This invention relates to printing telegraph apparatus and more particularly to telegraph printers having axially and angularly displaceable type carrying segments.

An object of the invention is the provision of a selector mechanism for printing telegraph apparatus which includes a minimum of parts capable of being manufactured and assembled at low cost and of being operated efficiently and reliably at high signaling speeds.

Another object of the present invention is the provision of a telegraph printer which is relatively inexpensive, simple and efficient and which may be operated at high signaling speeds.

According to the embodiments of the invention disclosed herein, there is provided a type segment divided into four horizontal sections and divided into two halves, each half having four vertical rows of character positions in each "case" shift position. The characters are arranged on the type segment for selection in response to the receipt of code signals in such manner that characters represented by signals having a marking characteristic for a predetermined impulse of a five impulse code are on one-half of the segment and characters represented by signals having a spacing characteristic for the said predetermined impulse are on the other half of the segment. Signal responsive means are provided which upon the receipt of said predetermined impulse will bias the segment to move in one direction or the other depending upon the character of the code impulse received. The spacing or marking impulses received in the other impulse periods determine the level to which the segment will be elevated and the angle of rotation thereof from a zero position, irrespective of the direction of rotation thereof. Signal responsive means is provided for permutatively shifting a series of three segmental stop members having segment stopping shoulders on them for controlling the distance the type segment will move when biased in one direction or the other. The impulses received in two of the impulse periods will control the setting of these segmental stops, whereas the impulses received in another two impulse periods will control the height to which the type segment is elevated, periodically operated mechanisms being provided for urging the type segment to rotate and to move upwardly at predetermined times in the cycle of operation of the apparatus and permutatively set means being provided for interrupting the rotative and upward movement of the segment at various angular positions and different levels.

The apparatus described generally herebefore will provide thirty-two selections; however, since it is necessary to have more than thirty-two characters, the type segment may be set by a case shifting and unshifting mechanism similar in ultimate effect to the case shifting mechanism of the usual form of typewriting or teletypewriting apparatus. This case of shifting mechanism comprises apparatus for shifting the entire assembly of segmental stop members a short distance upon receipt of a shift or unshift signal.

The foregoing brief description of the features of the present invention apply particularly to the mode of selecting the type to be utilized in printing a character. This apparatus is equally adaptable to either tape printing apparatus or page printing apparatus and may be almost identical in construction in either apparatus.

In accordance with one embodiment of the invention, as applied to a tape printer, the various functions, that is, the operations other than character printing operations which are to be performed by the machine, are controlled by permutatively set code bars which permit a shift lever or an unshift lever to move to a predetermined position under the influence of an actuating spring when a predetermined code is set up on the code bars. Movement of either of the aforementioned levers to their set position will control the shift or unshift operation of the apparatus. In the event that the transmitted signal represents either a shifting or unshifting operation, the print hammer, which in the case of a tape printer is invariably actuated and permitted to move under spring pressure toward printing position, is barred from striking the tape and instead of performing a printing operation the power stored in the print hammer actuating spring is used to effect the shift or unshift operation and the settable levers which control shifting or unshifting will move normally spring biased levers against the tension of their respective spring into position to be struck by an extending portion of the assembly which moves with the print hammer, thereby to cause the group of segmental stop members to be shifted bodily, due to the fact that the spring biased levers are mounted on the plate which carries the segmental stop members.

In the embodiment of the invention shown herein which is adapted for printing on tape, the only functions which are performed by the apparatus are shift, unshift and character spacing as is usual in tape printers. Accordingly, the shift and unshift operations are performed as de-
scribed hereinbefore and spacing is performed for each operation of the printing hammer whether the signal received is a character representing a signal or a shift or unshift signal.

In the embodiment of the invention applied to a page printing apparatus, wherein the code for figures case shift, in the standard start-stop five unit code in use, is all marking except the third impulse, whereas the code for letters case shift or unshift is all marking, the third pulse is utilized to control the direction of rotation of the type segment. In doing this the type segment, when in its uppermost position and its farthest position of rotation, turns a shift or unshift lever to permit the spring which biases the type segment in one direction or the other to move an assembly of segmental stops and thereby effect case shifting. In this embodiment of the invention the first and last impulses of the five unit code determine the setting of segmental stops to determine the amount of oscillation of the type segment, the second and fourth impulses determine the extent of elevation of the type segment, and the third impulse determines the direction of rotation of the type segment.

In the page printing embodiment of the invention, it is necessary to perform functions in addition to those which are performed in connection with the tape printing apparatus, that is, line feed and carriage return, and the mechanism for spacing is slightly more complicated due to the fact that the carriage must be spaced rather than simply character feeding a strip of paper tape. The mechanism is, however, controlled in substantially the same manner as in the tape printer in that the controlling of the functions is effected by slidable bars selectively driven by a selector cam assembly to select code bars for actuation. In addition there is provided in the main cam assembly a trip which releases the clutch of a secondary cam assembly near the end of the cycle of the main cam assembly for supplying actuating power to the function mechanism selected for actuation and this cam assembly will supply the power to cause either printing or the function to be performed during the setting up of the succeeding code of characters to be printed by the apparatus.

A better understanding of the invention may be had by reference to the following detailed description when considered in conjunction with the accompanying drawings, wherein,

Fig. 1 is a plan view of a tape printer embodying the features of the invention;

Fig. 2 is a side elevation view of the apparatus shown in Fig. 1, parts being broken away more clearly to show important parts which are in back;

Fig. 3 is a sectional view taken substantially along the line 3—3 of Fig. 1 in the direction of the arrows;

Fig. 4 is a fragmentary sectional view taken substantially along the line 4—4 of Fig. 3 in the direction of the arrows;

Fig. 5 is a fragmentary sectional view taken substantially along the line 5—5 of Fig. 2 in the direction of the arrows;

Fig. 6 is a fragmentary sectional view taken substantially along the line 6—6 of Fig. 5 in the direction of the arrows;

Fig. 7 is a diagrammatic chart showing the timing of the various parts of the tape printer apparatus with respect one to another;

Fig. 8 is a fragmentary sectional view taken on the line 8—8 of Fig. 3 in the direction of the arrows;

Fig. 9 is a side elevational view of the structure comprising the page printing embodiment of the present invention, part of the base and keyboard of the apparatus being broken away to show more clearly details of the invention by showing them on a large scale;

Fig. 10 is a plan view of the structure shown in Fig. 9, one end of the apparatus being broken off in order to show the important features of the structure on a large scale;

Fig. 11 is a transverse vertical sectional view taken along the line 11—11 of Fig. 9 in the direction of the arrows showing a large number of the parts of the apparatus in front elevation;

Fig. 12 is a plan sectional view taken along the line 12—12 of Fig. 9 in the direction of the arrows showing the arrangement of the segmental stops and some of the function selecting mechanisms, as well as a portion of the function performing mechanisms;

Fig. 13 is a plan sectional view taken along the line 13—13 of Fig. 9 in the direction of the arrows showing details of the function selecting mechanisms, particularly those mechanisms involved in spacing operations;

Fig. 14 is a vertical sectional view taken along the line 14—14 of Fig. 12 in the direction of the arrows showing some details of the mechanism for controlling the height to which the type segments will be elevated and the amount which it may be rotated;

Fig. 15 is a vertical sectional view taken along the line 15—15 of Fig. 12 in the direction of the arrows showing some details of the mechanism for actuating the segmental stops and restoring them to normal position, as well as some details of the mechanism for actuating and controlling the type segments' vertical movement;

Fig. 16 is a vertical sectional view taken along the line 16—16 of Fig. 12 in the direction of the arrows, showing some details of the function selecting mechanism for line feed, spacing, printing, spacing cut-out, carriage return and function restoring mechanisms;

Fig. 17 is a vertical sectional view taken along the line 17—17 of Fig. 16 in the direction of the arrows, and also showing some details of the segment controlling mechanisms and function selecting and operating mechanisms;

Fig. 18 is a plan sectional view taken along the line 18—18 of Fig. 15 in the direction of the arrows, and showing some of the details for biasing the type segment to rotate in a selected direction. This figure is on a somewhat enlarged scale to more clearly illustrate this portion of the apparatus;

Fig. 19 is a horizontal sectional view taken along the line 19—19 of Fig. 9 in the direction of the arrows, and showing some of the details of the apparatus for effecting case shifting operations;

Fig. 20 is a vertical sectional view taken along the line 20—20 of Fig. 19 in the direction of the arrows, showing in side elevation some of the mechanism for effecting case shifting operations;

Fig. 21 is a timing chart showing the relative time of operation of the various cams in the apparatus, and illustrating the time in which the various functional operations are performed;
motor 66 is either a synchronous motor or has the usual governor mechanism on it for regulating the speed of rotation of its driven shaft 67. The shaft 67 carries a spiral gear 68 which meshes with and drives a spiral gear 69 suitably connected to the right end (Fig. 1) of a shaft 70. The shaft 70 is journaled in a pair of posts 71 and 72 (Fig. 5) which are mounted upon the base plate 31 and extend upwardly therefrom, the posts being spaced apart and braced by a cross member 73. Mounted upon the several views of the shaft 70 are a series of sleeves 74 and 75, and 76 and 77 (Fig. 5). The sleeves 74 and 77 serve as spacers for suitably positioning the gear 69 with respect to the gear 68 and to hold the sleeves 75 and 76 in their proper position between the posts 71 and 72. The sleeve 75 is fixed to the shaft 70 and the sleeve 76 is freely rotatable about the shaft 70, the sleeve 75 carrying a driving clutch member 78 and the sleeve 76 carrying a driven clutch member and a series of cams for actuating the various parts of the apparatus at predetermined times in the rotation of the assembly in which they are included. The driving clutch member 78 is a ratchett wheel and is formed integrally with sleeve 75. Since the sleeve 75 is fixed to the shaft 70 the driving clutch member will rotate at all times that the power is supplied to the motor 65.

Fixed to the sleeve 76 is a relatively large disc 85 on which are carried a spring supporting post 86, a spring guiding post 87, a pawl carrying post 88 and a pawl stop (not shown). A series of springs 89 are fixed to the spring supporting posts 86 and normally tend to move pawl 81 individually to them in a direction so that the tips of the pawls will engage with the teeth of the ratchet or driving clutch member 78. The disc 85 is interconnected with the sleeve 76 by means of a plate 92 which has arms extending out from it and bearing against the disc 85, suitable screws 93 being provided for interconnecting the plates 92 with the disc 85. Suitably secured to the sleeve 76 as best seen in Fig. 6 are series of twelve cams which together with a cam formed on the disc 85 serve to operate the various instrumentalities of the apparatus in the proper sequential order. These cams reading from right to left in Fig. 6, are the armature blocking cam 94, the type segment oscillating cam 95, the type segment elevator stop cam 96, the segmental stop cam 97, the type segment restoring cam 98, the type segment elevator stop cam 100, the type segment oscillating cam 101, the code bar setting cam 102, the code bar unlocking cam 103, the print hammer actuating cam 104 and the type segment elevator cam 105, respectively. The time of operation of these cams is clearly illustrated in the timing diagram shown in Fig. 7.

