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PERMANENT MAGNET HAMMER MODULE IN HIGH SPEED PRINTERS

Filed Sept. 18, 1961

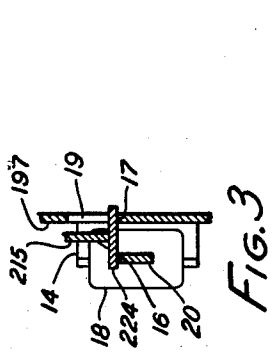


FIG. 3

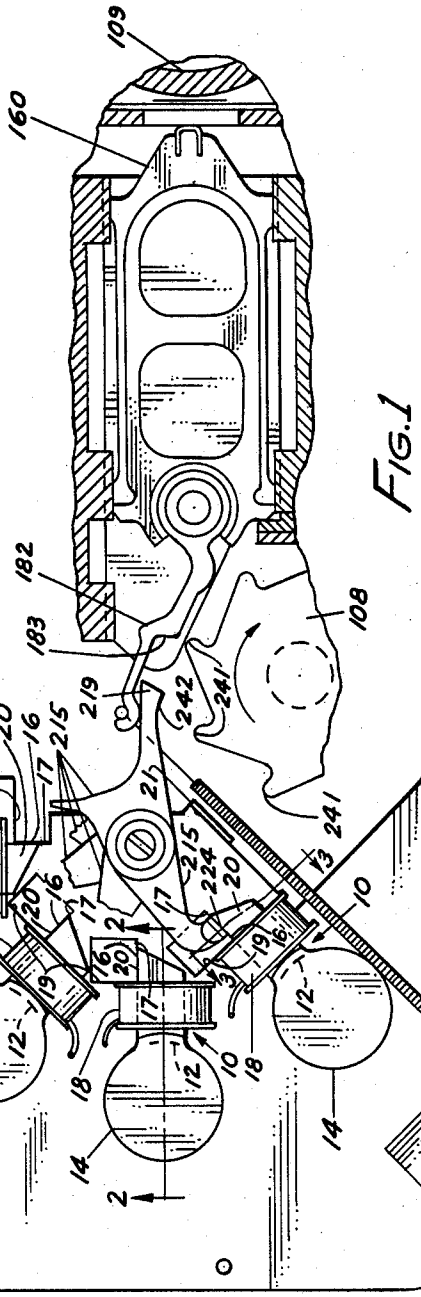


FIG. 1

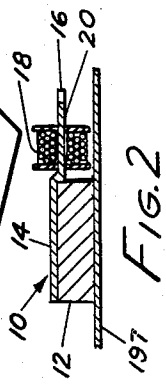


FIG. 2

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PERMANENT MAGNET HAMMER MODULE IN HIGH SPEED PRINTERS

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Filed Sept. 18, 1961, Ser. No. 138,991
3 Claims. (Cl. 101—93)

This invention relates to high speed printers, and particularly to a novel electromechanical, "on-the-fly" type printer.

More specifically, this invention relates to a modification of the print hammer mechanism disclosed in U.S. application Serial No. 138,157, entitled High Speed Printer, and filed on September 14, 1961, in the names of Arvin D. McGregor and James M. Irvine, Jr.

In the above referenced application, the disclosure of which is hereby incorporated by reference, each print hammer **160** had associated therewith an electromagnet **226** comprising two windings, one of the windings being termed a holding coil and the other winding being termed a pulse coil. The holding coil was continuously energized whenever the printer power was turned on, and the purpose thereof was to hold the print hammer interposer mechanism in the non-print position. Additionally addressing any given print hammer for printing involved energizing the pulse coil of the electromagnet associated with that particular hammer so as to cancel out the magnetic field of the holding coil and thereby permit the hammer interposer system to move to the print position. The printer disclosed in the above referenced application also contained a bail bar **243**, the purpose of which was to return the hammer interposer system to the non-print position upon the shut-down of the printer and immediately upon restarting the printer.

