Jan. 18, 1944. W. J. ZENNER 2,339,313

PRINTING TELEGRAPH APPARATUS

Filed June 9, 1941 14 Sheets-Sheet 1

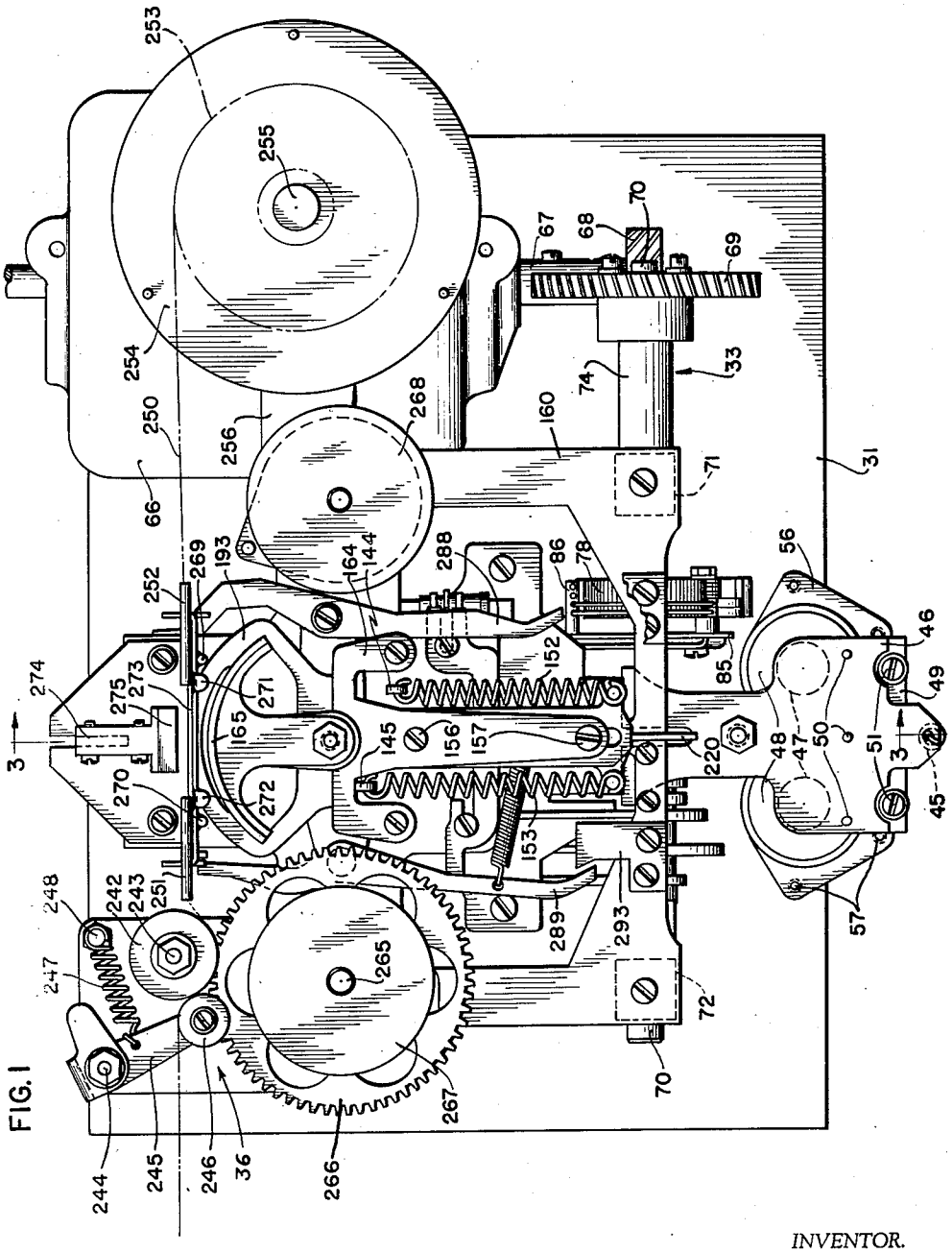

FIG. 1

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Jan. 18, 1944. W. J. ZENNER 2,339,313

PRINTING TELEGRAPH APPARATUS

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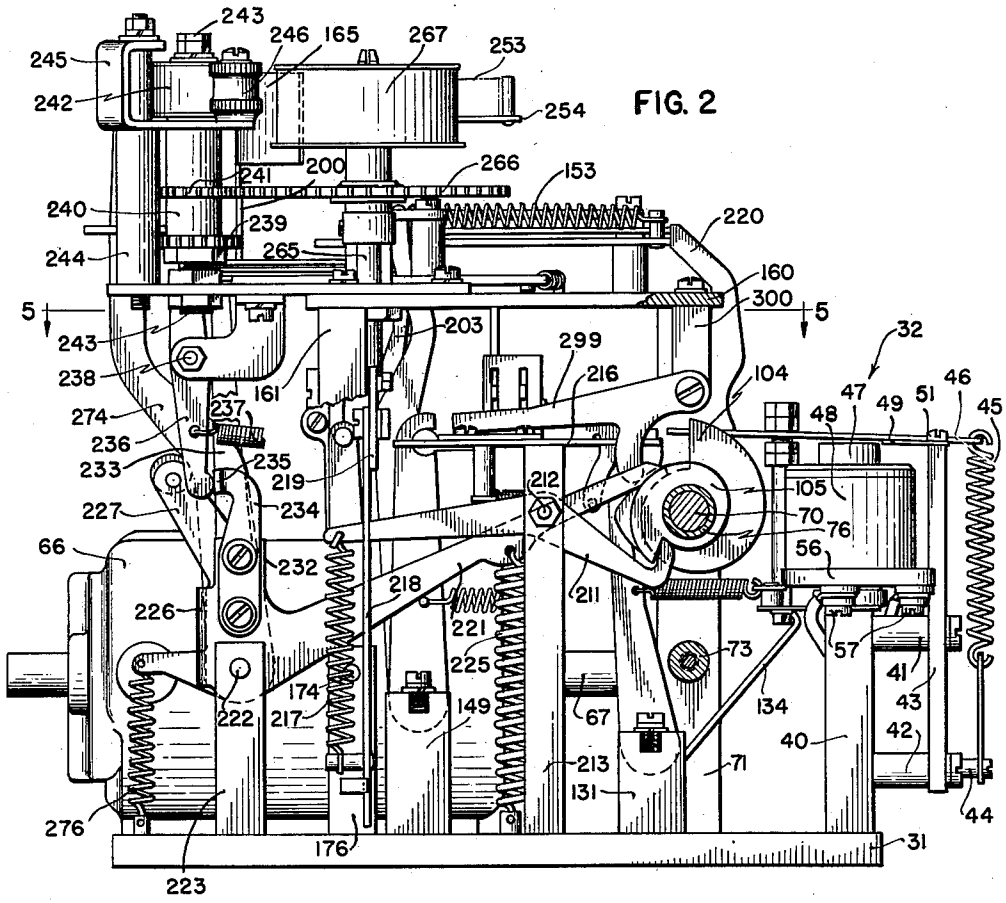

