in the diaphragm aperture of the projection

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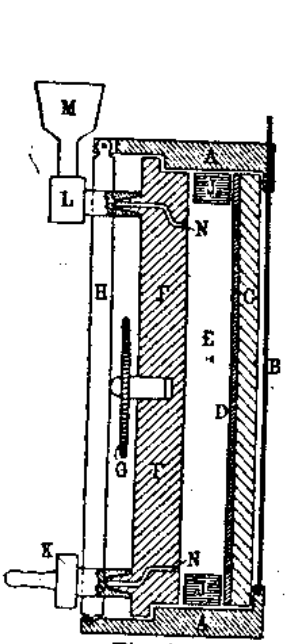

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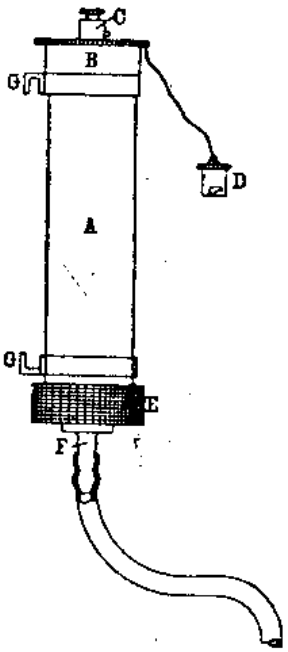

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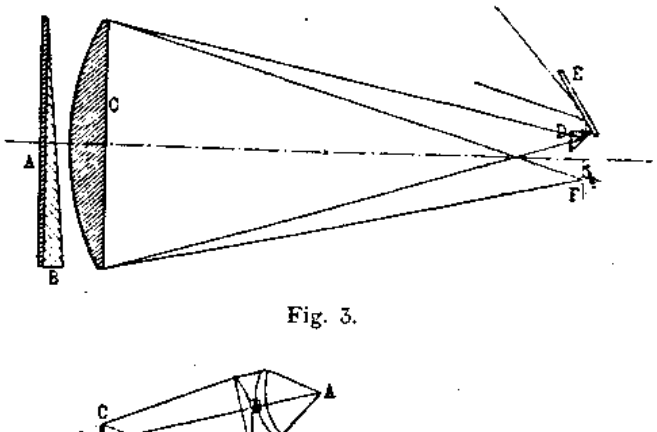

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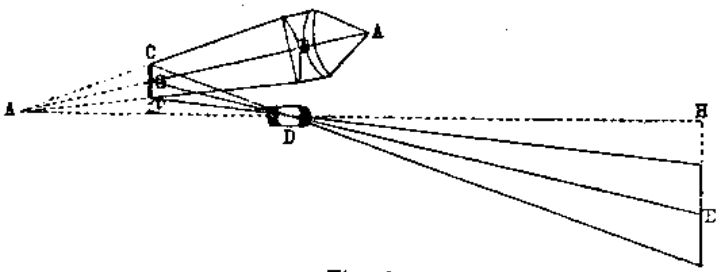

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Visitors to the exhibition of the Society of Colour Photographers were able, during the latter part of the time, to see the viewing instrument, and those who did so will confirm us in describing the effect as more closely resembling a small projection in colours than the lustrous appearance which the Lippmann heliochrome presents without some aid to its proper examination. At Jena we saw the Lippmann heliochromes projected with great brilliancy on a screen perhaps 6 ft. in diameter. The size of the projection is, of course, only limited by the power of the light with which the heliochrome can be illuminated.

To these notes on Dr. Lehmann's work we may appropriately add some particulars of the plate already referred to which appeared in the "Zeitschrift für Wissenschaftliche Photographie" at the time the plates were on the market. On the occasion of our visit to him Dr. Lehmann made an exposure through the correcting filter with a lens working at about *f*/5, and gave for a landscape subject a time of fifteen seconds. The finished heliochrome was ready for viewing within ten minutes.

The plates previously devised ("B.J.," November 30, 1906, page 946) required the use of a somewhat complicated filter to give correct colour rendering. The new plates only require an æsculine filter, 1 : 7,000 solution in 5 mm. thickness, or a gelatine filter of like character.

The maxima of sensitiveness of the new plates lie at λ 635, 585, 509, and 475 $\mu\mu$, and are in complementary pairs, thus 635 to 509, and 585 to 475, which agree with the measurements of A. König and C. Dieterici[1], and these apply for gaslight. In consequence of the maxima at 509 and 476 $\mu\mu$ being somewhat flat, and by suitable choice of proportions, these four maxima do not appear, and the result is that the whole of the picture is too red.

With normal exposure the maxima at 509 and 475 $\mu\mu$ combine to a single one at 492; this also applies to those at 635 and 585, which give one at 610 $\mu\mu$. The two maxima at 610 and 492 $\mu\mu$ are also complementary to one another for sunlight. The result of this process is that correct colour rendering, inclusive of white, is obtained.

The new plates have, however, two important advantages over the old; they are ten times as sensitive to light, and are very insensitive to the mercury, so that fog is not caused The exposure for a landscape in sunshine is six seconds, with *f*/3.

The colour sensitiveness is so adjusted that fixation of the pictures with a 20 per cent. solution of hypo produces a much better colour rendering. This is attained by increasing the sensitiveness of the plate for deep red.[2] Spectrograms must not, however, be fixed.

The following practical conclusions are arrived at by the author:—

1. Touching the film of the plate before exposure with the finger or brushing with a soft brush is a certain cause of spots. A plate which has been in contact with mercury becomes useless. On the other hand, it is advisable to brush the film after exposure and before development. Rubbing with a leather is useless, and even prejudicial.

2. As Valenta has remarked, the quantity of ammonia in the developer is of great importance. The author finds that increase of ammonia produces greater brilliancy, but lower saturation of the colours.[3] Dr. Lehmann only uses half the quantity of ammonia for spectra that he does for compound colour subjects, and blues and violets are thus rendered with brilliant purity and depth.

Experiments have proved that if the heliochromes have been well washed they can be dried in spirit, hence a considerable reduction of the time involved in making a plate.

4. The liquid generally used for examining a heliochrome in a cell is benzole, as suggested by Wiener, as it has about the same refractive index as gelatine. The author has found that the reflective power of the surface film is always greater than the refractive index for gelatine. The refractive index of the liquid must therefore be increased in order to completely obviate all surface reflections and improve considerably in colour rendering. The best mixture is 12 parts of benzole and 4-5 parts of carbon bisulphide. The unpleasant smell can be lessened by the addition of a few drops of oil of geranium or nitrobenzole.

5. Heliochromes, if unsatisfactory in colour rendering, can be used as ordinary negatives, and they certainly have extraordinary definition and colour rendering.

The great advantage of the new plate is, however, its rapidity. The Lippmann process, as it stands now, is the most interesting, the simplest, the shortest, and cheapest photographic process. From the exposure of the plate to projection on a screen of the finished picture scarcely ten minutes need elapse. A heliochrome 5 x 9 cm. costs about 2½d., and a 9 x 12 only 4d.

[1] A. König, Gesammelte Abhandlungen zur Physiologischen Optik, 1903. P. 363.

[2] The explanation of this will be obvious from a careful consideration of Professor Cajal's paper ("Colour Photography" Supplement, August, 1907), wherein it is proved the dissolving out the unacted-upon silver bromide must reduce the distance between the laminæ, and thus cause a shift of the colours towards violet.—EDS. "Colour Photography" Supplement.

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