

Jan. 4, 1966

B. HOWARD
ELECTRICALLY OPERATED PRINTER WITH TYPE BODY
AXIALLY MOVABLE AND ROTATABLE

3,227,259

Filed Aug. 22, 1963

3 Sheets-Sheet 1

FIG. 1

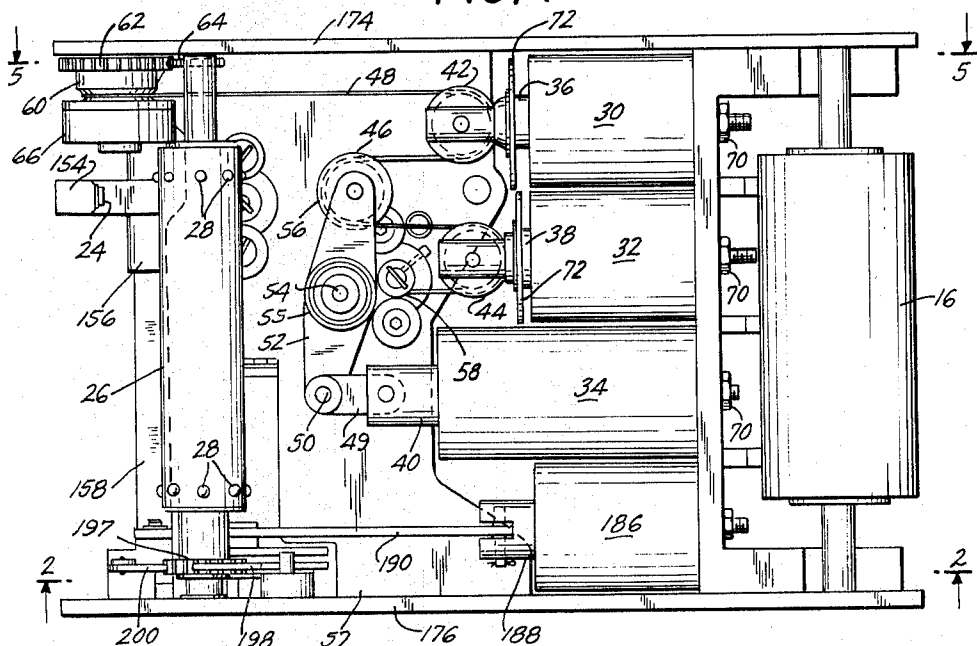
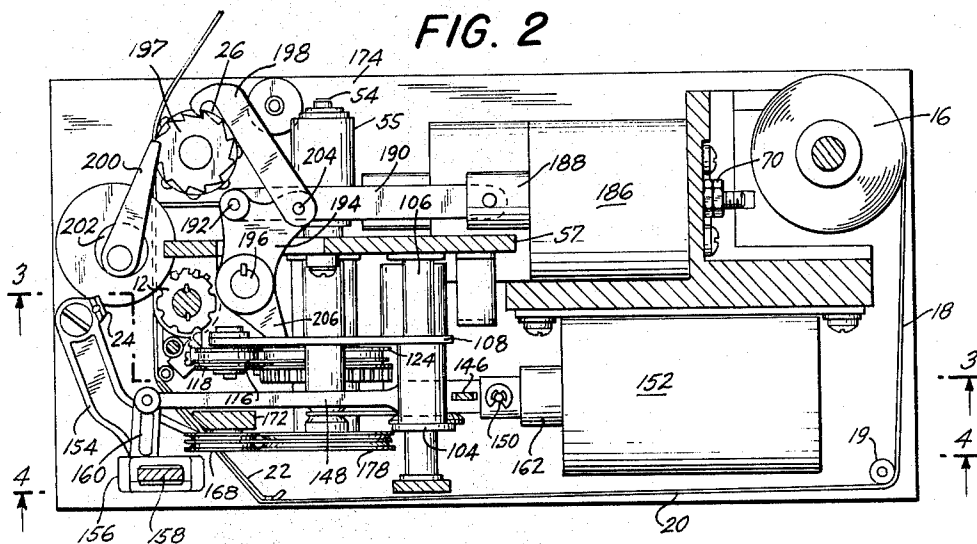