Operation selecting assembly

The cams on sleeve 76 not only control the operation of the various instrumentalities of the printing apparatus, under the selective operation of the selecting magnet assembly 32, but also they serve to actuate the various parts of the apparatus. Type segment oscillating cam 95, type segment elevator stop cam 96, segmental stop cam 97, type segment restoring cam 98, segment stop cam 99, type segment elevating cam 100, and type segment oscillating cam 101 form a part of the operation selecting assembly of the apparatus and they together with code bar setting cam 102 each have associated with them a lever for selectively actuating.
sildable bars designated 113 to 119, respectively, for association with the cam levers which are designated 123 to 129, respectively. These cam levers are pivotally mounted on a rod 130 (Fig. 3) which is mounted in a lever supporting block 131 and a lever 122 which also pivotally supports an armature blocking lever 132 (Fig. 5) and a center stop lever 133.

The armature blocking lever 132 is normally in the path of the armature and serves to prevent movement of the armature 45 toward the magnet 41. Between the places where the high portion of the armature blocking cam is in alignment with the armature blocking lever. The armature blocking lever is in turn held away from the low portion of its cam when the armature is attracted, the normal position of the armature.

When the apparatus is at rest, the starting pulse for the operation of the apparatus being a spacing pulse and the stopping pulse being a marking pulse. Thus, when a code has been received by the apparatus and the stop impulse or the marking impulse is then received, the armature will be attracted and the next time that the armature blocking cam moves the armature blocking lever away from the armature, the armature will be permitted to drop down into the path of the armature blocking lever and will carry latching arm 121 of the armature blocking lever into the path of the pawls 91. The pawls will thus be moved out of engagement with the ratchet and held in that position until a start or spacing pulse is received at which time the armature of the electromagnet will be released and will permit the armature blocking lever to move toward its cam under the action of its spring, a low portion of the cam being in alignment with the lever 132 at this time. In this manner, the clutch will be engaged and the cycle of operation of the cam on the cam sleeve 76 will follow in sequence.

The upper forward end of the cam levers 123 to 129, Fig. 8—A, inclusive, are notched in such a manner that they will be blocked from moving toward the right (Fig. 3) of the machine when the armature 45 is moved to its marking or spacing position at the time the low part of the cam associated with a particular cam lever is in alignment with the cam lever, thereby to prevent some of the cam levers from moving forward on a marking impulse and to prevent others of the cam levers from moving forward on the spacing impulse. Those cam levers which are prevented from moving forward at the interval in the cycle when they are in association with the low point on their associated cam will, when the high point of the cam moves into association with the cam lever, be rocked toward the rear of the machine without any effect on their associated slidable bars. However, if certain cam levers are permitted to drop to their forward position due to the fact that their upper portions do not engage the armature 49 in the position at which the cam comes into association with the low point on the cam, the levers will move toward the front portion of the machine and the slidable bars will be permitted to drop down in back of the cam levers for actuation by the cam levers when the cam levers are moved toward the rear of the machine to engagement thereof by the relatively high portion of the cam associated with them to perform certain mechanical operations of the apparatus. As shown in Fig. 3, the slidable bars 113 to 119 normally rest on the shoulders of the cam lowering block 120, so that when a cam lever is permitted by the armature 46 to rotate clockwise, its associated slidable bar will drop off said shoulder onto the plate 216 into position to be actuated leftwardly by the cam lever. At a predetermined instant in the cycle of operations, the slidable bars are again permitted to their respective positions on the shoulders of the cam lever by the arm 220—A of the function determining bar 220, which is caused to be raised by the lever 229 (Figs. 5 and 6).

By reference to the timing chart shown in Fig. 7, it will be learned that the cam levers 123 and 128 associated with the type segment oscillating cams 95 and 101 and the cam lever 125 associated with the indexing cam 102. As shown in Fig. 8—A, the upper end of the cam lever 123 associated with the type segment oscillating cam 95 is cut out so that, if a marking impulse is received, the lever 123 will be permitted to move forward when the low portion of its cam is in association with it. Therefore, upon receipt of a marking pulse, when the low portion of cam 95 is in alignment with the lever 123, the slidable bar 113 whose end adjacent the cam lever is normally resting on top of the cam lever 123, will be permitted to drop down in back of its associated cam lever 123 for actuation thereby when the high art of the cam engages the cam lever 123. If, however, a spacing impulse is received at the time when the cam levers 123, 128 and 129 are in association with the low portions of their associated cams 95, 101 and 102, the cam lever 123 will be blocked in moving forward and will not permit its associated slidable bar 113 to drop behind it; whereas the cam lever 128 will move forward due to the construction of its upper portion and the slidable bar 118 associated with it will drop below the cam lever and be actuated by it when the high portion of the cam 101 engages the lever 128. It should be noted that the code bar setting cam 102 is operable at the same intervals that the type oscillating cams are operable and that the upper end of the cam lever 128 is so cut as to permit the slidable bar 119 to drop behind it upon receipt of a marking signal whereby the slidable bars 113 and 119 will be moved to the rear of the machine simultaneously if a marking signal is received at the time interval when they are in association with the cam lever 123.

The slidable bar 119 has code notches cut in its upper surface to effect a function selecting operation as will be described more in detail hereinafter.

The slidable bars 113 and 118 are normally urged into engagement with type segment oscillating levers 144 and 145, respectively (Figs. 1 and 5), notches being formed in the type segment oscillating levers to receive the rounded extending rear end of the slidable bars 113 and 118. The springs which urge the slidable bars 113 and 118 into the notches in the type segment oscillating levers 144 and 145 are relatively light and are designated 146, a series of these springs being provided one for each of the separate slidable bars 113 to 119, inclusive. The springs 149 are not strong enough to move the cam levers 144 and 145 which the slidable bars are associated with which the levers are all drawn toward the front of the machine by much stronger springs designated 147. The type segment oscillating levers 144 and 145 are pivoted on a pivot rod 148 mounted in a block 149 extending upwardly from the base member 311. When the oscillating segment oscillating levers 144 and 145 are interconnected (Fig. 4) with a pair of slidable racks 150
and 151, respectively, by springs 182 and 183, respectively, the springs 182 and 183 normally tending to hold shoulders 14 and 155 formed on the racks 150 and 151 against the levers 144 and 145, respectively. Slots are formed in the racks 150 and 151 so that they may slide freely on pins 156 and 157 which will hold the teeth on the racks 150 and 151 in engagement with opposite sides of a gear 158.

The pin 157 has a shoulder 159 formed on it for supporting the lower rack 151 and the pin extends upwardly from an irregularly shaped frame plate 160 which is in turn mounted on the upper end of the cam lever 127. The upper end of the frame 157 is in turn supported by pivot posts 161 (Fig. 5). The plate 160 also carries on its upper surface a pair of short posts 162 and 163 and the posts 162 and 163 and the pin 157 serve to support a T-shaped plate 164 (Figs. 1 and 3) in which the guide pin 155 is mounted.

From the foregoing it is apparent that, if either the slidable bar 113 or the slidable bar 118 is selected for operation, that is, if its associated cam lever 123 or 128 is permitted to move into engagement with the lower portion of its associated cam shaft, that is, the bar 113 or 118 will drop in back of its lever 123 or 128, respectively, and will be rocked toward the rear of the apparatus upon the movement of the larger part of the cam into association with the cam lever. Whichever one of the slidable bars 113 or 118 is selected for operation, will move toward the rear of the machine and in so doing will force the lever 144 or 145, whichever one happens to be associated with it, toward the rear of the machine, thereby urging the associated cam lever 123 or 128 toward the rear of the cam shaft of the machine thus tending to rotate the gear 158 in either a clockwise or counterclockwise direction as viewed in Fig. 1. Thus the selection of one type segment oscillating lever 144 or the other type segment oscillating lever 145 for operation will bias the gear 158 to rotate in one direction or the other to carry with it a type segment 165 as will be described in more detail hereinafter in connection with the further description of the mechanism operated from the cam shaft under control of the armature 49.

The next cam on the cam shaft, that is, the type segment elevation stop cam 96, has associated with it the slidable bar 114 and cam lever 124 and serves to control the height to which the type segment 165 will be raised to select a row of type segments to be printed. As clearly shown in Figs. 3 and 5, the slidable bar 114 extends an appreciable distance beyond the rear end of the slidable bar 113 and has a slot 170 formed in its rear end as shown in Fig. 8. A pin 171 (Fig. 8) fixed in one arm of a U-shaped lever 172 by means of a nut 173 engages in the slot 170 so that when the slidable bar 114 is moved toward the rear of the machine the U-shaped lever 172 will be rocked about its pivot rod 174 which is in turn mounted in a pair of posts 175 and 176 extending upwardly from the base plate 31. The other arm of the U or L shaped lever 172 has the portion 177 formed on it for engaging an enlarged portion 178 of a slidable shaft 179 (Fig. 3) on the upper end of which the type segment 165 is fixed when the lever 172 is held in its clockwise position by its spring 147. The shaft 179 is slidable keyed in the gear 158 and thus will rotate with it through an axial manner. The portion of the slidable bar 114 is selected for operation and moved toward the rear of the machine, upon engagement of the high part of the cam 96 with the lever 124, the shoulder 171 will be moved out of the path of the enlarged portion 178 of the shaft 179 to permit the type segment 165 to be elevated to a position which will raise the enlarged portion 178 above the shoulder 171.

A second U-shaped lever 180 similar to the U-shaped lever 172 is provided for actuation by the slidable bar 117 upon the selection of the slidable bar 117 for actuation by the cam lever 127 which is in turn selected under control of the armature 49 and which is driven by the type segment elevator stop cam 100. The left arm (Fig. 8) of the U-shaped lever 180 has a shoulder 161 formed on it for controlling the amount of movement of the type segment by engaging the enlarged portion 178 of the shaft 179 when the slidable bar 117 is not selected for actuation and moved counterclockwise against the tension of its spring 147. Also pivoted on the pivot rod 174 and held in place between the adjacent arms of the U-shaped levers 172 and 180 is a lever 182 having shoulders 183 and 184 formed thereon for engaging the enlarged portion 178 of the shaft 179 to determine the amount that the type segment is elevated in any cycle of operation. The lever 182 has no slidable bar individual to it, but is provided with a spring 147 for normally urging it to rock toward the front of the apparatus as are the U-shaped levers 172 and 180. The lever 182 is actuated, however, whenever either the lever 172 or 180 is operated to move toward the rear of the machine due to the fact that it has a member 185 extending through it and into the path of the adjacent arms of the U-shaped levers 172 and 180.

With the just described construction the selection of either one of the slidable bars 114 or 117 for operation and their subsequent movement toward the rear of the apparatus will result in the U-shaped element 172 or 180 associated with the selected slidable bar being moved toward the rear of the machine and consequently the lever 182 will also be rocked toward the rear of the machine. Upon reference to Fig. 8, it will be noted that the shoulder 184 is the lowest one of the shoulders 171, 181, 183 and 184 and consequently when either of the levers 172 or 180 is actuated the shoulder 184 will be moved out of the path of the enlarged portion 178 of the shaft 179 to permit the shaft 179 to carry the type segment up until the enlarged portion 178 engages the shoulder on the U-shaped lever which was not actuated. If neither the U-shaped levers 172 or 180 is selected for actuation, then the enlarged portion 178 of shaft 179 will engage the shoulder 184 whereas if either of the levers 172 or 180 is actuated the type segment will be elevated until the enlarged portion 178 engages the shoulder on the lever which has not been actuated.

