March 21, 1967 A. L. FIELDER 3,310,146

BELT MOUNTED PRINTER HAMMERS MOVABLE BY SHORTEST DISTANCE TO INDEXED POSITION

Filed Sept. 7, 1965 2 Sheets-Sheet 1

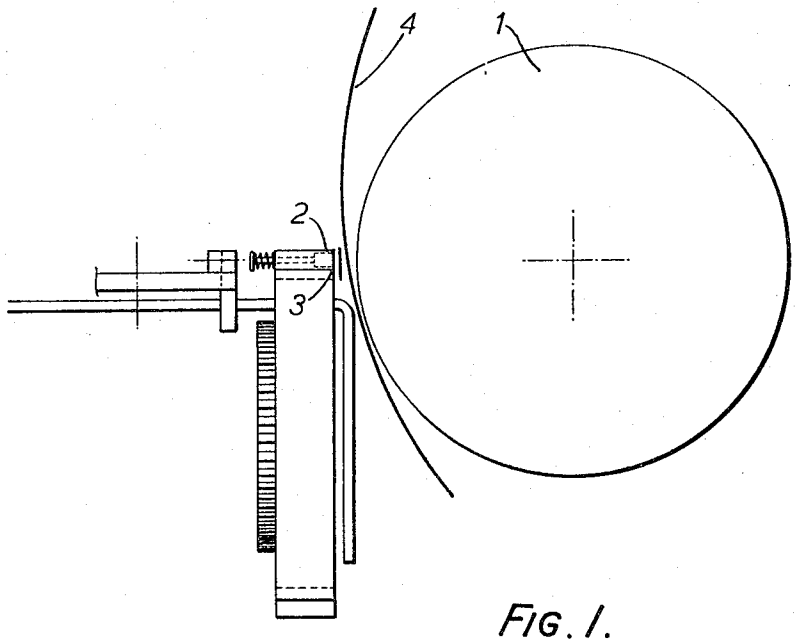


FIG. 1.

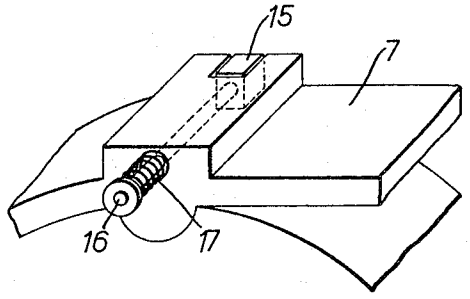


FIG. 3.

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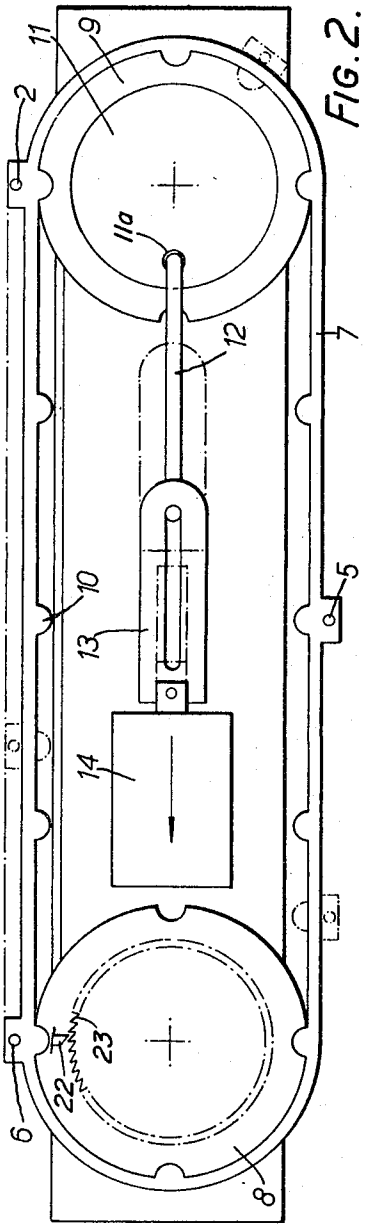


FIG. 2.

