United States Patent

[11] **3,629,755**

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[21] Appl. No. **70,268**
[22] Filed **Sept. 8, 1970**
[45] Patented **Dec. 21, 1971**
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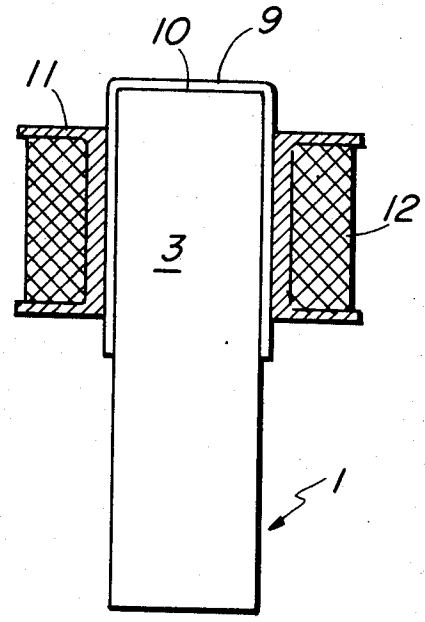
[54] **HAMMER ACTUATOR CONSTRUCTION FOR HIGH-SPEED PRINTERS**
3 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **335/271, 335/277**
[51] **Int. Cl.** **H01f 7/08**
[50] **Field of Search** 335/247, 248, 257, 271, 277

[56] **References Cited**
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Primary Examiner—G. Harris
Attorney—Rich & Ericson

ABSTRACT: A print hammer actuator for high-speed printers comprising a ferromagnetic core, an armature pivoted to the core, a coil on the core, and a nonmagnetic spacer comprising a strip of flexible insulating material held on the core in position to be struck by the armature when the coil is energized.



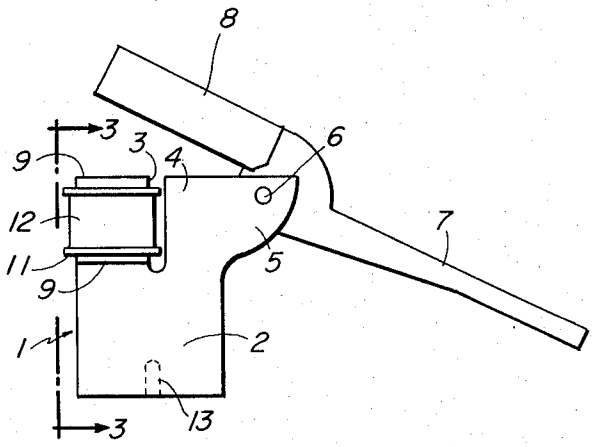


FIG. 1

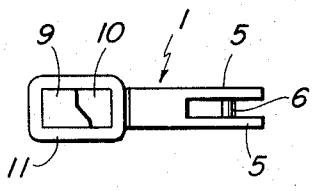


FIG. 2

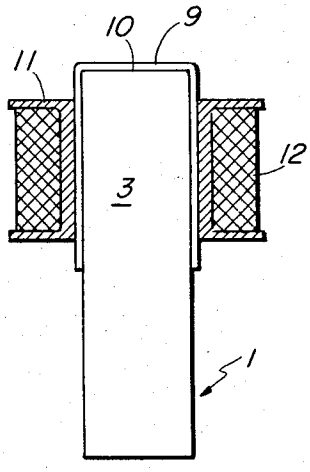


FIG. 3

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HAMMER ACTUATOR CONSTRUCTION FOR HIGH-SPEED PRINTERS

My invention relates to high-speed printers, and particularly to a novel hammer actuator construction for the same.

High-speed printers of the line at a time type have been highly developed and considerably refined since the first such machine was constructed over 20 years ago. A fundamental component of the line printer is the electromagnetically actuated hammer. Many varieties of hammer actuating constructions have been proposed, developed and used.

The basic elements of any such hammer actuating construction are a core, an electromagnetic coil on the core, and an armature arranged to be attracted to the core when the coil is energized. The armature may be directly connected to the print hammer, or it may be connected to an intermediate actuating arm that strikes the hammer.

It is long been known that performance would be greatly improved by interposing a nonmagnetic element between the armature and the core that would allow the armature to come close to, but not actually into contact, with the core. While that is apparently a simple and even trivial problem, in practice the solutions which have been proposed, prior to my invention, have presented problems of construction, assembly, cost, reliability, or maintenance. The difficulties are centered about the fact that each actuator assembly is abruptly energized several hundred times a minute in use, making onerous demands on each element of the assembly.

One approach has been to thickly electroplate the pole face on the core to which the armature is attracted with a hard coating of chromium. That is a workable expedient, but too costly to be generally used, since there are commonly well over 100 hammers in each printer. In addition, the dynamic properties of a hard metal contact surface are not ideal.

Another construction involves the spot welding of a thin nonmagnetic metal spacer to the pole face. That is also expensive, and the welds tend to break through fatigue in use.

Some manufacturers have cemented on pads of plastic or rubber. However, it is essential for good print quality that all of the hammers in a printer have substantially identical dynamic properties, and it is quite difficult to maintain uniform thickness in the cementing process. Also, the adhesives available tend to age and change their properties under repeated impact.