Thus it will be apparent that the selection of the height to which the type segment is elevated is controlled by the levers 172 and 180. In other words, the distance that the type segment is elevated is determined by the selection of the various shoulders for stopping the movement of the type segment upwardly and if a signal is received which does not result in either the U-shaped lever 172 or the U-shaped lever 180 being moved toward the rear of the machine, the lowest shoulder 184 will catch the type segment shaft enlargement 178 in the uppermost engagement thereof. If the U-shaped lever 180 is moved toward the rear of the machine, the lever 182 will be carried with it and the enlarged portion 178 will engage the shoulder 171. If the lever 172 is moved to-
ward the rear of the machine, the lever 182 will be carried with it and the enlarged portion 178 on the shaft 175 will engage the shoulder 181, whereas if both the levers 172 and 180 are moved toward the rear of the machine, the shoulder 183 which is always in the path of the enlarged portion 178 will serve as an abutment against which the enlarged portion 178 will move, there- to carry the type segment 180 to its highest position and bring the bottom row of type there- on into alignment with the print hammer which will be described more in detail hereinafter. It should be noted that the type segment 185 in each cycle moves down below printing position to ren- der the last typed character visible and that it moves up in each cycle until stopped by the engagement of enlarged portion 178 with one of the shoulders.

The next cam on the cam shaft, that is, the segmental stop actuating cam 97, has associated with it the cam lever 125 which under control of the armature 49 will select the sidable bar 115 associated with it when the signal received at the time when the low portion of the cam 97 is in association with the cam lever 125, is a mark- ing signal. The receipt of a marking impulse at this time will permit the lever 125 to move forwardly of the apparatus and will thereby permit the sidable bar 115 to drop in back of the lever 125 so that, when the high portion of the cam 97 en- gages the cam lever 125, the cam lever will push the sidable bar 115 to the rear of the machine. The rear end of the sidable bar 110 nests in a notch formed in a lever 191. This lever 191 (Figs. 3 and 4) extends upwardly and engages an extending portion 192 formed on a segmental stop member 193 which together with a pair of the segmental stop members 194 and 195 is supported upon a stop supporting plate 196. The stop supporting plate 196 is mounted upon the upper frame plate 160 and is oscillatable about a guide sleeve 197 in which the shaft 179 is sidable and about which the gear 199 is rotatable. The stop sup- porting plate carries a pin 198 at its rear end which engages in slots in the rear ends of the segmental stop members 193, 194 and 195 and cooperates with the bearing sleeve or guide sleeve 197 to guide the segmental stop members in their movement toward the rear of the machine. The plate 196 is adjustable in position is determined by the code impulses received by the selecting magnet mechanism and the position of the armature 45 at the time when the particular cam on the cam shaft 70 in predetermined position as explained hereinafter. Movements of the type segment in oscillating is also selectively determined in accordance with the received signal as described hereinafter. How-
The segment operating assembly

The segment operating assembly is part of the mechanism described herein for supplying power to oscillate the type segment to its various positions as determined by the segmental stop members and the biasing springs, which determine the direction of rotation of the type segment, include a means for moving the type segment to its uppermost position. At a predetermined time in the cycle of the apparatus this mechanism becomes effective and the mechanism is supplied with operating power from the cam shaft. The type segment elevating cam 105 (Fig. 2) supplies the power for elevating the type segment and this cam is effective at a predetermined time in the cycle of rotation of the cams to rock a cam lever 211 which is pivoted on a pin 212 fixed to a post 213. The post 213 (Fig. 2) and a similar post 214 (Fig. 3) also serve to support a plate 215 to which the springs 119 and 120 are attached. The posts 213 and 214 have mounted at their upper ends a plate 216 on which the slidable bars 113 to 119, inclusive, are slidable positioned, suitable slots being cut in the plate 216 to accommodate the downwardly extending portions of the bars 113 to 119 and the plate being cut out to receive the upper extending end of the cam levers 123 to 129, inclusive. This plate 216 is also slotted at its rear end to receive the levers actuated by the slidable bars 113 to 119, inclusive, and to accurately position them for actuation by the slideable bars.

The cam lever 211 (Figs. 2 and 5) which is actuated by the type segment elevating cam 105, extends towards the rear of the machine and is normally pulled downwardly by a spring 217 fixed to its rear end. The spring 217 has its opposite ends fixed to a link 218 which has formed thereon towards its upper extremity a slot through which the rear end of lever 211 projects and when the cam lever 211 travels away from the cam shaft due to its engagement by the gradually rising periphery of the cam 105, the link 218 will tend to move rearwardly with the rear end of the cam lever. This link 218 (Figs. 2 and 5) is pivotally connected to a lever 219 at a point intermediate the ends of the lever, one end of the lever being pivotally mounted upon the post 161 and the free end of the lever 219 extending under the end of the shaft 179. With the mechanism just described, the type segment is cyclically urged to move upwardly periodically in the cycle of rotation of the sleeve 176 and the movement of the segment will be interrupted by the mechanism described herebefore for stopping the segment at various levels to bring the selected level of type thereon into printing position, the upward movement of the shaft being stopped by the stop mechanism under control of the received signals.

In addition to the lever for elevating the type segment, by raising the shaft 179, further mechanism is provided for controlling the speed of the shaft and the mechanism operates under control of the type segment restoring cam 98 which has associated with it an irregularly shaped cam lever 220, the rear portion of which is of a goose-neck configuration, adapted to engage the shoulder 118 of the shaft 179 to move the shaft to its lowermost position to carry the type segment down to its lowermost position, at a definite time of the cycle of rotation of the sleeve 176. The forward end of the lever 250 and will engage the forward end of the rack 150 or 151, whichever one of them has been moved forward from the front of the machine in the process of determining the direction of rotation of the type segment, and this portion of the lever 220 will positively move the racks back to their normal position whereas the type segment is in its mid-position.

The print hammer cam 104 has associated with it a cam lever 221 which is pivoted on a rod 222 fixed in posts 223 and 224 at the rear of the apparatus (Figs. 2 and 3), and is normally urged by a rock in a clockwise direction about the rod 222 (Fig. 2) by a relatively heavy coiled spring 225 fixed to the lever 221 and to the base 31. The rear end of the lever 221 is bent to form a ball-like structure as is most clearly shown in Fig. 5 at 226. Extending upwardly from the right-hand portion (Fig. 5) of the ball-like structure 226 is an arm 227, interconnected to a similar arm 228 by a nut and bolt assembly 229. The arm 228 forms a portion of a ball-like structure 230, having an upwardly extending arm 231 fixed to it. The ball-like structure 226 is also rotatable about the rod 222, and being interconnected to the lever 227 by the nut and bolt assembly, the ball-like portion of the lever 227 will move with the lever 221 when the lever 221 is oscillated by its cam.

Extending upwardly from the left-hand portion (Fig. 5) of the lever 221 is an arm 232 which has fixed to it a pair of levers 233 and 234. The lever 234 is bent over as is shown at 235 and this bent over portion 235 extends over into the path of a pivoted lever 236 (Fig. 2) which is normally urged into engagement with the portion 235 by a contractile spring 237, the lever 236 being pivoted to the underside of the plate 160 by means of an arm 239 which extends down from the plate 160 to serve as a support for the lever. The upper end of the lever 236 has a pawl formed on it for engagement with a ratchet wheel 238 connected to a sleeve 240 on which there is fixed a gear 241 and a feed roller 242. The sleeve 240 is rotatable about a fixed shaft 243 mounted on the plate 160.

Positioned adjacent the fixed shaft 243 is a post 244 which carries an idler supporting lever 245 that is normally urged to carry a freely rotatable knurled idler roller 246 which is spring urged into engagement with a feed roller 242 by means of a spring 247 (Fig. 1) fixed to the lever 245 and to an upwardly extending pin 248. The feed roller 242 is adapted to draw a paper tape 250 through suitable guides 251 and 252 from a supply 253, the supply 253 being mounted on a disc 254 which is, in turn, supported on the upper end of a post 255 carried on the end of a plate 256 mounted on the upper frame plate 168.

Extending upwardly from the plate 160 is a rotatable shaft 265 to which there is fixed a gear 266 that meshes with a gear 241 on sleeve 240 and is driven by the gear 241 each time the ratchet wheel 239 is moved. The upper end of the shaft 265 is adapted to support an ink ribbon spool 267 and drive it at a much higher speed than the speed of movement of the feed roller 242, whereby to draw an ink ribbon from a supply spool 266 between a pair of pins 269 and 270 and a pair of extensions 271 and 272 formed integrally with the plate 273 which supports the guides 251 and 252.

Pivoted on the rod 222 intermediate the arms
227 and 228 of levers 221 and 230 (Fig. 5) is a print hammer bar 274 which carries at its upper end a print hammer 275. The lever 274 is in the form of a bell crank and its horizontally extending arm is interconnected with the base 31 by a coil spring 276, thereby normally to urge the lever 215 into engagement with a roller 277 which is mounted on the nut and bolt assembly 229.

In the foreground, it is believed to be apparent that each time the relatively heavy spring 225 snaps the lever 221 forward when the lever 221 passes off of the high point of its associated cam 104, the print hammer lever 224 will be snapped toward the front of the machine somewhat violently, and will overtravel a short distance against the tension of its spring 276 due to the inertia of its weight, thereby to carry the print hammer up against the tape 260 in the area between the guides 251 and 252, thereby to drive the tape against the ribbon which is guided in a path just in front of the paper tape. Reference to Fig. 1 will make it plain that the print hammer will strike against the tape to carry the ribbon against the type segment which is positioned in front of the hammer and which may be adjusted in its oscillating or elevation by the various type elements thereon in the position to print on the tape when the print hammer drives the tape against the carbon paper and drives the carbon ribbon against the type segment.

The hereinafore described apparatus provides for the selection of any one of thirty-two characters to be printed. However, it is well known that in printer telegraphy there may be more than thirty-two possible characters when fractions, punctuation marks, numerals, as well as letters are supposed and therefore it becomes necessary to provide some means for printing more than the thirty-two characters which the apparatus as hereinafore described may control by shifting in either of two directions and to any one of four positions in that direction as well as any one of four levels. Mechanism has been provided to shift the type segment's segmental stops a short distance to the right or left upon the receipt of a proper signal by the selector magnet. This shift is equal to one-half the distance that appears between characters which may be selected by the segmTental stops in the normal operation of the machine, and this lateral or oscillating case shift is performed upon the receipt of a proper signal by the mechanism now to be described.

The slideable bars 114, 115, 116, and 117 have code notches formed in their upper surface or edge which correspond to a predetermined permutation so that the slideable bars 114 and 115, 116 and 117, in addition to controlling the type segment, also serve as code bars in effecting a selection, in response to received signals, of any one of the segments. Each segment bar is pivoted on a rod 286 and being guided by a guide plate 287 to which the coil springs 283, 284, and 285 are attached. Each of the function determining bars 280, 281, and 282 has an upwardly extending portion which controls shift, upwardly extending portion which controls shift, upwardly extending portion which controls shift, and having a support shown in Fig. 4. Pivot, in general, is shown in Fig. 4 are a pair of levers 75.
the guide plate 281 and over the top of a lever 299, associated with cam 183. The lever 299 on being rocked counterclockwise will restore any one of the function determining bars 280, 281, or 283 which have been moved into aligned notches in the upper surfaces of the slidable bars and this lever 299 also serves to restore all of the slidable bars to their upper position where they may be selected for actuation by their associated cam levers, or where they may rest if the signal received in the selector magnet assembly does not call for their selection and operation. The lever 299 is pivoted on a U-shaped pivot block 300 which extends downwardly from the plate 160 and also serves as a pivot support for the lever 220.

