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Schneider

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[54] **MOSAIC PRINT HEAD**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.**................ **197/1 R,** 101/93 C, 335/274

[51] **Int. Cl.**.. **B41j 33/00**

[58] **Field of Search**......... 197/1 R; 101/93 C, 93 N; 335/274

[56] **References Cited**

UNITED STATES PATENTS

3,210,616	10/1965	Severn	335/274 X
3,467,232	9/1969	Paige	197/1 R
3,592,311	7/1971	Chou et al.	101/93 C X
3,672,482	6/1972	Brumbaugh et al.	197/1 R
3,729,079	4/1973	Zenner et al.	101/93 C X

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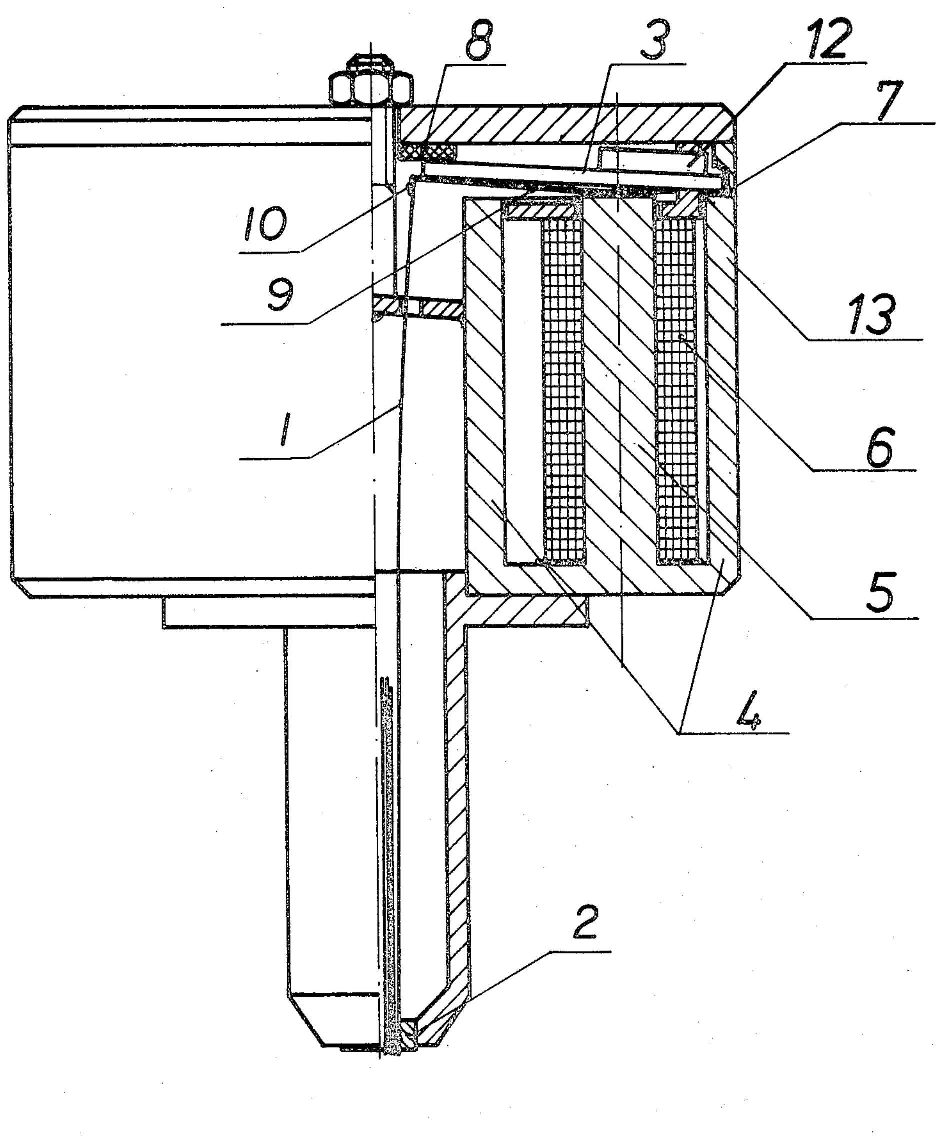
[57] **ABSTRACT**

A mosaic print head comprises a centrally arranged needle guide for holding individual printing needles substantially vertically and for permitting substantially vertical axial movement thereof for printing. A plurality of electromagnets are arranged around the upper ends of the needles and each includes an armature which is movable relative to a core. A leaf spring is disposed between the armature and the core and its outer end is engaged on an associated needle which is moved by the armature to actuate the needle during printing.

