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3,349,696

HAMMER MODULE ASSEMBLY IN HIGH SPEED PRINTERS

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2 Sheets-Sheet 1

Fig. 1.

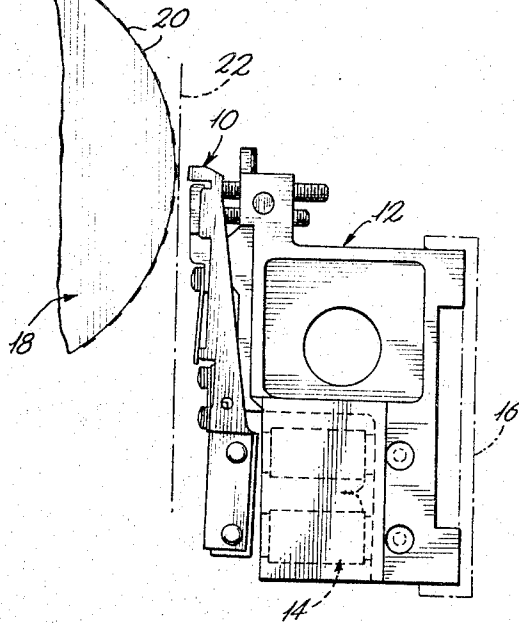
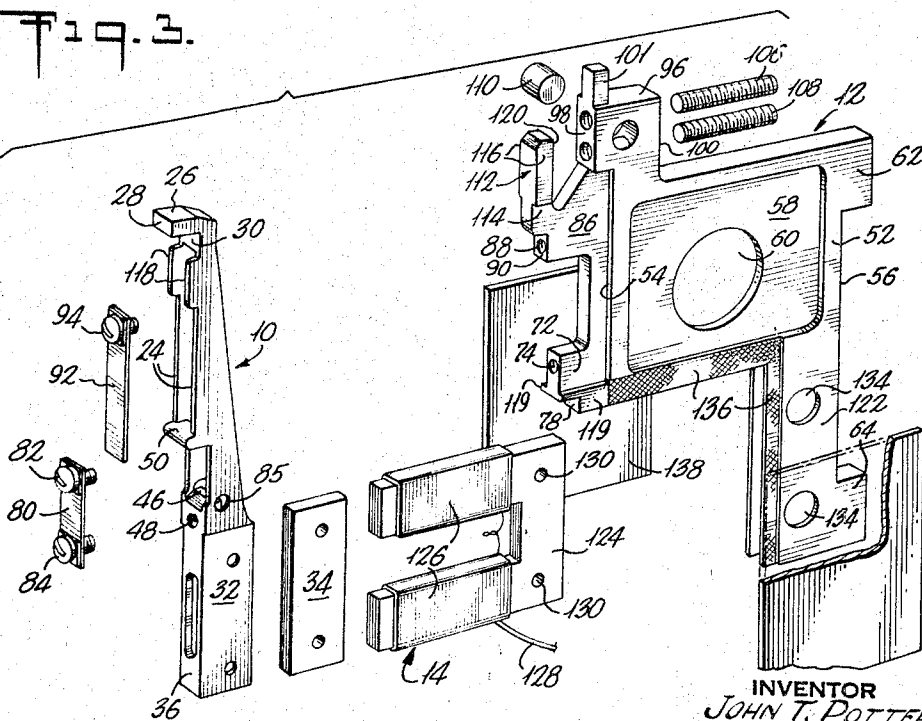


Fig. 2.



Fig. 3.



