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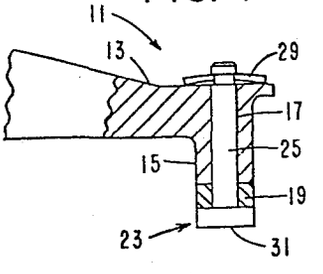
(54) Print hammer in an impact printer.

(57) A print hammer in an impact printer comprises a hammer body (13) having an end portion (15) containing a cavity (17) passing therethrough, an annular, separable compressible member (19), and a separable hammer tip (23) having a flat first face (31) for impact printing and having an elongated member (25) which passes through the compressible member (19) and the cavity (17). A removable fastener (29) secures the elongated member (25) to the end portion (15) to hold the compressible member (19) between the end portion (15) and second face of the hammer tip (23) opposite said first face 31. When the hammer tip (23) strikes against a printing surface, the subsequent compression of the compressible member (19) provides a combination of optimum force and contact time for the best ink transfer from a medium such as a ribbon to a print paper. Whenever the print quality deteriorates, the fastener (29) can be temporarily removed to replace either or both of the hammer tip (23) and compressible member (19).

FIG. 1



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PRINT HAMMER IN AN IMPACT PRINTER

Technical Field

This invention relates to a print hammer in an impact printer. The invention is concerned in particular with a print hammer suitable for use in MICR (magnetic ink character recognition) printing.

Background Art

In the impact printing art, a print hammer having an impacting tip at its free end is caused to impact an ink ribbon against a type wheel supported print paper. In a known impact printer, such as is disclosed in U.S. Patent No. 3,568,593, a buffer layer made of an elastomer material such as polyurethane is bonded between the hammer tip and the hammer body to improve the MICR print quality. This buffer layer absorbs some of the printing force applied from the hammer body to the hammer tip to prevent the hammer from immediately bouncing back after impacting with the type wheel during each character printing. Thus, the hammer tip stays in contact with the ink ribbon for a sufficiently long time to enable the ink from the ribbon to be properly absorbed by the paper and thereby improves the print quality. However, since the hammer tip, buffer layer and hammer body are integrated into one solid assembly, when either the tip or buffer layer becomes worn to an extent such that the print quality degenerates the whole hammer assembly must be replaced.

The replacement of the impact hammer in an impact printer frequently requires a skilled technician to be present at the customer's site to replace the hammer and then align or adjust the entire hammer mechanism movement. An operator generally lacks the necessary skill to properly make such an adjustment. As a result, the customer not only has to pay for a new hammer, but also incurs additional costs relative to the down time of the equipment until it is repaired and the costs and travel expenses of the skilled technician. These additional costs can be quite substantial.

Disclosure of the Invention

It is accordingly an object of the present invention to provide a print hammer of the kind incorporating a compressible buffer layer which largely overcomes the problems experienced with prior art impact printers having such hammers when the tip or buffer layer of a hammer becomes worn.

According to the invention there is provided a print hammer in an impact printer, said print hammer including a hammer body having an end portion, a hammer tip having a first face for impact printing, and resilient compressible means disposed between said end portion of said hammer body and said tip for permitting movement of said tip relative to said hammer body and for partially absorbing impact force from said hammer body to said tip during each impact printing, characterized in that said tip is detachably secured to said hammer body and said compressible means is in the form of a separable compressible member detachably secured to said hammer body, and further characterized by retaining means for coupling said tip and said compressible member to said end portion for impact printing and for enabling said tip and said compressible member to be separated from said end portion to replace said tip or said compressible member.

Brief Description of the Drawings

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

Fig. 1 is a side elevational view of a print hammer constructed in accordance with a first embodiment of the invention;

Fig. 2 is a bottom view of the hammer of Fig. 1;

Fig. 3 is an exploded perspective view of the hammer of Fig. 1;

Fig. 4 is a side elevational view of a print hammer constructed in accordance with a second embodiment of the invention.

Best Mode for Carrying Out the Invention

Referring to Figs. 1, 2 and 3 of the drawings, the hammer shown therein is a replaceable sandwich tip hammer which can be used in impact printing, and particularly in MICR printing.

As shown in Figs. 1, 2 and 3, the print hammer 11 comprises a hammer body 13 having an end portion or head 15 through which a central longitudinal cavity 17 passes. Disposed on or against the bottom portion of the body 13 is an annularly-shaped, resilient compressible member 19 made of, for example, elastomer. The compressible member 19 contains a centrally located hole 21 of substantially the same diameter as that of the cavity 17. A hammer tip 23 having an elongated member 25 is located below the compressible member 19 with the elongated member 25 extending through the hole 21 and the cavity 17 past the top of the end portion 15. The upper part of the elongated member 25 contains a slot or groove 27 for receiving a conventional retention ring or snap ring 29. When in place in the groove 27, the snap ring 29 operates to hold together the assembly comprised of the hammer tip 23, the compressible member 19 and the hammer body 13, with the correct initial compression of the compressible member 19.