10 Claims, 5 Drawing Figures



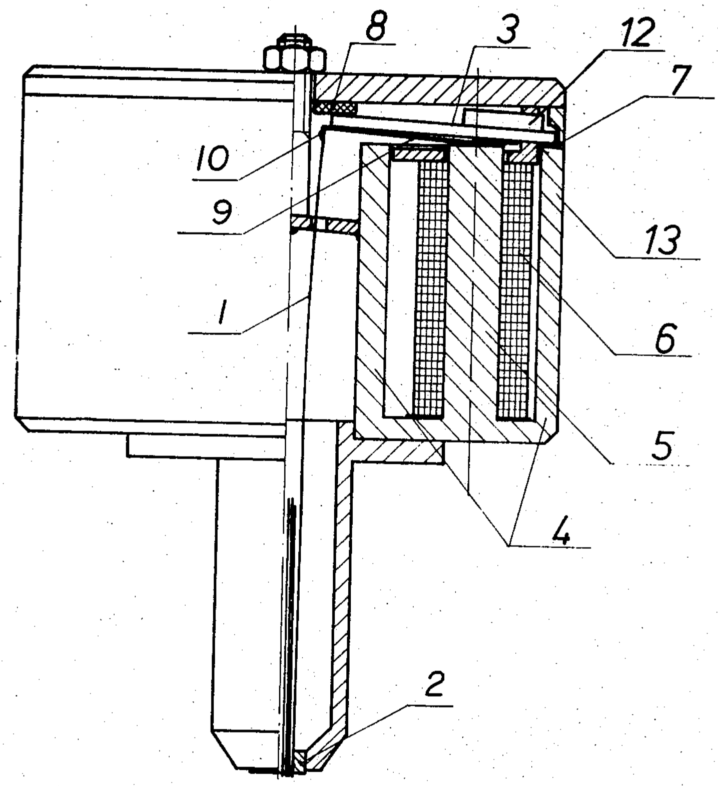


FIG.1

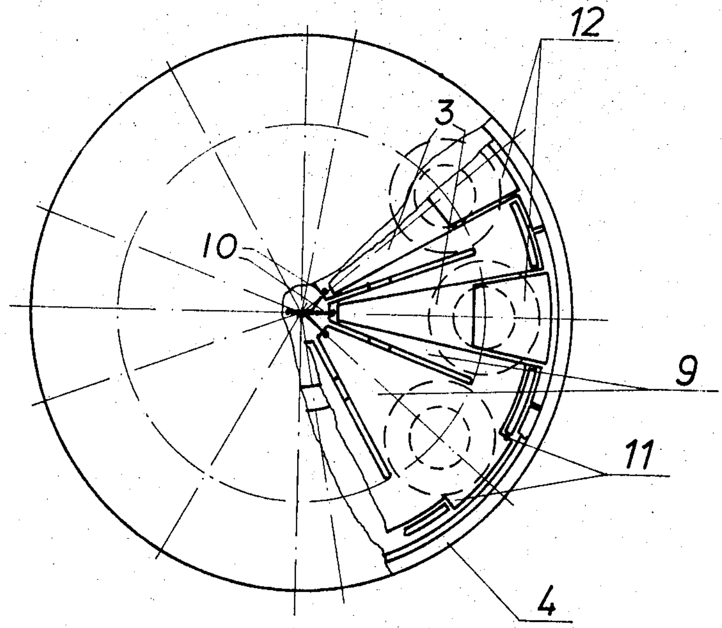


FIG.2

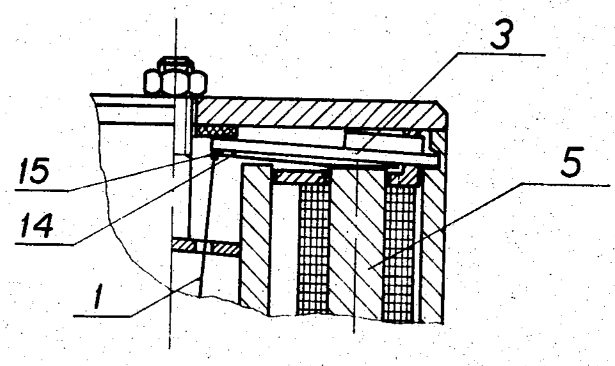


FIG. 3

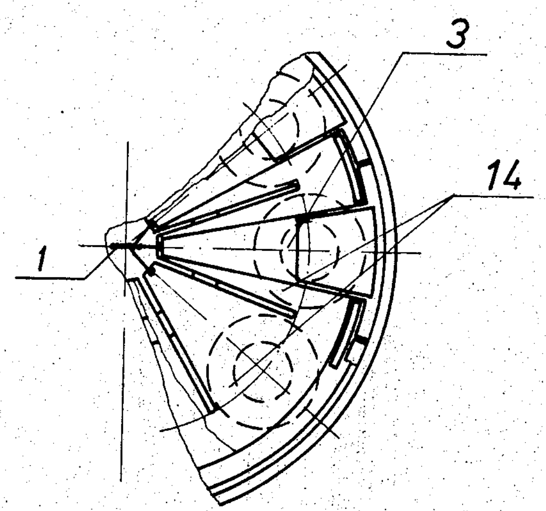


FIG. 4

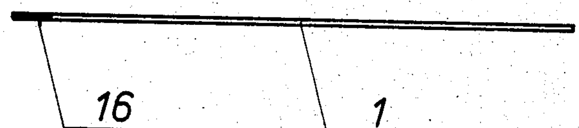


FIG. 5

MOSAIC PRINT HEAD

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to printing devices and, in particular, to a new and useful mosaic printing head having a plurality of vertically arranged needles which are actuated by a movable armature and which includes a spring member disposed between the armature and the needle head.

