United States Patent

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[33] **Great Britain**
[31] **29536/67**

[54] **HAMMER BLOCK ASSEMBLY FOR LINE PRINTER**
4 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **101/93**
[51] **Int. Cl.** **B41j 9/10**
[50] **Field of Search** 101/93AC, 93Min, 109, 94

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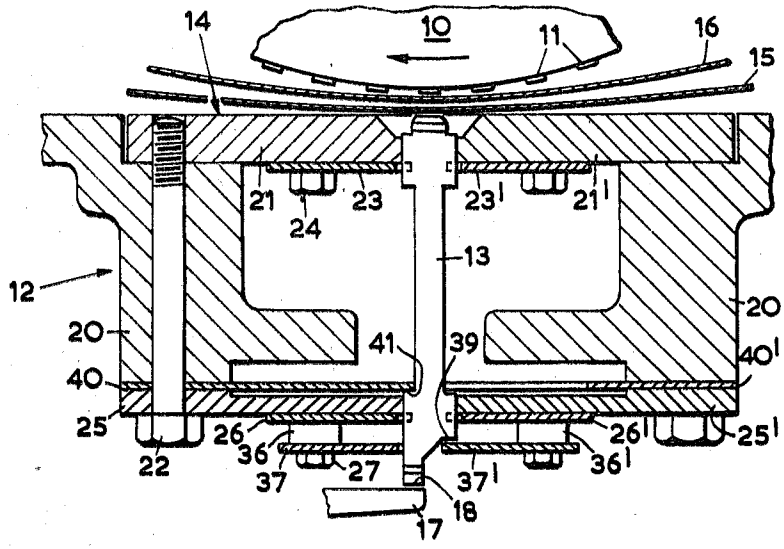
ABSTRACT: This invention relates to a hammer block assembly in a line printer. The assembly supports a line of hammers aligned for printing transversely across a web of paper moved longitudinally through the printer, the hammers extending perpendicularly to the paper. Each hammer is retained at four points laterally and longitudinally, longitudinal retention being achieved by straight-edged bar means which extend across the whole width of the printer, and lateral retention being achieved by comb means attached to the respective bar means. The bar and comb means are each accurately dimensioned in only one dimension. Stop means and spring means are provided to retain the hammers in their rest position. The comb means at the ends of the hammers remote from the paper are arranged to retain the hammers on only one side giving effectively only three-point retention laterally.



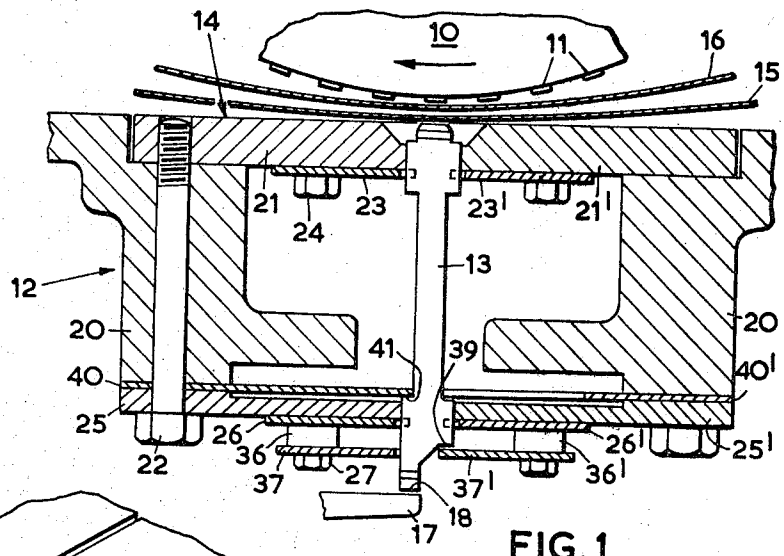

14
10
11
16
15
21
23
24
23'
21'
12
13
20
41
39
20
40
40'
25
26
36
27
22
37
37'
36'
26'
25'
18
17

