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Schneider

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[54] **MOSAIC PRINTING HEAD WITH ELECTROMAGNETICALLY ACTUATED NEEDLES WITH A COMMON YOKE FOR ALL ELECTROMAGNETS**

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Related U.S. Application Data

[63] Continuation of Ser. No. 227,515, Feb. 18, 1972, abandoned.

[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **197/1 R;** 101/93.05

[51] **Int. Cl.** **B41j 3/04**

[58] **Field of Search** ..... 197/1 R; 335/278; 101/93 C

[56] **References Cited**

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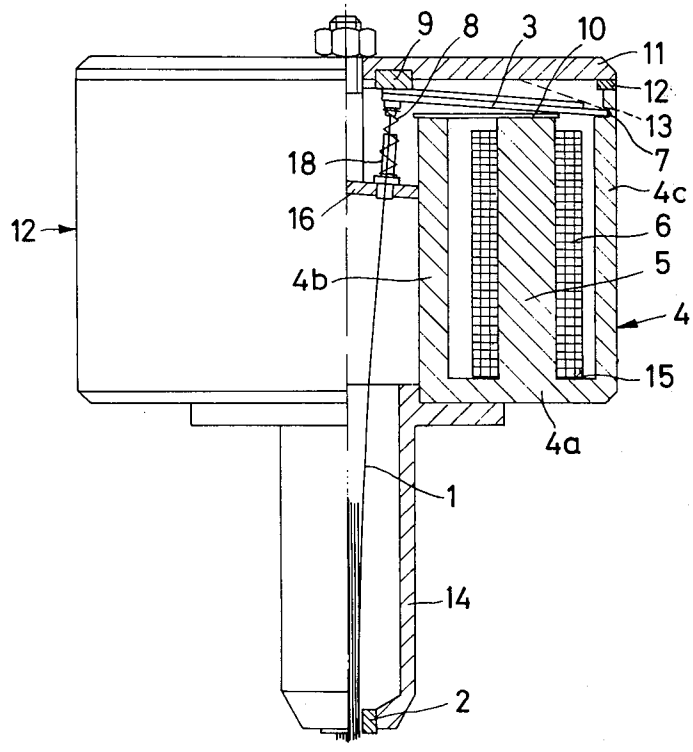
[57] **ABSTRACT**

An electromagnetic drive for the operation of printing needles of a mosaic printing head includes a pivotally mounted armature for each needle which are arranged along a circular arc. The construction includes a common yoke for all of the electromagnets which comprises two concentric cups or walls forming a single unit with cylindrical cores arranged at equal intervals along a circular arc parallel to the genatrix of the cup and located between the individual yoke cups.