FIG. 2

FIG. 7

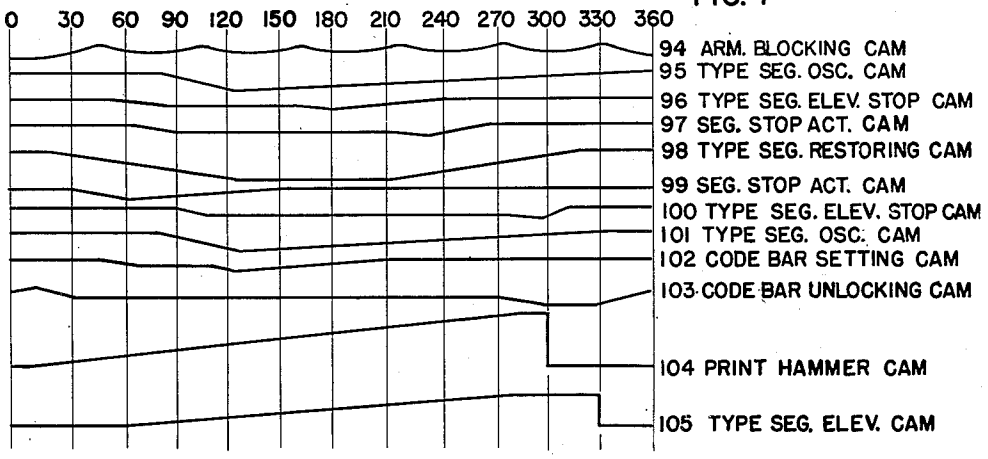

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FIG. 3

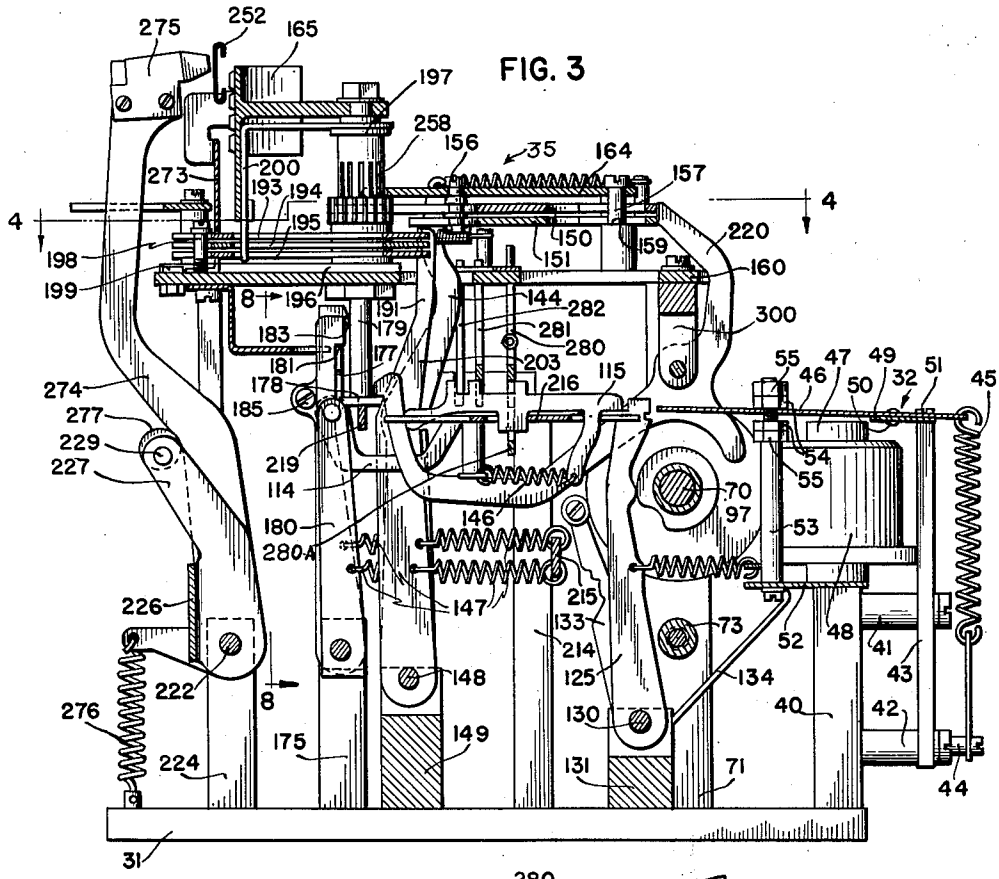

FIG. 4

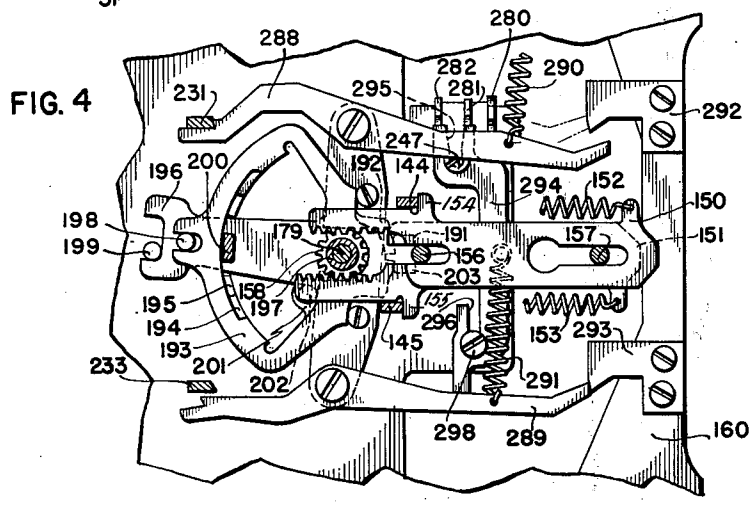

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FIG. 5

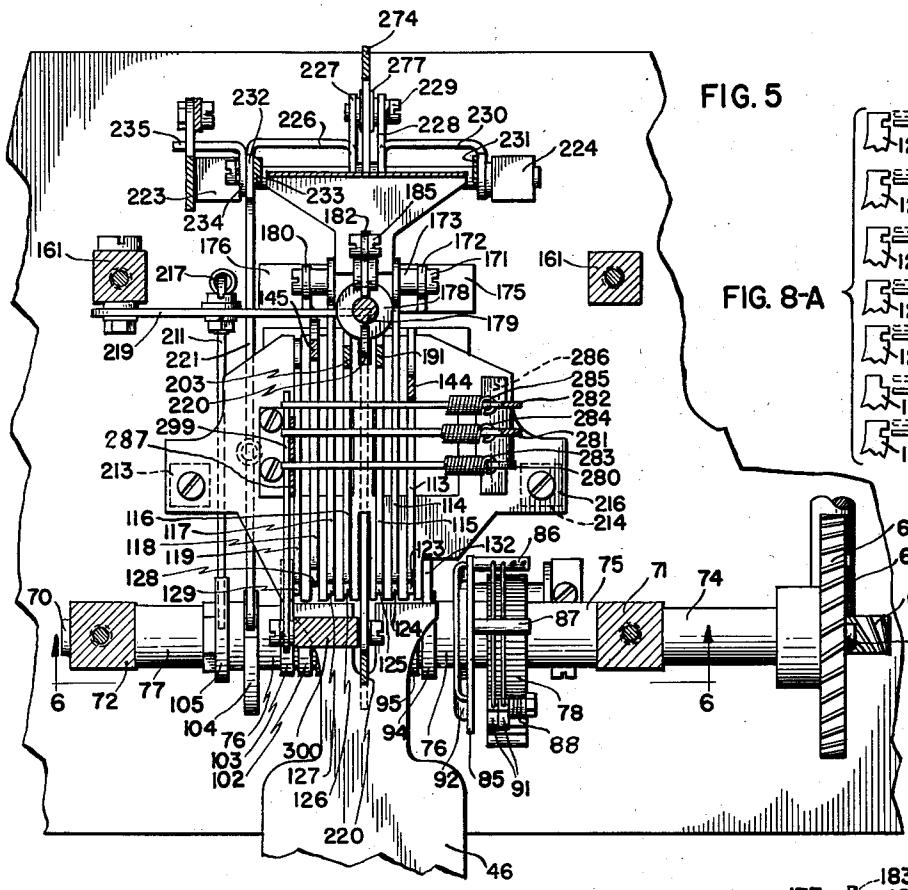


FIG. 8-A

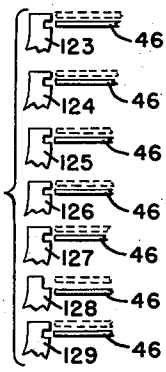


FIG. 6

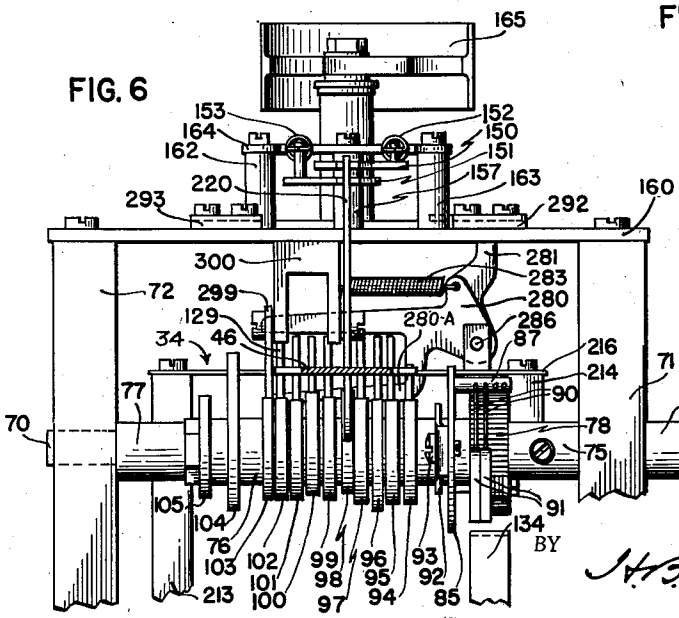
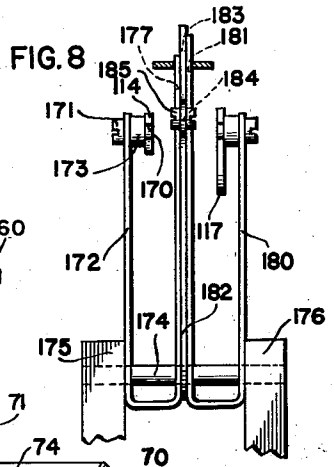


FIG. 8



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Jan. 18, 1944. W. J. ZENNER 2,339,313

PRINTING TELEGRAPH APPARATUS

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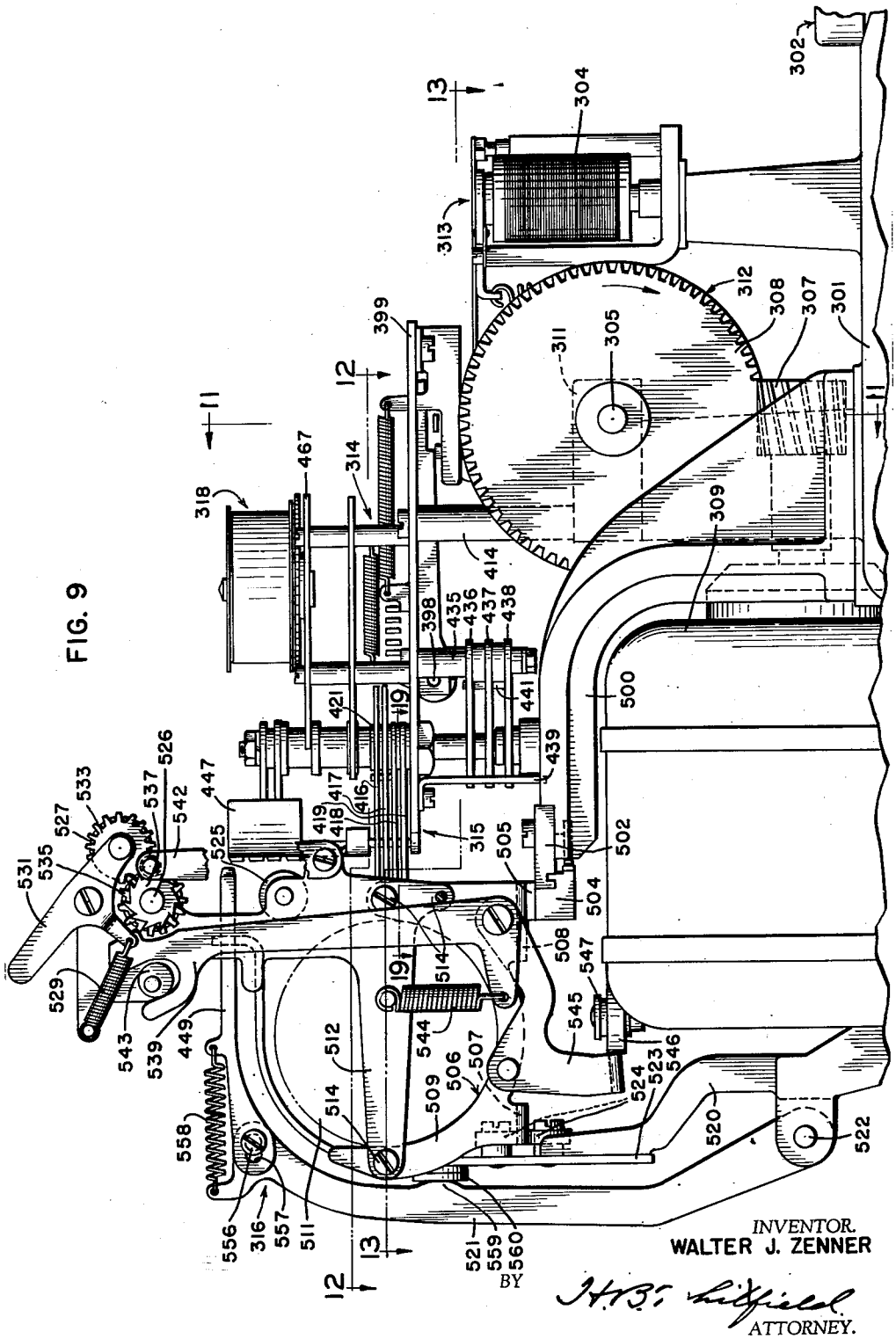