FIG. 1

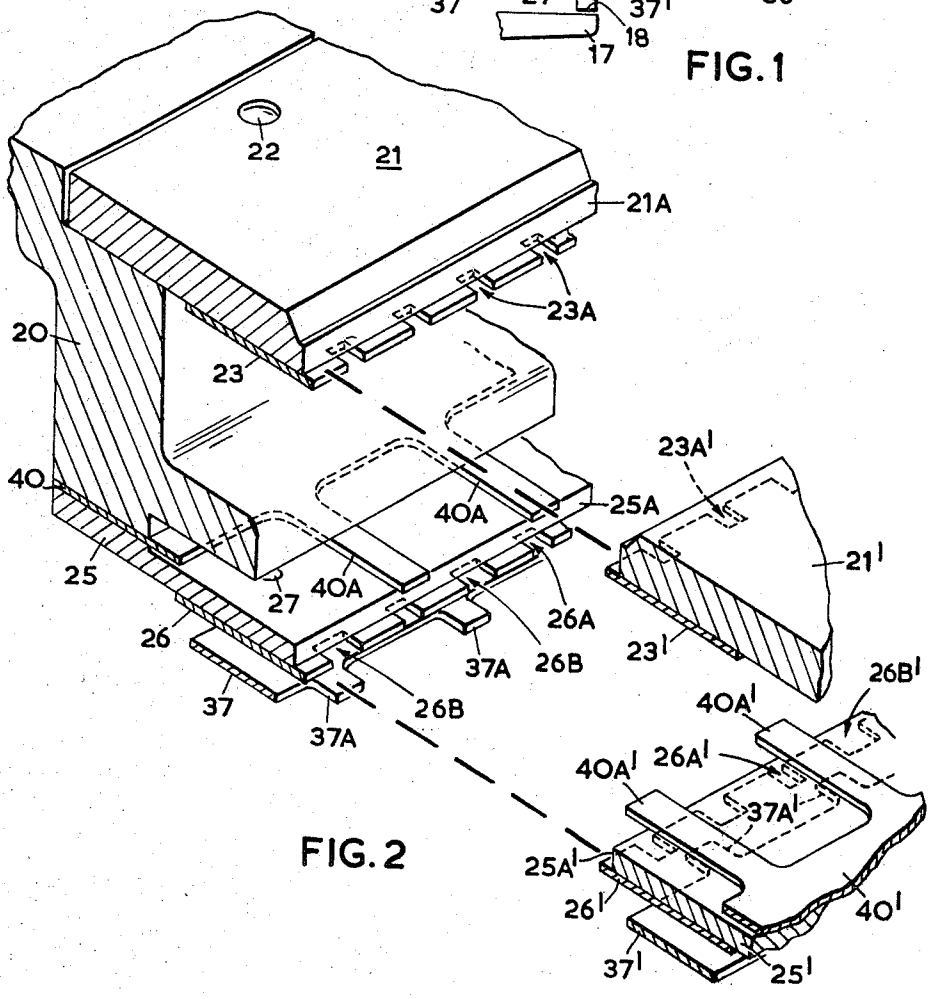

22
21
21A
23A
20
23
23A'
40
40A
25A
21'
25
27
40A
26A
26
37A
26B
23'
26B'
37
26B
40A'
37A
40A'
26A'
37A'
25A'
26'
40'
37'
25'

FIG. 2

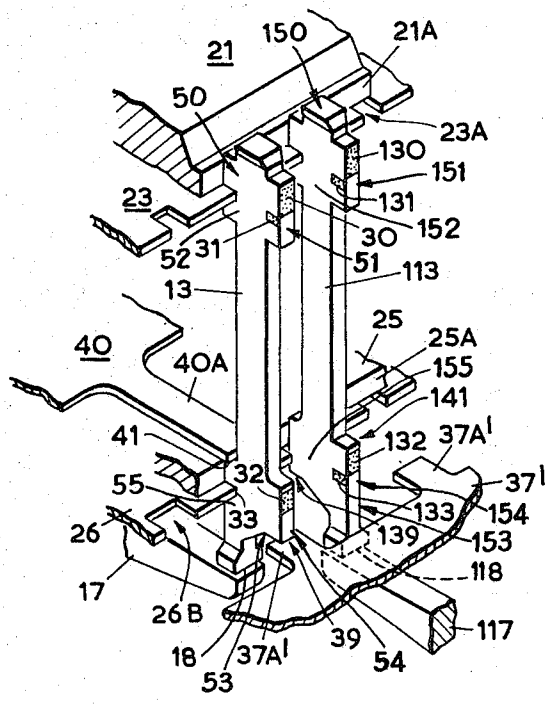

21
150
21A
50
23A
130
151
23
131
152
30
52
31
51
113
13
25
40
25A
40A
155
141
41
132
37A'
32
37'
55
133
154
33
139
153
26
118
17
26B
117
18
37A'
39
54
53