It should, of course, be realized that means other than the groove 27 and snap ring 29 could be utilized to hold the assembly of the elements 23, 19 and 13 together. For example, the end of the elongated member 25 could be clamped with a clamp or threaded with a nut screwed thereon to hold the assembly together.

For durability, the hammer body 13 and the hammer tip 23 may each be made of steel. The hammer tip 23 also has a substantially flat face 31 for providing printing impact.

When used in impact printing and particularly in MICR impact printing, the hammer assembly 11 is initially mounted and aligned in an impact printer (not shown). In an impact printing operation, the head 15 is selectively

moved to cause the face 31 of the tip 23 to impact an ink ribbon (not shown) against a print paper (not shown) supported by a type or character wheel (not shown). Each time that the face 31 of the hammer tip 23 strikes a character (not shown) on the character wheel, the tip 23 moves towards the bottom portion of the body 13, causing the compressible member 19 to compress. This compression of member 19 provides an optimum force and contact time combination for the best ink transfer from the ink ribbon to the print paper. Reaction force following the contact of the face 31 with the character wheel forces the hammer tip 23 away from the character wheel.

After the face 31 of the hammer tip 23 has impact printed, for example, 50,000,000 characters on a few million documents, the face 31 of the hammer tip 23 becomes scored. This scoring of the face 31 causes the quality of the printed characters to deteriorate. In the MICR printing of checks and other financial documents, such deterioration of print quality causes the impact printer to no longer meet the stringent MICR print quality requirements specified by the banking industry.

Normally, in prior art impact printers the entire hammer assembly would be replaced when the print quality deteriorates. However, by virtue of the invention being disclosed, it is no longer necessary to replace the whole hammer assembly.

Whenever the print quality of the hammer 11 sufficiently deteriorates, the retention ring or snap ring 29 is removed to remove the hammer tip 23 and the compressible member 19 from the hammer body 13. The hammer tip 23 can then be replaced with a new hammer tip. If necessary, the compressible memeber 19 can also be replaced. The hammer 11 is then reassembled by inserting the elongated member 25 of the hammer tip 23 through the hole 21 in the compressible member 19 and through the cavity 17 in the head 15 before replacing the retention ring 29 in the groove 27 of the member 25.

With the above-described, easily replaceable hammer tip 23, as well as the replaceable compressible

member 19, the life of the impact hammer 11 of the first embodiment of Figs. 1, 2 and 3 can be many years, compared to the useful life of from four months up to at most two years of the present-day, throw-away, impact hammers.

After many millions of impact printings by the impact print hammer 11, the back and forth movements of the elongated member 25 in the cavity 17 causes the external surface of the elongated member 25 to wear and the cavity 17 to enlarge in size. Since the hammer tip 23 is periodically replaced, the wear of the elongated member 25 is no real problem. However, the continuous enlargement of the cavity 17 can cause a misalignment between the elongated member 25 and the cavity 17 which, in time, could affect print quality. It is to correct this long-term problem, and still further improve the improved impact hammer assembly 11 of the first embodiment of Figs. 1-3, that the second embodiment of the invention is directed.

The second embodiment of the invention is illustrated in Fig. 4. This second embodiment shows a print hammer 11_1 similar in structure, structural functions and operation to the print hammer 11 of Figs. 1-3, but providing a more friction-free movement of the elongated member 25 of the tip 23 through a cavity 17_1 during each printing operation.

This more friction-free movement of the member 25 results from the additional use of an annular guide element 33 in the print hammer 11_1. The guide element 33 is seated on an upper end surface 35 of an annular shoulder 37 which shoulder 37 projects from the end portion or head 15_1 of hammer body 13_1 into the cavity 17_1. An annularly-shaped resilient compressible member 19_1 is disposed within the space bounded by the bottom portion of the body 13_1, a lower end surface 39 of the shoulder 37 and the tip 23. The elongated member 25 of the tip 23 passes through a hole 21_1 in the compressible member 19_1, through the cavity 17_1 and through a hole 41 in the guide element 33. As discussed before, means such as a groove 27 (Fig. 3) in the

member 25 and a snap ring 29 (Fig. 3) are utilized to hold together the assembly, which in Fig. 4 is comprised of the tip 23 (including the member 25), the compressible member 19_1, the guide element 33 and the end portion 15_1.

The guide element 33 can be made of an elastomer material or any other suitable bearing material which does not readily wear out.

In printing operations the internal surfaces of the guide element 33 and the compressible member 19_1 bear the brunt of the back and forth printing movements of the elongated member 25 in the cavity 17_1. However, the internal surfaces of the element 33 and the member 19_1, through which the elongated member 25 moves, provide less friction to the movement of the member 25 therethrough than the internal surface of the shoulder 37.