FIG. 9

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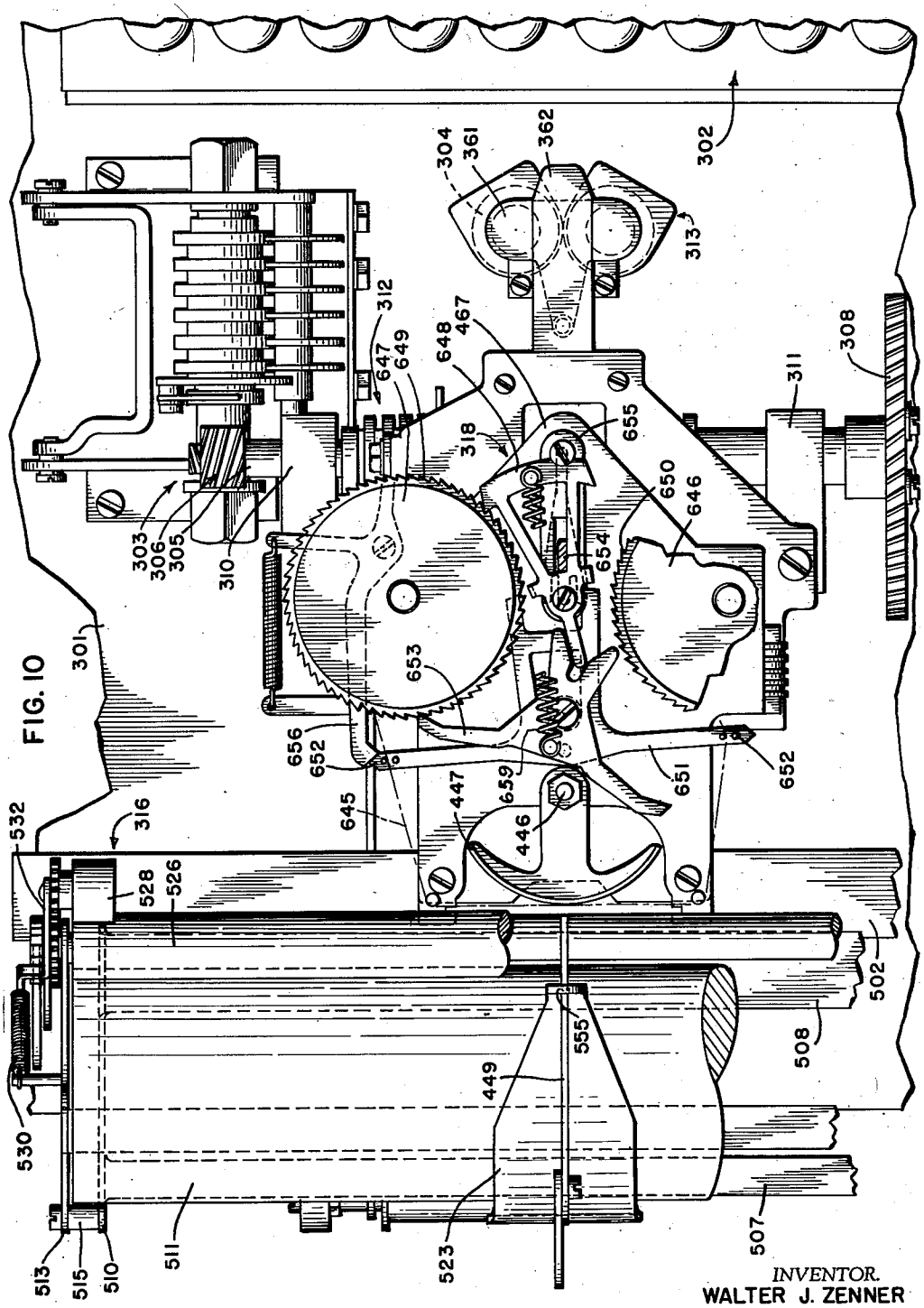

FIG. 10

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PRINTING TELEGRAPH APPARATUS

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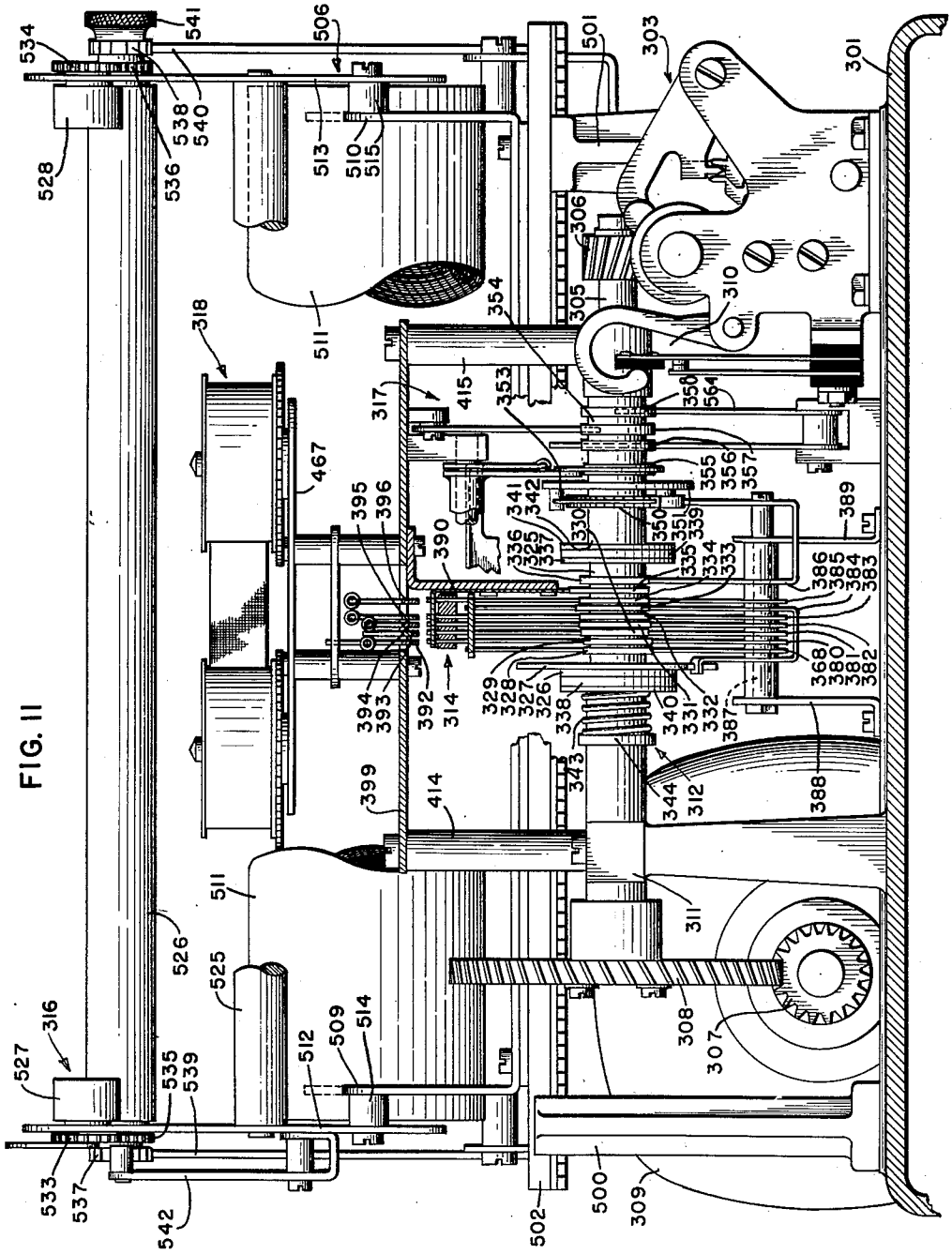

FIG. 11

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Filed June 9, 1941 14 Sheets-Sheet 8