FIG. 2



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FIG. 5

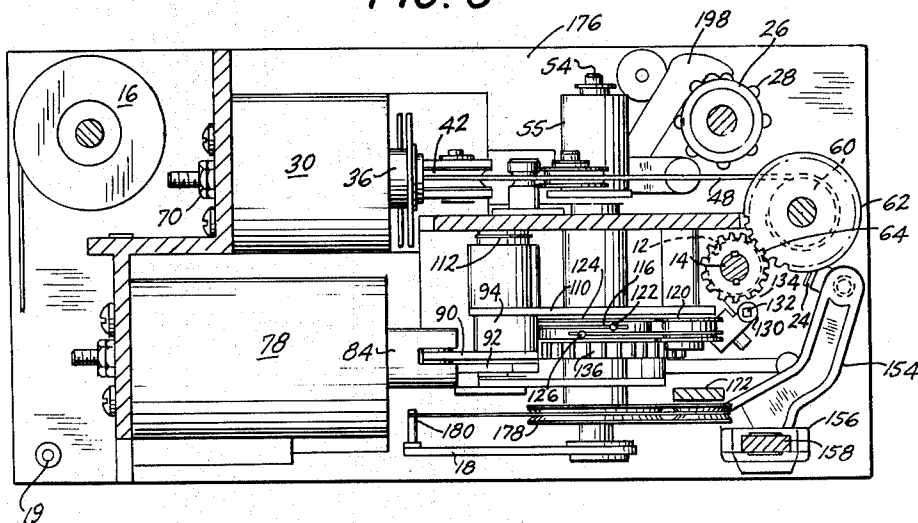


FIG. 6

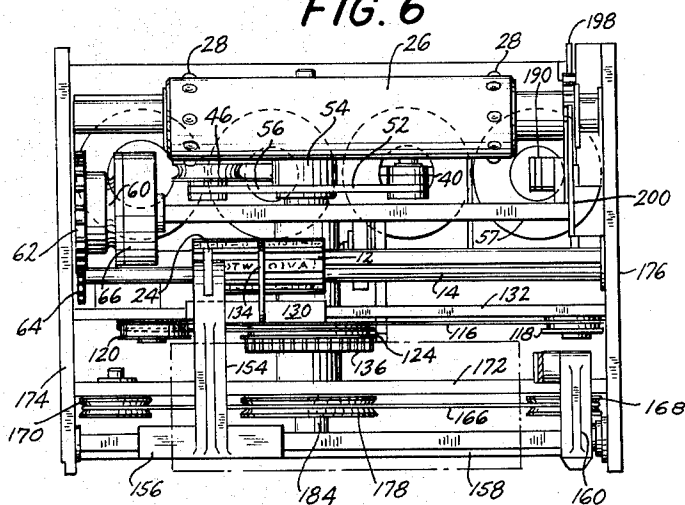
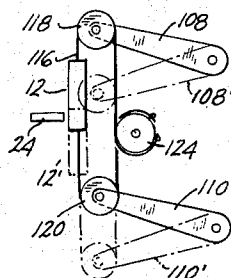


FIG. 7



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3,227,259

ELECTRICALLY OPERATED PRINTER WITH TYPE BODY AXIALLY MOVABLE AND ROTATABLE

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8 Claims. (Cl. 197—49)

This invention relates to electrically operated printers, particularly but not necessarily for telegraphy.

The general object of the invention is to improve electrically operated printers. More particular objects are to provide such a printer which is very compact in dimension and relatively light in weight, thereby adapting it for airborne use and for portable military use.

Another object is to provide such a printer which prints in page form. The page may be narrow, compared to letter size, and the roll of paper used may be a roll of wide tape such as is used in some business machines.

A further object of the invention is to provide a novel system and mechanism for properly combining the character selection movement of a type body with the character advance movement, that is, the step-by-step feed of the type body across the paper, the character selection movement being independent of the character advance movement.

In my prior Patents 2,727,944 granted December 20, 1955, and 3,063,540 granted November 13, 1962, both entitled "Telegraph Printer," I employ a solenoid operated pulley and cable system for rotary and for axial character selection. Alternate solenoids point in opposite direction, and are longitudinally displaced substantially more than for end-to-end relationship. One additional object of the present invention is to greatly reduce the dimension of the printer by disposing the solenoids side by side, in two decks, with all of the solenoids pointing in the same direction.