Whenever the snap ring 29 is removed to disassemble the impact hammer 11_1 in order to replace the hammer tip 23, either or both of the compressible member 19_1 and the guide element 33 can also be replaced. Thus the internal wear of the cavity 17_1 is minimized by the second embodiment of Fig. 4 to further extend the useful life of the impact hammer 11_1.

CLAIMS

1. A print hammer in an impact printer, said print hammer including a hammer body (13) having an end portion (15), a hammer tip (23) having a first face (31) for impact printing, and resilient compressible means disposed between said end portion of said hammer body and said tip for permitting movement of said tip relative to said hammer body and for partially absorbing impact force from said hammer body to said tip during each impact printing, characterized in that said tip is detachably secured to said hammer body and said compressible means is in the form of a separable compressible member (19) detachably secured to said hammer body, and further characterized by retaining means (29) for coupling said tip (23) and said compressible member (19) to said end portion (15) for impact printing and for enabling said tip and said compressible member to be separated from said end portion to replace said tip or said compressible member.

2. A print hammer according to claim 1, characterized in that said end portion (15) has a cavity (17) therein, said compressible member (19) has an opening (21) therethrough, and said tip (23) has an elongated member (25) extending away from said first face (31) and passing through said opening into said cavity, said retaining means (29) being adapted to retain said elongated member (25) in said cavity and being removable from said elongated member so as to enable said tip and said compressible member to be separated from said end portion (15).

3. A print hammer according to claim 2, characterized in that said cavity (17) extends through said end portion (15), and said elongated member (25) passes through said cavity, said retaining means (29) being adapted to engage with said end portion (15) and with that end of said elongated member (25) remote from said first face (31).

4. A print hammer according to claim 3, characterized in that said compressible member (19) is compressed

between said end portion (15) and a second face of said tip (23) opposite said first face (31).

5. A print hammer according to any one of claims 2 to 4, characterized in that said compressible member (19) provides a bearing surface for said elongated member (25) during movement of said tip (23) relative to said hammer body (13).

6. A print hammer according to claim 5, characterized in that said compressible member provides less friction to movement of said elongated member (25) therethrough than does the surface of said cavity (17).

7. A print hammer according to any one of claims 2 to 6, characterized by a guide member (33) which is positioned in said cavity (17) and which surrounds and provides a bearing surface for said elongated member (25), said retaining means (29) being adapted to retain said guide member in said cavity, and said guide member being removable form said cavity when said retaining means (27) is removed from said elongated member (25).

8. A print hammer according to claim 3, characterized in that said end portion (15) contains a shoulder (37) within said cavity (17), said shoulder having first (35) and second (39) end surfaces, a guide member (33) which surrounds and provides a bearing surface for said elongated member (25) being positioned between said first end surface (35) and said retaining means (29), and said compressible member (19) being positioned between said second end surface (39) and a second face of said tip (23) opposite said first face (31).

9. A print hammer according to either claim 7 or claim 8, characterized in that said guide member (33) is of an elastomer material.

10. A print hammer according to any one of claims 7 to 9, characterized in that said guide member (33)

provides less friction to movement of said elongated member (25) therethrough than does the surface of said cavity (17).

FIG. 1

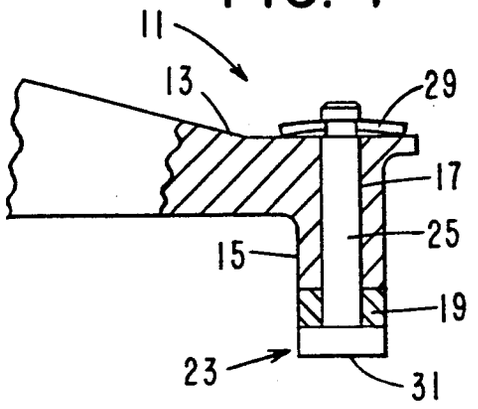

FIG. 4

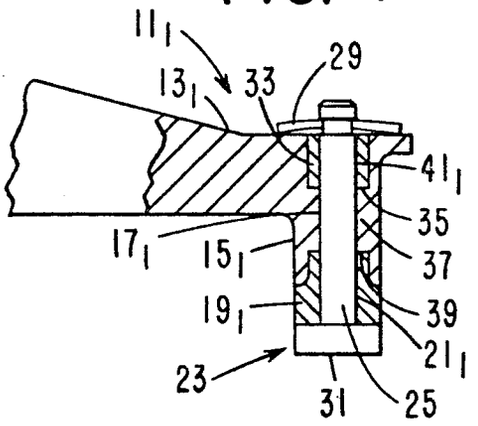

FIG. 2

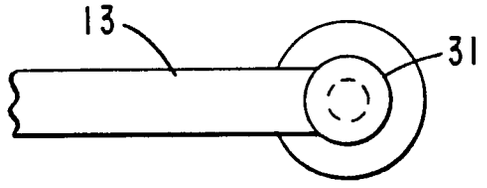

FIG. 3