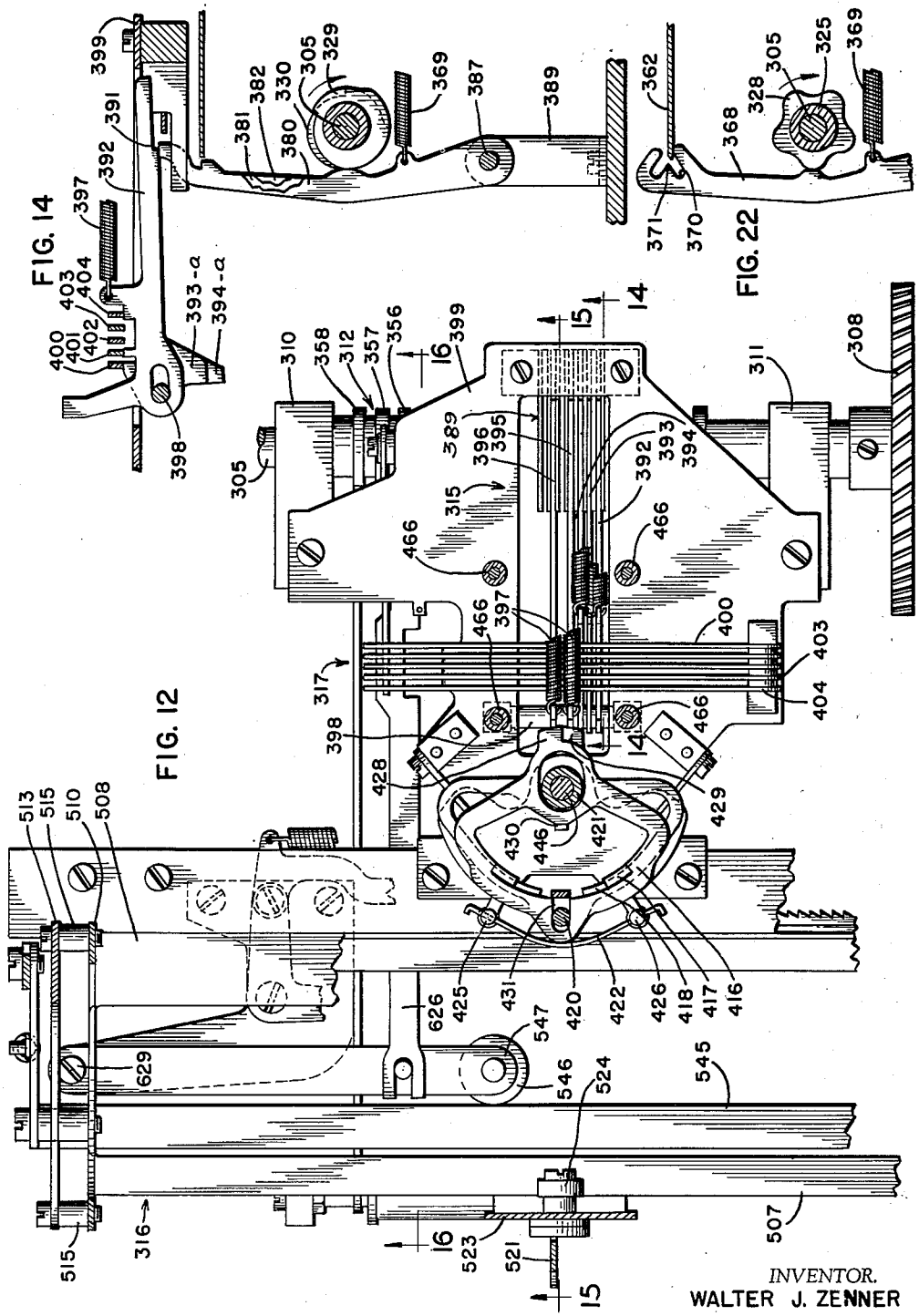

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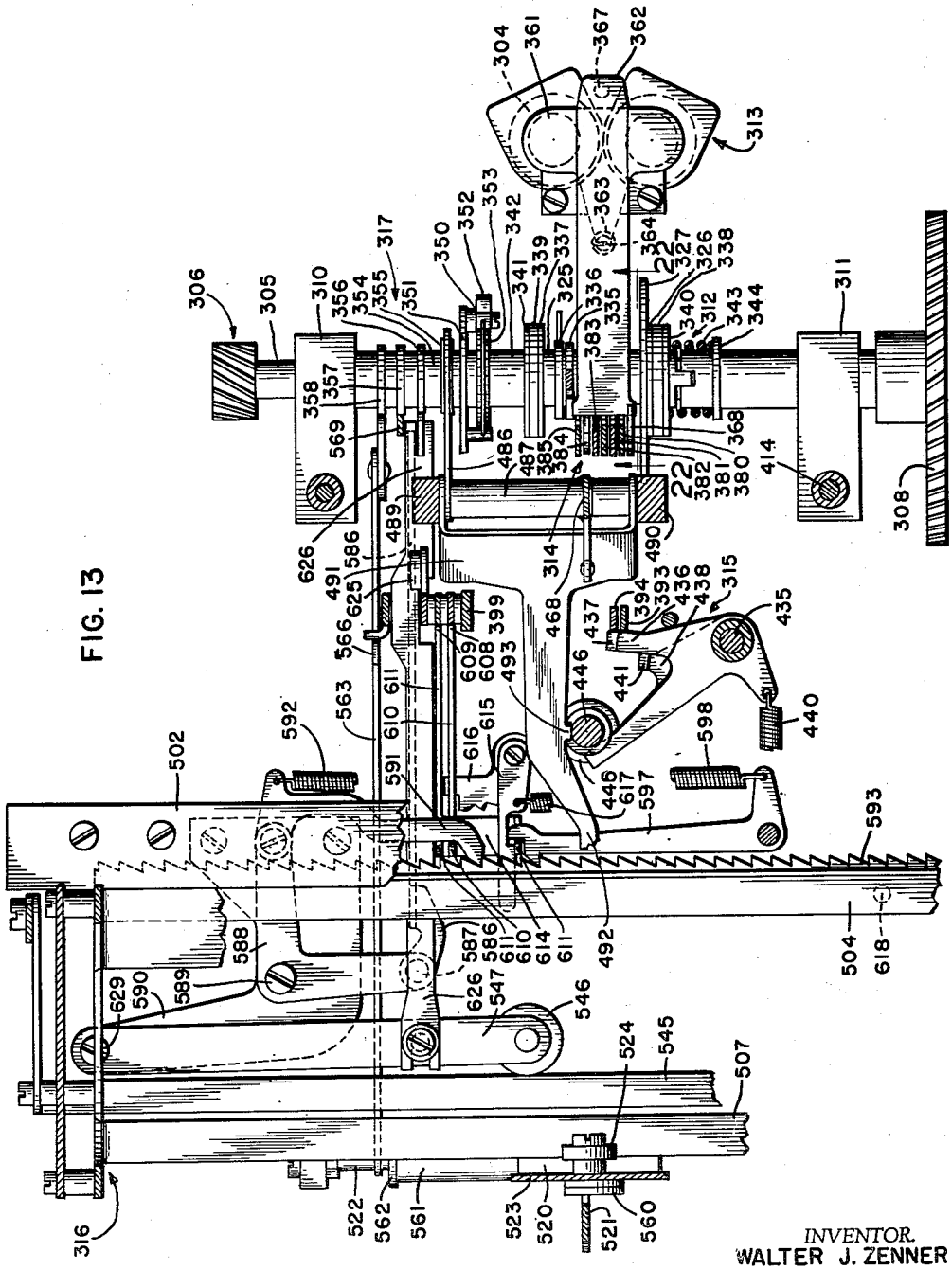
FIG. 13



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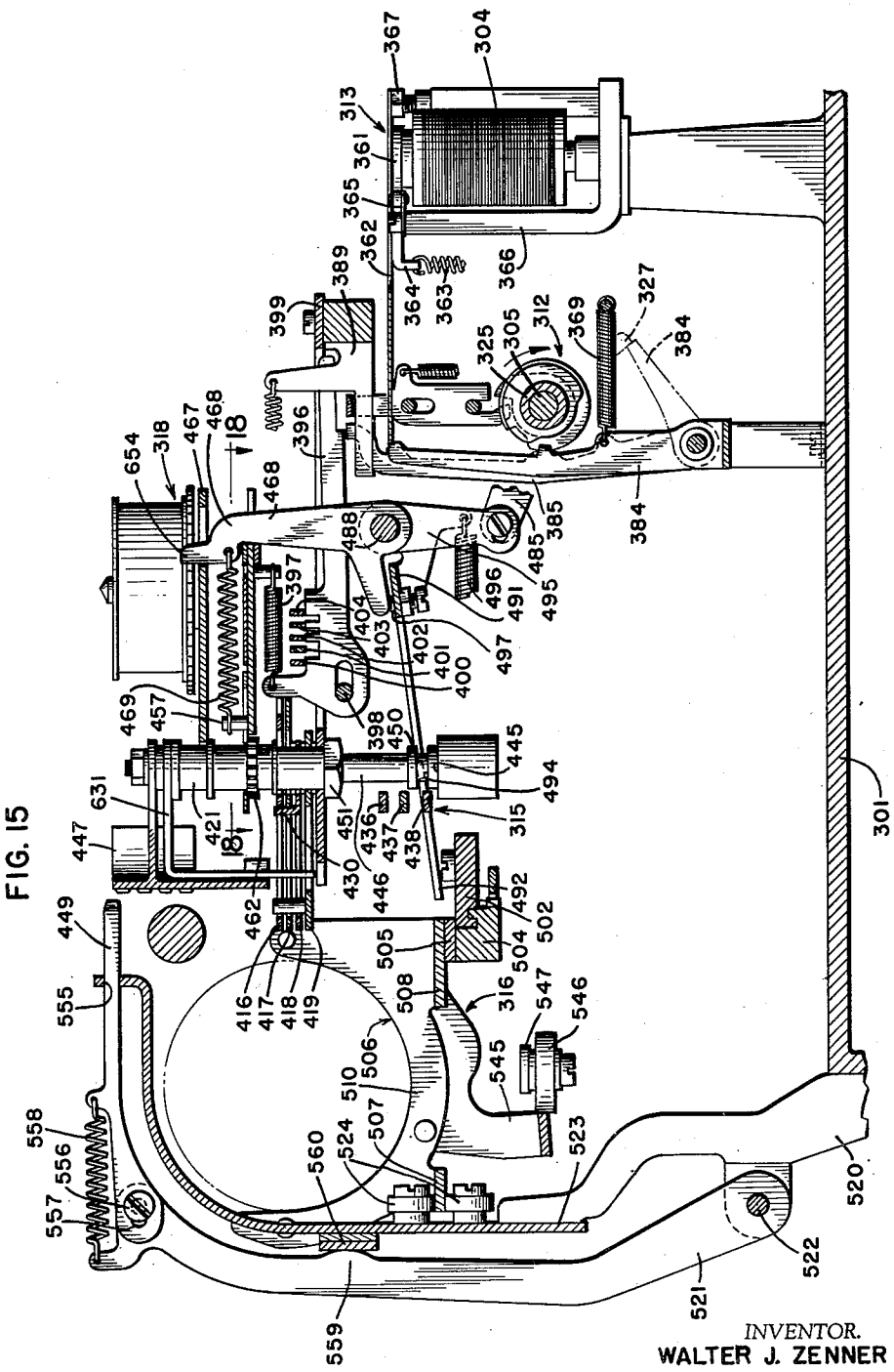