2. Description of the Prior Art

The present invention particularly relates to a mosaic print head in which the printing needles are actuated by flap-armature magnets, and particularly to the guidance and design of the printing needles.

In such mosaic print heads, the printer magnets are mostly arranged on a circular arc, with the conical flap armatures directed towards the center of the circle and actuating the printing needles via these ends. Because of the spatial extent of the magnetic systems, the printing needles are spread asunder at the upper end and are so guided at the printing side that their ends lie in one plane and thus form the printing column. To achieve an advantageous transmission of the force from the magnets, the printing needles are slightly curved so as to be guided approximately perpendicularly in the lower part.

The upper end of the printing needles terminates in a wider portion (hat), which serves as pressure surface, with the needle permanently connected with the hat and the latter loosely resting against the armature or loosely guided therein and, by means of a spiral spring, forced against the armature.

This design of the mosaic print head, and particularly the fact that the hat loosely rests against the flap armature, requires a relative movement between the flap armature and the needle end which, due to the relatively small bearing surface of the hat and to the high printing rate, results in considerable attrition and, consequently, in undesirable wear. Another critical wearing spot is the needle point, which, when forced against the paper, first rounds off and then is subject to heavy wear.

SUMMARY OF THE INVENTION

In accordance with the invention, there is provided a printing head which does not have the disadvantages of the prior art and which includes a leaf spring disposed between a movable armature and the electromagnetic core and which is preferably formed as a continuous annular curve with individual radially extending finger elements and which engage between the armature and the needles to actuate the needles upon movement of the armature.

The invention is characterized in that, for reducing wear, there is provided between the flap armatures and the yokes a loosely supported leaf spring to whose end directed to the center of the circle the printing needle is permanently attached. Advantageously, all leaf springs are made from one piece, so that a comb-like shape is obtained.

The invention offers a number of considerable advantages. For example, the relative movement between the armature and the leaf spring is nearly zero; furthermore, the upper end of the needle can be moved closer to the center of the circle, so that the needles are less curved, and, finally, the bearing surface between the armature and the leaf spring is considerably larger than in the known systems. The result is that attrition is virtually negligible.

In addition, since the hat and the pressure spring are no longer required, a reduction in the mass to be moved during printing is obtained, which fact, together with the likewise reduced friction between the needle head and the armature, the reduced curvature of the needle as well as the possibility of adapting the progressive load deflection curve of the leaf spring to the characteristic of the magnetic force, can be utilized to considerably increase the printing rate.

The comb-like design of the leaf spring simplifies the manufacture; also, no clamping of the leaf-spring comb is necessary if only a protection against torsion is provided. If non-ferromagnetic or almost non-magnetic material is used for the leaf spring, the otherwise necessary anti-sticking foil between the armature and the yoke can be dispensed with.

With the conventional printing wires made of carbon steel, alloy steels, or tungsten, the point of the printing needle wears rapidly. However, if a carbide tip is attached to the end of the printing needle, wear is considerably reduced.

Another possibility of producing wear-resistant printing needles is to make them of titanium and to convert the point into titanium carbide or titanium nitride. The point can be converted completely or partially; in the latter case, a soft, tough core is preserved. This conversion of the point can also be achieved with tungsten, tantalum, molybdenum, or chromium. A considerable advantage of titanium, however, is its low specific gravity and, consequently, a higher printing rate.

Accordingly it is an object of the invention to provide an improved mosaic print head in which a bundle of needles are guided for vertical movement and arranged centrally within circumferentially spaced flap armatures and wherein a leaf spring is disposed between the armature and the individual needles and engages the needles for actuating them upon movement of the armature.

A further object of the invention is to provide a mosaic printing head which is simple in design, rugged in construction and economical to manufacture.

For an understanding of the principles of the invention, reference is made to the following description of typical embodiments thereof as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

In the drawings:

FIG. 1 shows a partial section through the novel mosaic print head;

FIG. 2 is a top view of this mosaic print head with partially removed cover;

FIG. 3 shows part of another embodiment of the novel mosaic print head in a sectional view;

FIG. 4 is a top view of this mosaic print head, and

FIG. 5 shows the novel design of a printing needle.

