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WRITING HEAD PRODUCING A JET OF INK

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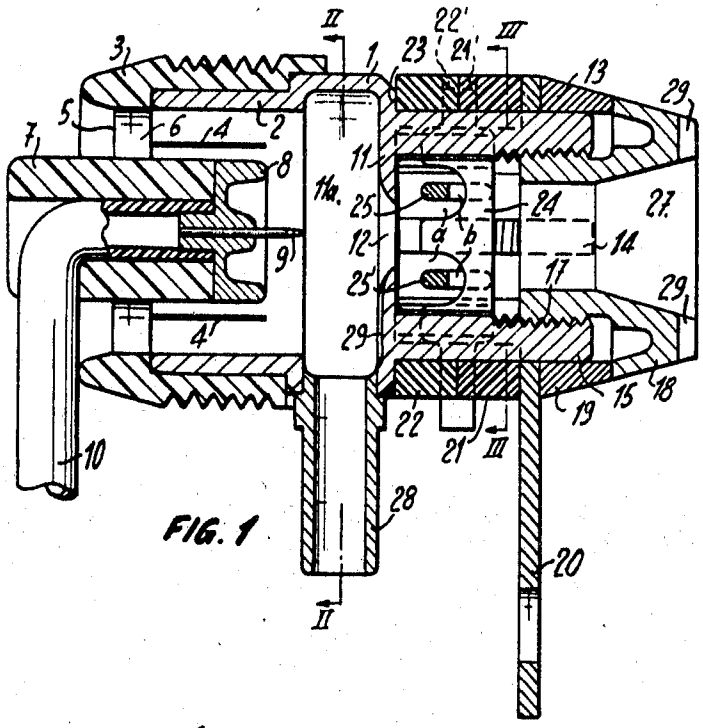

FIG. 1

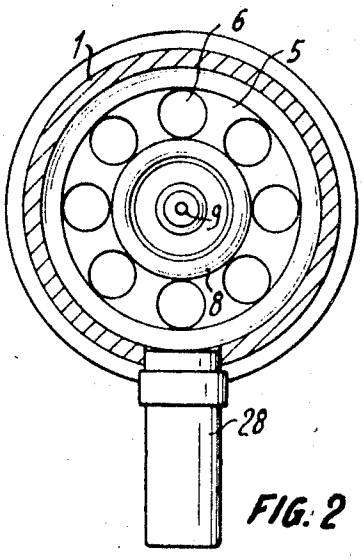

FIG. 2

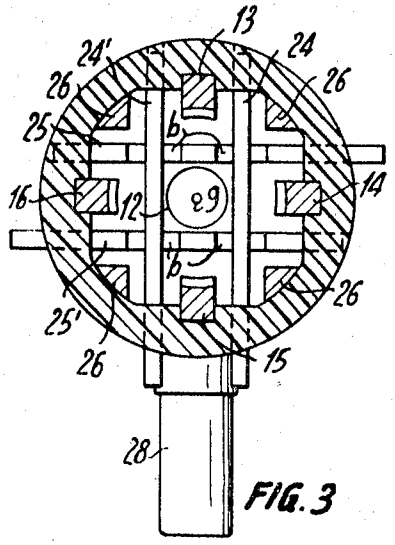

FIG. 3

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WRITING HEAD PRODUCING A JET OF INK

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ABSTRACT OF THE DISCLOSURE

A writing head producing a jet of ink inside a support provided with an output port beyond the electrodes and with air input means arranged for instance round the tube feeding the ink so as to prevent objectionable modifications in pressure inside the head. The electric charges on the insulating parts of the support cannot disturb the uniformity of the electric field acting on the jet of ink by reason of the interposition of metal parts concealing the insulating parts carrying the electrodes.

Background of the invention

Writing heads producing a jet of ink are known which include a body carrying a tube constituting a nozzle for the jet of ink and jet-deflecting electrodes located to either side of the axis of said tube.

In the known arrangements of this type, the tube constituting the nozzle for the ink and the deflecting electrodes are carried by a support, but are exposed to shocks through possible impact against other objects and also to the deposit of dust. These different parts, the geometrical size of which must be perfectly unvariable so as to obtain a uniform writing, are thus subject to deformation or else their outer outline is liable to be modified by a deposit of particles adhering to said parts.

Experiments made for protecting said parts inside a casing have failed hitherto because the jet of ink projected at a high speed through an opening in such a casing produces modifications in pressure in the latter, which modifications prevent the jet of ink from being sufficiently uniform.

Summary of the invention

The present invention has for its object an efficient shielding of the delicate parts of such a writing head and more specifically it covers a writing head including a body carrying a tube constituting a nozzle projecting the jet of ink and jet deflecting electrodes extending to either side of the tube axis. According to the invention, said tube and deflecting electrodes are fitted in a support of a generally cylindrical shape provided with an output port and with at least one further port through which the air carried along by the jet of ink through the output port is replaced by fresh incoming air.