**Operation of tape printer**

The hereinafore described structural features of a tape printer are operable to print the desired characters upon the tape 250 upon the receipt of a start-stop code of five character units. As is usual in start-stop printers, the start impulse is always spaced and therefore the apparatus is made to respond to a spacing impulse to initiate its cycle of operation. Upon the receipt of a spacing pulse, the armature 46 will be permitted to move upwardly under the action of the spring 45. In moving to its upper position on the receipt of the first spacing impulse, the armature will release the latching arm 134 and thus release the paws 91 to permit them to engage the driving clutch member 78. As soon as one of the paws 91 engages the driving clutch member 78, the paws will be driven by the driving member and will transmit rotary motion to the sleeve 76 on which the various cams for controlling the timing and the operation of the apparatus are mounted. The cam sleeve 76 will thus rotate in timed relation to the operation of a transmitting apparatus which may be sending code signal impulses to the selector magnet of the selector magnet assembly 32. As the cam sleeve 76 rotates, the cams carried by it will, in a definite timed relation, as illustrated in the timing chart shown in Fig. 7, permit the cam levers 123 to 128 to fall back and forth in the cam slots in the driving assembly and will not be blocked by the electromagnet armature 46. This condition prevails except in the case of the lever 128 which is to be selected for actuation by a spacing signal and is permitted to fall back and be actuated by the high portion of its cam upon the receipt of a spacing impulse at the time when the said lever 128 is engaging the low portion of its cam. Thus the slidable bars 118 to 119 will be actuated or will not be actuated depending upon the position of the armature 46 at the time the low portion of their associated cams are in alignment with the cam levers associated with them. The code of impulses received by the driving assembly known hereinafter as the driving assembly, which will be described more in detail. To facilitate an understanding of the structure of the present embodiment on the invention, each of the separate and distinct units thereof will be described separately, and the driving assembly, some of which have been described hereinafore, has been designated generally by the numeral 312 (Fig. 11) and constitutes one of several assemblies. In addition to the driving assembly 312 there are provided a
selector magnet assembly 313 (Fig. 10), an operation selecting assembly 314 (Fig. 9), a type segment operating assembly 315, a carriage assembly, 316, a function performing assembly 317, and a ribbon feed assembly 318. While these various assemblies overlap in their operation and control of the apparatus, they will, insofar as possible, be described separately to facilitate an understanding of the invention.

Driving assembly

The driving assembly 312, as most clearly illustrated in Figs. 9, 10, 11 and 13, comprises, in addition to the gearing for driving the shaft 305, two separate clutch assemblies one of which drives the function performing mechanisms and the other of which drives the type segment selecting or controlling mechanisms. Mounted upon and freely rotatable with respect to the shaft 305 is a cam sleeve 325, having fixed to it, reading from left to right (Fig. 11) a friction disc 326, a stop disc 327, a lock cam 328, a direction of rotation controlling cam 329, an elevation controlling cam 330, an elevation controlling cam 331, a rotation controlling cam 332, a start cam 333, a rotation controlling cam 334, a stripping cam 335, a function clutch tripping cam 336, and a friction disc 337. The friction discs 326 and 337 have associated with them friction washers 338 and 339, which are positioned between the disc 326 and 337 and the cooperating discs 340 and 341. The discs 340 and 341 are connected to and driven by the shaft 305, whereas the discs 326 and 337 are not fixed to the shaft, but may be driven with it. Positioned to the left of the friction disc 340 is a coil spring 343, which surrounds a shouldered sleeve 344 and normally urges the disc 340 to compress the friction washers 338 and 337, the friction disc 341 being formed integrally with a sleeve 342 fixed to the shaft 305. In this assembly there is a constant tendency for the discs 340 and 341 to drive the discs 326 and 337 with them to impart rotative movement to the cam sleeve 325.

As is usual in devices of this type the starting impulse is a spacing impulse, and the normal line condition is marking whereby, as will be described more in detail hereinafter, a spacing impulse will initiate operation of the printer mechanism under control of the selector magnet 304.

In the driving assembly, and constituting a part of the function performing assembly 317, there are a series ofcams and an eccentric for furnishing power to operate the various functional mechanisms of the apparatus. These cams and eccentric are mounted on the shaft 305 and are adapted to be driven by a clutch under control of the function clutch tripping cam 336 on the cam sleeve 305. Fixed to the sleeve 342 is a clutch ratchet 350 which constitutes the driving member of the clutch for driving the cams in the group which operates the function mechanisms. Mounted in association with the clutch ratchet 350 is a pawl supporting plate 351 on which there is provided a pawl whose teeth are engaged into engagement with the teeth of the ratchet 350 by a pallet type of spring 353. This clutching mechanism is quite similar to the clutching mechanism provided in the page printer described hereinafter, and operates upon the receipt of the pawl by a stop member to be described more in detail hereinafter. The pawl supporting plate 351 is concentric with and fixed to a cam sleeve 354 on which there is mounted an eccentric 355, a spacing and line feeding cam 356, a function controlling cam 357, and a printing cam 358. The two groups of cams described hereinbefore are effective to perform the functions incident to the operation of the machine, and to select and actuate the type segment to position it for printing.

Selector magnet assembly

The effectiveness of the cams described in the preceding paragraphs is controlled by the selector magnet assembly 313, which includes, in addition to the selector magnet 313, suitable means for supporting the magnet in position, and an armature 361 which in its attracted (marking) position will permit certain levers to be selected for operation. The levers are those individually associated with the cams described hereinbefore and other levers which will be described in detail hereinafter. The armature 361 carries a blocking plate, or selecting plate 362, and is urged to move in a counterclockwise direction (Fig. 15) by a coil spring 363, suitably connected to a fixed part of the apparatus and to a finger 364 extending outward from the illumination controlling cam 331. The armature is fixed to a reed or leaf spring 365 which is in turn mounted upon and fixed to an armature pivot plate 366. This construction provides a hinged for the armature 361 and permits it to be locked in response to the energization of the selector magnet 313 until the right end (Fig. 15) of the selecting plate 362 strikes an adjustable abutment member 367. At the left end (Figs. 15 and 22) of the selecting plate 362 there is provided a lever 368 which limits the movement of the selecting plate 362, and therefore limits the movement of the armature 361. In response to the tension of springs 363, this lever designated 369 is normally urged in a clockwise direction (Fig. 22) by a contractile spring 369 and against the surface of the cam 326 described hereinbefore. The left end (Fig. 22) of the selecting plate 362 extends into a U-shaped notch 370 formed in the upper end of the lever 368, and the movements of the selecting plate and consequent movement of the armature 361 are limited by the edges of the U-shaped notch. At the base of the lever 368, there extends an arbor projection 371, which serves to lock the selecting plate 362 and the armature 361 in either the marking or spacing position during the engagement of the lever 368 with a low portion of the lock cam 326. From the foregoing it will be apparent that during rotation of the cam sleeve 325, the selecting plate 362 and the armature 361 will be alternately released for movement, or locked against movement, by the configuration of the upper end of the lever 368 into which the left end (Fig. 22) of the selecting plate 362 extends.

Operation selecting assembly

The lever 368, as was pointed out hereinbefore, is associated with the locking cam 326, and the lever 369 (Fig. 11) together with a series of levers 366, 368, 369, 330, 331, 332, 333, 334, and 335, respectively, and are adapted to be actuated by the cams upon release of the
levers for forward movement under the influence of springs 389-389 one associated with each lever. It will be noted from Fig. 11, that there is a top lever 383, the stop 384 associated with the cam 335. However, there is associated with the cam 335 a slidable stripper plate 390, the purpose of which is to restore the slidable bars 392-396 (to be hereinafter described) to their original positions resting on the top edge of the guide plate 384, and letters 392 and 386. It will be noted, as shown in Fig. 22, that the left end of the selecting plate 362 is tapered to a point for cooperation with the projection 371. However, this plate 362 is tapered only in the area thereof associated with the lever 388, and the remainder of its left edge, as viewed in the various sectional views showing it, is square for cooperation with abutments adjacent to the upper ends of the levers 380 to 386. Thus, when the armature 361 is in its attracted position, the plate 362 will be rocking up out of the path of these abutments on the levers to permit the levers to rock in a clockwise direction if they are adjacent to the low points of their respective cams at the time when the plate is out of alignment with the abutments. The plate 362 will be returned, setting them in the levers in which being rocked by their springs 389 when a spacing condition prevails on the line connected to the selector magnet 304, whereas if a marking condition prevails, the levers will be permitted to move in a clockwise direction, thereby to become effective for operating slidable bars associated with them, which will now be described.

The next lever to the locking cam lever 368 in the row as viewed in Fig. 11 is the lever 380, which, as may be seen in Fig. 14, is urged to rock in a clockwise direction by its spring 389, and if at the time that the low portion of its associated cam 329 comes into alignment with its abutment the armature 361 is in its marking position, the lever 380 will be permitted to rock into the low portion of its associated cam 329, and in that position the upper end will drop behind a shoulder 391 on a slidable bar 332. When the high portion of the cam 329 engages the bump on the lever 380, if the lever 380 has been permitted to fall in a clockwise direction by the selecting plate 362, the upper end of the lever 380 being in position behind the shoulder 391 will drive the slidable bar 322 to the left (Fig. 14). Similarly, if the lever 381, lever 382, lever 383, or the lever 385 is permitted by the selecting plate 362 to move in a clockwise direction when the bump on it is engaged by its associated cam, then their upper ends will drop behind similar shoulders on slidable bars 339, 394, 395, and 396 to prepare these bars for actuation, and when the high portion of their respective cams engage the bump the levers will actuate their associated slidable bars. Thus, the selection of slidable bars for actuation in the tape printer apparatus is quite similar to the selection of slidable bars for actuation in the tape printer, and the ultimate result accomplished by the selection and actuation of these slidable bars is also quite similar to the ultimate result obtained in the tape printer apparatus. Reference to Fig. 12 it will be noted that each of the slidable bars 392 to 396, inclusive, is provided with a contractile spring 397, which urges it toward the front of the machine where its normal position is as shown in Fig. 12 or Fig. 15, with the lower surface of the slidable bar resting on top of its associated actuating lever, 75

As shown in Figs. 14 and 15 the slidable bars are provided with slots at their rear or left end for receiving a supporting pin 398. It should be noted that the slidable bars are guided in their reciprocatory motion by a horizontally disposed slotted or comb-like guide member 399 having suitable slots cut in it for receiving the slidable bars and guiding them and the upper ends of levers 380 to 386. The guide member 399 is secured to the underside of a plate 398 through which portions of the bars 392 to 396 extend. The slidable bars 392 to 396 have on their upper surface, as will be seen by reference to Figs. 14 and 15, a series of notches which are permutatively cut to select function bars 400, 401, 402, 403, and 404 for operation. These slidable bars 392, 393, 394, 395, and 396 thus serve a dual purpose, in that they select the function bars for operation and they also, upon receipt of the proper signals in the selector magnet assembly 319, serve to control the operation of the segment. In controlling the type segment, the slidable bars 395 and 396 control the amount of rotation of the type segment, the slidable bars 393 and 394 control the height to which the type segment is elevated, and the slidable bar 392 controls the direction from a position in which the type segment will be rotated, as will be described more in detail hereinafter.