The main feature of this invention is the substitution of a permanent magnet for the holding coil in the print hammer mechanism disclosed in the above referenced application.

Accordingly, one object of the invention is to provide a print hammer mechanism in which no exterior source of electrical power is required to hold the print hammer interposer system in the non-print position.

Another object of the invention is to provide a print hammer mechanism in which the printer interposer system is held in the non-print position even with the printer power turned off, thus making it possible to eliminate the bail bar and all elecrtonic and mechanical parts associated with the bail bar.

Another object of the invention is to provide a print hammer mechanism which is relatively inexpensive to construct and less likely to require repair.

These and other objects of the invention will become more apparent upon reference to the following specification and the attached drawings wherein:

FIGURE 1 is a fragmentary part elevational and part cross-sectional view illustrating a print hammer mechanism embodying the invention;

FIGURE 2 is a cross-sectional view taken on the plane of line **2—2** of FIGURE 1 and looking in the direction of the arrows;

FIGURE 3 is a fragmentary cross-sectional view taken on the plane of line **3—3** of FIGURE 1 and looking in the direction of the arrows.

Referring now to the figures in greater detail, FIGURE 1 is a view very similar to FIGURE 6 of the above referenced application, and all elements common with those in the above FIGURE 6 will be identified with the same reference numbers. Thus, the hammer module assembly **196'**, which may be completely interchangeable with module **196** of application Serial No. 138,157, comprises

a base plate **197** on which the four hammer actuating levers **215** are mounted. As before, each lever **215** has an arm **219** cooperating with the free end of the interposer lever **182**, sometimes referred to as a beaver tail **182**, which is pivotally connected to the print hammer **160**. The spring **186** urges the beaver tail **182** downwardly so that a lobe **241** of the cam **108** may impact the beaver tail **182** and drive the hammer **160** into the print drum **109** when the hammer is addressed for printing.

As explained in the above referenced application, each actuating lever **215** has a second arm to which there is attached an armature **224**, the armature being provided to hold the actuating lever **215**, and thus the beaver tail and hammer assembly, in the non-print position until the hammer is addressed.

In the Serial No. 138,157 construction, each hammer beaver tail **182** and actuating lever **215** comprised an interposer system and had associated therewith an electromagnet **226** having two windings, a holding coil which is continuously energized and a pulse coil which is energized only when the hammer in question was addressed for printing so as to release the armature **224** and allow the spring **186** to move the interposer system into the path of the cam **108**.

In the modified construction shown in FIGURES 1 and 2, the electromagnet associated with each of the hammer mechanisms is replaced by a combination permanent magnet and pulse coil assembly **10**. The four assemblies **10** are mounted on the base plate **197** in an arcuate pattern just as the electromagnets **226** were mounted, and each assembly **10** includes a permanent magnet **12** of predetermined magnetic force and a suitably formed pole piece **14** mounted on the magnet in such a way as to present an edge **16** to be engaged by the armature **224** of the actuating lever **215** in the same manner as shown in FIGURE 6 of the above referenced application. The base plate **197**, the permanent magnet **12** and the pole piece **14** together form a horseshoe magnet, the edges **16** and **17** of which attract and hold the armature **224** of the actuating lever **215** in the position shown in FIGURE 1 against the force of the spring **186**. Edge **16** is on the pole piece, while edge **17** is provided by an opening **19** in the base plate **197**.

A pulse coil **18** is mounted on the leg **20** of the pole piece **14**. The permanent magnet **12**, to which the pole piece **14** is attached, provides a force of attraction which holds the armature **224** of the lever interposer system in a non-print position against the leg **20**. The pulse coil **18** is wound in a particular direction so that when current is passed through the coil **18**, the resultant magnetic field is in a direction opposite to that of the magnetic field of the permanent magnet **12**. This serves to decrease the magnetic field in the pole piece **14** and in the armature **224** to the extent that the force of the spring **186** now exceeds the magnetic force and is thus capable of pivoting the actuating lever **215**, and hence, the armature **224**, away from the pole piece **14**.