To accomplish the foregoing general objects, and other more specific objects which will hereinafter appear, my invention resides in the electrically operated printer elements and their relation one to another, as are hereinafter more particularly described in the following specification. The specification is accompanied by drawings in which:

FIG. 1 is a plan view of a printer embodying features of the present invention, with the protective casing removed;

FIG. 2 is a vertical section taken approximately in the plane of the line 2—2 of FIG. 1;

FIG. 3 is a horizontal section looking upward, and taken approximately in the plane of the line 3—3 of FIG. 2;

FIG. 4 is a similar view taken approximately in the plane of the line 4—4 of FIG. 2;

FIG. 5 is a section looking in the direction of the arrows 5—5 of FIG. 1;

FIG. 6 is a front elevation; and

FIG. 7 is explanatory of the operation.

Referring to the drawing, and more particularly to FIGS. 5 and 6, the printer comprises a type body 12, and selector mechanism for moving the same. In the present case the type body 12 is cylindrical, and it is moved both axially and rotatively for character selection. For this purpose the cylinder 12 is slidable on a splined or non-circular shaft 14. In the present case it is eight characters long and has eight characters around, that is, there are eight lines of characters, each eight characters long.

The paper being printed is supplied from a paper roll 16 at the rear of the printer. The paper following the

roll 16 is omitted in most of the drawings in order to simplify the same, but the paper path may be described with reference to FIG. 2 in which the paper leaving roll 16 descends at 18 to a roller 19 and is guided forward at the bottom of the printer as shown at 20. It is then guided upward around a polished stationary guide plate 22, and passes in front of the type cylinder 12, at which point it is in back of an appropriate type hammer 24. The printer paper continues upward to a paper feed drum 26, the latter preferably having sprocket teeth 28 at each end, for use with perforated paper. The parts may be dimensioned to receive and handle a standard roll of paper of a type used in certain business machines, and in the present case the paper is a wide tape having a width of 2½ inches.

The selector mechanism for rotary selection is simpler than that for axial selection, and therefore is described first, with reference to FIGS. 1 and 5 of the drawing. The said mechanism comprises solenoids 30, 32 and 34 having movable cores 36, 38 and 40. The solenoids are disposed collaterally and in parallel relation, and all point in the same direction, as will be clear from FIG. 1.

The core 36 carries a movable pulley 42, and core 38 carries a movable pulley 44. A third movable pulley 46 is disposed for movement on a path between the paths of the movable pulleys 42 and 44. A cable 48 passes back and forth around the three movable pulleys, the pulley diameters preferably being selected to keep the passes of the cable parallel. The third movable core 40 is connected to a link 49 which is connected at 50 to a lever 52 pivoted at an intermediate point 54, and coupled at its opposite end to the cable 48. In the present case the movable pulley 46 is carried at the end of an arm 56 which is an extension of arm 52, both arms having a common and preferably substantial hub 55 (FIG. 5) on pivot 54. The pivot is fixed on a deck 57 (FIG. 2) extending between the upright side plates 174 and 176.

In the present case one end of cable 48 is fixed on a post 58, and the other end moves the type body. Post 58 is rotatable for fixed-adjustable positioning of the cable. The other end of the cable is secured to a drum 60 which rotates the splined shaft carrying the type cylinder. This could be done directly but in the present case it is done through step-up gearing, and referring to FIGS. 5 and 6, cable 48 is secured to drum 60 which carries a gear 62. The latter meshes with a gear 64 on the splined shaft 14. The cable and drum are spring loaded to keep the cable under tension, and in the present case this is done by means of a spiral spring within a suitable housing. Referring to FIGS. 1 and 6, the spring is contained within a housing 66 associated with drum 60 and gear 62. The housing could be directly on the splined shaft, but with some loss of compactness in axial direction, that is, the machine would be somewhat wider. The spring loading may be applied in other ways, as by use of a pull spring and cable, or a helical spring bent to U shape and acting on a pivoted arm to provide a substantially constant tension or load.