The plate 398, which is cut out to receive the upwardly extending ends of the slidable bars 392 to 396, inclusive, is mounted upon a pair of posts 414 and 415 (Fig. 11), which are in turn supported upon the bearing blocks 311 and 310, respectively. This plate 398 has the pin 399 suspended from it by means of suitable blocks (Figs. 9 and 14) and serves to support a series of segmental stops 416, 417, and 418 which are in turn mounted upon a segmental stop supporting plate 410 (Figs. 12, 19, and 20). Extending upwardly from the plate 419 is a post, or pin, 420 which cooperates with a sleeve 421 to guide the segmental stop plates 416, 417, and 418 in their reciprocatory movement, the space provided between the segmental stop plates, posts 423 and 425 being suitably apertured to receive the springs positioned on the segmental stop supporting plate 419. The springs 422, 423, and 424 normally urge the segmental stop plates 416, 417, and 418 toward the front of the machine, slots 431 being formed in the segmental stop plates to permit the plates to slide with respect to the sleeve 421 and the post 420 when the action of the springs 422, 423, and 424 is overcome by the action of one or the other of the slidable bars 395 and 396 being set in operation by its lever upon receipt of a proper signal in the selector magnet assembly 313, and being moved toward the rear of the machine. The effect of the operation of the segmental stop plates in the page printer being explained herein is similar to the effect of the segmental stops being moved in the tape printer described hereinafter; that is, if the plate 398 is provided with a rearwardly extending projection 428 is moved to the rear of the machine by the upwardly extending projection on the slidable bar 396, the segmental stop plate 418 will be moved with it due to the formation on the segmental stop plate 416 of an upwardly extending
projection 430 (Figs. 12 and 15), which lies in the path of the segmental stop plate 416. If, on the other hand, the slideable bar 395 is selected for operation and is moved toward the rear of the machine, it will strike the projection 429 on the segmental stop plate 417 to push the segmental stop plate 417 to the rear of the machine. As the segmental stop plate 417 moves toward the rear of the machine it will carry the common segmental stop plate 418 with it due to the engagement of the plate 417 with the projection 430. From the foregoing, it is believed to be apparent that if either or both of the plates 416 or 417 is moved toward the rear of the machine they will carry the plate 418 with them.

By reference to Fig. 12 it will be apparent that the plate 416 has a relatively narrow arcuate cut-out which will limit the rotation of the type segment in either direction depending upon which direction the type segment is urged to rotate, but if the segmental stop plates 416, 417, and 418 are not moved from their position as shown in Fig. 12, the amount of rotation imparted to the type segment will be one character space from central or normal position; whereas, if the segmental stop plate 416 is moved toward the rear of the machine and carries with it the common plate 418, then the shoulders on the plate 417 will control the amount of rotation of the type segment in either direction and will limit the movement thereof to two character spaces. If, on the other hand, the segmental stop plate 417 is moved toward the rear of the machine carrying with it the plate 418, the shoulders formed on the plate 416 will limit the movement of the type segment, and if both the segmental stop plates 416 and 417 are moved to the rear carrying with them the segmental stop plates 418, the type segment may rotate until a stem or downwardly extending projection 631 thereon, to be described more in detail hereinafter, abuts the edges of the cut-out portion of all of the segmental stop plates. In this manner, the control of the type segment in the amount of its rotation is effected through the setting of the slideable bars 396 and 395.

As pointed out hereinafter, the slideable bars 393 and 394 control the height to which the type segment may be elevated and these slideable bars are provided with downwardly extending projections, the downwardly extending projection 394a on the slideable bar 394 being somewhat longer than the projection 393a on the bar 393, as is clearly shown in Fig. 14. Suspended from the underside of the plate 399, Fig. 9, is a post 435 on which there are pivoted three bell crank levers 436, 437, and 438 suitably guided in a slotted plate 439 also suspended from the underside of the plate 399. The bell cranks 436, 437, and 438 are normally urged to rotate in a clockwise direction (Fig. 13) about the post 435 by contractile springs 440 being spaced apart by suitable spacers and being held on the post in any suitable manner. The bell crank 438 (Figs. 9 and 13) is adapted to be actuated by an arm of either of the bell cranks 436 or 437 due to the provision on the bell crank 438 of an upwardly extending projection 441 which lies in the path of the arms of the bell cranks 436 and 437. It being understood that the bell crank levers pivot in a horizontal plane about shaft 435 and the projection 441 extends in a vertical plane. While the bell crank 438 is adapted for actuation by either the bell crank 436 or the bell crank 437, the bell cranks 436 and 437 are adapted to be actuated by the downwardly extending projections 393a and 394a on the slideable bars 393 and 394, respectively.

It will be noted by reference to Figs. 13 and 15 that the rearwardly extending arms of the three bell crank levers, as most clearly shown in Fig. 15, are in the path of movement of the rearwardly extending projection 455 of a shaft 445. This shaft is at a predetermined time in the cycle of operation of the apparatus urged upwardly by mechanisms to be described hereinafter, and will move upwardly until the shoulder 446 thereon strikes one of the bell cranks. Further one of the projections of each bell crank being normally in the path of the shoulder 445. Since the shaft 446 carries at its upper end a type segment 447 having four horizontal rows of type formed thereon, it will be apparent that if the shaft 446, in being moved upwardly, has its shoulder engage the bell crank 438, one level of type will be stopped adjacent a printing hammer 448; whereas, if the shaft 435 moves upwardly until the shoulder 445 strikes the bell crank 437, a second row of type will be brought into alignment with the printing hammer, and if the shaft moves upwardly until the shoulder 445 strikes the bell crank 436 a third row of type on the type segment 447 will be moved into alignment with the printing hammer 448. In like manner, if the three bell cranks 436, 437, and 438 are rocked out of engagement of the shoulder 445, the shaft 446 will move upwardly until a second shoulder 456 thereon abuts a nut 457 surrounding the shaft 446. In this manner any one of four sections, or circumferential rows, of type on the type segment 447 may be elevated into association with the printing hammer 445 depending upon the code impulses received in the selector magnet assembly 313 and the consequent actuation or non-actuation of the slideable bars 393 and 394.

Selector bar 392 controls the direction in which the type segment 441 will be brought to a position as determined by the setting of the segmental stops 416, 417 and 418. The direction of rotation of the type segment is determined by the slideable bar 392 effecting a shifting of a doublesided pawl 452 (Fig. 16) into association with either a rack 453, or a rack 454. In the normal position of the bar 392, that is, in its unactuated position, the pawl 452 will engage the rack 454 as most clearly seen in Fig. 18 where the latch engaging portion 455 of the pawl 452 is in position to engage a shoulder 456 on the rack 454. Extending upwardly from the pawl 452 is a pin 457 by means of which the pawl may be shifted from the position shown in Fig. 18 where the portion 455 thereof will engage the shoulder 456 to a position where a portion 458 of the head of the pawl may engage a shoulder 459 formed on the rack 453. The racks 453 and 454 are slideable between a pair of guide members 460 and 461 being spaced apart due to the engagement of the teeth thereof with a gear 462 formed integrally with a sleeve 463 which is rotatable with the racks 453 and 454. As before, the shaft being slidably keyed to the sleeve 463 so that the shaft may be reciprocated vertically with respect to the sleeve but will rotate with it. Upper and lower guide plates 464 and 465 are fixed to the guide members 460 and 461 for holding the racks 453 and 454 in place between the guide members 460 and 461. The entire assembly of guide members 460 and 461 and guide plates 464 and 465 are mounted on four posts 466 which extend upwardly from the plate 399, suitable spacers being provided for spacing the guide mem-
bers 468 and 461 intermediate the plate 399 and a ribbon supporting plate 467, which the posts 468 also support. The pin 451, fixed to the pawl 452, is adapted to be actuated by a lever 466 through a contractile spring 469. In the normal position of the apparatus as shown in Fig. 18 the lever 468 is abutting an upper bent over portion 470 of the rack 454 and a lower bent over portion 471 of the rack 453, to hold the two racks 453 and 454 in the position as shown in Fig. 17 as the rack 453 will leave the type segment oscillating mechanism in the position as shown in Fig. 18 where the portion 455 thereof is in alignment with the shoulder 459 on the rack 454 and the receipt of a spacing signal since it does not result in actuation of the slidable bar 392 which will leave the type segment oscillating mechanism in the position as shown in Fig. 18 where the pawl will actuate the rack 454 to oscillate the type segment in a clockwise direction.

**Type segment operating assembly**

The mechanisms described hereinbefore, that is, the driving assembly, selector magnet assembly, and operation selecting assembly, all cooperate to set various parts of the apparatus to determine the character to be printed when the type segment is moved to its selected position and when the printing hammer operates. The mechanisms for operating the type segment will now be described. In order to start the apparatus in operation it is necessary to release the friction clutches described hereinbefore and permit the driving of the cam sleeve 325 which is normally blocked from operation by a projection on the left arm (Fig. 11) of the cam lever 384 which is in the path of a projection on the start cam 321 and when in this position serves to restrain the sleeve 325 from rotating with the shaft 206. The right arm of the lever 394 which is of U-shaped configuration as will be apparent by reference to Fig. 11, extends upwardly in association with the selecting plate 362 and when the selecting plate 362 is in its normal position, that is, in position where the selector magnet 304 is energized, the normal line condition to a selector magnet being a marking position, the left end of Fig. 15 of the plate 362 will be in the path of movement of the lever 384. The receipt by the selector magnet 304 of a spacing or open line signal will result in the spring 365 rocking the armature 351 and the plate 362 counterclockwise, thereby to move the left end of the plate 362 out of the path of the lever 384. The spring 365 associated with the lever 394 will thereupon rock the lever 384 clockwise to move the arm shown in dot and dash lines in Fig. 15 out of the path of the projection also shown in dot and dash lines in Fig. 15 and permit the cam 327 and the sleeve to which it is fixed to rotate in a direction indicated by the arrow (Fig. 15). Thus the receipt of a spacing signal on the normally energized line to the electromagnet 304 will result in the initiation of a cycle of operation of the cam sleeve 325.

The right-hand cam 336 (Fig. 11) on the cam sleeve 325 controls a U-shaped lever 336 which has its left arm in association with the cam 335 and its right arm in the path of the pawl 392 mounted on the pawl supporting plate 344. Toward the completion of the cycle of rotation of the cam sleeve 325, the cam 335 becomes effective to move the lever 392 out of the path of the pawl 352, thereby to permit the pawl supporting plate and the sleeve 344 to be rotated by the ratchet wheel 359. The cams on the sleeve 344 serve to actuate the functional mechanisms of the apparatus and also serve to elevate the type segment and to supply power for rotating the type segment.