FIG. 15

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FIG. 16

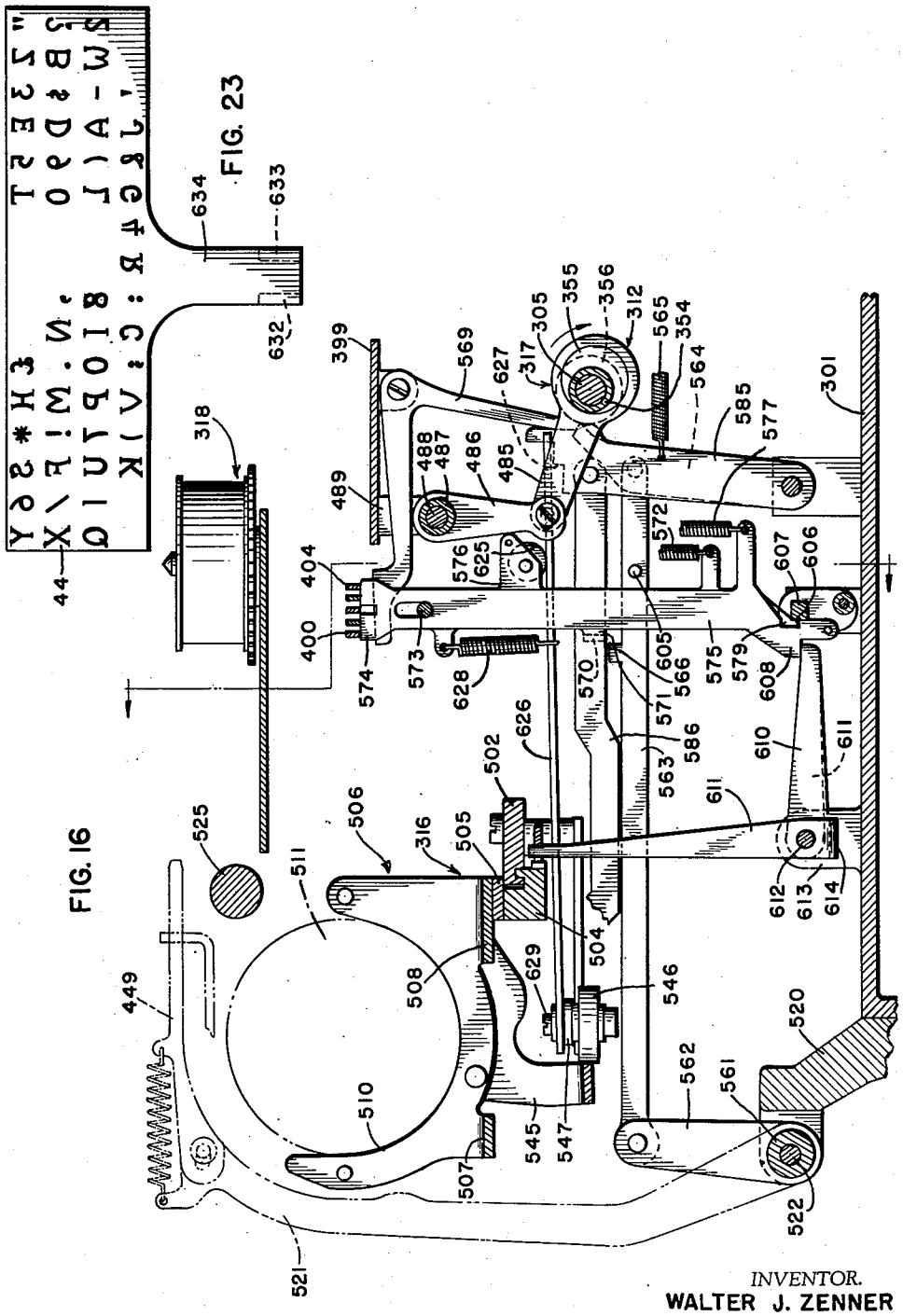

FIG. 23

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Jan. 18, 1944. W. J. ZENNER 2,339,313

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FIG. 17

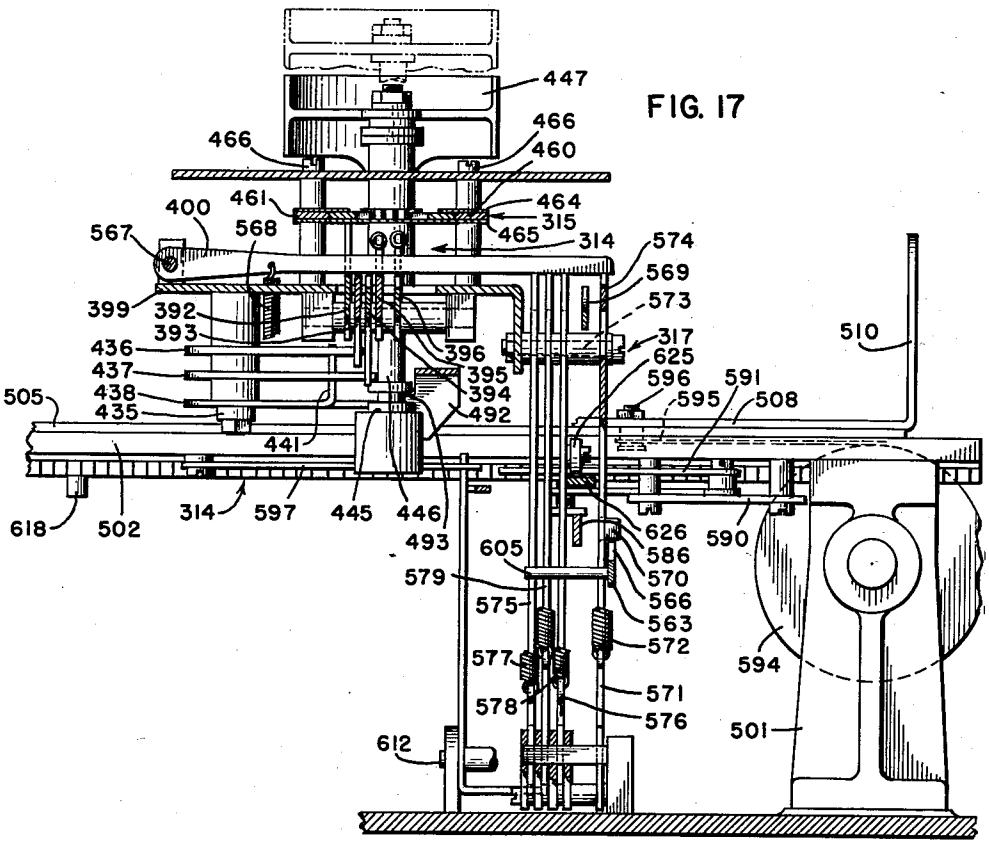
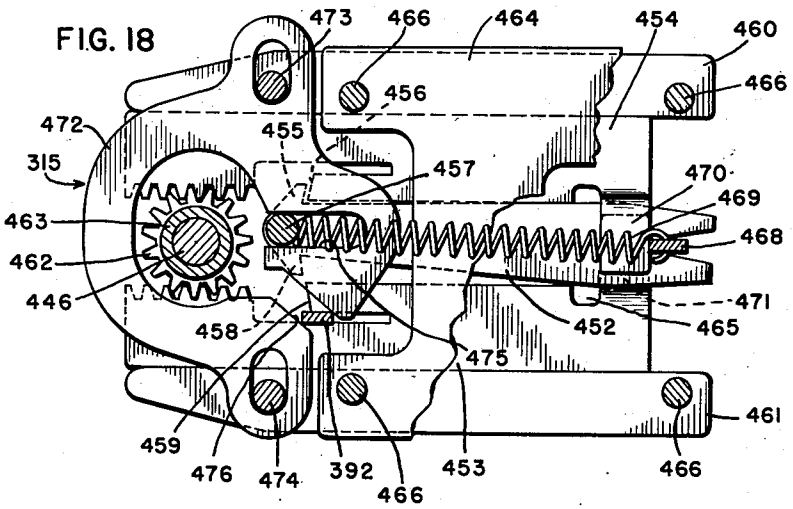


FIG. 18



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Jan. 18, 1944. W. J. ZENNER 2,339,313