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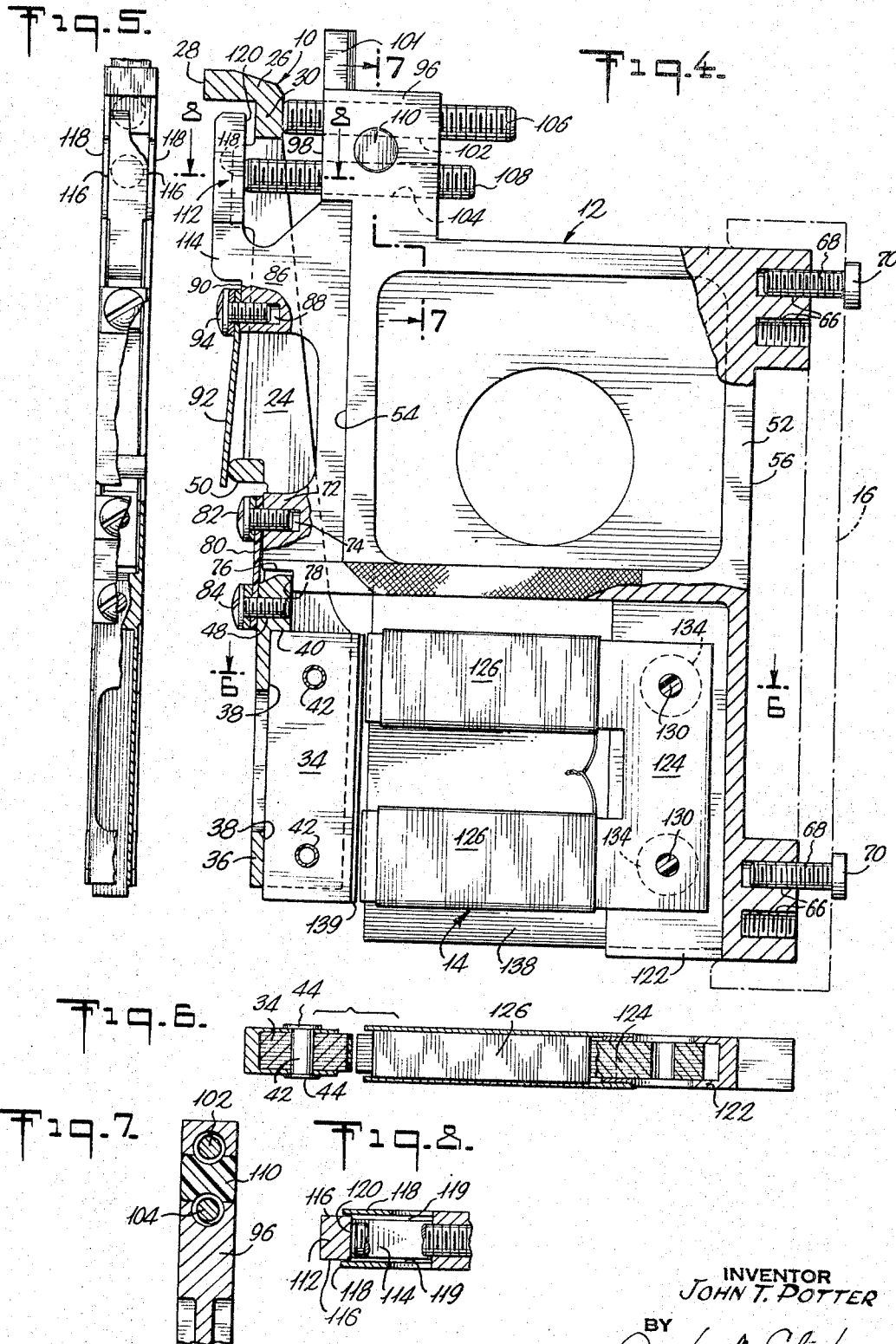
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HAMMER MODULE ASSEMBLY IN HIGH SPEED PRINTERS

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ABSTRACT OF THE DISCLOSURE

This disclosure includes drawings and a description of a hammer and hammer module assembly for high speed printers of the type used with data processing equipment. The hammer features a light-weight lattice beam construction and is supported in a self-contained module having a sufficiently small overall lateral dimension to enable an arrangement of the modules in side-by-side relation to achieve proper individual hammer spacing. The disclosure contains further, a method of assembling the module in a manner to accommodate the close tolerances required of high speed data processing equipment.

This invention, generally, relates to high speed printer hammer modules, and more particularly, it concerns an improved print hammer module for use in high speed printers of the type used with data processing equipment, as well as a unique method for assembling the module.

In high speed printers of the type aforementioned, a movable carrier supporting a plurality of type faces is moved continuously past a print line at a high rate of speed. A print medium, such as a web of paper, is fed incrementally, step by step, past the print line, and an aligned array of print hammers is arranged for impact printing along the print line, one hammer being provided for each print position. Because of the relative movement between the type faces on the carrier and the print medium during printing, it will be appreciated that the time of printing and, correspondingly, the time of flight taken by the respective print hammers in moving from a retracted position to a print position and back again must be extremely short to avoid smearing.