Brief description of the drawing

The accompanying drawings illustrate diagrammatically and by way of example a preferred embodiment of the invention. In said drawings:

FIG. 1 is a longitudinal sectional view of said embodiment.

FIGS. 2 and 3 are transverse cross-sections through lines II—II and III—III of FIG. 1.

Description of the preferred embodiment

The reading head illustrated includes a metal body **1** of which the cylindrical section **2** serves as a support for a coaxial bell-shaped member **3** of insulating material. Said bell-shaped member is merely slid over said cylindrical section **2** which is provided with longitudinal slots

4 adapted to increase its elasticity. The bell-shaped member **3** may be obtained through molding and it includes a transverse partition **5** provided with an annular series of openings **6** and rigid with a sleeve-shaped coaxial member **7**. Said sleeve-shaped member **7** forms a unit with the bell-shaped member **3** and may be cast for instance therewith out of synthetic material such as that sold under the registered trade name nylon. The sleeve **7** serves as a support for a metal annulus **8** inside which is set a tube **9** forming a nozzle projecting the jet of ink. The ink is fed to the tube **9** through a yielding pipe **10**.

The body **1** carries in its medial section a tansverse annular partition or wall **11** provided in its middle and in registery with the tube **9** with an opening **12** the edges of which are sharp.

The end of the body **1** opposed to its cylindrical section **2** forms longitudinal projections **13, 14, 15, 16** of which the inwardly facing surfaces are tapped at **17**. Said tappings **17** allow screwing inside the body **1** an outwardly projecting terminal metal member **18** adapted to clamp in position outside the body **1** a metal ring **19**, a securing plug **20** and two rings of insulating material **21** and **22** in contacting relationship with a peripheral shoulder **23** provided on the outer surface of the body **1**.

The two rings **21** and **22** serve as carriers for four plates **24, 24', 25, 25'** forming the electrodes deflecting the jet of ink projected out of the tube **9** through the opening **12** in the annular partition **11**. The surfaces facing each other on the rings **21** and **22** are provided with grooves **21'** and **22'** respectively, which serve as guides for the electrode plates. As illustrated in FIGS. 1 and 3, the plates **24** and **24'** are provided each with two notches, *a*, whereas the plates **25** and **25'** show each two notches *b*. The plates **24, 24', 25, 25'** are furthermore given substantially the same shape and are arranged pairwise at right angles and in opposed relationship. Said arrangement allows interengaging said plates without any electric contact between them, the plates **24, 24'** lying in two vertical parallel planes and the plates **25, 25'** in two horizontal planes. Said interengaging plates occupy thus a minimum space in a direction parallel with the axis of the tube **9**. Thus, the particles of ink pass simultaneously between the horizontal deflecting plates and the vertical deflecting plates. This leads to an important advantage since, if the pairs of deflecting plates were arranged in sequence along the path of the jet of ink, this would lead to a deformation of the character drawn by it as a consequence of the time required for the progression of the particles from one pair of plates to the next. The structure disclosed thus cuts out completely said drawback.

It should be mentioned that no part of insulating material is apparent to view from any point of observation located at the end of the nozzle tube **9**. As a matter of fact, said end of the tube **9** cannot possibly "see" the bell-shaped member **3** made of insulating material, which member is concealed by the inner annulus **8** and the outer cylindrical section **2**. Similarly, the two insulating rings **21** and **22** are concealed by the annular partition **11**. Thus, the electric field extending between the tube **9** and partition **11** is not subjected to the action of the electric loads which may be carried by the parts of insulating material as provided for instance by a capacitory influence.

In order to reduce as much as possible any parasitic action as a consequence of the static loads carried by the insulating parts, the two rings **21** and **22** are spaced with reference to the path followed by the jet of ink by the projections **13** to **16** on the support **2** and also by the intermediate projections **26** (FIG. 3) inserted between the former projections. Thus, the jet of ink is protected to a maximum extent against any parasitic action ascribable to the static loads possibly carried by the insulating parts. Furthermore, the sole parts of the jet of ink which might

be subjected to some slight action of the static loads carried by the rings **20** and **22** extend between the opening **12** and the entrance of the jet into the passage defined by the electrodes and also between the output of said passage and entrance of the opening **27** defined by the terminal metal member **18**.

It should be remarked that the plates **24**, **24'**, **25**, **25'** project beyond the outer periphery of the rings **21** and **22** so that it is possible to weld thereto conducting wires adapted to give said plates the desired instantaneous voltage.

The voltage applied to the tube **9** is transmitted either by the conductive ink or else by a metal lead which may, as a matter of fact, be inserted inside the yielding pipe **10**.