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FIG. 19

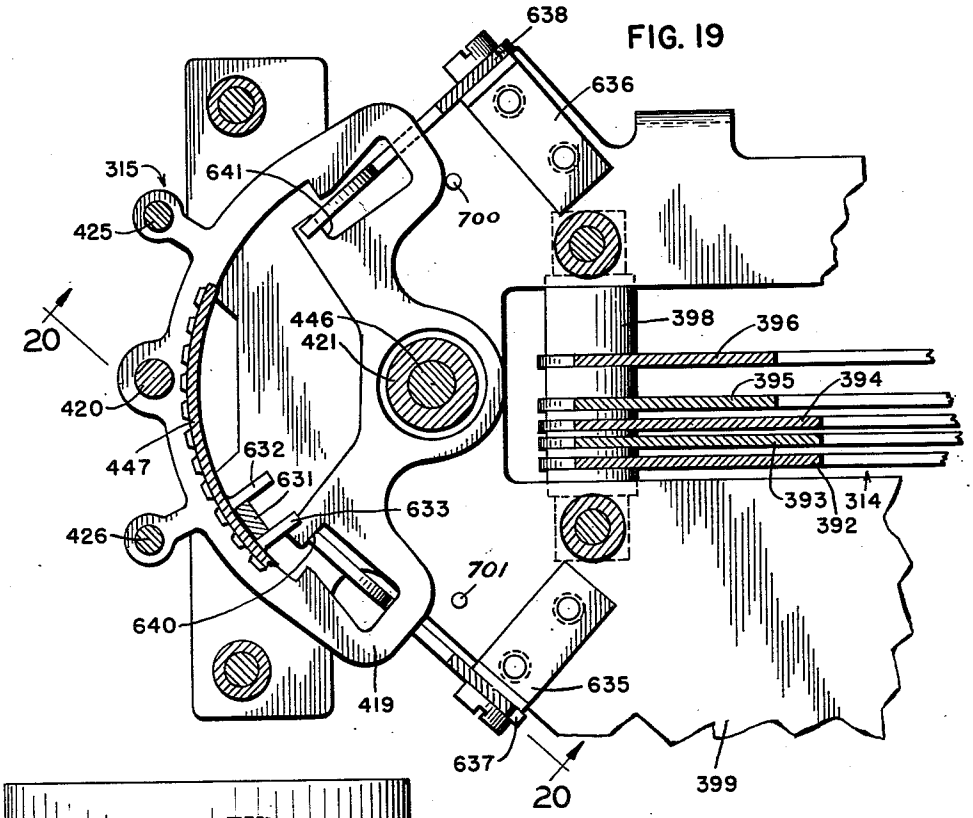
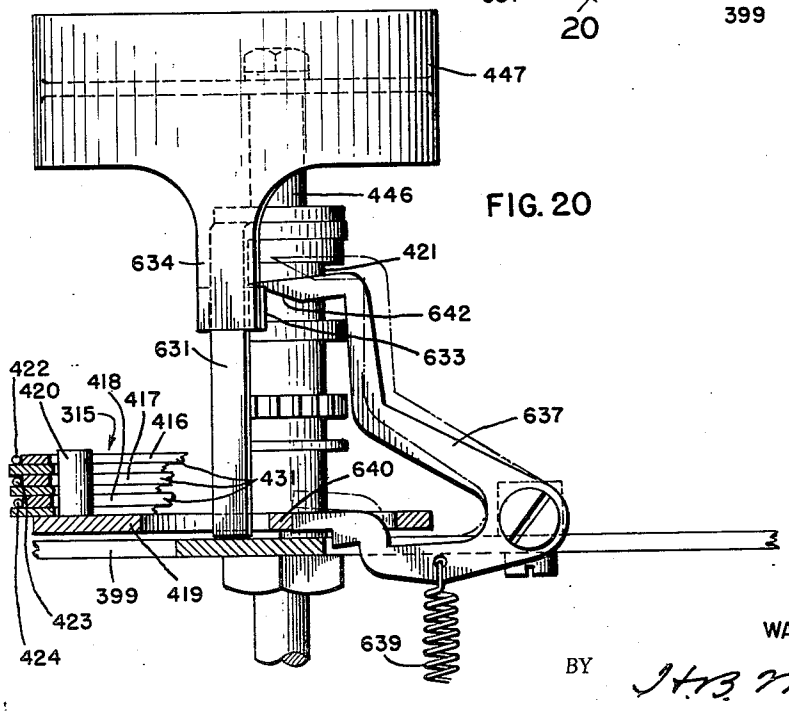


FIG. 20



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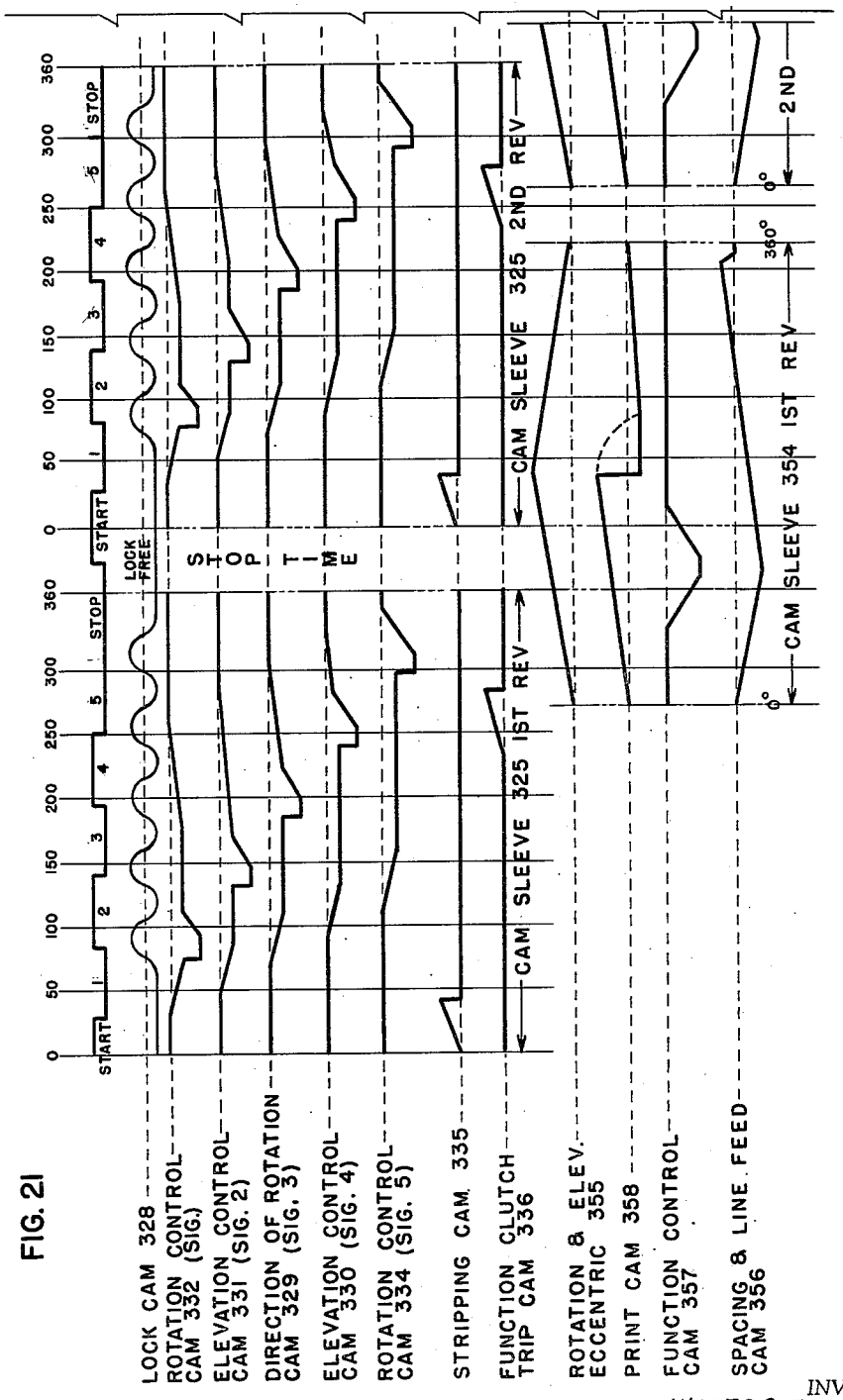

FIG. 21

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Patented Jan. 18, 1944

2,339,313

UNITED STATES PATENT OFFICE

2,339,313

PRINTING TELEGRAPH APPARATUS

Walter J. Zenner, Des Plaines, Ill., assignor to Teletype Corporation, Chicago, Ill., a corporation of Delaware

Application June 9, 1941, Serial No. 397,193

37 Claims. (Cl. 178—34)

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 hereinbefore 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 unshifing 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 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, trips 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 elevational 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. 8—A is a fragmentary detail exploded view of the cam levers which are selectively actuated to perform various operations in response to received signals;

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;

Fig. 22 is a fragmentary vertical sectional view, taken on the line 22—22 of Fig. 13 in the direction of the arrows, showing details of the part of the mechanism which initiates operation of the apparatus; and

Fig. 23 is a developed view of the face of the type segment.

Tape printer

Referring now to the drawings wherein like reference characters designate the same parts throughout the several views particular reference being had to Fig. 1 at this time, the numeral 31 designates a base plate upon which the apparatus is suitably mounted. In this embodiment of this invention the apparatus is shown as a receiving instrument and no transmitting apparatus has been shown in connection with it; it will be understood, however, that suitable transmitting apparatus to which the apparatus of the present invention may respond may be and usually is supplied with an apparatus for receiving messages such as that to be described herein. A suitable transmitting and controlling apparatus is shown in Patent No. 1,595,472 to H. L. Krum, dated August 10, 1926. The apparatus of the present invention is made up of a number of sub-assemblies suitably mounted on the base 31 and which will be designated hereinafter as the selector magnet assembly 32, Fig. 3, the driving assembly 33, the operation selecting assembly 34, the type segment operating assembly 35 and tape feeding assembly 36.

Selector assembly

The selector assembly has been designated with the reference numeral 32 (Fig. 2) and comprises a main supporting block 40 from which extend horizontally a pair of armature mounting bracket spacers 41 and 42 which in turn carry an armature pivot plate 43. Extending from the armature pivot plate is a pin 44 to which one end of a spring 45 is connected. The spring 45 has its opposite end connected to an armature 46 and normally tends to rock the armature 46 in a clockwise direction, Fig. 2, away from a core member 47 of a selector magnet having a pair of coils 48 and being responsive to transmitted signals which may be transmitted by any suitable transmitting apparatus either at a distant station or mounted in association with the apparatus constituting the present invention. The magnet assembly supporting block 40 has mounted upon it the coil and cores which form the magnet, and the armature 46 is interconnected with the armature supporting plate 43 by a leaf spring 49 riveted to the armature 46 as shown at 50 (Fig. 3) and secured to the supporting plate 43 by means of screws 51. A secondary plate 52 is mounted on the top of the supporting block 40 and supports an upwardly extending post 53 on the upper end of which are threaded armature adjusting nuts and lock nuts 54 and 55, respectively.

As is usual in magnet constructions of this general type, the magnet assembly 32 includes an insulator 56 (Fig. 2) carrying the usual terminal screws 57 to which the terminal of the wires of the magnet windings may be connected for connection of the incoming line to the magnet.