Although such printers have been found in practice to be extremely satisfactory for such uses as write-out components in electronic information processing equipment, many problems have been experienced in connection with the assembly, adjustment and operation of the print hammers because of the close tolerances required to achieve the needed accuracy at the extremely high speeds of operation. Also, many high speed printers presently available employ in excess of 120 hammers, each hammer occupying a space of less than 1/2 of an inch along the length of the print line. Each hammer has a separate electromagnetic actuating means which requires shielding, means for adjusting the depth of penetration of each hammer and also for adjusting the time of flight of each hammer. Thus, it will be appreciated that because of the number of component parts, close tolerances and space requirements, a serious problem of assembly and adjustment is presented.

With respect to adjusting the depth of penetration and the time of flight for each hammer, problems experienced with prior art devices have involved difficulty in gaining access to the adjustment means in the assembled printer and in rendering the adjustable means insensitive to vibrational forces developed during operation. From the standpoint of accessibility, print hammer modules heretofore available have required access to both sides of the print hammers for proper adjustment of the depth of hammer penetration and the time of hammer flight. These ad-

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justments, therefore, have required a physical separation of the type carrier and the hammers before they can be made. For a discussion of the problems arising due to the vibrational forces during operation, reference is made to U.S. Patent No. 3,177,803 issued to C. J. Antonucci on Apr. 13, 1965, and U.S. Patent No. 3,195,453 issued to F. V. Thiemann on July 20, 1965.

Perhaps the most serious operational problems with print hammers have concerned hammer inertia and the design together with frictional variations occurring in the bearing on which the hammers are pivoted. For a discussion of the problems associated with pivot bearings in print hammer assemblies of the general type here involved, see U.S. Patent No. 3,110,250 issued to J. Fradkin on Nov. 12, 1963. Slow motion camera studies have revealed that during operation of conventional print hammers constructed in the form of a pivoted rod or bar of generally uniform cross-section, substantial flexure and distortion of the hammer occurs. Also, it must be borne in mind that the material from which the print hammer is made must be impermeable to magnetic flux, thereby imposing a limitation on the choice of materials that might be used. Moreover, heat generated by the actuating coils in the operation of electromagnetically actuated print hammers is severe and requires provision of a hammer module which is capable of being cooled. In this respect, see U.S. Patent No. 3,086,457, issued to C. J. Antonucci on Apr. 23, 1963.

In accordance with the present invention, a print hammer module is constructed with each hammer mounted on a thin, integral frame which defines the overall width of the module. An actuating solenoid is secured within the frame accurately relative to an armature on the hammer. The hammer body is formed of two thin blade-like spaced apart members, the outer surfaces of which fall within the width of the frame.

The spaced apart body members are bridged at points along their lengths by the hammer head at one end, the armature at the other end, and by a fulcrum member positioned intermediate these ends.

To provide for a depth-of-penetration stop, a guide block is cantilevered integrally from the forward portion of the frame and is adjusted by a set screw accessible from the rear of the frame. A time-of-flight stop, which also establishes the rest position of the hammer, is located close to the depth-of-penetration set screw and is accessible also from the rear of the frame, so that both of these stops are adjustable from the same position.

A principal object of this invention is the provision of a print hammer module for use in high speed printers of the type referred to above and by which the problems experienced with prior print hammer modules are substantially and effectively overcome.

Another object of this invention is the provision of a compact, light-weight print hammer module of the type referred to which is easy to assemble and mount.

Still another object of this invention is to provide an electromagnetically actuated print hammer module of the type referred to which is virtually self-contained and which facilitates provision for cooling and magnetic shielding.

Yet another object of this invention is to provide a method of assembling a print hammer module of the type referred to which permits adjustment to close tolerances during operation.

A further object of this invention is the provision of an improved printing hammer for use in high speed printers of the type having a continuously movable element for supporting a plurality of type character faces.

A still further object of this invention is the provision of a printing hammer of the type referred to which is

light in weight, well balanced, and which resists erratic flexure during operation.

It is also an object of this invention to provide an improved pivotal mount for supporting a print hammer on a frame in a print hammer module.

Another object of this invention is the provision of a print hammer module of the type referred to having an improved hammer flight-time control, including means by which the hammer is guided or constrained to a pre-established striking path.

A still further object of this invention is the provision of a print hammer module of the type referred to which includes adjustable time-of-flight and depth-of-penetration stops, both of which are readily accessible for adjustment.

Still another object of this invention is the provision of adjustable time-of-flight and depth-of-penetration stops for a print hammer module of the type referred to which are insensitive to vibrational forces developed during high speed operation of the print hammer thereon.

