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Mihm et al.

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[54] **PRINTING NEEDLE FOR A NEEDLE PRINTING MECHANISM**

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[52] **U.S. Cl.** ..... **197/1 R,** 335/255

[51] **Int. Cl.** **B41j 3/44**

[58] **Field of Search** ..... 197/1 R; 335/209, 251, 335/255

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[57] **ABSTRACT**

Magnetically energized needle for printing. A magnetically energized needle or stylus is provided for effecting mosaic printing and utilizes various ways of connection of a needle into the armature of an electromagnet. In one form the needle is made from wire having a thickened portion at one end thereof which makes possible the use of an opening in the armature large enough to be conveniently made. Same is inserted in said opening and fastened therein in any convenient manner such as by peening, the end of the armature over a tapered portion of the needle. In a modification the fastening end of the needle is flattened, a hole provided therethrough and same is then pivoted to a pivoted or hinged type of driving armature. Either of these methods of fastening provides a wire of desirably small diameter at the operating end thereof but large enough at the fastening end to be capable of fastening in a simple, economic and effective manner.

3 Claims, 5 Drawing Figures

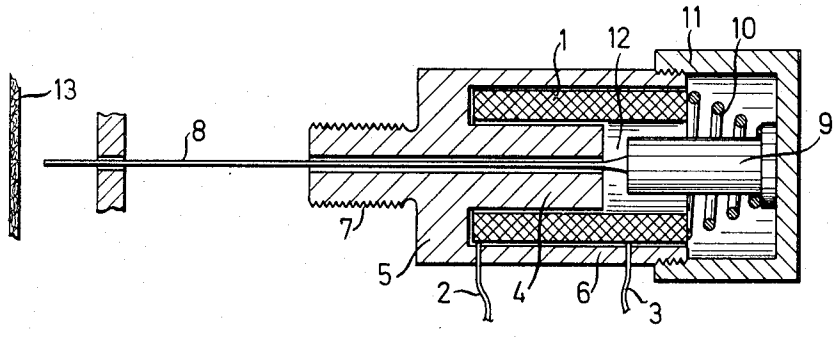
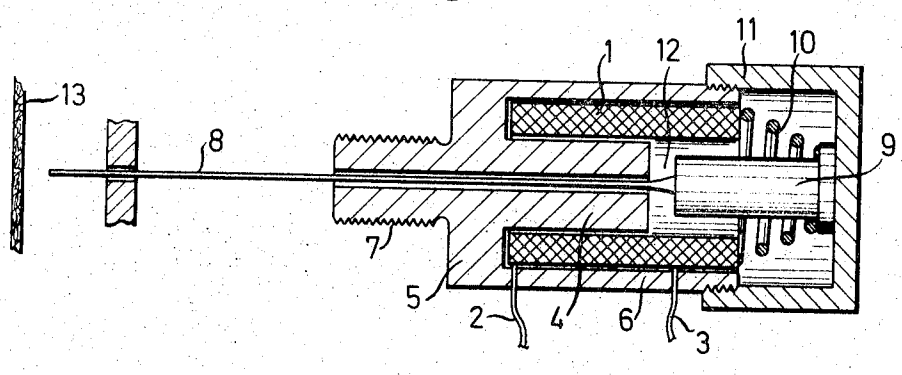