FIG. 3

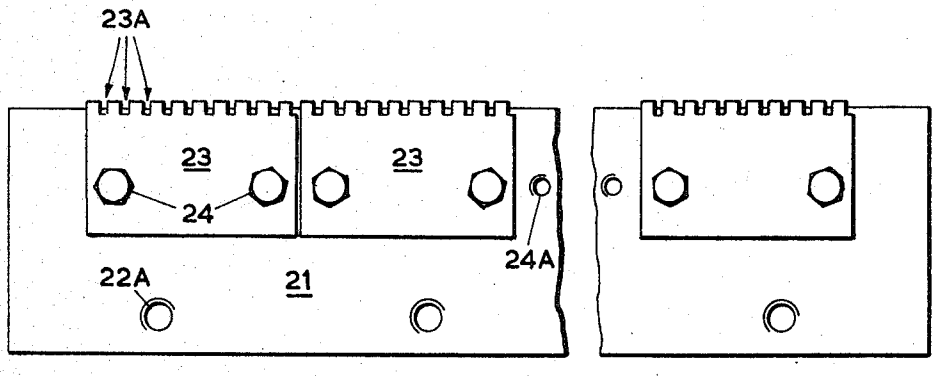

23A
23
23
24
24A
22A
21

FIG. 4

HAMMER BLOCK ASSEMBLY FOR LINE PRINTER

The present invention relates to line printers of the type used for high-speed printing of date from a computer, and specifically to hammer block assemblies in such printers.

In such a printer, the hammer block assembly supports a multiplicity of hammers aligned for printing transversely across a web of paper moved longitudinally through the printer, with the hammers extending substantially perpendicularly to the paper. The assembly must support the hammers in precisely determined positions, and the cost of manufacturing the assembly with, say, 160 hammers is therefore a major item.

The object of the present invention is to provide a line printer including an improved hammer block assembly. Thus according to the invention, such an assembly includes retaining bar means having a straight edge extending in the transverse direction, and retaining comb means comprising a multiplicity of teeth each adjacent to and extending longitudinally beyond the straight edge of the retaining bar means, each hammer being held between to adjacent teeth, which define its lateral position, and against the straight edge, which defines its longitudinal position. The retaining comb means are preferably rigidly attached directly to the retaining bar means.

The assembly may include further retaining bar means having a straight edge extending in the transverse direction and arranged adjacent to the hammers so that the two retaining bar means together define a slot through which the hammers pass. Preferably the further retaining bar means has respective retaining comb means rigidly attached directly to it.

The assembly may also include, for the or each of said retaining bar means, an additional retaining bar means located substantially perpendicularly below it and having a straight edge extending in the transverse direction and effective to define the longitudinal position of the ends of the hammers remote from the paper. Preferably the or each of the additional retaining bar means has respective retaining comb means associated therewith, effective to define the lateral positions of the ends of the hammers remote from the paper.

Preferably the hammers are driven by respective electromagnets via hammer levers extending longitudinally away from the lower ends of the hammers, the hammer levers extending alternately in opposite directions, and wherein the slots in the comb means associated with the additional bar means are widened opposite the hammer levers.

The assembly also preferably includes stop means comprising a plurality of stop tongues, one for each hammer, effective to determine the extreme positions of the hammers in the direction perpendicularly away from the paper. The assembly also preferably includes spring means comprising a plurality of spring tongues each of which projects onto a shoulder on a respective hammer and is effective to return the hammer to its extreme position against the respective stop tongue after operation of the hammer.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a longitudinal section through the hammer block assembly;

FIG. 2 is an exploded perspective view of a portion of the hammer block assembly, showing the framework;

FIG. 3 is a perspective view of another portion of the hammer block assembly, showing the hammers; and

FIG. 4 is a view from underneath of a further portion of the hammer block assembly.

With reference to FIG. 1, a character drum 10 having raised characters 11 thereon is supported adjacent to the surface 14 of a hammer block assembly 12. A paper web 15 and a printing ribbon 16 are passed between the drum 10 and the block 12. The block 12 includes a transverse line of hammers (only one of which, 13, is visible in FIG. 1), the line being parallel to the axis of the drum 10 and the heads of the hammers being adjacent to the drum. The characters 11 are arranged on the drum 10 in a regular pattern, all characters in a line parallel to the drum axis being identical and each circumferential band of characters containing a complete fount of characters and being opposite a respective hammer. In operation, the drum 10 is rotated at constant high speed, and the hammers are fired towards the drum at timed instants so as to cause the printing of the characters opposite the hammers at those instants. The hammers are fired by means of electromagnets (not shown) coupled by means of levers such as lever 17 to the lower ends of the respective hammers.