Other objects and further scope of applicability of the present invention will become apparent from the detailed description to follow below taken in conjunction with the accompanying drawings in which:

FIG. 1 is a fragmentary side elevation of a high speed printer showing the print hammer module of the present invention;

FIG. 2 is a fragmentary front elevation showing an array of print hammer modules of the type shown in FIG. 1 as they are arranged in a high speed printer;

FIG. 3 is an exploded perspective view of the print hammer module of this invention;

FIG. 4 is an enlarged side elevation in partial cross-section illustrating the print hammer module of this invention;

FIG. 5 is an end elevation partially cut away and taken from the left-hand side of the print hammer module shown in FIG. 4;

FIG. 6 is a cross-section taken on line 6—6 of FIG. 4;

FIG. 7 is a cross-section taken on line 7—7 of FIG. 4; and

FIG. 8 is a fragmentary cross-section taken on line 8—8 of FIG. 4.

The environment in which the print hammer module of this invention is used, as well as the general organization thereof, is depicted by FIGS. 1 and 2 of the drawings. As shown there, each module includes a hammer 10 pivotally supported on a frame 12 for actuation by a solenoid 14. A plurality of these modules are adapted to be supported one next to the other on a suitable mounting beam 16 forming part of a high speed printer. While any suitable means may be used to support and move type characters past the hammers, a continuously rotatable drum 18 is shown in the drawings.

In accordance with conventional practice, the drum 18 carries on its periphery alphanumeric type character faces 20 arranged in columns extending circumferentially about the drum, so that one column presents type characters sequentially to one print hammer at a printing line extending axially of the drum 18. This general organization is conventionally operated to print information on a print medium, such as a paper web 22, by rotating the drum 18 at high speeds, such as for example 1200 revolutions per minute, while feeding the printing medium 22 in line increments.

Each of the hammers 10 is synchronized with the rotation of the drum 18 and is fired to move the medium 22 sharply against a particular type face 20 to print an alphanumeric character thereon. An ink ribbon (not shown) customarily extends on the opposite side of the print medium 22 from the hammers 10 to provide the character impression on the print medium. Since printers of this type operate at extremely high speeds, it will be appreciated that the hammers 10 must be capable of operating within extremely close tolerances.

A more complete understanding of the hammer module of this invention and its method of assembly may be had by reference to FIGS. 3—8 of the drawings. As shown most clearly in FIGS. 3 and 4 of the drawings, the hammer 10 includes a pair of spaced, generally parallel, side members 24 attached integrally at one end to a hammer head 26 of generally L-shaped profile to define a striking face 28 and a neck portion 30.

The lower ends 32 of the side members 24 are of increased depth to receive an armature 34. The forward edges of the ends 32 are bridged by a front wall 36 defining a positioning stop surface 38, FIG. 4, and a shoulder 40 extending perpendicular to the surface 38 to facilitate accurate placement of the armature 34 between the ends 32 and to absorb some of the impact loading that otherwise would be absorbed solely by rivets 42 when the armature strikes the core 124. A pair of rivets 42 extending through aligned holes in the armature 34 and the ends 32 retain the armature fixedly in place.

It will be appreciated that since the ends 32 are recessed relative to the remainder of the sides 24, the rivet heads may be formed without increasing the lateral dimension, or the overall width, of the hammer 10.

The upper end of the bridging front wall 36, as shown in FIG. 4, terminates in an inwardly facing fulcrum 36 and is provided with an adjacent internally threaded hole 48. Spaced between the hammer head 26 and the fulcrum 46 is a spring abutment 50 which also bridges the sides 24 of the hammer.

It is noted at this point that the hammer construction thus provided is light in weight and well balanced due to the formation of the relatively heavy armature supporting end with the fulcrum 46 and the general tapering of the side members 24 from the fulcrum 46 to the hammer head 26. Also significant in the achievement of the lightness in hammer weight and low inertia is the thin blade-like construction of the side members 24. Yet, considerable strength and resistance to deformation is provided by virtue of the depth of the sides 24 and the reinforcement provided by the hammer head 26, the spring abutment 50, the fulcrum 46 and the bridging wall 36, all of which bridge the sides 24 to effect an open beam or truss extending from the fulcrum to the hammer head.