As soon as the difference in voltage between the partition **11** which is generally grounded and the tube **9** is sufficiently high, the ink escaping out of said tube forms a jet constituted by a succession of droplets. Said jet passing between the deflecting electrodes is shifted under the action of the voltages applied to said deflecting electrodes.

Preferably, the carrier parts made of metal, that is the parts **2**, **20** and **18** are subjected to the same voltage as the support carrying the surface to be written over. Consequently, the electric field between the opening **27** in the terminal member **18** and said surface showing the point of impact for the jet of ink is equal to zero and the path of the jet of ink can therefore no longer be modified between the output of the writing head and said point of impact onto the writing surface.

The extremely small ink droplets forming the secondary jet escape within a cone the apical angle of which is large and are arrested by the partition **11**. The latter is polished and the edge of the opening **12** therein is very sharp so that the droplets forming the secondary jet cannot collect on such a sharp cutting edge by reason of the surface pressure of the ink droplets. Furthermore, the sharp edge of the opening **12** merges into the surface of the partition **11** facing the tube **9** along a convex annular surface **11***a* which is also polished so as to further the coalescence of the extremely small ink droplets which may settle on said annular surface. Said droplets form thus a continuous annular sheet of ink which flows steadily towards an output port opening into the depending tube **28** as furthered by a vertical groove **29** extending between the convex surface **11***a* and said output port.

The above-described writing head shows numerous advantages over those proposed hitherto. As a matter of fact, said head is of a simple structure and shows a high rigidity. Furthermore, it forms a closed unit and the weak sections of said head are protected against shocks and the like objectionable actions.

By reason of the shield formed by the metal parts carrying the head, the electric fields inside said head remain always uniform and their values are well-defined. Said fields can be deformed neither by outer parasitic fields, nor under the action of the static loads which may collect on the insulating parts.

The openings **6** formed in the partition **5** allow air to enter the writing head so as to replace the air escaping through the opening **27** and which is carried along by the moving jet of ink. Thus, the air pressure inside the head remains substantially constant which is essential with a view to obtaining a clean writing.

The system of carrier parts is rigid with the securing lug **20** as provided by the mere screwing of the terminal member **18** inside the threads **17** cut in the longitudinal projections **13** to **16**. To this end, the terminal member **18** is provided along its outer edge with a slot **29'** adapted to be engaged by a screw-driver. Furthermore, the insulating bell-shaped member **3** rigid with the annulus **8** and

tube **9** may be removed through a mere sliding over the cylindrical section **2** of the body **1** which allows inspecting and cleaning easily said tube **9**.

I claim:

1. In a writing head comprising a nozzle adapted to project a jet of ink and jet-deflecting electrodes extending to either side of the tube axis, the provision of a generally cylindrical support enclosing said tube and electrodes and provided with an output opening for the jet of ink passing out of the nozzle and between the electrodes and for the air carried along by said jet and with at least one input opening located ahead of the nozzle output and forming a passage for the external air replacing that carried along by the jet of ink.

2. A writing head as claimed in claim **1**, wherein the support includes insulating parts carrying respectively the nozzle and the electrodes and metal parts shielding the output end of the nozzle against any electric charges carried by the insulating parts.

3. A writing head as claimed in claim **1**, wherein the support includes insulating parts carrying respectively the nozzle and the electrodes, metal parts shielding the output end of the nozzle against any electric charges carried by the insulating parts carrying the electrodes, an annular metal dished member inserted between the nozzle and the corresponding insulating part, the outer edge of which surrounds the nozzle in proximity therewith to protect against undesired increase the field arising between the nozzle and the electrode-carrying metal parts upon application of voltage thereto.

4. A writing head as claimed in claim **1**, wherein the support includes insulating parts carrying the electrodes, a metal part rigid with said insulating parts and shielding the output end of the nozzle against any electric charge carried by said insulating parts, a cylindrical extension of said metal part surrounding coaxially the nozzle, an insulating bell-shaped member fitted coaxially with a sliding fit on said cylindrical extension, a transverse centrally apertured web rigid with the inner surface of said bell-shaped member and an annular dished member carried by said web and surrounding the nozzle, the outer end of which dished member surrounds the nozzle in proximity therewith to shield the latter against any electric charges carried by the bell-shaped member and web, the web being provided with the input openings.

5. A writing head as claimed in claim **1**, wherein the support includes insulating parts carrying respectively the nozzle and the electrodes and metal parts shielding the output end of the nozzle against any electric charges carried by the insulating parts, one of said metal parts including a generally tubular section extending within the insulating parts carrying the electrodes and provided with a plurality of inwardly directed longitudinal projections and with slots extending between said projections, said slots being engaged with clearances by the electrodes carried by the corresponding insulating parts.

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