Fig. 1



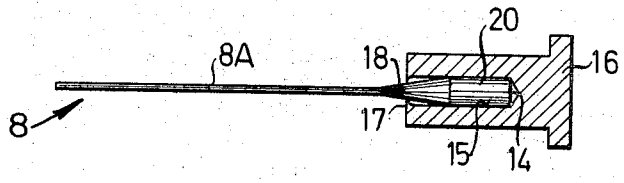


Fig. 2

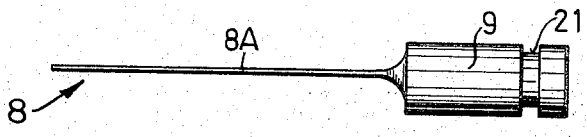


Fig. 3

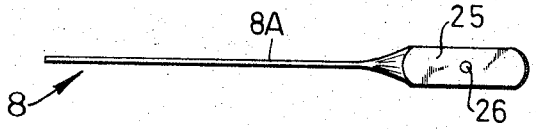


Fig. 4

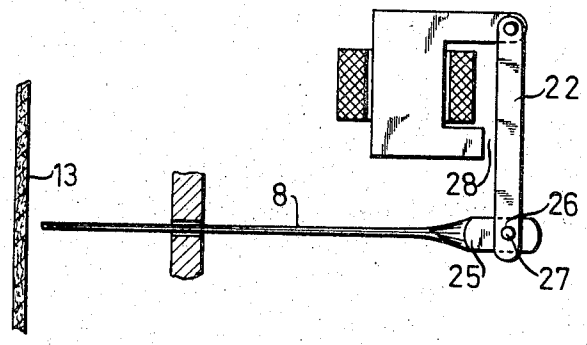


Fig. 5

PRINTING NEEDLE FOR A NEEDLE PRINTING MECHANISM

The invention relates to a printing needle for a needle printing mechanism comprising a printing wire and armature and particularly one wherein the printing wire is connected to the armature.

In place of recording mechanisms with a symbol storage in the form of printing type, so-called mosaic printing mechanisms are being used increasingly. The symbols are thereby formed by a dot system, preferably in a pattern 7 × 5 dots. The dots are applied by mechanically operating needles.

The needles are in such a system usually driven electromagnetically. For this purpose the needles are secured on the armature of the electromagnet.

By subdividing a type receiving area, of such size as to correspond to the conventional typewriter type, into 35 dots, there is obtained a needle diameter in the magnitude of approximately 0.3 mm. Up to now it has been common to manufacture such printing needles from a spring steel wire by cutting same to length and then connecting same nonreleasably to the armature. This connection was usually effected by providing the armature with an opening into which the wire was introduced and then glued or soldered. This technique was disadvantageous in that it was very difficult and expensive to drill an opening of 0.3 mm. deep into the steel. Furthermore the connection by means of gluing or soldering was not safe enough so that the proper operation was not always assured.

A different connection of armature and printing wire consisted in drilling the opening in the armature larger, for example 1 mm. in diameter and then to fill the space surrounding the thinner printing wire. This filling can either be done by casting with a castable resin or by a capillary tube. With this technique the manufacture of an opening is easily accomplished, but it does not always provide a safe connection between printing wire and armature. The 0.3 mm. thin wire is supported on the base of the opening of the armature and, because of the constant hitting during writing, it can work itself into the armature of soft iron. Thus the writing needles become shorter and because the armature can now hit on the magnetic core, the system may be destroyed.

The purpose of the present invention consists in producing a printing needle for a needle printing mechanism of the type mentioned above which can be made in a simple manner and which will operate safely and reliably.

This purpose is attained according to the invention by forming the printing needle from a thickened diameter of the initial material, whereby the connecting point between printing wire and magnetic armature has dimensions exceeding the diameter of the printing wire. This makes possible the desired simplicity in manufacture and also assures a secure connection between printing wire and armature.

A further feature of the invention is that the armature can have an opening exceeding the printing wire diameter, into which opening the thickened end of the printing wire is inserted. The printing needle is thus constructed in two parts and through the thickened end a safe holding of the printing wire in the armature is assured.

As a still further feature of the invention, the printing wire is connected to the armature by compressing the edge of the opening of the armature over the tapering portion of the printing wire. This results in a simple, but very effective connection of printing wire and armature.

It is also possible to construct the armature and the printing needle of one piece wherein the printing wire is forged from the diameter of the armature. This also secures a simple construction of the inventive printing needle.

In a needle printing mechanism with hinged armature magnets, according to a still further embodiment of the invention, the thicker end of the printing wire which is manufactured from the thickened diameter of the initial material may be pressed flat and provided with positive means for connection to a hinged or pivoted armature. This too results in an easily manufacturable and functionally safe printing needle.

The invention will be described hereinafter more in detail and in connection with the exemplary embodiments illustrated in the drawing, in which:

FIG. **1** is a longitudinal cross-sectional view of an electromagnet of the mosaic printing head;

FIG. **2** is a longitudinal cross-sectional view of the printing needle with armature;

FIG. **3** illustrates a different embodiment of the printing needle with its armature;

FIG. **4** illustrates a printing needle for a pivoted armature magnet;

FIG. **5** is a schematic illustration of the pivoted armature magnet with the inventive printing needle.