The travel of each core may be accurately adjusted by means of motion limiting nuts 70 at the rear end. In the other direction the core bottoms or seats inside the solenoid. The nuts 70 are lock nuts, as will be seen from FIGS. 2 and 5. It will be understood that the travel of the solenoid cores is so adjusted that they produce motions of the cable in the ratio of one to two to four. By appropriate energization of one or more of the solenoids the drum may be turned to any one of eight positions, for use with a type cylinder having eight characters around its surface. The discs 72 are heat shields to protect the pulley and cable from the heat of the solenoid.

The selector mechanism for axial selection may be de-

scribed with primary reference to FIG. 3 of the drawing. Here again there are three solenoids 74, 76 and 78 having movable cores 80, 82 and 84. The solenoids are collateral and point in the same direction. Core 80 carries a movable pulley 86, core 82 carries a movable pulley 88, and core 84 is connected by a link 90 to a lever 92 having a hub 93 turning about a pivot 94. At its other end, lever 92 carries pulley 96, the latter being disposed for movement on a path lying between the paths of pulleys 86 and 88. A cable 98 passes back and forth around the three movable pulleys, the pulley diameters preferably being selected so that the passes of the cable are parallel. One end of the cable is fixed-adjustably secured on a post 100, and the other end is connected at 102 to an arm 104 which is pivoted at 106. Oscillation of arm 104 moves an arm 108 which is pivoted at one side of the printer. A preferably parallel arm 110 is similarly pivoted at 112 at the other side of the printer. Means are provided, in this case a simple connecting link 114, to cause simultaneous equal movement of the movable ends of the arms 108 and 110. The type cylinder is connected to the arms and is moved thereby for character selection.

More specifically the type cylinder is moved by a cable 116 which extends collaterally of the splined shaft of the type cylinder. There is a guide pulley 118 and another 120 at the sides of the printer around which the cable 116 passes. Arm 108 carries pulley 118, and arm 110 carries pulley 120. The cable is connected to slide 130 (FIG. 6) and yoke 134 received in a groove of cylinder 12. The yoke slide is omitted in FIG. 3. The end of cable 116 leaving the back side of pulley 118 (FIG. 3) is secured at 122 to a character advance drum 124. The other end of the cable leaving the back side of pulley 120 is connected to any suitable means which affords compensatory movement. The latter end of the cable may be connected to a takeup spring or a spring drum etc. but in the present case it is simply extended to and around the same drum 124, and secured thereto as shown at 126. The ends move in opposite direction. The two back passes of the cable are preferably kept parallel to the front pass 116.

The operation may be explained with reference to schematic FIG. 7, in which the solid line position of arms 108 and 110 locates one end of type cylinder 12 in front of hammer 24, whereas the dotted line position 108' and 110' of the arms locates the other end of the type cylinder in front of the hammer 24, as is shown by the broken line position 12' of the type cylinder. This is accomplished without any change of the cable relation to the drum 124, the latter being on a fixed pivot, and being assumed stationary during the aforesaid character selection movement of the arms. Conversely, the step by step character advance produced by means of the drum 124 does not affect the character selection position, it being kept in mind that a drum 128 beneath drum 124 also moves the hammer step by step.

FIG. 6 also shows the character selection cable 116 extending around the movable pulleys 118 and 120. This cable is secured to a movable sleeve 130 which is slidable on a guide rod 132, and which carries a yoke 134 which is received in a groove in the type cylinder, and which thus serves to shift the type cylinder axially on its splined shaft 14 without interfering with rotation of the shaft and type cylinder.

FIG. 6 also shows the cable drum 124 previously referred to, the said drum being secured to a ratchet wheel 136 which provides the character advance movement. The drum 124 receiving cable 116, and the ratchet wheel 136 are also shown in FIG. 5 of the drawing, which incidentally also shows solenoid 78 connected by link 90 to lever 92. It further shows the oscillatable arm 110 which carries the movable end pulley 120.

Referring now to FIG. 4, the ratchet wheel 136 asso-

ciated with the character advance drum is turned step-by-step by means of a feed pawl 138 connected to a pawl arm 140 which is pivoted at 142, and which is rocked by an arm 144, the arms 140 and 144 constituting an angle lever. The movable end 146 of arm 144 passes through and is received in a slot in a link 148, which is connected at 150 to the core of a hammer operating solenoid 152. The arrangement is such that the return movement of the hammer after printing a character causes the desired character advance of the type cylinder. The ratchet wheel 136 also has a check pawl, which is not visible because it is disposed beneath the feed pawl 138.