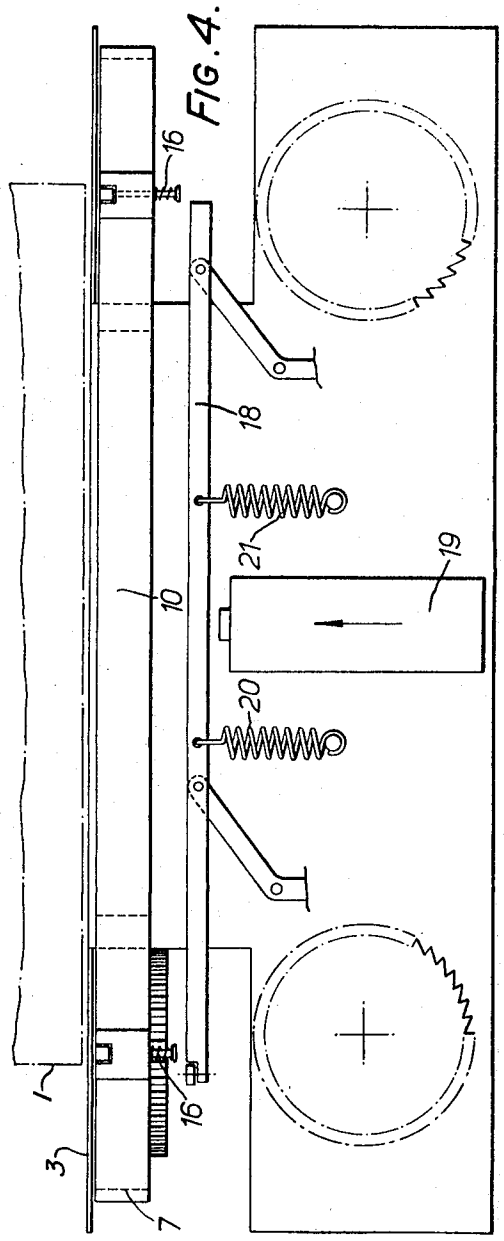


FIG. 4.

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3,310,146

BELT MOUNTED PRINTER HAMMERS MOVABLE BY SHORTEST DISTANCE TO INDEXED POSITION

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8 Claims. (Cl. 197—49)

The invention relates to electro-mechanical printers of the kind having a character-bearing member which carries characters to be printed and which during printing is moved so that the characters continuously and in turn pass a hammer, printing of a particular character being effected by timing the actuation of the hammer to strike when the appropriate character passes, the character being impressed thereby against the paper and an inked ribon. The characters may be the character cyphers carried each on a flat base plate from which they are raised by embossing or engraving, or each character cypher may be recessed into a base plate by punching or engraving, leaving the remainder of the plate raised relative thereto. Such printers find application in, for example, printing the outputs from teleprinters.

When printing a line of characters across a page with a printer of the kind referred to it is necessary to move the hammer across the paper from one character to the next and when the end of a line is reached it is necessary to bring the hammer as quickly as possible back to the line start position. An imaginary line extending across the paper from margin to margin and on which characters are printed is hereinafter termed a "print line." Inertial effects limit the speed at which the hammer can be brought back to the line start position and thus seriously limit the performance of the printer. It is an object of the invention to provide a printer with improved effective "hammer-return" time.

According to the invention a printer of the kind referred to comprises at least three hammers spaced apart by the length of a print line on an endless belt which is straight over a portion adjacent the print line, means being provided for advancing the belt, and thus the hammers, by one character space at a time along the print line. It is to be understood that the term "endless belt" may include any other endless hammer-carrier such as, for example, a chain.

