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(54) **Improved deflection electrode arrangement for an aspirated ink jet printer.**

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Improved deflection electrode arrangement for an aspirated ink jet printer

The present invention relates to an aspirated ink jet printer, and more particularly relates to a deflection electrode arrangement for an aspirated ink jet printer.

In U. S. patent 4,097,872, issued on June 27, 1978 is described an axial ink droplet aspirator for an ink jet printer. The purpose of an aspirator in an ink jet printer is to inhibit if not altogether cancel the effects of aerodynamic interaction on the drop (in a continuous type or Sweet type ink jet printer) so that complex drop interaction algorithms are unnecessary when printing. In an aspirated printer, the aspirator tunnel which is positioned downstream of the ink emitting nozzle, may become coated with electrically conductive ink as a result of ink particles being misdirected upon ink stream start up and shut down. The electric deflection field geometry is altered by this misdirection and coating, printed drop trajectories are thereby changed, and the resulting printed characters are distorted. Accordingly, it is desirably to incorporate some means to maintain print quality even in the presence of ink "splatter."

Thus it is a principle object of the present invention to provide means for maintaining print quality in an aspirated ink jet despite ink splatter which may occur during ink stream start up and shut down.

The means for accomplishing this described herein is based on an aspirator configuration with sidewalls that include electrically conductive and ink absorbing characteristics. The preferred embodiment of the invention, includes means defining a tunnel for passage therethrough of air and stream of ink, and first and second longitudinally extending deflection electrodes in spaced apart confronting relation in the tunnel for effecting deflection of charged drops in the ink stream passing therebetween, the improvement comprising; electrically conductive continuations of at least one of the deflection electrodes extending toward the other electrode and along the interior of the tunnel so that during start up and shut down of the ink stream, misdirection from the stream direction of a drop which would tend to impact the sidewall of the tunnel will strike the electrically conductive continuations thereby inhibiting ink drop contamination of the tunnel interior.

A more complete understanding of the invention may be had by referring to the following specification taken in conjunction with the following drawings.

Fig. 1 is a fragmentary sectional view in side elevation of an ink jet aspirator head assembly including a deflection electro-arrangement constructed in accordance with the present invention;

Fig. 2 is a fragmentary perspective view of the tunnel portion of the aspirator assembly illustrated in Fig. 1 and illustrating more clearly the apparatus of the present invention; and

Fig. 3 is a fragmentary sectional view taken along line 33 of Fig. 2.

Turning now to the drawings and especially Fig. 1 thereof, an aspirator assembly 10 of a continuous type (Sweet type) ink jet printer is illustrated therein. As is conventional, the printer includes a printhead 11 having an outlet nozzle 12 to which ink is applied under pressure so as to produce a stream of ink from the nozzle 12. Within the printhead is means (not shown) to effect a perturbation of the ink at some cyclical rate which perturbates the stream ejected from the nozzle causing the stream to break up into drops which receive a charge from a charge ring or electrode 13. The ink stream then passes between deflection electrodes 21 and 22, in the present instance mounted interiorly of a tunnel 20. Depending upon the charge placed on the ink drops by the charge electrode 13, the charged droplets will be deflected because of the electric field provided between the deflection electrodes 21 and 22 to effect the printing of indicia or the like on a print receiving medium 30. The aspirator assembly 10 includes a housing 14 having a cavity 15 therein which cooperates with a core or body portion16 which carries the tunnel 20 and deflection electrodes 21 and 22. As illustrated, the body portion has an enlarged portion 16a and a reduced portion 16b, the reduced portion forming in conjunction with the cavity 15 a settling chamber 17 for receiving a supply of air through a tube 18 which passes through the housing 14. A blower (not shown) provides a supply of air to the settling chamber 17 to effect air flow entry into the tunnel 20 colinearly with the stream of ink droplets, and at approximately the same velocity. A gutter 19, as is conventional in continuous ink stream ink jet printers, is utilized to catch ink drops not being utilized for printing and return the ink to the ink supply system.

Referring now to Figs. 1 and 2, the tunnel 20 including the upper deflection electrode 21 and lower deflection electrode 22 conventionally would have the sidewall or walls thereof 23, 24, composed of a ceramic or other insulative material which upon start up and shut down of the ink stream oft times will become contaminated, especially in the area of the dotted lines designated 25, by stray ink contamination. This kind of contamination results in distortion of the electric field intermediate the deflection electrodes because the ink itself is conductive.