Referring now to FIGS. 1 and 2, the hammer 24 is carried at the upper end of a hammer arm 154, the lower end of which is enlarged to form a sleeve-like hub portion 156 which is slidable on a non-circular hammer shaft 158. In the present case the hammer shaft is rectangular in section, but at its ends it is rounded or suitably pivotally mounted to afford a rocking motion.

At one end the hammer shaft 158 carries an upstanding arm 160, best shown in FIGS. 2 and 6. The upper end of this arm is connected to a generally horizontal link 148 which extends rearwardly to and is pivotally connected at 150 to the solenoid core 162 of the hammer solenoid 152. It will be evident that each time the solenoid 152 is energized the hammer hits the paper and forms a character.

It is common to employ an inked ribbon between the hammer and the paper, but for simplicity the inked ribbon and its spools and their ribbon feed mechanism are not shown. Indeed they may be entirely omitted when using a special paper of a type which carries concealed inking material which is exposed where hit. Such impact sensitive paper is self inking, thus dispensing with the use of an inked ribbon. For purpose of the present disclosure, it may be assumed either that special impact-sensitive paper is used, or that ink ribbon mechanism is used but not shown because it may be conventional.

FIG. 2 also shows how the rear end portion of link 148 is slotted to receive the movable end 146 of the angle lever, which lever is best shown in FIG. 4 at 144 and 140, and which provides the desired character advance movement on the return movement of the solenoid core after each hammer stroke. FIG. 4 shows a return spring 164 which moves the hammer back and pulls the solenoid core 162 outward, and which provides the motive power for character advance or step-by-step feed across the paper.

The hammer moves across the page in synchronous step-by-step relation with the character advance of the type cylinder. For this purpose a hammer cable 166 is provided, and is best shown in FIGS. 4 and 6. This cable extends generally beneath and parallel to the cable 116, or differently expressed, it is collateral of the hammer shaft 158. It is secured to the hammer arm 154, or it could be secured to the sleeve 156 of the hammer arm. The cable 166 passes around a guided pulley 168 at one side of the printer, and a corresponding guide pulley 170 at the other side of the printer. These are fixedly mounted on a stationary bar or crosspiece 172 which extends between the upright side plates 174 and 176 of the printer. The end of the cable leaving pulley 168 is connected to and is moved by a cable drum 178, which is disposed beneath and mounted on the same shaft 184 as the character advance drum 124 and the ratchet wheel 136.

The other end of cable 166 passes around the guide pulley 170 and is connected to any desired means affording compensatory movement of the cable. It may be connected to a pull spring of suitable length, or to a rotatable drum having a spiral load spring, or to an arm biased by a helical spring which is bent to U shape to act as a constant tension spring. It also may be connected to the same drum 178, much as was described above for the character advance cable 116, both ends

of which are connected to the character advance drum 124.

In FIG. 4 the cable end is shown connected at 180 to an arm 182 which is fully pivoted, in this case at shaft 184. A constant tension spring may be applied to the arm 182, as shown at 183. This is a helical spring bent to U shape. The drum 124 itself has a spiral load spring, not shown. The load spring must have sufficient tension to produce the so-called "carriage return."

Separate springs are here used, for example, a spiral spring for drum 124, and the bent helical spring 183 for the hammer cable. The arm 182 is not secured to the shaft 184. If the cable 166 were secured to the front side of drum 178 (like cable 116 on drum 124) a single spring on the two drums would suffice.

At the end of a printed line the feed pawl and check pawl of the ratchet wheel are released, thereby permitting the said load springs to pull the type cylinder and hammer back across the page to starting position. This is accomplished by "line feed," that is, an upward movement of the paper preparatory to the printing of the next line.

The mechanism for line feed may be described with reference to FIGS. 1 and 2 of the drawing. This is accomplished by a solenoid 186 having a movable core 188 connected to a generally horizontal link 190. The forward end of this link is pivotally connected at 192 (FIG. 2) to a triangular plate or angle lever 194, which is itself pivoted on a fixed pivot at 196.

