Sept. 23, 1969 R. H. LEE ETAL 3,468,246

PRINT HAMMERS WITH ELECTROMAGNETIC ACTUATING MEANS

Filed March 9, 1967 2 Sheets-Sheet 1

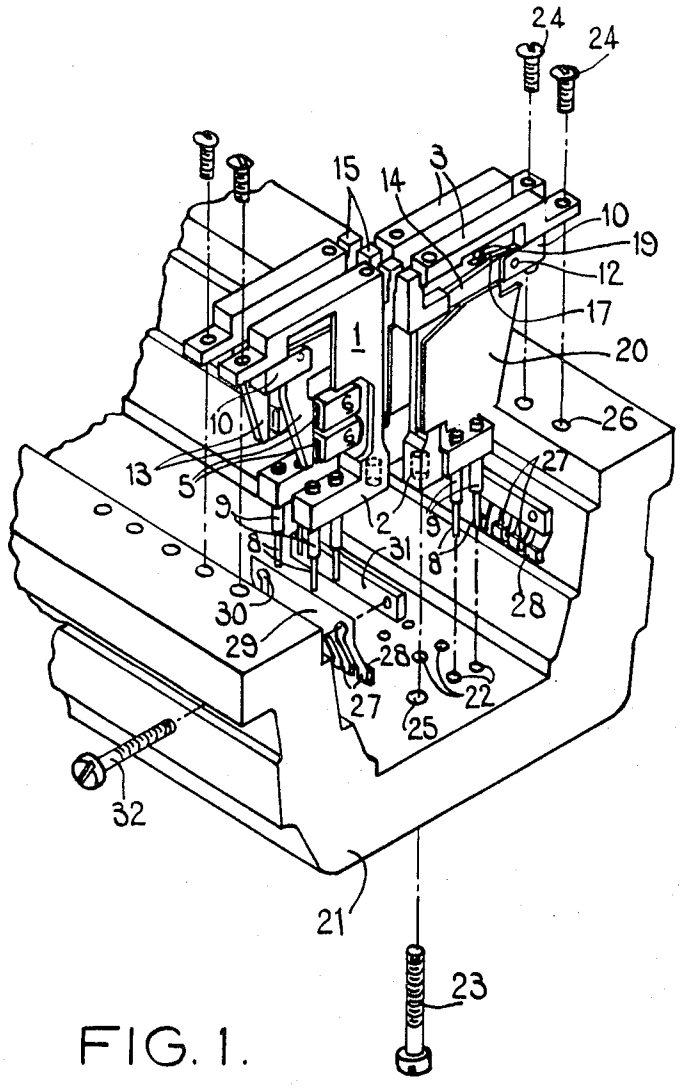


FIG. 1.

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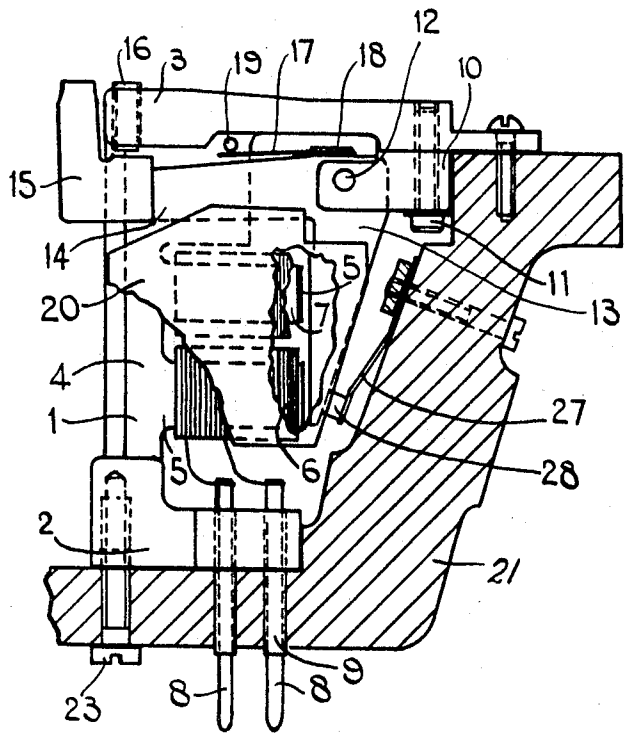


FIG. 2.