In accordance with the invention, electrically conductive continuations 26 and 27, (see Fig. 3) of at least one of the deflection electrodes, in the present instance the deflection electrode 22, extends toward the other or confronting electrode 21 and along the interior of the tunnel 20 so that during start up and shut down of the ink stream, misdirection from the stream direction of a drop which would tend to impact the sidewall of the tunnel, will instead strike the

electrically conductive continuations 26 and 27 thereby inhibiting ink drop contamination of the uncovered tunnel interior which otherwise would cause field distortion. The electrically conductive continuations 26 and 27 may be composed of the same material as the deflection electrodes 22, for example of an ink absorbing material such as porous stainless steel. Alternatively, the electrical continuations may be formed of an electrically conductive thin film, such as a paint or deposited upon the side wall as at 26 and 27 and in contact with the porous or ink absorbing deflection electrode 22.

As illustrated best in Fig. 2, the tunnel shape is such that a cross section through any portion of the tunnel 20 (perpendicular to the central axis of the tunnel) results in a substantially constant cross sectional area. This is desireable to maintain uniformity of air velocity. Inasmuch as the ink drops are deflected in a vertical plane (in the present instance) the outlet 20b of the tunnel has a greater vertical extent than does the inlet 20a, the height of the tunnel gradually increasing (inlet to outlet) in longitudinal cross section (see Fig. 1) so as to diverge from the inlet to the outlet. Accordingly, the electrical conductive continuations 26 and 27 are preferably also made diverging from the inlet to the outlet so that the space between the upper or vertical terminal edge 26a, 27a of the electrically conductive continuations and the upper deflection electrode 21 is uniform across the longitudinal section.

It should be recognized (see Fig. 3) that a cross section taken along any part of the tunnel (once again perpendicular to the central axis of the tunnel 20, and again considering the preferred embodiment) will give the lower channel a substantially U-shaped or trough like appearance in cross section.

In operation, upon start up or shut down of the printer, stray drops will tend to impact the electrically conductive continuations 26 and 27, and if they are composed of the same material as the lower electrode, for example a porous stainless steel, that will tend to absorb the ink. Moreover, even if the ink drys on the electrically conductive continuation, such as if the electrically conductive continuations are painted or deposited, because the continuation is conductive the field formed between the upper electrode 21 and the lower electrode 22 and electrically conductive continuations 26, 27 will remain substantially unchanged regardless of the contamination of the continuations resulting in lower maintenance time (down time of the machine) and permitting of longer distortion free printing.

Although the invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made only by way example and that numerous changes in the details of construction and the combination and arrangement of parts may be made without departing from the scope of the invention as hereinafter claimed.

Claims

1. Deflection electrode arrangement (10) for an aspirated, ink jet printer wherein charged ink drops are deflected by charge deflection electrodes to effect printing, including means defining a tunnel (20) for passage therethrough of air and said stream of ink, and first (21) and second (22) longitudinally extending defection electrodes in spaced apart confronting relation in said tunnel (20) for effecting deflection of charged drops in said ink stream passing therebetween; said arrangement being characterized in that it comprises:

— electrically conductive continuations (26, 27) of at least one of said deflection electrodes (22) extending toward said other electrode (21) and along the interior of said tunnel (20) so that during start up and shut down of said ink stream, misdirection from the stream direction of a drop which would tend to impact the sidewall of the tunnel will strike said electrically conductive continuations thereby inhibiting ink drop contamination of said tunnel interior.

2. Arrangement in accordance with Claim 1 wherein said continuations (26, 27) and said one electrode (22) form a deflection electrode substantially U-shaped in cross section.

3. Arrangement in accordance with Claim 2 wherein said U-shaped electrode (22) is the lower electrode.

4. Arrangement in accordance with Claims 1, 2 or 3 wherein said electrically conductive continuations (26, 27) are formed of an ink absorbing material.

5. Arrangement in accordance with any one of Claims 1 to 4 wherein said tunnel (20) has substantially the same cross sectional area throughout its longitudinal extent, said tunnel (20) diverging in longitudinal section, said electrically conductive continuations (26, 27) also diverging whereby the height thereof increases along the length of said tunnel (20).