Preferably, the hammer is integrally cast from a beryllium copper alloy, solution annealed and age hardened, though it will be appreciated that the hammer may be formed by other techniques and from other non-magnetic materials by forging or by welding, brazing or soldering the bridging portions between strips forming the side members 24.

The frame 12 is formed as a single unit, preferably from a beryllium copper alloy, and includes a pair of opposed parallel planar surfaces 52 having front and rear edges 54 and 56, respectively. The frame 12 has a central recess 58 extending slightly below each of the opposed surfaces 52 and having a relatively large central aperture 60 therethrough. The thinness of the recess 58 together with the aperture 60 effect both a reduction in weight and also permit better cooling of the module.

An upper and lower mounting boss 62 and 64, respectively, project rearwardly from the rear edge 56 of the frame 12. As shown in FIG. 4, each of the bosses 62 and 64 is provided with two vertically spaced, internally threaded bores 66 for receiving mounting screws 68 having heads 70. The arrangement of two threaded holes 66 in each of the bosses facilitates mounting a plurality of modules on the beam 16 by alternating or staggering the holes used in successive modules. In this manner, the heads 70 of the mounting screws may be of a diameter larger than the thickness of the frame and yet not interfere with one another when the frames are mounted on the beam one next to the other in the manner shown in FIG. 2.

Projecting forwardly from the front edge 54 of the frame 12 is a hammer mounting boss 72 having an in-

ternally threaded bore 74 opening to the front face thereof. A step 76 forms a pivot ledge 78 adjacent the lower portion of the boss 72.

The hammer 10 is mounted to the frame 12 for pivotal movement relative thereto by a flexible strap 80 of nylon or like flexible material secured at one end to the mounting boss 72 by a screw 82 received in the bore 74 and at its other end to the hammer by a screw 84 received in the bore 48. Hence, pivotal movement of the hammer 10 relative to the frame 12 is effected by flexure of the strap 80 and movement of the hammer about the fulcrum 46 in abutment with the pivot ledge 78 on the frame.

In order that the abutting position of the fulcrum 46 and the pivot ledge 78 may be observed, apertures 85 may be drilled through the side members 24 at the point of the fulcrum.

A spring mounting boss 86 also projects forwardly of the front edge 54 of the frame and is provided with an internally threaded bore 88 opening to its front face 90. A leaf spring 92 is cantilevered from the face 90 by a screw 94 extending through the spring 92 and into the bore 88. As shown in FIG. 4, the leaf spring 92 extends downwardly to engage the spring abutment 50 on the hammer 10.

The frame 12 includes an integral hammer control block 96 projecting upwardly at the front corner and having front and rear surfaces 98 and 100, respectively. A lateral positioning block 101 extends upwardly along the front surface 98 and facilitates proper positioning of the modules, one next to the other, on the mounting beam 16 as shown in FIG. 2.

The control block 96 also is provided with a pair of front-to-rear, internally threaded through-bores 102 and 104 for receiving a time-of-flight adjustment screw 106 and a depth-of-penetration adjustment screw 108, respectively. Both of the screws 106 and 108 in the embodiment shown are Allen-type set screws in which the socket heads thereof both face rearwardly of the frame. Hence, both screws 106 and 108 are accessible for adjustment simultaneously at substantially the same location.

Also, a transverse bore is formed in the control block 96 of a diameter slightly larger than the spacing between the through-bores 102 and 104 to receive a cylindrical locking plug 110 of nylon or similar material. The function of the plug, as described in the above-mentioned U.S. Patent No. 3,177,803, is to avoid the effects of vibrational forces developed during operation of the hammer module in upsetting the adjustment of the screws 106 and 108. This function obtains by virtue of threads on the screws 106 and 108 cutting into the nylon plug 110, as they pass through the bores 102 and 104 as shown most clearly in FIG. 7 of the drawings.

It will be noted by reference to FIG. 4 of the drawings that the time-of-flight adjustment screw 106 determines the rest, or retracted, position of the hammer 10 by abutting directly against the rear surface of the hammer head neck 30. Moreover, since the spring abutment 50 is positioned between the hammer head 26 and the fulcrum 46, the leaf spring 92 bearing against the abutment 50 will hold the hammer in a position such that the neck 30 abuts the screw 106 in the retracted position and also the fulcrum 46 is retained in abutting relation at all times with the pivot ledge 78. Since the vertical, and to some extent the lateral positioning of the hammer relative to the frame is effected by the strap 80 which is capable of bending easily about the axis of hammer pivotal movement, it will now be appreciated that a substantially friction-free pivot bearing is afforded for mounting the hammer on the frame.