Driving assembly

The driving assembly which is designated generally by the reference numeral 33 (Fig. 1) comprises a motor 66 mounted on the base 31 and connected to any suitable source of power. The 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 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 ratchet 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 66.

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 90 are fixed to the spring supporting posts 86 and normally tend to move pawls 91 individual 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 actuating cam 97, the type segment restoring cam 98, the segmental stop actuating cam 99, 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 actuating cam 97, type segment restoring cam 98, segment stop actuating cam 99, type segment elevating stop 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

slidable 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 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 46 toward the magnet core 47 except at 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 134 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 cams 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 49 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 levers, 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 cams come into association with the low point on the cams, 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 due 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 levers 123 to 129, 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 restored to their respective positions on the shoulders of the cam levers by the arm 280—A of the function determining bar 280, which is caused to be raised by the lever 299 (Figs. 5 and 6).

By reference to the timing chart shown in Fig. 7, it will be apparent that three of the cam levers are adapted to engage the low portion of their respective cams simultaneously; that is, the cam levers 123 and 128 associated with the type segment oscillating cams 95 and 101 and the cam lever 129 associated with the code bar setting 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 part of its cam is in association with it. Therefore, upon receipt of a marking pulse, when the low part of cam 95 is in alignment with 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 behind it and will be actuated by it when the high portion of the cam 101 engages the lever 128. It should be noted that the code bar seting cam 102 is operable at the same intervals that the type oscillating cams are operable and that the upper end of the cam lever 129 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 selectable position. 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, inlcusive. The springs 146 are not strong enough to move the levers with which the slidable bars are associated since 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 31. The upper extending ends of the type segment oscillating levers 144 and 145 are interconnected (Fig. 4) with a pair of slidable racks 150

and 151, respectively, by springs 152 and 153, respectively, the springs 152 and 153 normally tending to hold shoulders 154 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 rack 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 posts 70 and 71 and a pair of rear posts 161 (Fig. 5). The plate 160 also carries on its upepr 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 156 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 95 or 101, respectively, the slidable 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 high 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 rack 150 or 151 to move toward the rear 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 more in 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 elevator 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 thereon for printing. As most clearly seen 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-shaped lever 172 has a shoulder 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 slidably keyed in the gear 158 and thus will rotate with it but may be moved axially of it. Thus when 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 177 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 177.

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 181 formed on it which limits 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 lever 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 177, 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 of 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 selecting 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 upward movement 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 177. 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 179 will engage the shoulder 181; whereas if both 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, thereby to carry the type segment 165 to its highest position and bring the bottom row of type thereon into alignment with the print hammer which will be described more in detail hereinafter. It should be noted that the type segment 165 in each cycle moves down below printing position to render 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 slidable 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 marking signal. The receipt of a marking impulse at this time in the cycle of the apparatus will permit the lever 125 to move forwardly of the apparatus and will thereby permit the slidable bar 115 to drop in back of the lever 125 so that, when the high portion of the cam 97 engages the cam lever 125, the cam lever will push the slidable bar 115 to the rear of the machine. The rear end of the slidable bar 115 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 similar 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 slidable and about which the gear 158 is rotatable. The stop supporting 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 stop supporting plate 196 is shiftable by mechanisms to be described hereinafter to rock it about the guide sleeve 197, a pin 199 being fixed in the upper frame plate 160 and engaging one or the other edges of a U-shaped notch formed or cut in the rear end of the segmental stop plate 196 to set the stop supporting plate 196 in either of its adjusted positions. The segmental stop members 193, 194 and 195 are of substantially the same configuration as far as their profiles are concerned but it will be noted that each of them has shoulders formed on it, which as most clearly shown in Fig. 4, serve as abutments against any of which the depending portion of arm 200, fixed to gear 158, will engage when the segmental stop members are shifted. The racks 150 and 151, depending upon the direction in which they are moved, will determine which side of the segmental stop members will be effective to stop the depending portion of arm 200. The bottom segmental stop member 195 has a projection 201 formed on it which extends inwardly toward the center or open portion of the stop member and this projection 201 has a pin 202 fixed to it so that when either one of the other segmental stop members 193 or 194 are shifted toward the rear of the apparatus, segmental stop member 195 will be carried with them. The segmental stop member 194 is adapted to be actuated by a lever 203 similar to the lever 191 and the lever 203 may be shifted toward the rear of the apparatus by the slidable bar 116 which is similar to the slidable bar 115.

From the foregoing it is believed to be apparent that the segmental stop members may be shifted in a manner similar to the shifting of the levers which block the movements of the type segment upwardly, the segmental stop members to be moved out of the path of the depending portion of arm 200 being determined by the position of the armature 49 at the time when the associated lever is engaging the low point of the cam associated with it. Specifically, the distance which the springs 152 and 153 will be permitted to move the type segment in its oscillating movement will be determined by the position of the segmental stop members which are positioned selectively in accordance with the received code signals. If the segmental stop member 193 is shifted toward the rear of the machine, the segmental stop member 194 will have its shoulders in the path of the depending portion of arm 200 and the shoulders formed on the inner surface of the segmental stop 195 will be moved out of the path of the depending portion of arm 200 due to movement of the segmental stop member 195 under the action of the pin 202 and the movement of the segmental stop member 193.

In other words, the segmental stop member 193 will carry the segmental stop member 195 with it. Similarly, if the segmental stop 194 is moved toward the rear of the machine, then the depending portion of arm 200 will be permitted to move until it engages the shoulder on the segmental stop 193 due to the fact that the segmental stop member 195 will be moved with the segmental member 194. If both the segmental stop members 193 and 194 are moved toward the rear of the machine they will carry the segmental stop member 195 with them and the depending portion of arm 200 will be able to move in either direction, depending upon which of the springs 152 or 153 is under tension, until the depending portion of arm 200 strikes the edge of all the segmental stop members, all the shoulders having been moved out of the path of the depending portion of arm 200. If a signal is received, which does not result in either the segmental stop members 194 or 193 being moved toward the rear of the apparatus, then the shoulders on the segmental stop members 195 will limit the amount of movement of the type segments in both directions and the type segment will be moved by the spring 152 or 153 that is under tension against the shoulders on the segmental stop member 195.

As described hereinbefore, the particular area of the type segment to be presented in printing position is chosen by limiting the amount of movement of the type segment in its oscillation and in its elevation. This selection of the area of the type segment 165 to be presented in printing position is determined by the code impulses received by the selecting magnet mechanism and the position of the armature 46 at the time when the particular cams on the cam shaft 70 are in predetermined position as explained hereinbefore. Movements of the type segment in oscillating are also selectively determined in accordance with the received signal as described hereinbefore. How-

ever, the elevating mechanism for raising the type segment to its position as determined by the type segment stopping mechanism described hereinbefore, operates in the same manner in each cycle and will be described hereinafter.

Type segment operating assembly

The type segment operating assembly in addition to the mechanism described hereinbefore for supplying power to oscillate the type segment to its various positions as determined by the segmental stop members and the biasing spring, which determine the direction of rotation of the type segment, include a means invariably tending to move 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 **147** 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 slidably 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 slidable 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 end 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 upwardly with the rear end of the cam lever. The 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 **76** and the movement of the segment will be interrupted by the mechanism described hereinbefore 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 movement of the shaft and this 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 gooseneck configuration, adapted to engage the shoulder **178** 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 **76**. The forward end of the lever **220** extends upwardly and will engage the forward end of the rack **150** or **151**, whichever one of them has been moved toward 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 whereat 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 to 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 bail-like structure, as is most clearly shown in Fig. 5 at **226**. Extending upwardly from the right-hand portion (Fig. 5) of the bail-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 bail-like structure **230**, having an upwardly extending arm **231** fixed to it. The bail-like structure **230** is also rotatable about the rod **222**, and being interconnected to the lever **227** by the nut and bolt assembly, the bail-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 **238** 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 **239** connected to a sleeve **240** on which there is also 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 **160**.

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 slower speed than the speed of movement of the feed roller **242**, thereby to draw an inking ribbon from a supply spool **268** 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 275 into engagement with a roller 277 which is mounted on the nut and bolt assembly 229.

From the foregoing, 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 274 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 250 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 oscillation or elevation to carry 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 hereinbefore 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 counted and therefore it becomes necessary to provide some means for printing more than the thirty-two characters which the apparatus as hereinbefore 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 segmental 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 slidable 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 slidable 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 three function determining bars 280, 281, and 282. The function determining bars 280, 281, and 282 extend laterally across the top of the slidable bars and are normally urged downwardly into engagement with them by coil springs 283, 284, and 285, the function determining bars being 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, unshift, or space and unshift functions.

Pivoted on the stop supporting plate 196 and normally urged to rotate in a counterclockwise direction as viewed in Fig. 4 are a pair of levers 288 and 289 having springs 290 and 291, respectively, fixed to them for urging them to rotate in a counterclockwise direction. The lever 280 is adapted for actuation by its spring and is permitted, upon the proper selective positioning of the code bars or slidable bars 114, 115, 116, 117, and 119 to rock the lever 288 against the action of its spring 290, thereby to move the right end, Fig. 4, of the lever 288 out of the path of a stop member 292 and to move the rear end of the lever into the path of the arm 231 extending upwardly from the bail-like structure 230 which is adapted for actuation by the print hammer cam, as described hereinbefore. When the lever 280 moves the lever 288 to the position shown in Fig. 4 where the rear end of the lever 288, the left end in Fig. 4, will be in the path of the arm 231, the print hammer assembly on moving to printing position will cause the arm 231 to engage the lever 288, thereby to rock the stop supporting plate 196 in a clockwise direction, inasmuch as both levers 288 and 289 are mounted on the common supporting plate 196, which is of a T-shaped configuration. When the plate 196 rocks in a clockwise direction, the lever 289 will be drawn by its spring 291 into engagement with the left edge (Fig. 4) of a stop member 293. When this occurs, the energy of the spring 225 will be expended in moving the stop supporting plate 196 and the parts thereon, and no printing will occur since the print hammer will not overtravel against the tension of spring 276. The shifting of the stop supporting plate about its pivot, however, will bring a different row of type on the type segment into alignment with the printing hammer so that upon the receipt of the next signal corresponding to a character to be printed, the upper case characters will be printed; that is, the numerals and the punctuation marks.