The block 12 comprises a single case framework 20 to which the remainder of the block assembly is bolted. Referring now to FIGS. 1 and 2 together, a bar member 21 having an accurately formed straight edge 21A is bolted to the frame 20 at its left-hand side (as seen in the drawings) by transversely spaced bolts 22 passing through holes 22A in bar 21. A plurality of comb members 23 are bolted to the underside of the bar 21 by means of bolts 24 passing through holes 24A in the members 23; FIG. 4 illustrates the bar member 21 with the comb members 23 in position, as seen from below. Each comb member has a plurality of teeth forming accurately defined slots 23A, and the spacing between adjacent comb members 23 on the bar member 21 is such that the regularity of the slots 23A is maintained along the whole length of the bar member 21. A second bar member 25, having an accurately formed straight edge 25A, is also bolted to the frame 20, and has comb members 26 bolted to it by means of bolts 27, the comb members 26 accurately defining slots 26A corresponding to the slots 23A.

In order to accommodate the electromagnets associated with the hammers, the electromagnets are placed alternately to one side and to the other of the line of hammers. Thus the two adjacent hammers 13 and 113 are operated via levers 17 and 117 respectively, as shown in FIG. 3, the faces 18 and 118 of the hammers 13 and 113 against which the levers 17 and 117 strike being offset to one and other side alternatively of the line of hammers. The slots 26A and 26A' are alternated with wider slots 26B and 26B' in the comb members 26 and 26', as shown in FIGS. 2 and 3, so that the wide slots 26B and 26B' are opposite the corresponding levers such as 17 and 117.

Corresponding bar and comb members are bolted to the right-hand side of the frame 20 (as seen in the drawings), these parts being identified by the same references with a prime added.

FIG. 3 illustrates the manner in which the hammers are retained by the bar and comb members, two adjacent hammers 13 and 113 being shown. It will be seen that the straight edge 21A defines the longitudinal position of the heads 50 and 150 of the hammers in the direction of motion of the drum 10; similarly, the longitudinal position of the heads of the hammers in the opposite direction is defined by the straight edge 21A' (not shown in FIG. 3), against which the areas 30 and 130 of surfaces 51 and 151 of the hammers 13 and 113 abut. Also, the comb members 23 and 23' define the transverse position of the heads of hammers, each hammer fitting into one of the slots 23A and the opposite slot 23A'; thus the areas 31 and 131 of surfaces 52 and 152 abut against the sides of two slots 23A in comb member 23' (not shown in FIG. 3).

In a similar manner, the lower ends 53 and 153 of the hammers are accurately located in the transverse and longitudinal directions by the straight edges 25A, 25A' and slots 26A, 26A'; the areas 32 and 132 of surfaces 54 and 154 abut against the straight edge 25A' and the areas 33 and 133 of surfaces 55 and 155 abut against the sides of two slots 26A and 26A'. Since the slots 26A and 26A' face slots 26B' and 26B respectively, each hammer is therefore located laterally by only three slots. This means that the hammers can move vertically freely even if they should be slightly twisted (e.g. as a result of the manufacturing process); if the slots 26B and 26B' were as narrow as the slots 26A and 26A', the hammers would be located at four points and any twist would result in binding.

The straight edge 21A is of substantial width. This is because when a hammer, e.g. hammer 13, is fired against the

paper 15 and the drum 10, the drum 10 snatches at the head of the hammer and imparts to it a substantial impulse to the left (as seen in FIG. 1). The hammer head therefore strikes the straight edge 21A a substantial blow, and a narrow edge would tend to wear unduly. The opposite edge 21A' is of the same width, both to limit wear as the hammer head rebounds from the edge 21A and for symmetry and simplicity.

In order to locate the hammers in the direction perpendicular to the paper 15, each of the members 25 and 25' has a respective stop plate 37 and 37' bolted to it by the bolts 27 and 27' and spacer members 36 and 36'. Each of the stop plates 37 and 37' is formed with stop tongues 37A and 37A' respectively spaced at intervals equal to twice the interval between the slots 23A, and the two stop plates have their tongues staggered so that there is one stop tongue per hammer. Each hammer is formed with a shoulder at its lower end opposite the associated operating lever which abuts against the corresponding stop tongue. Thus hammer 13 (FIG. 3) has a shoulder 39 which abuts against a stop tongue 37A', and hammer 113 has a shoulder 139 which abuts against a stop tongue 37A: for clarity, stop tongue 37A is not shown in FIG. 3. The stop plate 37 and 37' thus define the lower limiting positions of the hammers in the direction perpendicular to the paper 15.