With the arrangement according to the invention only one hammer at a time is adjacent the print line. However, when a hammer reaches the end of the print line there is another hammer ready at the beginning of the line to print the next line and the hammer carriage can continue in the same direction at the same speed. Thus in the usual case when the line of characters ends at the end of the print line (which extends for nearly the whole width of the paper) no change in the hammer drive is necessary. However, it frequently happens that a line of characters ends before the end of the print line (at the end of a paragraph, for example). Preferably therefore there are provided re-positioning means which re-position a hammer at the line start position immediately the preceding line of characters has ended, if said line of characters ends before the end of a print line. Further, with the arrangement according to the invention it is possible to provide re-positioning means which reverse the direction of belt progress to return the printing hammer to the line start position if at the end of the line of characters it has progressed less than half-way along the print line but which advance the belt to bring the next hammer into the line start position if the printing hammer has progressed more than halfway along the print line. With this arrangement therefore it is never necessary to move the belt suddenly by more than half a print line length.

Preferably the re-positioning means comprise a wheel coupled to move with the belt one revolution per print line length, an eccentric on the wheel, a solenoid and a connecting rod between the solenoid armature and the eccentric, the innermost position of the solenoid corresponding to a hammer being at the line start position and energisation of the solenoid being effective to draw the armature to its innermost position and thus by acting through the wheel and belt bring back or advance a hammer to the line start position in dependence upon whether the eccentric and armature have not reached or have passed their outermost position.

Preferably the belt is passed around the wheel in frictional contact therewith. The closed loop of the belt is preferably completed around another wheel spaced from the first and which is driven to provide the required hammer traverse, but the drive to which is over-ridden by the action of the re-positioning solenoid.

Each hammer preferably comprises a head carried on a shaft slidably mounted in a passage extending across the width of the belt, the shaft protruding from the side of the belt remote from the hammer head and actuating means being provided for striking the protruding shaft end and thereby operating the hammer. Preferably the actuating means comprises a bar extending parallel to the print line along the length thereof, being movable towards the print line to strike the protruding shaft wherever it should be along the print line. Preferably the hammer shafts and actuating bar are spring loaded in a direction away from the print line.

The character-bearing member may be a rotating drum or disc or a belt carrying raised characters which has a portion moving over the print line in parallel therewith.

The invention will further be described with reference to the accompanying drawings of which:

FIGURE 1 is a side elevation of a printer according to the invention;

FIGURE 2 is a front elevation of the printer of FIGURE 1;

FIGURE 3 is a perspective view of a hammer of the printer of FIGURES 1 and 2, and

FIGURE 4 is a plan view of the printer of FIGURES 1 and 2.

Referring to the figures there is shown a printer having a rotating print drum **1** (see FIGURE 1) on which are embossed sets of characters (not shown). Each set of characters comprises one of each character which may be printed, all the different characters of the set being distributed evenly around the circumference of the drum. Each set is only one character width wide and the sets are arranged side by side along the length of the drum. Printing is effected by striking a hammer **2** against an inked ribbon **3** and the paper **4** on which printing is to be effected, the moment of actuation of the hammer being selected so that the appropriate character is struck. As the printed line of characters progresses the hammer is moved along the print line from set to set of characters on the drum **1**.

FIGURE 2 shows the mechanism for transporting the hammers. There are three similar hammers, **2**, **5**, and **6** mounted in a flexible endless belt **7** which is carried by two wheels **8** and **9** arranged so that the belt has a straight portion **10** adjacent the print line of the paper. Wheels **8** and **9** are so dimensioned as to rotate one revolution as the belt **7** moves a distance equal to the length of a print line. As printing progresses, wheel **8** is driven clockwise step by step by a pawl **22** and ratchet **23** fast with the wheel **8** so that the belt moves from left to right one character space at a time. Wheel **9** is

driven by the belt. The three hammers are spaced apart around the belt by distances equal to the length of a print line. In the position shown in FIGURE 2, hammer **2** is at the end of the print line and hammer **6** has just arrived at the beginning. Thus it will be seen that the next line of print is commenced by shifting the paper upwards a line space and continuing as before, no change in the direction or speed of movement of the belt **7** and wheels **8** and **9** being necessary, printing merely being effected by means of hammer **6** instead of hammer **2**.