Cooperating with the eccentric 355 on the sleeve 344 is a pitman 366 to the other end of which there is connected a lever arm 466 (Figs. 13, 15 and 16). The lever arm 466 forms a part of a
The rocker assembly comprised of a sleeve 487, the lever 468 and a ball 491. The sleeve 487 is rotated and supported by a rod 488 suspended from the under side of the plate 399 by posts 499 and 490. The lever 468 and lever arm 486 are rigidly connected to the sleeve 487, whereas the ball 491 is pivotally supported by the rod 488 which also supports the sleeve 487. Formed integrally with the ball 491 is a rearwardly extending projection 492 on which there is an extension 493, as most clearly shown in Fig. 13. The extension 493 extends into the notch formed by the shoulder 450 and a cooperating shoulder 454 formed on the shaft 448. The ball 491 has a downwardly extending arm 465 (Fig. 15) to which there is attached a contractile spring 496 for normally urging the ball 491 to rock about the shaft 458 in a clockwise direction. Fixed in the ball 491 is an adjustable abutment screw 497 which engages a horizontally disposed arm of the lever 468, whereby the ball 491 tends to move with the lever 468, sleeve 487, and lever 466 unless the ball 491 is interrupted in its travel for example, by the stopping of the type segment supporting shaft 446 at some point below its uppermost position and thereby prevented from actuating with the operating selecting assembly. Also as pointed out in the description of the operating selecting assembly, the upper end of the lever 468 is interconnected by the spring 469 to the pin 457.

It is believed to be apparent for the foregoing that as the eccentric 355 imparts oscillatory movement to its pitman 465, the eccentric rod will in turn rock the sleeve 487 about the rod 488 and in so doing will rock the lever arm 468 first in a clockwise direction and then in a counterclockwise direction to actuate the early arm 456 or the rack 464 which ever had been selected for actuation. The selected rack will move toward the front of the machine, that is, to the right (Fig. 10) as the lever 458 moves in a clockwise direction (Fig. 16) (to the right Fig. 16) thereby to impart rotational motion to the gear 462.

The apparatus just described will therefore tend to rotate the type segment in one or the other direction and will also tend to rotate the segment stops 415, 417 and 418 (Fig. 11) to limit the movement of the type segment in its rotary motion and the bell crank levers 435, 437 and 439 acting on the shoulder 445 serving as abutments for stopping the upward movement of the shaft 446 selectively.

Carriage assembly

The carriage is supported on a pair of brackets 500 and 501 (Fig. 11) mounted upon the base member 301 at opposite ends thereof and carrying a horizontal rail 502. The rail 502 supports the forward end of the carriage, a rack carrying guide bar 594 being locked on the rail 502, as most clearly seen in Figs. 9, 15, and 16, by means of a plate 505 to which there is in turn secured a paper roll carrying basket 506. The basket 506 comprises a pair of horizontally extending base members 507 and 508 and an irregularly shaped end plate 509 and 510 (Figs. 9, 11, and 16) on which a roll of paper 511 may rest, as shown most clearly in Fig. 11. The roll of paper 511 rests on the rounded edges of the end plates 509 and 510 and is held in position therein by irregularly shaped end brackets 512 and 513 which are supported in spaced relation to the end plates 509 and 510 by posts 514 and 515 there being three of the posts 514 and three of the posts 515 provided as shown in Figs. 9, 11, and 12. The brackets 512 and 513 also serve to hold the roll of paper 511 on the end plates 509 and 510 but also serve to support the paper feeding mechanism and will be described in detail hereinafter.

Fixed to the base 301, as shown most clearly in Fig. 16, is the hammer bracket 520 carrying a print hammer arm 521 which is pivoted on it by means of a pivot pin 522 and serving to engage a hammer guide plate 523 which, in turn, supports a pair of rollers 524 positioned to engage the upper and lower surfaces of the base member 501 of the paper supporting basket. The rollers 524 thus guide and support the rear end of the bracket 506 in its movement across the apparatus to carry the paper web from roll 511 into printing position on line spacing operations. The paper roll carrying basket 506 is thus supported at its forward end by the rail 502 and supported at its rear end by the rollers 524 cooperating with the base member 501.

As most clearly seen in Fig. 11, the end brackets 512 and 513 support a guide roll 525 and a feed roll 526 which extend the way of the apparatus between the two end brackets and serve to feed and guide the paper from the roll 511 in its movement past the printing position. The paper is held in engagement with the feed roller 526 by a pair of rollers 521 and 528 supported by the end brackets 512 and 513 and normally urged into engagement with the feed roller 526 by springs 529 and 530 connected to the brackets 512 and 513 and to a pair of substantially T-shaped levers 531 and 532 which directly support the rollers 527 and 529, respectively, and which are pivotally mounted for rotation on the upper ends of the brackets 512 and 513. The clamping rollers 527 and 528 are fixed to gears 533 and 534, respectively, which in turn mesh with gears 535 and 536 (Figs. 9 and 11) fixed to the opposite ends of feed roller 526 whereby the clamping rollers 527 and 528 will be driven at the same speed as the feed roller 526. Also connected to the feed roller 526 are a pair of ratchets 537 and 538 adapted to be driven by line feed pawls 539 and 540, respectively. The line feed pawls 539 and 540 are adapted to operate with the ratchets 537 and 538 in the ordinary operation of the machine. However, when a new roll of paper 511 is being inserted in the apparatus it may be necessary to rotate the feed roller 526 and clamping rollers 527 and 528 independently of the pawls 539 and 540, and accordingly, the extreme right end of the shaft of feed roller 526 has a knurled finger wheel secured to it whereby it may be rotated independently of the pawl. In order to hold the feed rollers in the proper position and to insure that a measured amount of paper is fed at each step, a detent 542 (Fig. 9) is mounted upon the end bracket 512 and is urged to carry its center stop roller into the teeth of the pawl 537 and prevent accidental displacement thereof.

The line feed pawls 539 and 540 are of identical configuration and only the line feed pawl 539 will be described in detail. This pawl is bifurcated at its upper end to receive an adjustable eccentric 543 into engagement with which the left side of the bifurcated portion of the pawl is urged by a contractile spring 544 secured to the end bracket 512 and horizontally disposed arm of the pawl 539. The pawl's point of engagement with the ratchet 537 is governed by the eccentric which will permit the pawl to engage with the ratchet 537 during the downward
movement of the pawl to effect line feeding operation. At the juncture of its vertical and horizontal portions, the pawl 539 is pivoted on a horizontal lever 542 and is urged into end ball 543 which has a transverse arm extending across the carriage and held in engagement with a roller 545 upon the end of a line feed lever 547, by the action of spring 544. The remainder of the mechanism for operating the line feed mechanism described to it and to a position as described in detail in conjunction with the description of the function performing assembly 317.

**Function performing assembly**

In the operation of the apparatus, the printing function is performed each time a character is selected for printing by properly positioning the type segments, and accordingly, the mechanism for effecting the printing function will be described first. The print hammer 449 performs this function by an overtravel stroke, and the hammer 449 being guided in a slot 555 in the guide plate 523 which, as best seen in Fig. 15, is bent over the top of the roll 511 of paper in position in the paper carrying basket 506 and then bent upwardly to receive the printing hammer 449, and the arm of the hammer 449, at its rear end by means of a pin 556 riding in a slot 557 formed in the upper end of the print hammer actuating lever 521. The hammer is normally held in a retracted position; that is, away from the type segments by a spring 559 fixed to it and acts as a bumper plate 558, the printing hammer 449 of its own inertia will overtravel against the action of the spring 558 and will thrust the paper from the roll 511 toward the type segment. The print hammer actuating lever 521 as described herein has a connection on the pin 532 and is connected by means of a collar 561 (Fig. 16) to a lever arm 562, the assembly thus forming in effect a bell crank lever. The lever arm 562 has pivoted thereto a link 563, the other end of which is connected to a print cam lever 564. The print cam lever 564 is engaged with the printing cam 359 by a relatively heavy coil spring 565 and due to the configuration of the cam 358, as illustrated in the chart shown in Fig. 21, the link 563 and consequently the print hammer actuating lever 521 will be snapped sharply toward the front of the machine upon the print hammer cam lever 564 moving off of the high point of its associated cam and thus printing will be effected unless an abutment 556 on the link 563 strikes an obstruction which will prevent the link from moving forward to its ultimate position. An obstruction is desired to suppress printing, for example, when a spacing, line feeding or carriage return function is being performed.

The other function mechanisms only operate when no printing operation is to take place and these functions will be described selectively upon the selection of one of the function code bars 400, 401, 402, 403, or 404 which control in part the shifting, line feeding, spacing, carriage returning, andblanking functions, respectively. The function bars 400 to 404, inclusive, are pivotally supported on a pivot rod 567 suitably sup-ported above the plate 389 and they are urged to rock about their pivots in a clockwise direction by springs 566 individual to them, as most clearly seen in Fig. 17. Adjacent to the end of the function bars 400 to 404, inclusive, as viewed in Fig. 17, there is provided a function bar restoring lever 568 which holds the function code bars in their upper position during the shifting of the slidable bars 392 to 396, inclusive. The function bar restoring lever 568 is in the form of a bell crank pivoted to the under side of the plate 399 and having its vertically extending arm engaging the function control cam 357 (Figs. 11 and 16).

At the proper time in the cycle of operation of the apparatus as indicated by the timing chart in Fig. 21, the lever 569 will rock in a counter-clockwise direction (Fig. 16) to assume approximately the position as shown in such figure and in so doing will permit one of the function code bars 400, 401, 402, 403, or 404 to drop into aligned notches in the slidable bars 392 to 396. At the point in the cycle of operation of the apparatus where the function restoring lever 568 moves down and releases the function code bars 400, 401, 402, 403, and 404 for actuation by their springs 566, one of the bars 392 to 396 inclusive, may be permitted to move about its pivot pin in a clockwise direction if no character is selected for printing and the signal received in the selector magnet assembly 318 is a function signal. If any function is to be performed then, of course, there should be no print hammer and accordingly an obstruction should be moved into the path of the abutment 566 on the link 563 to prevent the print hammer from being thrown forward sufficiently to cause the printing of a character. Such an obstruction is provided in the form of a bent metal finger 570 formed on a printing blocking slide 571 (Fig. 16). The printing blocking slide is normally urged upwardly by a spring 512 (Fig. 16) and is slotted adjacent its upper end to receive a pin 573 which is rigidly fixed to a bent down portion of the print cam lever 564 and serves to support the print blocking slide as well as three other slides to be described in more detail hereinafter. The print blocking slide is provided with a relatively wide head portion 574 (Fig. 17) which extends across the extreme ends of the function code bars 400 to 404. The spring 572 (Fig. 17) is relatively weaker than the springs 566 so that when the slidable bars 392 to 396 are in proper position to permit one of the function code bars 400 to 404 to drop into aligned notches on the upper surfaces thereof, the spring 566 associated with the particular bar above aligned notches will move the function code bar downwardly, thereby to carry the print blocking slide to its lowermost position, where the finger 570 will be in the path of the abutment 566. If the case shift function bar 404 is the one selected for operation, it will not only move the print blocking slide 571 downwardly but will also move a spacing cut-out slide bar 575 downwardly. If the line feed function bar 403 is selected for actuation by the slidable bars 392 to 396, the line feed function bar will move the print blocking slide 511, the spacing cut-out slide 575, and a line feed slide 576 downwardly against the action of their respective springs 571 and 570.