In order to ensure that the hammers return to the desired position defined by the plates 37 and 37' after a firing and printing operation, each of the members 25 and 25' has a respective spring plate 40 and 40' clamped between it and the frame 20 by the bolts 27 and 27'. Each of the spring plates 40 and 40' is formed with spring tongues 40A and 40A' spaced at intervals equal to twice the interval between the slots 23A, and each spring tongue 40A and 40A' is opposite a corresponding stop tongue, i.e. 37A' and 37A respectively. Each hammer is formed with an upwardly facing shoulder near its lower end against which a corresponding spring tongue bears. Thus hammer 13 (FIG. 3) has a shoulder 41 against which a spring tongue 40A bears, and hammer 113 has a shoulder 141 against which a spring tongue 40A' (not shown in FIG. 3) bears. The spring plates 40 and 40' are formed of suitably resilient material, so that when a hammer is fired towards the drum 10, the associated spring tongue is weak enough to have little effect on the first forward stroke but is strong enough to ensure that the hammer is returned to and kept in its initial position fairly rapidly. The springs may be of duplex form, this giving a suitable degree of damping.

The entire hammer block assembly 12 is thus constructed of easily made parts, none of which require accurate machining in more than one dimension. Thus the slots in the comb members, for example, must be accurately spaced transversely, but their exact longitudinal dimensions are immaterial. The manner in which the various components are bolted together allows each component in turn to be adjusted into its correct and accurate position and enables relative assembly techniques to be used, producing a standard interchangeable unit. Also, the bar members may be made slightly flexible, so that they can be straightened out during assembly should they have a uniform but slightly bowed shape when manufactured.

I claim:

1. A print hammer assembly including a support constructed to permit interchange of print hammers manufactured within a tolerance limit; a plurality of print hammers each including a head of rectangular cross section having a pair of opposed first surfaces and a pair of opposed second surfaces, a portion of rectangular cross section spaced longitudinally of the hammer from said head and having a pair of opposed third surfaces and a pair of opposed fourth surfaces aligned approximately parallel within a tolerance limit with the first and second surfaces respectively; said support including first guide means engaging the pair of first surfaces of each hammer to locate the heads in line and second guide means engaging the pair of second surfaces of each hammer to locate the heads in spaced relationship along the line with the second surfaces of the hammers parallel to one another said first and second guide means permitting longitudinal movement of each hammer towards and away from a corresponding print area; first locating means engaging the pair of third surfaces of each hammer to locate said portions in a direction transverse to said line and second locating means spaced from said second guide means engaging the pair of fourth surfaces of each hammer at a single pair of opposed areas of small transverse extent relative to the transverse dimension of said fourth surfaces to locate the portions in spaced relationship corresponding to the spacing of the head and maintain the hammers substantially parallel to one another, the fourth surfaces being unrestrained through the remainder of their transverse dimension and the hammers being unrestrained between the respective second guide means and the second locating means to thus avoid jamming during longitudinal movement of the hammers due to misalignment of said portion relative to the head of the respective hammers.

2. A print hammer assembly as claimed in claim 1 in which the second locating means includes first and second comb members disposed on opposite side of the line of hammers, each comb member having projections extending from an edge thereof towards the other comb member between the portions of adjacent hammers; the projections of the first comb member engaging opposed fourth surfaces of alternate ones of the hammers and being spaced from the opposed fourth surfaces of the remainder of the hammers; and the projections of the second comb member engaging opposed fourth surfaces of the remainder of the hammers and being spaced from the opposed fourth surfaces of the alternate hammers.

3. A print hammer assembly as claimed in claim 1 in which the first locating means includes a pair of members each having a straight guide surface and mounted with said guide surfaces in spaced parallel relationship engaging the third surfaces of each of the hammers located between said members.

4. A print hammer assembly as claimed in claim 3 in which the second locating means includes a comb member having spaced projections extending from an edge of the member, the projections being arranged in pairs and the portions of each hammer being located between the projections of a different one of the pairs of projections respectively.

4. A print hammer assembly as claimed in claim 3 in which the second locating means includes a comb member having spaced projections extending from an edge of the member, the projections being arranged in pairs and the portions of each hammer being located between the projections of a different one of the pairs of projections respectively.