6. Arrangement in accordance with Claim 5 wherein said electrically conductive continuations (26, 27) have a terminal edge (26a, 27a) substantially uniformly spaced from said confronting deflection electrode (21) along the length of said electrical continuations.

Revendications

1. Ensemble d'électrodes de déflexion (10) d'une imprimante à jet d'encre dans lequel des gouttellettes d'encre chargées électriquement sont déviées par des électrodes de déflexion aux fins de l'impression, comportant des moyens définissant un conduit (20) permettant le passage de l'air et dudit jet d'encre, ainsi qu'une première (21) et une seconde (22) électrodes de déflexion disposées dans le sens longitudinal,

opposées à distance l'une à l'autre, dans ledit conduit (20) de façon à dévier les gouttellettes chargées électriquement contenues dans ledit jet d'encre injecté entre lesdites électrodes; ledit ensemble est caractérisé en ce qu'il comporte :

des prolongements (26, 27) conducteurs d'électricité d'au moins une desdites électrodes (22) qui s'étendent d'une part vers l'autre dite électrode (21) et, d'autre part, dans l'axe longitudinal de l'intérieur dudit conduit (20), de telle sorte que, lors du début et de l'arrêt de l'injection dudit jet d'encre, toute gouttelette inopportunément déviée vers la paroi dudit conduit, atteint, lesdits prolongements conducteurs d'électricité empêchant ainsi de salir la paroi intérieure dudit conduit.

2. Ensemble selon la revendication 1 où lesdits prolongements conducteurs d'électricité (26, 27) et une desdites électrodes (22) forment une électrode de déflexion qui a une section droite pratiquement en forme de U.

3. Ensemble selon la revendication 2 ou l'électrode (22) en forme de U est l'électrode inférieure.

4. Ensemble selon les revendications 1, 2 ou 3 où lesdits prolongements conducteurs d'électricité (26, 27) sont constitués d'un matériau absorbant l'encre.

5. Ensemble selon l'une quelconque des revendications 1 à 4 où la section droite dudit conduit (20) est la même tout au long de son axe longitudinal tandis que sa section longitudinale varie, et où la section desdits prolongements conducteurs d'électricité (26, 27) varie aussie, sa hauteur augmentant au fur et à mesure dans l'axe longidutinal dudit conduit (20).

6. Ensemble selon la revendication 5 où lesdits prolongements conducteurs d'électricité (26, 27) ont, tout au long de leur axe longitudinal, leur extrémité (26a, 27a) respective située pratiquement à égale distance de l'électrode de déflexion (21) opposée.

Patentansprüche

1. Anordnung von Ablenkelektroden (10) für einen Tintenstrahldrucker mit einer Saugvorrichtung, bei der aufgeladene Tintentröpfchen durch Ablenkelektroden zum Drucken abgelenkt werden, mit Mitteln, die einen Kanal (20) für die durch denselben fließende Luft und den genannten Tintenstrahl bestimmen, so-wie mit ersten (21) und zweiten (22) sich im Kanal längserstreckenden, einander gegenüberliegenden Ablenkelektroden, welche die aufgeladenen Tröpfchen des den Raum zwischen den genannten Elektroden passierenden Tintenstrahles ablenken, gekennzeichnet durch elektrisch leitende Weiterführungen (26, 27) für mindestens eine der Ablenkelektroden (22), die innerhalb des Kanals (20) in seiner Längsrichtung auf die andere Elektrode weisend angeordnet sind, so daß beim Einschalten und Ausschalten des genannten Tintenstrahles ein aus dem Strahl abgelenktes Tröpfchen anstatt auf die Innenwand des Kanals auf die genannten elektrisch leitenden Weiterführungen auftrifft, wodurch der Innenraum des Kanals nicht verunreinigt wird.

2. Anordnung nach Anspruch 1, bei der die genannten elektrisch leitenden Weiterführungen (26, 27) und die genannte eine Elektrode (22) eine Ablenkelektrode mit einem im wesentlichen U-förmigen Querschnitt bilden.

3. Anordnung nach Anspruch 2, bei der die genannte U-förmige Elektrode (22) die niedrigere Elektrode ist.

4. Anordnung nach Anspruch 1, 2 oder 3, bei der die genannten elektrisch leitenden Weiterführungen (26, 27) aus einem Tinte absorbierenden Material bestehen.