If the spacing function bar 402 is selected for operation it will push the print blocking slide 571 downwardly. If the carriage return function bar 401 is selected for actuation it will push down a carriage return slide 579, the spacing cut-out
slide 575, and the print blocking slide 571. If the blank function bar 400 is selected for actuation by its spring will rock it; about its pivot 667 and move the spacing cut-out and print blocking slides 575 and 571, respectively, downwardly and if the case shift or blanking function bar 404 is selected for actuation the print blocking cut-out and the print blocking slides will be actuated. If the line feed function bar 403 is selected, then the print blocking slide and the spacing cut-out slide will also be actuated whereas only the print blocking slide will be actuated when the spacing function bar 462 is selected for operation. In other words, the case shifting operation, the line feeding operation, the carriage return operation, and the blanking operation necessitates the elimination of spacing and printing and these operation blocking slides are therefore actuated. The tops of the slides 571, 574, 576, and 578 are cut out in such a manner that they will be actuable only upon the selection of certain function bars.

Since in the normal operation of the machine each time a character is printed a spacing operation is performed, the line feed and spacing cam 599 has a lever associated with it which is normally used into engagement with its camming surface and this spacing lever designated 585 has an irregularly shaped link 586 (Fig. 13) pivoted to it and extending toward the rear of the machine (Fig. 16). The rear end of the link 586 is forced to receive a pin 587 whereby it is pivoted on a bell crank 588 (Fig. 13). The bell crank 588 is pivoted at 589 on a bracket 590 fixed in spaced relation to the underside of the rail 592. The free end of the bell crank 588 has pivotally mounted thereon a spacing pawl 591. Spring 592 tends to rock the pawl 591 about its pivotal connection with the bell crank 588 thereby normally to hold the operation end of the pawl 591 in the teeth of a rack 593 which is in turn suitably fixed to the rack supporting slide 594 secured to the underside of the paper carrying basket 595.

From the foregoing it is believed to be apparent that upon the receipt of a spacing signal by the selector magnet assembly 313, the slidable bars 312 will be moved to the right to permit the spacing function bar 402 to rock in a clockwise direction (Fig. 17) thereby to move the print blocking slide 571 downwardly to carry the finger 570 thereon through the path of the abutment 366 on the print actuating link 663 thus effecting spacing without printing. In a similar manner, upon the receipt of a character representing signal by the selector magnet assembly 313, the type segment will be moved to a selected position and none of the function code bars will be in alignment with notches into which they can fall in the slidable bars 312 to 315. Therefore, the spacing operation will take place in timed relation to the printing operation in a cycle of that type.

The bracket 501 supports a spring drum 594 in which a spring 595 tends to coil itself. The configuration of the left end of the spring 595 is fixed to the carriage assembly as shown at 586 and normally tends to move the carriage to the right (Fig. 17). As may be seen by reference to Fig. 13, the carriage is prevented from moving to the right by a retaining pawl 597 which is lugged into engagement with the teeth of the rack 593 by a coil spring 598. The pawl 597, as may be seen in Fig. 17, is pivotally mounted on the underside of the rail 502, and in normal operation will retain the rack 593 in any position to which it is advanced by the spacing pawl 591. After the completion of a line of typing of any desired length, the carriage may be returned to its right-hand position under the influence of the spring 595 by releasing the spacing pawl 591 and the retaining pawl 597.

Upon the receipt by the selector magnet assembly 313 of a proper code signal indicating carriage return, the slidable bars 312 to 316 will be positioned to permit the carriage return function bar 402 to fall into aligned notches in the slidable bars. When the carriage return function bar 403 is moved by its actuating spring it will move the spacing cut-out slide 575 and the print blocking slide 571 downwardly as well as the carriage return slide 574, thus to block printing and spacing and to effect a carriage return by releasing the retaining pawl 591 and the spacing pawl 597. It should be noted at this time that the link 663 carries a pin 665 which extends across in front of the print blocking slide 571, spacing cut-out slide 576, line feed slide 578, and print blocking slide 571 so that each time the link 663 is actuated, the pin 665 carried by it will engage these slides and move them to the left (Fig. 16). It should also be noted that each of the slides with the exception of the carriage return slide, has a notch formed adjacent its lower end and as seen most clearly in Fig. 16, for engagement with a square bar 607 whereby when one of the slides is moved downwardly it will be locked in position engaging the square bar 607 until the printing link 593 moves forwardly to push it to the left and disengage it from the bar 607. Of course, the carriage return slide 579 not having any notch at its lower end will not be caught by the bar 607.

The spacing cut-out slide 575 and the carriage return slide 579 (Figs. 13 and 16) have shoulders 608 and 609 formed on them for engaging latch tripping levers 610 and 611, respectively. The levers 610 and 611 are pivoted on a rod 612 which is positioned in a bracket 613 extending upwardly from the base 501. The lever 611 is an ordinary bell crank lever, the vertical arm of which extends up in back of the spacing pawl 591 (Fig. 13) so that upon actuation of the lever 610, the pawl 591 will be disengaged from the rack 593 and when the actuating mechanism for the pawl 591 is operated the pawl will be ineffective due to the fact that it is removed from the notches in the rack 593. The formation of the cam 356 is such that the printing link 593 will not carry its pin 605 into engagement with the slides 571, 573, 575, and 578 until after the spacing pawl 591 has been moved over the edge of its next tooth.

The latch tripping lever 611 also has a vertically extending arm which will actuate the spacing pawl 591 and has a second arm interconnected with the first arm by means of a web 614 and this second arm extends upwardly in a slot (Fig. 17) of the spring 595 formed on the retaining pawl 597 whereby upon carriage return operations being initiated by the receipt of a proper signal in the selector magnet assembly 313, both the pawl 591 and the pawl 597 will be moved out of the teeth of the rack 593, 579. A carriage return slide 597 is formed on the lever 611. The latch tripping lever 611 is actuated it will be locked in its actuated position to hold the pawls 591 and 597 out of engagement with the rack 593 by a carriage return latch 615 pivoted on a bracket 616.
12, 14 or 16 will be placed in alignment with the printing hammer. In other words, the vertically extending rows of the type segment are alternately made up of letter and figure characters.

As pointed out hereinbefore, the type segment is mounted on the shaft 446 and may be reciprocated vertically with respect to the lever 421 which has a gear 462 either formed on it or fixed to it. At the upper end of the sliance 421 there is fixed to it an L-shaped arm 631 (Figs. 15, 19 and 20). The vertically extending portion of the arm 631 serves as a key for keying the type segments, 447, to the sliance 421, a pair of projections 623 and 633 being provided on a depending portion 634 of the type segment 447 for engaging the sides of the arm 631 thereby to interconnect the type segment to the arm 631 and permit movement of the type segment vertically with respect to the arm 631.

By reference to Fig. 23, it will be seen that no characters are assigned to the lowermost row or level of the type segment in the first and sixteenth or left and right-hand vertical rows of type faces. This arrangement of type on the face of the type segment 447 is chosen since the case shifting is effected when the type segment is elevated to its uppermost position to bring the lower level of type faces into alignment with the printing hammer and when the type segment is shifted to its ultimate position, either to the right or to the left. Type case shifting is effected by shifting the segmental stop supporting plate 419 a distance equivalent to the distance between two adjoining rows of type faces on the type segment 447 to carry all of the segmental stops 416, 417 and 418 with the segmental stop of supporting plate 419. Extending upwardly from the plate 439 (Figs. 19 and 20) are a pair of brackets 535 and 536 on which are pivoted the pair of locking levers 637 and 638, respectively. The levers 637 and 638 are irregularly shaped arm cranks and their substantially horizontal arms are urged downwardly by springs 539. This tends to bring the free ends of the horizontal arms into the path of internal shoulders 640 and 641 formed on the segmental stop supporting plate 419. The upwardly extending ends of the levers 637 and 638 have cam faces formed on them as shown at 642 for cooperation with the projection 633 or the projection 632, respectively. Thus, when the type segment is shifted to its uppermost position and rotated to its ultimate rotational position upon the receipt of a signal in the selector magnet assembly 313 which indicates a case shifting operation, it will carry either the projection 633 or the projection 632 under the cam surface 642 on the lever 637 or the lever 636 depending upon the direction in which the type segment is rotated. In Fig. 19, the projection 633 is shown approaching the lever 637 and if the projection 633 strikes the lever 637 it will rock the lever 637 against the action of its spring 639 to move the end of the horizontal arm of the lever 637 out of the path of the shoulder 640 thereby to release the supporting plate 419 from engagement by the end of the lever 637; the type segment 447 will then be permitted to rotate to its ultimate counterclockwise position and in so doing will move the segmental stop plates 416, 417 and 418 and the segmental stop supporting plate 419 counterclockwise one character space. When the plate 419 moves one character space in its counterclockwise direction, the end of the horizontal arm of lever 638 is dropped into the path
of the shoulder 641 on the plate 419 and there-
by locks the segmental stop plates 416, 417 and
418 on the segmental stop supporting plate 419
in letters case position. Upon the receipt of
a signal representing figures case function by
the selector magnet assembly 313, the type
segment 447 will be elevated to its upper-
most position and rocked to its farthest clock-
wise position, thereby to bring the projection
632 under the lever 638 to disengage the
horizontal arm of the lever 638 from the should-
er 641 and oscillate the entire group of seg-
mental stop plates and the supporting plate 419
in a clockwise direction to position the horizontal
arm of the lever 637 to drop back of the should-
er 640. Stop pins 700 and 701 are mounted
on plate 399 for engagement with plate 419 to
limit the oscillatory movement of the type seg-
ment in either direction.

Ribbon feed assembly

Positioned for movement between the web of
paper being drawn from the roll 511 by the feed
roll 526, and the type segment 447 is a strip or
tape of pigment transferring material such as
ordinary typewriter ribbon shown in dot and
dash line in Fig. 10 and designated 645. The
ribbon 645 may be transferred from a spool 646
to a spool 647 by a shiftable pawl 648 which may
be shifted into engagement with either a ratchet
649 or a ratchet 650 by a shifting lever 651 of
T-shaped configuration which carries pins 652
for engagement by the usual rivet placed adja-
cent the end of a typewriter ribbon. The pawl
648 is urged into engagement with whichever
ratchet it may be associated with by an over-
centering coil spring 659 which has its opposite
end secured to a retaining pawl lever 653 as is
usual in typewriter ribbon feeding mechanisms
of this general type. The pawl 648 is adapted to
be actuated by an upwardly extending projection
654 formed on the lever 656 (Fig. 15). When a
sidable plate 655 is engaged by the projection
654 and moved to the right (Fig. 10) it will carry
the pawl 648 with it and the spring 659 will
return the pawl to the position shown thereby
to impart rotation to the spools 646 or 647 which
are interconnected with the ratchets 649 and
650 in the usual manner. The lever 651 may be
held in either of its adjusted positions by a re-
taining pawl 656 engaging one end of the lever
651 in either of two adjusted positions as will be
apparent by reference to Fig. 10.

The operation of the page printing embed-
ment of the present invention is quite similar to
the operation of the tape printing embodiment
therein in that the selection of the type on the
type segment for printing is performed by selec-
tively operating the sidable bars 382 to 386 to
bias the type segment for movement in one di-
rection or the other and to set stops which will
limit the amount of its rotation. The height to
which the type segment is elevated is also con-
trolled by two sidable bars which will inter-
pose stops in the path of the type segment, as
shown, to limit its movement upwardly under
the impulse of its actuating lever. Furthermore,
the page printing apparatus is similar to the tape
printing apparatus in that the selection of func-
tions for performance is effected by setting the
70 code bars 400 to 404, inclusive, by the position-
ning of the sidable bars 382 to 386. The selec-
tion of functions for operations as pointed out
above, in detail hereinbefore, will result in the
setting of the selected function mechanism for
operation and in some cases the blocking of
other of the function mechanisms.

