ABSTRACT: There is disclosed a fragmentary portion of a printer having print hammer modules, each module having a frame, print hammers, and print hammer operators, and a printed circuit board.
COMBINED PRINT HAMMER MODULE AND PRINTED CIRCUIT BOARD

BACKGROUND OF THE INVENTION

1. Field of the Invention
This invention relates to a high speed printer and in particular to print hammer modules utilized in such a printer.

2. Description of the Prior Art
Printers with print hammer modules are known in the art.

SUMMARY OF THE INVENTION

The invention provides a compact construction by which access to adjustable component parts is attained, and by which ease of assembly and manufacture is facilitated.

The invention is useful where either single or plural print hammer modules are provided. In printers having plural print hammer modules, that is, a whole bank of modules, the space between the modules is small. By combining a printed circuit board for each module, space is conserved, and this space is available for specific purposes, for example, for adjusting the print hammers and for mounting electronic components such as diodes, transistors, and so on.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partially broken away perspective view of a portion of a drum printer and shows an assembled group of print hammer modules secured on stationary frame structure in accordance with an embodiment of the present invention;

FIG. 2 is a side elevation view of a print hammer module and a fragmentary portion of a print symbol carrier shown in FIG. 1;

FIG. 3 is a sectional view taken along line 3-3 of FIG. 2; and

FIG. 4 is a fragmentary perspective view of a hammer operator assembly in conjunction with a printed circuit board.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In general, FIG. 1 depicts the arrangement of a print drum and a series of print hammer modules. The modules are individually clamped in module frame structure secured to the printer frame. Each module has print hammers adapted for movement into printing cooperation with the print drum and an equal number of hammer operator assemblies. Ready adjustment of the print hammers is provided while the modules are held clamped in the module frame structure and any module is removable from the module frame structure without disturbing the other modules.

Referring in particular to FIGS. 1 and 2 of the drawings, there is shown a fragmentary portion of a data communication printer generally indicated at 10. A moving print symbol carrier 11 is shown in the form of a rotating print drum, although a belt-type or any other suitable type of print symbol carrier could be used. The symbol carrier 11 is shown to have rows of identical print symbol or raised type elements 12. A series of print hammer modules 13 are stacked in vertical side-by-side relationship in frame structure generally indicated at 14. The frame structure 14 is shown to include support plates 16 and 17 at each end of a baseplate 18, and bars or braces 19, 20 and 21 interconnecting the support plates 16 and 17 by means of threaded fasteners 22. The baseplate 18, extending normally with respect to the modules 13, is adjusted securely to the frame 15 of the printer 10 by machine screws 23 (only one of which is shown) which extend through enlarged bores 24 in the printer frame 15. The baseplate 18 is suitably secured as by threaded fasteners (not shown) to the support plates 16 and 17. Side guides are secured to the frame 15 by threaded fasteners 26 which extend through enlarged bores 27 in the guides 25 and are threadably received in the frame 15. Once the frame structure 14 is aligned with the print symbol carrier 11, the threaded fasteners 26 can be tightened and thereafter the frame structure 14 can be slid out of position and subsequently slid back into position without further adjustment.
printing cooperation with the print symbol carrier 11. A record medium R' is fed stepwise in line-feed direction between the print symbol carrier 11 and the inked ribbon R by means of a set screw 78. The ball 76 and the spring 77 form a resilient clamping structure 79, and there is one such clamping structure 79 for each module frame 28 although only one is shown in FIG. 2.

During the printing operation, the symbol carrier rotates at a constant rate. If a particular symbol such as a "G" is to be printed at a particular location along the line, the head 40 of the proper print hammer 35 is driven into printing cooperation with the print symbol "G" when it is presented in front of that print head 40. Should it happen that the printed line is slightly uneven, it indicates that one or more of the print hammers 35 is driven into printing cooperation with the selected symbol element 12 either too early or too late. With the symbol carrier 11 rotating in the direction shown in FIG. 2, assuming a symbol is printed too high with respect to other symbols in the line as a result of the print hammer 35 arriving too late at the printing location, an adjustment can be made in the stop screw 61 of its associated hammer operator assembly; namely, the stop screw 61 should be turned to bring the armature 56 closer to the pole face 54' of the electromagnet. The head 40 of that print hammer 35 will then be in a return stop position in close proximity to the symbol carrier 11. Thereafter, when the coil 55 of that hammer operator assembly is energized, the print hammer 35 will effect recording of the symbol in line with the other symbols in the line, assuming the stop screw 61 has been correctly adjusted. The compactness of the arrangement of print hammer module and printed circuit board allows the adjusting screws 61 to be clearly visible to the person making the adjustment and not the hindrance of a maze of insulated wires. In addition, the chance of wires becoming disconnected is greatly minimized, thereby increasing reliability. Assuming now that a symbol is printed too low with respect to other symbols in the line as a result of the print hammer 35 arriving too early at the printing location, an adjustment can be made in the stop screw 61 of its associated hammer operator assembly: namely, the stop screw 61 should be turned to bring the armature 56 further away from the pole face 54' of the electromagnet. The head 40 of the print hammer 35 will then be in a normal stop position further away from symbol carrier 11. Thereafter, when the coil 55 of that hammer operator assembly is energized, the print hammer 35 will effect recording of the symbol in line with the other symbols in the line, assuming the stop screw 61 has been correctly adjusted. The electromagnet 53 is adjustable with respect to the frame 28 by virtue of machine screws 54' threadably received by the frame 28 which extend through enlarged bores 54'. It is preferred that the adjustment of each electromagnet be such that its respective armature abuts the pole face 54' before the head 40 of the print hammer 35 strikes the ribbon R, thus providing a predetermined amount of separation or lack of contact between the hammer operator lever and its related print hammer and free flight of the print hammer. The ends 45', 46', 47' and 48' and the lever arms 41, 42, 43 and 44 are so dimensioned that such separation therebetween is capable of taking place, as indicated in FIG. 2.

The print hammer module 13 can be mounted by a carriage, as shown in said U.S. application, similar to the symbol carrier 11. The guide rod can extend through an enlarged bore 82 in the module frame 28, also shown in said application. The carriage can be actuated by any suitable means, not shown in said application but disclosed, for example, in U.S. Pat. No. 3,280,256.

Other embodiments and modifications of this invention will suggest themselves to those skilled in the art, and all such of these as come within the spirit of this invention are included within its scope as best defined by the appended claims. I claim:

1. An impact printing apparatus including a plurality of electronically driven print hammers which strike a recording surface at an impact zone, wherein the improvement comprises a frame 28 and 277 form a resilient clamping structure 79, and there is
means defining positioning channels approximately perpendicular to the recording surface at the impact zone into which said modules may be slid into printing position; fastening means for securing said modules in printing position; and second electrical contact means positioned adjacent the means defining positioning channels and engaging said first electrical contact means on each module when the module is in printing position; whereby each module may be easily and quickly removed from and returned to said printing apparatus.

2. An impact printer in accordance with claim 1 wherein the modules also carry a printed circuit board supporting printed circuits which couple the first electrical contact means to the driving mechanisms.

3. An impact printer in accordance with claim 2 wherein at least part of the control circuitry for the driving mechanisms is attached to the printed circuit board.

4. An impact printer in accordance with claim 1 wherein the modules are planar and wherein the positioning channels engage the module edges.

5. An impact printer in accordance with claim 1 wherein the fastening means for each module include an elongated, pivotable lever perpendicularly attached to the end of the corresponding means defining a positioning channel and adjustable screw means passing through said lever and into the means defining a positioning channel, whereby a module can be removed by loosening the corresponding screw means and rotating the corresponding lever.