4 Claims, 2 Drawing Figures



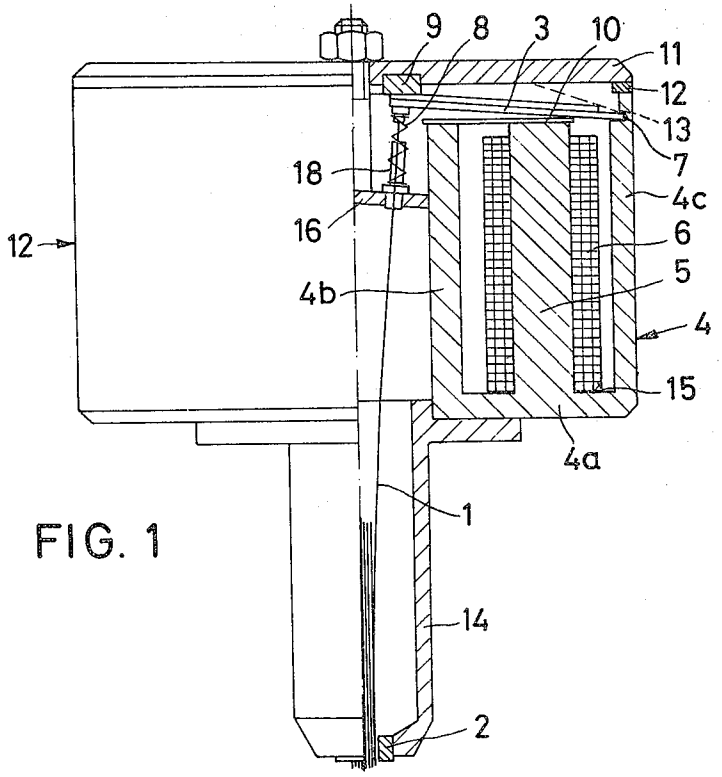


FIG. 1

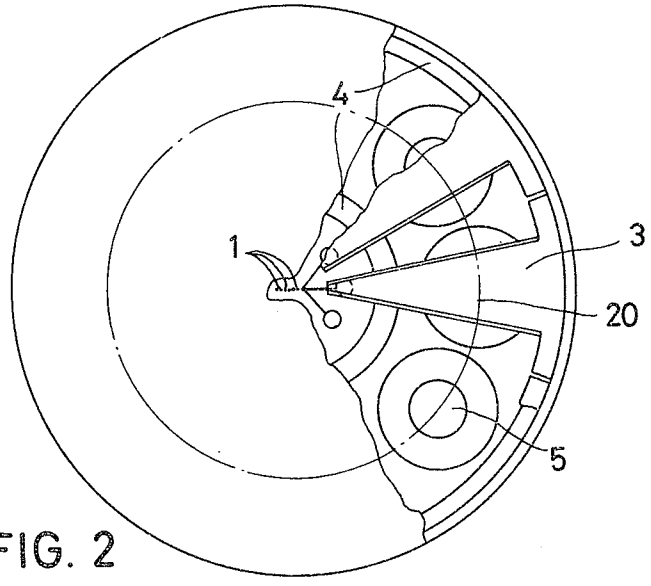


FIG. 2

MOSAIC PRINTING HEAD WITH ELECTROMAGNETICALLY ACTUATED NEEDLES WITH A COMMON YOKE FOR ALL ELECTROMAGNETS

This is a streamline continuation of application Ser. No. 227,515, now abandoned, filed Feb. 18, 1972.

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 an electromagnetic drive for the printing needles.

2. Description of the Prior Art

In the art of record the printing needles of the mosaic printing heads are generally arranged one above the other so that they form a gap in the mosaic raster. The needles are displaceable by electromagnets in a longitudinal direction of the lines. As a rule, 7 by 5 or 9 by 6 frames are employed with such printing. In order to activate the printing needles, plunger type armature magnets or hinged or pivotal armature magnets have been used. Both systems are very complicated and large and require therefore very strong inclination of the needles which is achieved by an appropriate curvature thereof. The drawback of such construction is that the needles are subjected to a bending force during their movement which entails energy losses and also produces a high frictional wear on the needles with respect to their supporting elements. In addition, oscillations can be induced which jeopardize the printing function during high printing speeds. In the case of the so-called plunger type armature magnets, the plunger armature is additionally subjected to high friction and consequently to great wear and tear. Finally, the large inert mass of the plunger type armature magnets is also a disadvantage.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided an electromagnetic drive for printing needles of a mosaic printing head which is designed so that the disadvantages of the known heads are avoided. The present invention provides an arrangement employing a plurality of pivotally hinged armature magnets which are arranged around a circular path. The feature of the construction is that one common yoke is provided for all of the magnets. The yoke is advantageously formed out of two concentrically arranged cups or wall portions which are made preferably of a single piece. Cylindrical cores are arranged at equally spaced intervals around a circular path located between the walls and parallel to the genatrix of the wall formation.

The hinged armatures are advantageously supported in a groove defined on an inner circumference of the outer yoke cup or wall so that the armature ends which are opposite the pressure end can rest loosely in the groove. The armatures are further improved by shaping them so that their support ends are wider than their pressure ends. A washer of an elastic material is arranged concentrically in respect to the cup axis in order to absorb vibrations. A common thin sheet of elastic material is placed over the cores and the inner yoke cup in order to provide a protection against adhesion of the armature to the operating core.

A chief advantage of the invention lies in the fact that the electromagnetic systems can be arranged so as to take a very little space, as a result of which only a slight curvature of the printing needles is required. In addition, the moments of inertia are very small in such an arrangement. Because there is only one yoke which forms a single unit for all of the magnets, high magnetic losses which occur in other systems due to the division of the magnets, can be avoided. Such measures mean a reduction of the magnetic cross section which in turn decreases the force of attraction. In addition, the new drive does not have any loss gaps because the common yoke comprises a single piece. Another advantage is that the armature is supported along the entire width of the magnetic system in a circumferential groove so that the armature is always strongly attracted toward the inside of the groove to result in a low magnetic contact resistance and a very stable support. Thus, while a high force of attraction is obtained it is not necessary to provide additional guiding means for the armatures. In addition, the constructions provide an arrangement where there is very little wear on the supporting areas.

The cup shaped yoke is advantageously made of a sintered material into which the cores can be sintered, so that the yoke and the cores form a single unit. The armature bearing can receive a continuous lubrication due to the use of the sintered materials.

Accordingly, it is an object of the invention to provide an electromagnetic drive for the operation of printing needles which includes a plurality of pivotal armature magnets arranged around a circular arc with a common electromagnetic yoke for all of the electromagnets which is formed of a cup member having two concentric inner and outer walls with cylindrical cores arranged between the walls at equal intervals along the circular arc.

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

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its uses, reference should be had to the accompanying drawing and descriptive matter in which there is illustrated a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a partial elevational and partial transverse sectional view of a mosaic printing head constructed in accordance with the invention; and

FIG. 2 is a partial top plan and partial broken away view of the head shown in FIG. 1.

GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings in particular, the invention comprises a mosaic printing head generally designated 12 and comprises a tubular support 14 having a guide member 2 at the lower end thereof which defines a passage therethrough for mosaic printing needles 1. Only one of the mosaic printing needles 1 is shown with its complete upper portion which extends upwardly through a guide plate 16 and a guide tube 18 into contact with a pivotal armature 3. The printing end of the needle 1 is guided inside the guide member 2 while the other end rests against the armature 3. The printing

needle is curved only slightly as shown in respect to the single needle which is illustrated.

In accordance with the invention the magnetic system for the printing needles is arranged along a circle. There is included a yoke **4** which includes a base portion **4***a* and inner and outer concentric wall portions or legs **4***b* and **4***c*, respectively. Individual cores **5** of cylindrical formation are arranged at spaced locations along a circular center line **20** and each is provided with its own winding or coil **6.** The cores are oriented below the associated hinged armature **3** between the walls **4***b* and **4***c*. The cylindrical cores **5** may be secured in any manner such as by screws, rivets or being integrally cast with the yoke **4.** In the preferred form the yoke and the core are made of a magnetic sintered material and the cores are cast into the yoke. Such a construction is advantageous because the joints cannot come apart even though it is subjected to continuous high impulse like stresses.

Each armature **3** includes a widened inner portion which engages into a circumferential groove **7.** The armature also rests on the core **5** and the outer end rests on the needle **1.** In order to reduce the vibration of the needle and to limit its lifting movement a washer **9** made of an elastic material is engaged at the inner end of the armature **3** and it is carried in a cover member **11.** A thin film of elastic material **10** is applied over the inner yoke wall **4***b* and the core **5.** This prevents the armature from sticking to the core due to the residual magnetic flow. The film of plastic material is common to all the systems. This insures a reduction of interference oscillations between the armature and the needle and consequently the needle frequency that is the printing speed can be increased and the noise level decreased. It is also possible to provide individual damping means for each magnetic system.

Above the coils **6,** there is located the common cover **11** which also serves to hold the armature when the armature is not attracted by the magnet. The bottom of the yoke **4** is provided with an insulating film **15.** The cover **11** may be redesigned to extend downwardly as indicated by the dotted lines **13** to provide the top holding element for the armature if desired.

While a specific embodiment of the invention has 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.

What is claimed is:

1. An electromagnetic drive for the operation of printing needles of a mosaic printing head, comprising a housing having a tubular support portion with a guide for a plurality of needles, a plurality of needles in said guide arranged for substantially axial movement for printing, an annular common magnetic yoke for all of said needles made of magnetic material and being connected to said support portion, said yoke including an outer and an inner annular wall portions located exteriorly of and generally concentric to said needles, said yoke also including a pole piece of magnetic material for each needle arranged in circumferentially spaced locations between said outer and inner wall portions and each having a coil winding, said pole pieces and said outer and inner walls having outer end faces terminating in substantially the same plane, an armature having an outer end pivoted on said outer annular wall portion and overlying said pole piece and the end face of said inner annular wall portion and having an inner end connected to a respective needle, and spring means biasing said armature away from engagement with said pole piece.

2. An electromagnetic drive according to claim **1,** wherein said yoke is made of a single piece, said spring means comprising a coil spring and engaged around a respective needle and urging the associated armature away from the pole piece, and a cover overlying said yoke and having a washer of elastic material overlying the end of said armature connected to said needle, said spring means biasing said armature into engagement with said washer.

3. An electromagnetic drive, according to claim **1,** wherein said armature includes a curved outer end, said yoke outer wall portion having an arcuate receiving groove extending therearound, said armatures having curved outer ends engaged in the arcuate receiving grooves.

4. An electromagnetic drive for operating printing needles of a mosaic printing head, comprising a housing including a tubular portion defining a printing needle guide, a plurality of printing needles disposed in said guide and having portions projecting outwardly therefrom, a yoke of magnetic material comprising three upstanding portions including a first inner cylindrical wall portion surrounding the portions of the needles which project out of said housing tubular portion, a second outer cylindrical wall portion surrounding said first inner cylindrical wall portion and spaced outwardly therefrom, a third pole piece portion having a coil winding and a base portion connected to all of said first, second and third portions and extending between said outer cylindrical wall portion and said inner cylindrical wall portion, said third pole piece being an armature pole for each needle disposed between said outer cylindrical wall and said inner cylindrical wall arranged on an arc surrounding said needles, an armature aligned with each pole, each having an inner end pivotally connected to said outer cylindrical wall and extending over its associated pole and having an outer end connected to a respective needle, each pole having an exciting coil therearound which may be energized to attract said armature for moving the associated needle.

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