If the line feed slide 576 is selected for oper-
atation by its associated function bar, the print
blocking slide and the spacing cut-out slide 571
and 575 will also be actuated and will prevent
the printing operation and the spacing opera-
tions from taking place during line feed.

Similarly, if the carriage return slide 519 is se-
lected for operation by its associated function
code bar, printing will be blocked by the oper-
atation of the print blocking slide 571, the spacing
will be blocked by the operation of the spacing
cut-out slide 575, and the carriage return will be
effected by moving the paws 591 and 597 out of
the teeth of the rack 593 to let the spring 595
draw the carriage back to its extreme right-hand
position. It should also be noted as described
more in detail hereinbefore, that upon the selec-
tion of the function bar 404, for operation, the
figures and letters case shift will take place under
control of the type segment in its uppermost
point of elevation and its farthest point of rota-
tion, and that when such a function is to be per-
formed the carriage 510 will move forward but the
print blocking slide 571 will both be operated.

Although only two embodiments of the inven-
tion have been disclosed hereinbefore, it will be
understood that the invention is subject to many
other modifications and adaptations, not disclosed
herein, without departing from the scope thereof
which is to be limited only by the appended
claims.

What is claimed is:

1. In a printing telegraph apparatus, a type
segment and controlling means therefor includ-
ing means for urging said type segment from
a normal to a predetermined position, selectively
operable means for blocking movement of said
type segment at other predetermined positions
intermediate its normal position and said previ-
ously named predetermined position, selectively
operable means for urging said type segment to
rotate in either of two directions, and selectively
operable means for blocking the rotative move-
ment of said type segment at predetermined posi-
tions.

2. In a printing telegraph apparatus, a type
segment, selectively actuable bars for control-
ling the oscillatory and axial movement of said
type segment, function bars associated with said
selectively actuable bars for selection thereby,
and function mechanisms operable under control
of said function bars.

3. In a printing telegraph apparatus, a type
segment, a carriage for supporting a web of paper
for movement adjacent said type segment, selec-
tor bars responsive to received signals for con-
trolling the operation of said type segment, func-
tion bars associated with said selector bars for
selection thereby, and means controlled by said
function bars for performing printing functions,
space functions, and carriage return functions.

4. In a printing telegraph apparatus, a type
segment, a carriage for supporting paper for
movement adjacent said type segment, selectively
actuable bars responsive to received signals for
controlling the position of said type segment,
means controlled by said selectively actuable
bars including selection bars for selection by said
selectively actuable bars, means controlled by
said function bars for performing printing, space-
ing, and carriage return functions, and means
for blocking the operation of the printing and
spacing functions upon operation of said carriage return function.
5. In a printing telegraph apparatus, a signal responsive means, selectively settable members controlled by said signal responsive means, a type segment rotatable in two directions and variably positionable under control of said selectively settable members, and means responsive to certain of the selectively settable members for controlling the positioning of the type segment including means responsive to one impulse of the received permutation code signal for determining the direction of rotation of the type segment.
10. In a printing telegraph apparatus, a cam shaft, signal responsive cam levers for actuation by said cam shaft, a series of slidable bars operated by said cam levers, a type segment controlled by said slidable bars, function bars selectable by said slidable bars, and function operating mechanism operable in response to the setting of said function bars.
15. In a printing telegraph apparatus, a cam shaft, a series of cam levers associated with said cam shaft, signal responsive means for controlling the effect of said cam levers, a series of slidable bars associated with said cam levers and adapted for selective operation thereby in response to the operation of said signal responsive means, an oscillatory and axially movable type segment operable under control of said slidable bars, and a printing hammer timed to cooperate with the type segment upon the setting of the type segment to a selected position to effect a printing operation.
20. In a printing telegraph apparatus, a type segment oscillatable in either of two directions, a printing hammer cooperating with said type segment, selectively settable levers to bias the type segment for rotation in one direction or the other, and means responsive to permutation code signals for controlling said biasing lever.
25. In a printing telegraph apparatus, a type segment oscillatable in either of two directions in response to an impulse of a permutation code, a set of stop members settable for controlling the amount of oscillation of the type segment, and means for performing a case shifting operation including means to displace the whole set of stop members in response to a case shift indicating signal.
30. In a printing telegraph apparatus, a type segment oscillatable in either of two directions, a signal responsive means for determining the direction of rotation of the type segment, a print hammer associated with the type segment, a series of stop members positionable in response to a received signal for limiting movement of the type segment, and means actuable by the print hammer for bodily shifting the group of stop members to effect case shifting.
35. In a printing telegraph apparatus, a type segment shiftable selectively to four levels and rotatable in either of two opposite directions, means responsive to received signals to stop the rotation of the type segment in any one of four positions in either direction of rotation, means responsive to a received signal for selecting the direction of rotation of the type segment, and means responsive to received signals for determining the level to which the segment will be shifted.
40. In a printing telegraph apparatus, a type carrying member rotatable in two directions, selectively actutable bars, and means responsive to one impulse of a received permutation code signal for selectively actuating one of said bars to
control the direction of rotation and by other impulses on the received permutation code signal for selectively actuating others of said bars to control the amount of movement of said member.

20. In a printing telegraph apparatus, a type carrying member rotatable in two directions, and means responsive to the receipt in said apparatus of one impulse of a permutation code for controlling the direction of rotation of said member.

21. In a printing telegraph apparatus, a type carrying member rotatable in two directions and operable to prevent either of two areas in said planes, means for determining the plane to which the member may be shifted, means for determining the area to which said member will oscillate, and means for determining the extent of oscillation of said member.

22. In a printing telegraph selector, a plurality of cams, a follower associated with each cam and urged to engage the surface thereof, said cams having low portions into which the followers are urged followed by raised portions for actuating the followers, invarably, a slidable actuator associated with each follower, and a signal responsive means common to all of the followers for blocking their movement toward the low portions of their associated cams.

23. In a printing telegraph apparatus, a selector including a plurality of cams, a follower associated with and urged into engagement with each of said cams, said cams having low portions for receiving the followers followed by raised portions for actuating the followers invarably, a slidable actuator associated with each follower for actuation thereby, and a signal responsive means operable selectively to block the followers from engagement with the low portions of their cams to prevent operation of the actuators by the followers.

24. In a printing telegraph apparatus, the combination with a selector including a plurality of cams, a follower associated with and urged into engagement with each of said cams, said cams having low portions for receiving the followers followed by raised portions for actuating the followers invarably, a slidable actuator associated with each follower for actuation thereby, and a signal responsive means operable selectively to block the followers from engagement with the low portions of their cams to prevent operation of the actuators by the followers.

25. In a printing telegraph apparatus, a combination with a selector comprising a plurality of selectable elements, a cam shaft having a cam associated to each selecteble element, a cam operable member individual to each cam, and signal responsive means common to said cam operable members for controlling the effective cooperation of the cam operable members with the selectable elements, of character representing means, and means actuated by power communicated from said cams through the selectable elements for operating said character representing means.

26. In a printing telegraph apparatus, a type carrier positionable in accordance with a signal code combination, means to move said carrier in a predetermined direction in response to the character of a portion of a signal code combination, means to limit selectively the amount of movement of said carrier in its predetermined direction of movement in response to the character of another portion of a signal code combination, and means to position said carrier at a predetermined elevation in response to the character of another portion of a signal code combination.

27. In a printing telegraph apparatus, a type carrier movable from a normal position in either of two directions, a plurality of pairs of stops for said carrier for enabling varying degrees of movement thereof in either direction, and means operable in response to signal code combinations to select a predetermined pair of said stops to enable said predetermined amount of movement of said type carrier.

28. In a printing telegraph apparatus, a type segment, means to move said type segment in a predetermined direction, means to elevate said type segment to a predetermined position, means to variably limit the movement of said type segment in either of its predetermined directions, and case shift means operable to shift said type segment to a new case position when said segment is moved to an extreme elevated position and either of its extreme functional positions.

29. In a printing telegraph apparatus, a series of selectable elements, means for setting said selectable elements in predetermined positions, a plurality of function mechanisms, a set of function control bars for said mechanisms selectable by said elements, and means operable upon the selection of a predetermined function control bar for restraining the operation of predetermined function mechanisms.

30. In a printing telegraph apparatus, a series of selectable elements, means for setting said selectable elements in predetermined positions, a plurality of function mechanisms, a set of function control bars for said mechanisms selectable by said elements, and a set of slidable members selectively operated by said function bars for restraining the operation of predetermined function mechanisms upon the selection of a predetermined function control bar by said selectable elements.

31. In a printing telegraph apparatus, a type carrying member movable in either of two predetermined directions from a normal position and operable to a predetermined elevational position, a series of selectable elements, means operable upon the selection of certain of said elements to determine the direction of movement of said type member, means operable upon the selection of others of said elements to determine the elevational position of said type member, and means to move said type segment to a position determined by said composite selections.

32. In a printing telegraph apparatus, a type carrying member movable in either of two predetermined directions from a normal position and movable to a predetermined elevational position, a series of selectable elements, means operable upon the selection of certain of said elements to determine the direction of movement of said type member, means operable upon the selection of others of said elements to determine the elevational position of said type member, and means to move said type segment to a position determined by said composite selections.

33. In a printing telegraph apparatus, a type carrying member movable in either of two predetermined directions from a normal position and movable to a predetermined elevational position, a series of slidable bars, means operable to se-
elect certain of said slidable bars to determine the direction of movement of said type member, means operable to select others of said slidable bars to determine the elevational position of said type member, means operable to select others of said slidable bars to variably limit the movement of said type segment in its predetermined direction of movement, and means to move said type segment to a position determined by said selections.

In a printing telegraph apparatus, a type segment rotatable in two directions, selectively actuable bars, means for setting said bars one of which determines the direction of rotation of said segment and the others of which determine the selective position of said segment, function bars cooperating directly with said selectively actuable bars and selected directly by and through the setting of said selectively actuable bars, and function mechanisms controlled by the selection and operation of said function bars.

In a telegraph printer having an oscillatable and shiftable type segment, means responsive to the character of one impulse of a permutation code for controlling the direction of rotation of the type segment, means responsive to the character of other impulses of said code for controlling the amount of movement of the segment, and means responsive to the character of still other impulses of said code for controlling the degree of shifting of the segment.

36. In a printing telegraph selector, a plurality of spring-urged members, a lever individual to each member, a cam shaft with a cam thereon for each lever, signal responsive means operative with said levers to determine their operative relation with said members and condition said members for operation, means for operating said levers to operate the conditioned members against the action of their spring, a type wheel controlled by said members, and function mechanism also controlled by said members.

37. In a printing telegraph selector, a plurality of notched selector members, spring means for urging said members to their normal or unoperative position, a lever individual to each member, a cam shaft with a cam thereon for each lever and for operating each lever successively, signal responsive means operative with said levers for determining their operation by said cams and thus their operative relation with said members, means for operating said levers and through such levers said members which assume operative relation with said levers against the action of said spring means, function bars cooperating with the notched portion of said members, function mechanism controlled by said bars, and means also operated by said members for determining the character to be printed.

WALTER J. ZENNER.