The end of the depth-of-the-penetration screw 108 bears against a stopping and guide beam 112 integrally carried on the upper end of a cantilevered neck 114 extending from the spring mounting boss 86. As shown

most clearly in FIGS. 3, 5 and 8 of the drawings, the beam 112 is provided with opposed parallel planar surfaces 116 spaced apart by a distance slightly less than the space between the inside surfaces of the side members 24 of the hammer. Each of the sides 24 is provided with a guide 118 which cooperates with the planar surfaces 116 to constrain the hammer head 26 against lateral movement. It will be noted that the bosses 72 and 86 together with the neck portion, which are integral with the frame 12, define a portion of reduced width relative to the frame width as established by the planar surfaces 52. The amount of this reduction in width is sufficient to permit the outer surfaces of the side members 24 of the hammer to fall within the width of the frame and also to avoid any frictional contact between the portion of reduced width and the inside of the hammer side members 24. Hence, a clearance 119 is provided along the inside of the side members as shown in FIG. 8.

The width of the stopping and guiding beam 112, as shown also in FIG. 8, is slightly larger than the neck 114 to provide for guiding the hammer as above mentioned, but provides some clearance between the surfaces 116 and the guides 118 on the hammer sides to avoid unnecessary physical contact between these relatively movable members. To insure the slight clearance referred to, the surfaces on the inside of the guides 118 are formed carefully to match the surfaces 116.

The beam 112 is further provided with a rearwardly facing flat surface 120 which extends upwardly to be engaged by the front surface of the hammer head neck 30 when the hammer head 26 is moved forwardly to an input printing position. Because of the cantilevered construction of the neck 114, the depth-of-penetration adjustment screw 108 which bears against the surface 120 on the beam 112 will be effective to precisely position the beam and thus the surface 120 to establish the forwardmost point in hammer travel or its depth of penetration.

At the rear lower portion of the frame 12, a downwardly extending core channel portion 122 is formed to receive the base of a U-shaped core 124 for the solenoid 14. A pair of coils 126 are positioned about the forwardly projecting legs of the core and provided with an electrical lead 128 (FIG. 3) by which the coils may be connected with appropriate hammer firing circuits (not shown).

The core 124 is provided with a pair of holes 130 which are aligned generally with relatively large holes 134 extending through the channel portion 122 to facilitate potting the solenoid 14 in the position on the frame 12 in a manner which will be described more completely hereinafter. To effectively shield the solenoid 14, the frame 12 is provided on each side with recessed and roughened flat surfaces 136 against which suitable shields in the form of a suitable magnetic material 138 such as "Hypemik," "Mu-Metal," etc. may be secured by cementing or the like. It will be appreciated that the thickness of the shims 138 is equal to or less than the depth by which the flat surfaces 136 are recessed inwardly from the planar surfaces 52 of the frame 12 so that the shims do not increase the thickness of the frame.

The method by which the module of this invention is assembled may be understood most clearly by reference to FIG. 3 of the drawings. After the armature 34 is riveted between the ends 32 of the side members 24 on the hammer 10, the hammer is placed over the stopping and guide beam 112 on the frame and secured in place by threading the screws 82 and 84 through the strap 80 and into the bores 74 and 48 on the frame boss 72 and the hammer front wall 36, respectively.

Thereafter, the spring 92 is mounted in place by threading the screw 94 through the spring and into the bore 88 presented in the face 90 on the spring mounting boss 86. Either before or after placing the hammer on the frame in this manner, the locking plug 110 is inserted in place

within the hammer control block 96, and the adjustment screws 106 and 108 are threaded into the bores 102 and 104, respectively.

When the depth-of-penetration adjustment screw 103 is properly positioned, to locate the approximate forward-most position of the hammer 10, the solenoid 14 is placed into the channel 122. Then, while the hammer is held in a stopping relationship relative to the face 120, such as by temporarily advancing the screw 106, the solenoid 14 is oriented relative to the armature 44 on the hammer. While the solenoid is retained in this position against the armature, a potting resin or plastic in molten form is poured through the holes 134 and 130. The holes 130 will be located finally somewhere within the boundary of the holes 134 because of the relatively large diameter of the holes 134 relative to the diameter of the holes 130. The solenoid will be held in position until the potting resin has solidified to rigidly hold the solenoid in place. Thereafter, excess potting resin is removed, and the shielding shims 138 are cemented in place.