5. Anordnung nach einem der Ansprüche 1 bis 4, bei welcher der genannte Kanal (20) in seiner Längsrichtung einen im wesentlichen gleichen Querschnitt aufweist und die Abmessungen in seiner Längsrichtung sich verändem, und die elektrisch leitenden Weiterführungen (26, 27) sich auch so ändem, daß ihre Höhe in der Längsrichtung zunimmt.

6. Anordnung nach Anspruch 5, bei der die elektrisch leitenden Weiterführungen (26, 27) jeweils einen Pol (26a, 27a) aufweisen, der entlang der genannten Weiterführungen mit im wesentlichen gleichen Abstand von der genannten gegenüberliegenden Ablenkelektrode (21) angeordnet ist.

FIG. 1

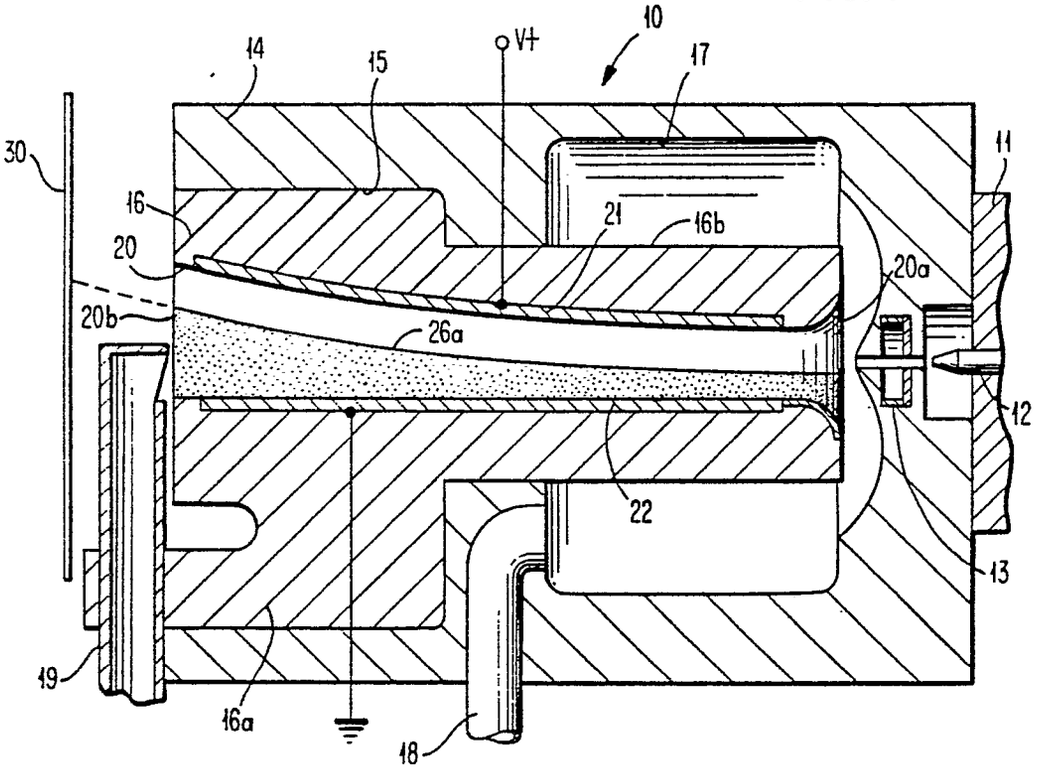

FIG. 2

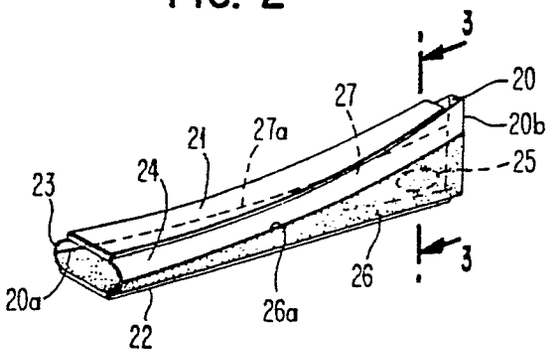

FIG. 3