In another construction that has been employed, all the hammers and their actuators are first installed, and then a single strip of plastic is run through all the air gaps, the strip being secured at its ends to the frame. That construction makes access to the hammers difficult. In addition, since various number of hammers in random relationships one to the other can be actuated at any given time, the common spacer element creates the possibility of undesired mechanical crosstalk.

Finally, it has been proposed to spray a coating of plastic on the pole face. That has turned out to be very difficult to control to the extent necessary to obtain uniformity from hammer to hammer.

The object of my invention is to facilitate the manufacture of reliable and reproducable print hammer actuator assemblies, while simplifying their manufacture and maintenance.

Briefly, the above and other objects of my invention are attained by a hammer actuator comprising a ferromagnetic core to which an armature is pivotally attached in position to be attracted towards a pole face formed at the end of a leg formed on the core. A strip of flexible and nonmagnetic material is placed over the pole piece and folded over the sides of the leg. An electromagnetic coil is wound on a bobbin having a central aperture that is a press fit over the core leg with the flexible strip in place. The bobbin thus holds the strip firmly in position on the pole piece so that the strip is held in position without any special fastenings, cement or heat treatment of the parts. No connection to any other hammer actuators is required, except through the frame to which the core is attached, so that the probability of mechanical interaction between the actuators is minimized. The manner in which the spacer is installed does not impose any difficult problems of assembly or positioning, and the overall length of the spacing strip is not critical.

The manner which the apparatus of my invention is constructed, and its mode of operation, will best be understood in the light of the following detailed description, together with the accompanying drawings, of a preferred embodiment thereof.

In the drawings;

FIG. 1 is a schematic elevational view of a print hammer actuator in accordance with my invention;

FIG. 2 is a plan view of the apparatus of FIG. 1 with the armature and its associated actuating arm removed;

FIGURE 3 is a end view of the apparatus of Fig. 1 with the armature and actuating arm removed, taken substantially along the lines 3—3 in Fig. 1.

Referring to Fig. 1, as shown a hammer actuator comprising a ferromagnetic core generally designated 1 and preferably made from silicon steel. The core 1 may be considered to be functionally divided into a central leg portion in the vicinity designated by 2, and a pair of generally parallel leg portions, in the regions designated by 3 and 4, extending from the central leg portion. A pair of ears 5 are formed on the leg portion 4 and serve as supports for a pivot pin 6 which pivotally supports an actuating arm 7. The arm 7 may be stamped from pretempered steel. The arm 7 is welded or otherwise secured to an armature 8, also preferably of silicon steel. A strip 9 of flexible nonmagnetic material, and preferably of Mylar film (a polyester condensation product of terephthalic acid and ethylene glycol) extends over one side of the leg 3, over a pole face 10 formed at the end of the leg 3, and down on the other side of the leg 3 as best shown in Fig. 3. The strip 9 is preferably 0.005 inch in thickness. Mylar film of great uniformity is widely available in this thickness.

Over the leg 3 and the strip 9 is placed an electromagnetic coil comprising a bobbin 11 on which a wire coil 12 is wound. The bobbin 11 is made with a central rectangular aperture that is a close press fit on the leg 3 when the latter is overlayed with the strip 9. The assembly can be completed simply by laying the strip 9 over the top of leg 3 with the ends of the strip extending down over the sides of the leg, and press-fitting the bobbin down over the strip. The exact lengths of the strip 9 on the sides of the leg is not critical. In use, when the coil 12 is energized with current, the armature 8 is attracted down until it strikes the strip 9, thus coming close to the pole face 10 but not engaging it.

As indicated by the dotted line at 13 in Fig. 1, the core 1 is preferably drilled and tapped for a screw that will secure it to the printer frame. That is the arrangement used when an arm 7 generally parallel to the armature 8 is employed, as shown in Fig. 1. In practice, actuators of the form shown in Fig. 1 are interspersed with other actuators in which the arms 7 are formed at generally 90° to the armature 8. In that construction, the core assembly is exactly the same, except the mounting hole 13 would be located on the left side of the core 1 as seen in Fig. 1. The point is that there is no difference in the installation and construction of the spacer 9 with that change in the actuator.

While I have described my invention with respect to the details of a particular and preferred embodiment thereof, many changes and variations will occur to those skilled in the art upon reading my description, and such can obviously be made without departing from the scope of my invention.

Having thus described my invention, what I claim is;

1. A hammer actuator for a high-speed printer, comprising a ferromagnetic core having a central leg portion and a pair of parallel leg portions extending from said central leg portion and terminating in adjacent parallel pole faces, a strip of flexible nonmagnetic material extending along a portion of a first side of of said legs, over the pole face on that leg and down a portion of said first leg on a second side of said first leg opposite said first side, a coil bobbin mounted on said first leg adjacent said pole piece and engaging snugly, surrounding and

securing the portions of said strip on the sides of said first leg, an electromagnetic coil wound on said bobbin, a ferromagnetic armature, and means pivotally mounting said armature on said core for pivotal motion into and out of engagement with said strip, whereby current flowing through said coil produces a field attracting said armature into engagement with said strip.

2. The apparatus of claim 1, in which said strip consists of a polyester condensation product of terephthalic acid and ethylene glycol.

3. The apparatus of claim 2, in which said means pivotally mounting said armature comprises a pair of parallel ears formed on said second leg and extending from said second leg in a direction away from said first leg, a hammer actuator arm pivotally mounted between said ears, and means securing said actuating arm to said armature.

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