It has been found desirable to use spacer shims in most modules, such as illustrated in FIG. 4 by the numeral 139 and described and claimed in U.S. Patent No. 3,195,453 to F. V. Thiemann.

In use, the print hammer modules, thus assembled are mounted on a support such as the mounting beam 16, indicated in phantom lines in FIG. 4, by threading screws 70 into the bores 66 in alternating fashion to position the modules substantially one next to the other as shown in FIG. 2 of the drawings. To compensate for any play that may exist between the screws and bores formed through the mounting channel, the precise position of each module and particularly the precise position of the hammer head 26 is adjusted by manipulation, using the lateral adjustment block 101. Thereafter, the screws 70 are tightened in place to secure the modules firmly in their operative positions relative to the printing drum 18.

During operation, as the printing drum 18 is rotating, selective ones of the solenoids 14 are energized instantaneously or fired by appropriate circuitry (not shown) to draw the armature and, thus the lower end of the hammer 10 toward the solenoid core 124. In this manner, the hammer is pivoted at extremely high speeds about the fulcrum 46 in engagement with the pivot ledge 78 to advance the hammer head against the face 120 on the stopping and guide beam 112.

The return stroke of the hammer is initiated by the impact of the hammer neck against the stop beam 112 and followed up by the bias of spring 92 to hold the head against the base of the time-of-flight adjustment screw 106. The stopping and guide beam 112 limits the forward travel, or depth of penetration, of the hammer head 26 so that the print medium 22 is moved against the type faces 20 on the drum sufficiently for a character to be imprinted on the medium. Slight adjustments of the rear face 120 on the stopping beam 112 may be effected by adjustment of the depth-of-penetration adjusting screw 108 until the desired intensity of character print is achieved.

Similarly, the screw 106 may be adjusted to accomplish a vertical registration of characters on the print medium along the printing line. For example, a decrease in hammer travel time effected by advancing the screw 106 toward the printing drum results in the hammer head 26 reaching its forward stop position in a shorter duration and lowers the character on the print-out, assuming the drum to be rotating counter-clockwise as shown in FIG. 1. Conversely, an increase in the time of hammer flight effected by retracting the time-of-flight adjustment screw 106 away from the drum raises the character on the line print-out.

Thus, it will be seen that by this invention there is provided an extremely effective print hammer module for use in high speed printers and by which the above-mentioned objects are fulfilled completely. Such features as

the integral frame 12 and the manner in which the module may be assembled reduces the costs of manufacture and maintenance substantially. In this latter respect, it will be noted also that the hammer 10 can be removed and replaced on any given module mounted one next to the other as shown in FIG. 2 of the drawings due to the direct access from the front of the module to the screws 82, 84 and 94.

Similarly, and as above mentioned, both adjustment screws 106 and 108 are available for access from the rear of each module without requiring separation of the modules from the printing drum. Also, and as above mentioned, the truss or open beam-like design of the hammer not only avoids erratic deflection during operation but also contributes to improved hammer flight characteristics, to proper distribution of weight, to the provision for a substantially frictionless pivot bearing, and provides for constraining the hammer to an accurate flight path.

While the embodiment described and illustrated herein is a preferred form of the present invention, it will be appreciated that various modifications and changes can be made in the disclosed embodiment without departing from the true spirit and scope of the present invention. Accordingly, it is to be distinctly understood that the foregoing description is illustrative of a preferred embodiment of the invention only, not limiting, and that the true scope of the present invention is to be determined by the appended claims.

The invention claimed is:

1. In a hammer module for a high speed printer of the type having a continuously movable type-supporting element, the combination comprising:

- a frame having opposed surfaces defining the lateral dimension of the module;
- a pivotal hammer having a pair of spaced blade-like side members, the outer surfaces of which fall within the lateral dimension defined by said frame surfaces;
- a hammer head fixed between adjacent terminal ends of said side members;
- fulcrum means fixed between said side members and spaced from said hammer head;
- said frame having a pivot ledge formed therein to be engaged by said fulcrum means; and
- flexible means connected between said frame means and said hammer to support said hammer on said frame with said fulcrum means engaging said pivot ledge.

2. In a hammer module for a high speed printer as set forth in claim 1 including a hammer return stop on said frame and positioned to abut said hammer head when retracted.