The paper feed drum 26 has a paper feed ratchet wheel 197 at one end, and this is moved by a paper feed pawl 198. It is held by a check pawl 200, the position of which may be made adjustable by means of an eccentric mounting 202.

The lower end of pawl 198 is pivoted at 204 on the angle lever 194. It will be evident that the horizontal movement of link 190 is converted to a sloping or nearly vertical movement of pawl 198, and the parts are suitably proportioned to provide the desired spacing between successive printed lines on the paper.

As previously mentioned, the upward paper feed is accomplished by carriage return, and in FIG. 2 there is a depending arm 206 which is mounted on and oscillated by the shaft 196 on which angle lever 194 is mounted.

Referring now to FIG. 4, the lower end of the depending arm 206 is located behind the feed pawl 138, and also behind the check pawl, not shown. During line feed the part 206 moves to the left, thereby disengaging the pawls from the ratchet wheel 136, whereupon the return springs of the cables 116 and 126 (FIG. 6) cause a return movement of the type cylinder and hammer to a starting position near the left edge of the paper.

The printer is assumed to be energized by a multiple wire parallel electrical input. There would be a minimum of nine wires, one for each of the eight solenoids, and a common return. Other electrical arrangements may be provided, including the use of more than one electrical return. The printer is housed in a suitable casing, not shown, and may be slid from the casing for reloading of a paper roll, or for other servicing.

By comparison of FIGS. 1 and 3 it will be seen that less room in a fore and aft direction is needed for the rotary selection linkage of FIG. 1, than is needed for the axial selection linkage of FIG. 3. The solenoids may be located further forward in FIG. 1 than in FIG. 3, and this difference is apparent in FIG. 2. It is utilized to provide room for the paper roll 16, which is located behind the upper solenoids, and above the rear ends of the lower solenoids. It would be possible, though somewhat less desirable, to put the rotary selection solenoids in the lower deck, in which case the paper roll would be located behind the lower solenoids instead of on top as here shown.

It is believed that the construction and operation of my improved printer, as well as the advantages thereof,

will be apparent from the foregoing detailed description. It will also be apparent that while I have shown and described the invention in a preferred form, changes may be made without departing from the scope of the invention, as sought to be defined in the following claims.

I claim:

1. A printer comprising paper support and feed means, a print hammer, a type body slidable on a guide extending across said paper to afford character selection and character advance, a cable collateral of said guide for moving said type body, a guide pulley at each side of the printer around which the cable passes, a character advance drum to which one end of the cable is connected, means affording compensatory movement of the other end of the cable, a pivoted arm at one side of the printer carrying one of the guide pulleys, a pivoted arm at the other side of the printer carrying the other guide pulley, means connecting said arms to cause simultaneous equal movement of the pulleys, and a selector means to oscillate said arms for character selection relative to said hammer independently of the step by step character advance.

2. A printer as defined in claim 1 in which there is a non-circular hammer shaft collateral of the guide, said hammer being slidable on said hammer shaft, means to rock the hammer shaft to cause printing of a character, a cable collateral of the hammer shaft for hammer advance across the paper, a hammer advance drum rotatable with the character advance drum to which one end of the hammer cable is connected, and means affording compensatory movement of the other end of the hammer cable.

3. An electrically operated printer comprising paper support and feed means, a type cylinder slidably splined on a shaft extending across said paper to afford rotative and axial character selection and axial character advance, a cable collateral of said shaft for moving said type body, a guide pulley at each side of the printer around which the cable passes, a character advance drum to which one end of the cable is connected, means affording compensatory movement of the other end of the cable, a pivoted arm at one side of the printer carrying one of the guide pulleys, a parallel similarly pivoted arm at the other side of the printer carrying the other guide pulley, a link connecting said arms to cause simultaneous equal movement of the arms and pulleys, and an electrically operated selector means to oscillate said arms for axial character selection independently of the character advance.

4. An electrically operated printer as defined in claim 3 in which there is a hammer shaft collateral of the splined shaft, a hammer splined and slidable on said hammer shaft, means to rock the hammer shaft to cause printing of a character, a cable collateral of the hammer shaft for hammer advance across the paper, a hammer advance drum mounted on the same shaft as and rotatable with the character advance drum and to which one end of the hammer cable is connected, and means affording compensatory movement of the other end of the hammer cable.