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PRINT HAMMERS WITH ELECTROMAGNETIC ACTUATING MEANS

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Int. Cl. B41j 1/48
U.S. Cl. 101—93 3 Claims

ABSTRACT OF THE DISCLOSURE

A print hammer assembly, for use in a printing apparatus employing a transfer medium to print characters from a type carrier onto a document or other record, is secured to the armature of an electromagnet. The armature is spring-biassed to an unoperated position and in this position it rests on a resilient backstop. The backstop consists of a resilient finger with a resilient pad, preferably of high hysteresis rubber, interposed between the finger and the armature. The backstops for a row of hammers may have their resilient fingers formed from a single strip of resilient material, such as Phosphor bronze.

CROSS REFERENCE TO RELATED APPLICATION

The apparatus disclosed herein is also disclosed, in part, in copending patent application Ser. No. 622,604, filed Mar. 13, 1967, filed by the same inventors and assigned to the same assignee as the present application.

BACKGROUND OF THE INVENTION

The present invention relates to printing apparatus of the so-called on-the-fly kind and in particular to print hammer mechanisms suitable for use in conjunction with printers in which a type carrier carrying a repertoire of characters is moveable past a printing position and in which a particular character is selected to be printed by the timed operation of a print hammer.

It has previously been proposed to provide on-the-fly printing apparatus in which a record member, such as a document is positioned adjacent a printing member having, for example, a group of rotating typewheels each carrying a repertoire comprising a sequence of different characters. A transfer medium, such as a typewriter ribbon is interposed between the typewheels and the document, and a group of print hammers, one for each print wheel, is provided on the opposite side of the document from the transfer medium. By selectively energising electromagnets associated respectively with the hammers in timed relationship to the rotation of the typewheels, the hammers are impelled towards the typewheels so that characters carried by the typewheels are caused to be printed on the document, a particular character from any wheel being printed by the impulsion of the associated hammer at that time instant when the required character is opposite the printing line with which the hammers are aligned. In the operation of high speed printers, in order to ensure correct alignment and even density of printing, one limitation on the achievable speed is the requirement that the hammer assembly shall be allowed time to settle into a consistent rest position before being reoperated.

SUMMARY

In accordance with the present invention a print hammer assembly includes at least one print hammer supported on an electromagnet armature, the armature being spring-biassed towards an inoperated position and being moveable to an operated position in response to the electrical energisation of the electromagnet, and a backstop against which the armature rests in the unoperated position, the backstop being sufficiently resilient to damp the armature against rebounding after moving from the operated to the unoperated position.

The present invention is particularly suited for use in conjunction with print hammer assemblies that are required for high speed printing operations. As the speed of printing rises it will be appreciated that the time available in which a print hammer may settle down after it has been operated and before it is required to be reoperated is decreased. In order to ensure evenness of print quality, however, it is desirable that a print hammer, immediately before it is operated on each occasion that it is is required to print, should occupy a standard nonoperated position, so that it always traverses a consistent printing stroke distance. Hence, by damping the tendency of the hammer to rebound against the backstop, the period between consecutive operations of a single hammer may be shortened without the sacrifice of print quality, thus enabling the printing apparatus to be operated at a higher speed without diminution of quality.

BRIEF DESCRIPTION OF THE DRAWING

FIGURE 1 shows in diagrammatic form, a perspective view of a print hammer assembly.

FIGURE 2 shows a partial cross-section through a hammer assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGURE 1, a number of individual print hammer assemblies are provided. Each such assembly includes a unitary structure **1** of magnetic material having a foot portion **2** and a head portion **3** joined by a web which is formed to include a pair of polepieces **5**. Eelectromagnet coils **6** are arranged on the polepieces **5**, electrical connections to the coils **6** being provided through contact pins **8** carried in insulating sleeves **9** by the foot portion **2** of the unitary structure **1**.

The head portion **3** carries a pivot block **10** which, in turn, carries a pivot pin **12** on which is supported an armature **13**, the armature **13** being arranged so that it lies close to the pole pieces **5**. The armature **13** has an extension **14** carrying a print hammer **15** which is shaped to project beyond one end of the head portion **3**. The armature **13** is biassed in a direction toward an unoperated position by a spring **17** acting on a stud **19** carried by unitary structure **1**, the armature being spaced away from polepieces **5** in the unoperated position.

The individual print hammer assemblies are mounted in a generally trough-shaped aligning member **21** to form a multiple hammer assembly. Each of the individual assemblies are located in position by the engagement of the insulated contact pins **8** with holes **22** formed in the base of the trough-shaped member **21**, and are secured into the position in which they are located by means of fixing screws **23** and **24**, the screw **23** passing through a hole **25** in the base of the member **21** into the foot portion **2** of the unitary structure of the individual hammer assembly while the screw **24** passes through the head portion **3** of each individual hammer assembly into a threaded hole **26** formed in the top of the trough-shaped member **21**. In order to prevent undesirable interaction between adjacent hammer assemblies, each assembly carries a shield **20** so positioned that external magnetic fields produced by the energisation of any of the electromagnets are screened from interfering with the magnetic circuits of any others of the individual hammer assemblies.