With the exception of the above specific construction described above, the other remaining details of the hammer module **196'** shown herein may be exactly the same as that of the hammer module **196** disclosed in application Serial No. 138,157. This being so, the hammer module **196'** could be substituted directly for the hammer module **196** of the above referenced application.

Stating the mechanical operation of this modified hammer mechanism very briefly, the last portion of the printing cycle is for a cam lobe **241** to strike the surface **242** on the arm **219** of the actuating lever **215**, thus rotating the lever **215** so that the armature **224** engages the edges **16** and **17** of the horseshoe magnet. Since the pole piece **14** is a part of a permanent horseshoe magnet having sufficient strength to retain the armature **224** against

the force of the spring 186, the armature 224 will be retained by the pole piece until the pulse coil 18 is energized when it is desired that that particular hammer print a character, this being accomplished in the same manner as described in Serial No. 138,157. When coil 18 is energized, thus cancelling the holding force of the permanent magnet in the manner described above, the armature 224 is released and the spring 186 pulls the interposer assembly comprised of the actuator lever 215 and the beaver tail 182 downwardly to the stop 21 so that a cam lobe 241 may strike the surface 183 of the beaver tail, after which the next succeeding cam lobe will strike surface 242 of the arm 219 and rotate the actuator lever 215 to the non-print position.

With this modified construction, it is apparent that no external power is required to energize a separate holding coil when the printer is turned on or off. Since the permanent magnets 12 provide a permanent holding force that exists even when the printer is turned off, all of the actuating levers 215 will be in the non-print position shown in FIGURE 1 at all times, except when the pulse coil 18 is energized. Momentum or the inertia of the cam 103 at the end of the print cycle will return all actuating levers to the FIGURE 1 position before the printer is turned off; thus, the bail bar 243 provided in the printer disclosed in application Serial No. 138,157 and all the parts associated therewith are not required and can be eliminated to reduce the overall cost of the printer. Since all of the actuating levers will be retained in the non-print position at all times when the printer is shut off, it is apparent that meaningless lines of print will not occur when the printer is subsequently turned on.

It should be apparent that certain modifications may be made without exceeding the scope of the following claims.

What I claim as my invention is:

1. In an electromechanical printer having a print drum, a movable print hammer having one end confronting said drum, a first lever having an impact surface and pivoted to the opposite end of said hammer, means to mount and to constrain the movement of said hammer in excursions toward and away from said drum, a mounting plate, a second lever having an impact surface and pivoted to said plate for movement in a plane coplanar with the plane of said first lever, said second lever having a first arm operatively associated with said first lever to form a cooperating lever system, resilient means operatively connected with a lever of said system in a manner such that said levers are normally biased to a print position, a cam adapted to strike the impact surface of one of said levers and thereby drive said hammer toward said drum when said levers are in said print position, said cam also adapted to strike the impact surface of the other of said levers to position said levers in a non-print position after said hammer is driven toward said drum, said second lever having a second arm, a stationary permanent magnet structure adjacent to said second arm, an armature attached to said second arm, said armature holding said lever system in said non-print position against the force of said resilient means when said armature is in engagement with said permanent magnet structure, a bucking coil associated with said permanent magnet structure, and said coil when energized adapted to reduce the armature-holding force of the magnet structure an amount sufficient to release the armature under the influence of said resilient means thereby enabling said resilient means to pivot the levers of said lever system to said print position at which said cam sequentially engages said levers.

2. The subject matter of claim 1 wherein said permanent magnet structure includes a permanent magnet core, a pair of pole pieces in flux linkage with said core and having a pair of spaced free ends, and said armature bridging said free ends when engaged with said permanent magnet structure thereby forming a closed-loop magnetic circuit.

3. The subject matter of claim 2 wherein one of said pole pieces is composed of a part of said mounting plate.

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