5. A printer comprising paper support and feed means, a type body slidable on a guide extending across said paper to afford character selection and character advance, a cable collateral of said guide for moving said type body, a guide pulley at each side of the printer around which the cable passes, a character advance drum to which one end of the cable is connected, means affording compensatory movement of the other end of the cable, a pivoted arm at one side of the printer carrying one of the guide pulleys, a pivoted arm at the other side of the printer carrying the other guide pulley, means connecting said arms to cause simultaneous equal movement of the pulleys, and a selector means to oscillate said arms for character selection independently of the step by step character advance, said selector means comprising three solenoids having movable cores disposed in parallel relation and pointing in the same direction, the first and second movable solenoid cores carrying pulleys, a third movable

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pulley being disposed for movement on a path between the the paths of the first two movable pulleys, a cable passing back and forth around the three movable pulleys, the third movable core being connected to a lever pivoted at an intermediated point and being coupled to the cable at its opposite end, said cable also being operatively coupled to the arms to move the arms.

6. A printer comprising paper support and feed means, a type body slidable on a guide extending across said paper to afford character selection and character advance, a cable collateral of said guide for moving said type body, a guide pulley at each side of the printer around which the cable passes, a character advance drum to which one end of the cable is connected, means affording compensatory movement of the other end of the cable, a pivoted arm at one side of the printer carrying one of the guide pulleys, a pivoted arm at the other side of the printer carrying the other guide pulley, means connecting said arms to cause simultaneous equal movement of the pulleys, and a selector means to oscillate said arms for character selection independently of the step by step character advance, said selector means comprising three solenoids having movable cores disposed in parallel relation and pointing in the same direction, the first and second movable solenoid cores carrying pulleys, the third movable core being connected to a lever pivoted at an intermediate point and carrying a movable pulley at its opposite end, said latter movable pulley being disposed for movement on a path between the paths of the first two movable pulleys, a cable passing back and forth around the three movable pulleys, one end of said cable being fixed, and the other end of said cable being connected to move the type body.

7. A printer comprising paper support and feed means, a type cylinder slidably splined on a shaft extending across said paper to afford rotative and axial character selection and axial character advance, a cable collateral of said shaft for moving said type body, a guide pulley at each side of the printer around which the cable passes, a character advance drum to which one end of the cable is connected, means affording compensatory movement of the other end of the cable, a pivoted arm at one side of the printer carrying one of the guide pulleys, a pivoted arm at the other side of the printer carrying the other guide pulley, means connecting said arms to cause simultaneous equal movement of the pulleys, and two selector means, one to oscillate said arms for axial character selection independently of the character advance, and the other to rotate the type cylinder, said selector means each comprising three solenoids having movable cores disposed in parallel relation and pointing in the same direction, the first and second movable solenoid cores carrying pulleys, a third movable pulley being disposed for movement on a path between the paths of the first

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two movable pulleys, a cable passing back and forth around the three movable pulleys, the third movable core being connected to a lever pivoted at an intermediate point and coupled to the cable at its opposite end, said cable also being operatively coupled to said arms to move the type body.

8. A printer comprising paper support and feed means, a type cylinder slidably splined on a shaft extending across said paper to afford rotative and axial character selection and axial character advance, a cable collateral of said shaft for moving said type body, a guide pulley at each side of the printer around which the cable passes, a character advance drum to which one end of the cable is connected, means affording compensatory movement of the other end of the cable, a pivoted arm at one side of the printer carrying one of the guide pulleys, a similarly pivoted arm at the other side of the printer carrying the other guide pulley, means connecting said arms to cause simultaneous equal movement of the arms and pulleys, and two selector means, one to oscillate said arms for axial character selection independently of the character advance, and the other to rotate the type cylinder, said selector means each comprising three solenoids having movable cores disposed in parallel relation and pointing in the same direction, the first and second movable solenoid cores carrying pulleys, the third movable core being connected to a lever pivoted at an intermediate point and carrying a movable pulley at its opposite end, said latter movable pulley being disposed for movement on a path between the paths of the first two movable pulleys, a cable passing back and forth around the three movable pulleys, one end of said cable being fixed, and the other end of said cable being connected to move the type body.

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EDGAR S. BURR, *Assistant Examiner*.