FIG. 1 shows the novel mosaic print head, scaled up to about twice its natural size. For clarity, only one printing needle 1 is shown. The printing ends of the needles lie one after the other in one plane and form the printing column; this is shown schematically in FIG. 2. The printing end of the printing needle 1 is guided in the guide 2.

The magnetic systems for actuating the printing needles 1 are arranged on a circle as shown in FIG. 2. The sectional view of FIG. 1 shows that the magnet yoke 4 is U-shaped. Located between the legs of the magnet yoke 4 is the core 5, around which the field coil 6 is wound. The magnet yoke 4 is common to all magnetic systems and forms an integral part, so that two concentric cups consisting of one turned part are obtained. FIG. 2 also shows that the coil cores 5 are cylindrical, as well s the design of the flap armature 3. The latter has a wide bearing portion, which is placed into the groove 7 extending all around and rests on the core 5. To reduce the bouncing of the needles and to limit the stroke, the ring 8 made of elastic material is provided.

According to a feature of the invention, a comb-like leaf spring 9, whose design can be seen in FIG. 2, is located between the armature 3 and the core 5. Attached to those ends of the tongues 10 of the leaf spring 9 which are directed towards the center of the circle are the upper ends of the printing needles 1.

As can be seen in FIG. 1, the tongues 10 can be placed very close to the center of the circle, so that the printing needles 1 are curved outwardly toward their tops only very little. The leaf spring 9 lies loosely and under slight resilient pretension between the armature 3 and the core 5 and is protected against torsion only by the torsion protection 11.

The ferromagnetic lamina 12 joined to the armature 3 serves to increase the magnetic flux via the outer jacket 13, the armature 3, and the core 5, whereby the armature force is increased. The resulting increase in the inertia of the system is negligible because the lamina 12 lies near the armature fulcrum and is relatively small. The lamina 12 can be joined to the armature 3 by spot welding or projection welding.

FIGS. 3 and 4 show another embodiment of the invention in which the printing needles 1 are passed through that end of the tongue of the leaf-sprint comb 14 which is directed toward the center of the circle, and are secured against slipping by the small hat 15. As in the example of FIGS. 1 and 2, the relative movement between the armature and the leaf spring is nearly zero.

FIG. 5 shows the novel design of the printing needle 1 in which the tip 16 is made of cemented carbide to achieve a reduction in wear. The carbide tip 16 may be attached, for example, by soldering or by laser-beam welding. This also reduces the wear to which the needle point is subjected in the guide 2, which has a favorable effect on the type.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

I claim:

1. A mosaic printing head, comprising at least one elongated printing needle, needle guide means for holding said needle substantially vertically and permitting substantial vertical axial movement thereof for printing, an electromagnet including a pole core, an armature having a first end movable toward and away from said pole core and an opposite second end, means pivotally supporting the opposite second end of said armature, and a leaf spring having a first end supported between said first end of said armature and said pole core and having a second end engaged with said needle to displace said needle upon movement of said armature.

2. A mosaic print head, according to claim 1, wherein there are a plurality of needles arranged in spaced circumferential locations, said needles each having an armature, said leaf spring comprising a comb-like member having comb fingers disposed between the armature and the associated needle.

3. A mosaic print head, according to claim 1, wherein said leaf spring is made of a non-ferromagnetic material.

4. A mosaic print head, according to claim 1, wherein said needle is joined to said leaf spring by a weld.

5. A mosaic print head, according to claim 1, wherein said leaf spring includes a tongue portion having a hole therethrough for the passage of the needle therethrough, and a hat engaged over the hole for holding the needle in position.

6. A mosaic print head, according to claim 1, wherein said needles have a carbide tip secured thereto.

7. A mosaic print head, according to claim 1, wherein said printing needle is made of titanium having a tip made at least partially of titanium caribde.

8. A mosaic print head, according to claim 1, wherein said printing needle is made of one of the following: tungsten, tantalum, molybdenum, vanadium and chromium, and wherein the needle has a point comprising a carbide material.

9. A mosaic print head, according to claim 1, including a ferromagnetic laminar secured to said armature adjacent its pivotal mounting and covering at least a portion of said pole core.

10. A mosaic print head comprising a housing having a needle guide with a lower print head guide and an upper guide portion, a plurality of needles engaged with said lower print head guide and said upper guide portion and being disposed for vertical axial movement, a plurality of electromagnets arranged around said needles each having a pole core and an armature movable relative to said pole core having a first end movable toward and away from said pole core and an opposite second end, means pivotally supporting said opposite second end of said armature located radially outwardly of said core, and a leaf spring having a first end supported between said first end of said armature and said pole core and having a second end engaged with a respective needle, said leaf spring comprising a continuous member having comb-like fingers with a respective finger engaging respective needle.

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