As will be seen from FIGURE 1 two rows of individual hammer assemblies are located in the aligning mem-

ber 21 with their print hammers facing inwards, the print hammers of the two rows being interleaved to form a single row when in position within the member 21. Associated with each individual hammer assembly is a backstop 27. The backstops 27 are positioned on the sides of the trough-shaped alignment member 21 so that with the individual hammer assemblies correctly located in the member 21, the backstop 27 associated with each hammer assembly is opposite the appropriate armature 13. When in the unoperated position as shown in FIGURE 2, the armature 13 of each individual hammer assembly rests in contact with the backstop 27, so that the backstop 27 determines the normal unoperated position of the armature 13.

The backstops 27 are each formed by a finger of resilient material, such as a strip of phospor bronze, for example, and each backstop carries a resilient pad 28 which actually contacts the armature 13 of the corresponding individual print hammer assembly.

In operation the entire multiple hammer assembly is positioned adjacent a type carrying arrangement, such as a row of type wheels, and a document or other record on which characters from the type wheels are to be printed is interposed between the type wheels and the hammers, a transfer medium being positioned between the type wheels and the document. In order to print a character from a particular wheel the hammer associated with that wheel is actuated in the conventional manner att the time when the required character is at the printing station as defined by the row of hammers 15. Each of the hammers 15 is actuated by the electrical energisation of the electromagnet coil 6, which causes the armature 13 to pivot about pin 12 from its normal unoperated position towards a position in which it bridges the pole pieces 5. Movement of the armature in this way causes a corresponding movement of the associated print hammer 15 towards the document, so that the required character is printed by impact in the conventional manner. The electromagnet coils 6 are energised by an electrical impulse and at the end of the impulse the spring 17 restores the armature to its unoperated position.

It will be appreciatetd that the restoration of the armature takes a certatin time, part of which is occupied in the movement of the armature from the operated to the unoperated position and another part of which is required in order to allow the armature to settle into a stable position in its unoperated position before it is required to be used in a further printing operation. If the hammer is not in such a stable state there is a risk that the characters next to be printed may not be of the same print density as that which has just been printed, or that the next character may not be clearly printed, or that because of variations in flight time of the hammer the next character may be printed out of alignment. (This last effect being appropriate to a so-called "on-the-fly" printing apparatus in which the type wheels are continuously rotating.) It has been found that the use of the resilient pad 28 in conjunction with the resilient backstop 27 rapidly absorbs the energy possessed by the armature moving to its unoperated position. Thus the resilient backstop rapidly damps the armature and greatly reduces any tendency for it to rebound, thereby greatly reducing the time taken for the armature to become stable in the unoperated position. The use of this form of backstop significantly improves the high-speed operation of the apparatus. It is preferred that the pad 28 should be of high hysteresis rubber.

As indicated in the drawing, where a number of individual hammer assemblies are arranged in a row, the resilient strips 27 may conveniently be formed from a single strip of spring material 29. The strip 29 is cut to form a number of tongues each tongue being bent to form a single strip 27. The strip 29 is pierced to form fixing holes 30, and the entire strip 29 is then secured to a side of the member 21 by means of a clamping plate 31 and fixing screws 32.

We claim:

1. A print hammer assembly including
an aligning member,
a plurality of print hammer units releasably mounted side by side in a row on said aligning member,
a base member with a head portiton affixed thereto,
an armature pivotally carried by said head portion,
a printing hammer carried by said armature,
an electromagnet, effective when energised, to move the armature to an operated position, thereby actuating said printing hammer,
a strip of resilient material extending adjacent the row of print hammer units and secured to the aligning member, and a plurality of leaf spring elements extending from the edge of said strip to form backstops, a different one of said backstops being provided for each armature, and
spring means for biassing the armature away from the operated position toward an unoperated position in which the armature rests against a corresponding one of said backstops.

2. An apparatus as claimed in claim 1 in which the extending ends of said leaf spring elements are freely cantilevered to move with corresponding armatures when said armature is returned to its unoperated position.

3. An apparatus as claimed in claim 2 in which the backstop includes a pad of resilient material affixed to the leaf spring element, said pad formed of a rubber having a high hysteresis effect.

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