In the event that a line of characters is finished before the end of a print line, provision is made to bring a hammer immediately to the line start position (the position of hammer **6** in FIGURE 2). The mechanism for doing this includes a disc **11** mounted on wheel **9** and having an eccentric pivot hole **11***a* coupled by a connecting rod **12** to a slotted extension **13** of the armature of a solenoid **14**. The position shown in full line in the drawing is the innermost position of the armature—that to which the armature is drawn on energisation of the solenoid. It will be seen that in this position a hammer is at the line start position. The position shown in broken line is that normally assumed by the extension **13** and as wheel **9** rotates the end of the connecting rod slides up and down the slot in extension **13**. Activation of the solenoid drives wheel **9** and the belt to the innermost position, shown in full line, over-riding the drive to wheel **8**. If solenoid **14** is energised before the printing hammer has reached the mid-point of the print line, wheel **9** will have revolved less than half a revolution from the position shown and the wheel and belt will be drawn by the connecting rod backwards so that the printing hammer is brought to the line start position. If, on the other hand the printing hammer has proceeded further than the mid-point of the print line, energisation of solenoid **14** will draw the wheels and belt on in the same direction so that the next hammer is stationed at the line start position.

Detail of a hammer is shown in FIGURE 3, from which it will be seen that the hammer comprises a flat-faced head **15** mounted in a recess of a thickened portion of the belt **7**. Head **15** is mounted on the end of a shaft **16** which passes through the width of the belt and protrudes from the other side. A spring **17** biasses the hammer head into its recess.

FIGURE 4 shows the means for actuating the hammers as comprising a straight bar **18** mounted parallel to the straight portion **10** of the belt **7** and movable theretowards to strike the shaft **16** of the only hammer which at any one time is opposite the print line. The bar **18** is moved to strike the hammer by the action of a solenoid **19** and is spring biassed clear of the hammer shaft by springs **20** and **21**.

I claim:

1. A printer of the kind referred to, comprising an endless belt mounted for movement with a portion thereof extending straight along the print line; at least three hammers mounted on said belt and being spaced apart therealong by the length of a print line; means for driving said belt and said hammers in one direction and thereby successively advancing said hammers by one character space at a time along the print line; and hammer repositioning means operable (1) for reversing the direction of belt drive to return the last hammer which printed to the line start position if, at the end of a printed line of characters, said last printing hammer has progressed less than half way along the print line, and (2) for driving said belt in said one direction to bring the next hammer into the line start position if, at the end of a printed line of characters, said last printing hammer has progressed more than half way along the print line.

2. A printer as claimed in claim **1** and wherein said re-positioning means comprise a wheel coupled to move with the belt one revolution per print line length, an eccentric on the wheel, a solenoid and a connecting rod between the solenoid armature and the eccentric, the innermost position of the solenoid corresponding to a hammer being at the line start position and energisation of the solenoid being effective to draw the armature to its innermost position and thus by acting through said connecting rod, said eccentric, said wheel and said belt bring back or advance a hammer to the line start position in dependence upon whether the eccentric and armature have not reached or have passed their outermost position.

3. A printer as claimed in claim **2** and wherein the belt is passed around the wheel in frictional contact therewith.

4. A printer as claimed in claim **3** and wherein the closed loop of the belt is completed around another wheel spaced from the first and which is driven to provide the required hammer traverse, but the drive to which is overridden by the action of the re-positioning solenoid.

5. A printer as claimed in claim **1** and wherein each hammer comprises a head carried on a shaft slidably mounted in a passage etxending across the width of the belt, the shaft protruding from the side of the belt remote from the hammer head, and actuating means being provided for striking the protruding shaft end and thereby operating the hammer.

6. A printer as claimed in claim **5** and wherein the actuating means comprises a bar extending parallel to the print line along the length thereof, being movable towards the print line to strike the protruding shaft wherever it should be along the print line.

7. A printer as claimed in claim **6** and wherein the hammer shafts and actuating bar are spring loaded in a direction away from the print line.

8. A printer as claimed in claim **1** and wherein the character bearing member is a rotating element carrying raised characters which has a portion moving over the print line in parallel therewith.

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