According to FIG. **1** the electromagnet consists of a coil **1** with the connecting wires **2** and **3** and the ferromagnetic circuit for compressing the magnetic lines of force, which is formed of hollow core **4,** flange **5** and sleeve **6.** A threaded zone **7** is provided for securing the electromagnet in a housing.

The printing needle **8** according to the invention consists of the printing wire **8A** fixed to the armature **9** which is pressed by means of a pressure spring **10** in rest position against a stop cap **11.** An operating air gap **12** exists between the armature **9** and the hollow core **4.** Upon operation of the electromagnet the printing needle **8** acts onto a writing surface **13.**

According to FIG. **2,** the printing needle **8** comprises an elongate slim printing wire **8A** and at its end facing away from the writing surface **13** substantially shorter, radial enlargement **20** which lies with its end **14** in the bottom of the opening **15** of the armature **16.** The opening edge **17** can be peened over the cone **18** joining the printing wire **8A** to the needle enlargement **20.** Through this the needle end **14** is firmly pressed against the bottom of said opening. The needle is thus positively held in the armature by the flanged edge. This peening can be done easily and the fastening can be checked non-destructively. Due to the enlarged support surface at the end of the opening, the printing wire **8** can no longer work itself into the armature.

The printing wire has a diameter of approximately 0.3 mm. and is, as illustrated, made larger in the zone of the armature opening. This larger diameter corresponds to an opening diameter in the armature which is large enough to be manufactured economically. The support of the printing needle **8** on the bottom of the opening is furthermore provided over a substantially larger surface which in turn diminishes the surface

pressure during hitting of the printing needle **8.** This further diminishes the working of the printing wire into the armature. The tapering printing wire thus makes possible through compression a positive connection between armature and printing needle.

The smaller diameter of the printing wire is advantageously manufactured through reduction of a thicker wire.

According to FIG. **3** it is also possible to manufacture the armature **9** and the printing needle **8** entirely of one piece, i.e. integrally. From the diameter of the armature of for example approximately 3 mm., the needle is forged with a diameter of for example approximately 0.3 mm. A groove **21** in the body of the armature **9** serves in this embodiment to support a return spring.

As shown in FIGS. **4** and **5,** the printing needle of the invention can also be used in other magnetic systems, as for example in hinged or pivoted armature magnets, as schematically illustrated in FIG. **5.** These pivoted armature magnets are for example used for heads with seven needles. In this arrangement, there exists the problem of providing a hinged connection between hinged armature **22** and the needle **8.** The needle is according to the invention again manufactured by forging from the enlarged end **25,** wherein the thicker end is pressed flat and is provided with positive fastening means, for example a bore **26.** Thus the needle **8** is connected to the pivoted armature **22** through a pin **27.** An operating air gap **28** is provided between the magnet and the armature.

Thus, the invention provides a simple manufacture for a printing needle for mosaic printing heads **1,** whereby in spite of the accomplished simplicity of manufacture, there is also obtained a high operation safety and a long lifetime in operation.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A printing needle device for a printing mechanism comprising a printing needle and an enlarged diameter, substantially cylindrical armature adjacent one end thereof, said printing needle having an elongate, relatively small diameter printing wire and a relatively short, enlarged diameter end portion adjacent said armature, said enlarged diameter end portion terminating and being integral with said printing wire, said printing needle including a somewhat tapered portion integrally joining said printing wire and enlarged end portion, said armature having a diameter exceeding that of said enlarged end portion, the armature having an opening which substantially exceeds the printing wire diameter, said enlarged end portion of the printing needle being inserted in said opening and substantially fully housed therein to connect with said armature, whereby to facilitate manufacture of and enhance reliability of a printing wire-armature interconnection.

2. The device of claim **1** in which said tapered portion is partly received in said opening, the edge of said armature opening being peened against said tapered portion of said printing needle and firmly connecting same to said armature.

3. The device of claim **1** in which said enlarged end portion is substantially cylindrical and said tapered portion is conical and tapers from said printing wire to said enlarged end portion, said armature being coaxial with the printing wire.

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