3. A hammer module for a high speed printer as set forth in claim 2 including spring means located between said hammer head and said fulcrum means to bias said hammer to a position wherein said hammer head abuts said return stop and said fulcrum means abuts said pivot ledge.

4. A hammer module as recited in claim 1 including further:

- a depth-of-penetration stop; and
- means for adjusting said depth-of-penetration stop.

5. The hammer module as recited in claim 4 including a hammer return stop, means for adjusting said hammer return stop, and wherein said adjustment means for both of said stops are accessible from the same side of said frame.

6. A hammer module as recited in claim 4 in which said depth-of-penetration stop includes an integral beam member cantilevered from said frame and extending between said hammer side members, said beam member having guide surfaces on opposite sides thereof for restricting lateral movement of said hammer.

7. A hammer module as recited in claim 1 including further:
 an armature on said hammer positioned oppositely from said hammer head relative to said fulcrum; and
 a solenoid supported on said frame in a position relative to said armature to actuate said hammer.
8. A hammer module as recited in claim 7 including further means for magnetically shielding said solenoid.
9. A hammer module as recited in claim 1 wherein said frame member includes module mounting means on the rear edge thereof.
10. A hammer module as recited in claim 1 wherein said frame is integrally formed and includes an apertured central portion recessed from said opposed surfaces to facilitate cooling.
11. A hammer module as recited in claim 1 in which said pivotal hammer includes:
 a spring abutment fixed between said side members and between said hammer head and said fulcrum means;
 an integral hammer mounting boss on said frame extending between said side members and between said fulcrum means and said spring abutment; and
 an integral spring mounting boss on said frame extending between said side members and between said hammer head and said spring abutment;
 and spring means comprising a leaf spring cantilevered from said spring mounting boss and in engagement with said spring abutment.
12. A hammer module as recited in claim 11 in which said spring means and said flexible strap are secured to said frame by means removable from the front of said frame.
13. In a high speed printer having a continuously movable type-supporting element, a hammer module comprising,
 a frame;
 a hammer mounted on said frame for movement about a pivotal axis, said hammer comprising,
 a pair of spaced blade-like side members extending from said pivotal axis, and
 a hammer head fixed between said side members near adjacent terminal ends thereof spaced from said axis, and
 means to actuate said hammer for movement relative to said frame.
14. A hammer module for a high speed printer of the type having a continuously movable type-supporting element, said module comprising,
 a frame having opposed planar surfaces defining the lateral dimension of the module;
 a pivotal hammer having
 a pair of spaced blade-like side members, the outer surfaces of which fall within the lateral dimension defined by said planar surfaces, and
 fulcrum means fixed between said side members;
 a boss portion on said frame extending between said side members; and
 means including a flexible strap connected at one

- end to said boss portion and at its other end to said fulcrum means for supporting said hammer for pivotal movement on said frame.
15. In a print hammer module for high speed printers of the type having a continuously movable type-supporting element,
 a hammer having spaced side members;
 a frame; and
 means supporting said hammer for pivotal movement on said frame, said means comprising
 a pivot ledge on said frame,
 a fulcrum on said hammer, and
 means including a flexible strap extending through said spaced side members to retain said fulcrum in abutting relationship with said pivot ledge.
16. In a print hammer module for high speed printers of the type having a continuously movable type-supporting element, said module including an integral frame and a hammer having spaced side members terminating in a hammer head and pivotally supported on said frame, means for controlling the flight of said hammer head comprising:
 an integral stopping beam cantilevered from said frame and extending through said spaced side members to be positioned forwardly of a portion of said hammer head;
 a hammer control block on said frame positioned on the opposite side of the said hammer head from said cantilevered stop block;
 an adjustable hammer return stop mounted on said control block for direct abutment with said hammer head to establish the retracted position thereof; and
 further adjustable means on said control block for abutting said stopping beam to adjust the position thereof by flexure.
17. The apparatus recited in claim 16 wherein said stopping beam is provided with guide surfaces on each side thereof and wherein side members include means cooperable with said side surfaces to retain said hammer against lateral movement.
18. The apparatus recited in claim 16 wherein said adjustable means are set screws extending through said control block to be accessible for adjustment from the same side of said block.
19. A hammer module as recited in claim 7 wherein said solenoid and said frame have generally aligned apertures formed therein and which a potting resin filling said apertures fixes said solenoid in said position on said frame.

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