Upon receipt of either a space signal or the unshift signal, the levers 281 or 282, respectively, will be permitted to be moved by their associated springs 285 or 286, and when so moved will bring the upper end of one of them into engagement with the points of a bifurcated plate 294 which is mounted upon the upper frame plate 160 and is slidable with respect thereto, slots 296 and 295 being formed in the plate 294 to receive pins 298 and 297, respectively, extending upwardly from the upper frame plate 160. One end of the plate 294 engages the lever 289 and when the plate 294 is moved by either of the levers 281 or 282, it will move the lever 289 out of engagement with the stop member 293 and into the path of the lever 233. When the lever 233 (Fig. 5) is snapped back under the action of the spring at 225, and through cooperating members 221, 226 and 227 the stop supporting plate 196 will be rocked in a counterclockwise direction to effect an unshift operation and, of course, printing will be omitted when this operation is effective. Upon release of the lever 289 from the stop member 293 and the movement of the segmental stop assembly bodily about its pivot, the spring 290 will be permitted to draw the lever 282 up into the position shown in dotted lines in Fig. 4 where its movement will be blocked by the stop member 292.

It should be noted that the function determining bar 280 is bifurcated and has its lower arm, as is most clearly shown in Figs. 3, 5, and 6, extending beneath all of the slidable bars 113 to 119, inclusive, and that the left end of each of the levers 280, 281, and 283 extend out through

the guide plate 287 and over the top of a lever 299, associated with cam 103. 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 hereinbefore 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 spacing 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 pawls 91 to permit them to engage the driving clutch member 78. As soon as one of the pawls 91 engages the driving clutch member 78 the pawls will be driven by the clutch 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 129 to fall back toward the cam shaft 70 and if at the interval when the low portion of the respective cams is in alignment with its cam lever, a marking impulse is sent to the selector assembly 32 the cam levers will be permitted to fall back 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 113 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 selector magnet assembly 32 will determine, first, the direction of rotation of the type segment, secondly, the height to which the type segment will be elevated, and thirdly, the amount of rotation which the springs 152 or 153 may impart to the type segment. As the sleeve 76 rotates, the type segment 165 will be set in the selected position, the print hammer lever will actuate the print hammer 275 to cause either the printing of a selected character or to cause the spacing of tape without any printing, or lastly, to cause a shifting or unshifting of the case of the characters and the type segment by shifting the entire group of segmental stops as described hereinbefore.

In this manner the printing of characters may be performed by the apparatus upon receipt of proper signals to shift the type segment to the proper case and then upon receipt of a character representing signal to shift it to the proper selected position for printing. The afore-described apparatus is adapted to print on a tape moved step-by-step past a printing position. This apparatus is adaptable for use in a page printing telegraph printer and the second embodiment, which may be the preferred embodiment of the invention, relates to a page printing apparatus embodying the basic features of the tape printer described hereinbefore.

Page printer

The page printing embodiment of the present invention is mounted upon a base 301 of suitable irregular configuration to support all of the various parts of the apparatus. On the front or forward end, the right end in Figs. 9 and 10, of the base 301, there is provided a suitable keyboard 302, whereby impulses may be transmitted to a cam distributor designated generally by the number 303 (Fig. 11). The keyboard, through suitable permutatively settable contacts and slidable bars, serves to set up electrical conditions representing permutation code signals which may be picked up by the distributor 303 and directed to a selector magnet 304 for controlling the apparatus disclosed in detail hereinafter or may be transmitted to a distributor at a distant station. In this manner the apparatus may be utilized either as a receiving instrument or as a home recording transmitting instrument for telegraph signals. The keyboard mechanism and its associated contacts which are set upon operation of the various keys in the keyboard 302 and the distributor mechanism do not, per se, form a part of the present invention, and are disclosed in detail in various patents, for example, the patent to H. L. Krum No, 1,595,472, dated August 10, 1926, and need not be described in detail herein. The distributor 303 is driven directly by a shaft 305 through suitable gearing as shown at 306. The shaft 305 is in turn driven by a gear 308 meshing with a gear 307, and said gear 307 is in turn mounted upon the drive shaft of a motor 309. This motor 309 may be a synchronous motor, or may be equipped with suitable controlling mechanism for controlling its speed of rotation in timed relation to the speed of rotation of a motor at a distant transmitting station. The motor 309 is mounted upon the base 301 in any suitable manner, and the shaft 305 is journaled in bearing blocks 310 and 311 suitably supported in spaced relation to the base 301.

The mechanisms described hereinbefore, in connection with the page printing apparatus, constitute for the most part mechanisms forming part of an 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 details of which have been described hereinbefore, 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 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, the receipt of 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 of cams 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 352 which is adapted to be urged 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 hereinbefore, and operates upon the release of the pawl 352 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 304, 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 downwardly from the armature. 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 hinge for the armature 361 and permits it to be rocked in response to the energization of the selector magnet 304 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 368 is normally urged in a clockwise direction (Fig. 22) by a contractile spring 369 and against the surface of the cam 328 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 U-shaped notch there is provided a sharp 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 328. 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 328, and the lever 368 (Fig. 11) together with a series of levers 380, 381, 382, 383, 384, 385, and 386 are pivoted on a pivot rod 387 which is in turn supported from the base member 301 by a pair of brackets 388 and 389, suitable spacing members being provided between the various levers to hold them in their proper spaced relation. The levers 368, 380, 381, 382, 383, 384, 385, and 386 are in alignment with the cams 328, 329, 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 369—369 one associated with each lever. It will be noted from Fig. 11, that there is no lever in the group of levers 368 and 380 to 386 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 top of the extremities of levers 368, and levers 382 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 368, 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 rocked 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, therefore, serves to prevent the levers from being rocked by their springs 369 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 369, 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 so doing will fall to a position where its upper end will drop behind a shoulder 391 on a slidable bar 392. 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 392 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 393, 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 printing 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 printing apparatus.

By 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. 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 also be noted that the slidable bars are guided in their reciprocatory motion by a horizontally disposed slotted or comb-like guide member 389 having suitable slots cut in it for receiving the slidable bars and guiding them and the upper ends of levers 380 to 385. The guide member 389 is secured to the underside of a plate 399 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 313, serve to control the operation of the type 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 zero position in which the type segment will be rotated, as will be described more in detail hereinafter.

The plate 399, 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 399 has the pin 398 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 419 (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. Suitable spacers are provided between the segmental stop plates 416, 417, and 418 adjacent the pin, or post, 420 and adjacent the sleeve 421 to separate the segmental stop plates and hold springs 422, 423, and 424 (Figs. 12 and 20) in position against the end of the segmental stop plates, posts 425 and 426 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 the 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 hereinbefore; that is, if the plate 416 which 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 418 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 slidable 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 418 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 center 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 slidable bars 396 and 395.

As pointed out hereinbefore, the slidable bars 393 and 394 control the height to which the type segment may be elevated and these slidable bars are provided with downwardly extending projections, the downwardly extending projection 394*a* on the slidable bar 394 being somewhat longer than the projection 393*a* 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 393*a* and 394*a* on the slidable 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 a shoulder 445 of a shaft 446. 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 445 thereon strikes one of the bell cranks 436, 437, or 438, one of the extremities 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 449; 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 449. In like manner, if the three bell cranks 436, 437, and 438 are rocked out of the path of the shoulder 445, the shaft 446 will move upwardly until a second shoulder 450 thereon abuts a nut 451 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 449 depending upon the code impulses received in the selector magnet assembly 313 and the consequent actuation or non-actuation of the slidable bars 393 and 394.

Selector bar 392 controls the direction in which the type segment 447 will be oscillated 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 slidable bar 392 effecting a shifting of a double-sided pawl 452 (Fig. 18) 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 slidable 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 shaft 446 described hereinbefore, 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 460 and 461 intermediate the plate 399 and a ribbon supporting plate 467, which the posts 466 also support. The pin 457, fixed to the pawl 452, is adapted to be actuated by a lever 468 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 in alignment and thereby hold the type segment in its mid-position. The portions 470 and 471 of the racks 454 and 453, respectively, form a nest in which the pawl 452 is slidable and when the lever 468 is moved to the right as viewed in Fig. 18 by mechanism to be described hereinafter, the springs 469 will tend to draw the rack that the head of the pawl engages toward the right. As will be obvious the pawl engaging on a shoulder of one of the racks and drawing it to the right (Fig. 18) will serve to rotate the gear 462 and therefore move the opposite rack to the left whereas movement of the lever 468 to the left will tend to restore either one of the racks 453 or 454 which have been drawn to the right to the position shown and in so doing will of course draw the opposite rack in the opposite direction due to the engagement of the teeth of the rack with the gear 462.

Slidably positioned on the guide members 460 and 461 is a shiftable plate 472 which rides on a pair of pins 473 and 474 extending upwardly from the guide members 460 and 461, respectively, suitable slots being formed in the plate 472 to receive the pins 473 and 474, and a slot 475 being formed in the plate 472 to receive the upwardly extending pin 457. From the foregoing, it will be apparent that the plate 472 may be shifted on the pins 473 and 474 and when so shifted will cause the pin 457 and the pawl 452 to be moved with it, thereby to carry the pawl 452 out of engagement with the rack 454 and into engagement with the rack 453. Slidable movement is imparted to the plate 472 by the slidable bar 392 upon its selection and actuation due to the receipt of a code signal indicating that the type segment shaft 446 should be rotated in a counterclockwise direction as viewed in Fig. 18. This action is effected by the movement of the slidable bar 392 to the left, the upper end of the slidable bar 392, as seen in Fig. 18, extending into a camming slot 476 in the slidable plate 472. Thus upon the receipt of a marking signal in the selector magnet assembly 313 at the time when the cam lever 380 is in association with the low part of its cam 329, the lever 380 will be permitted to drop in back of the slidable bar 392 and thereafter upon the engagement of the high part of the cam 329 with the bump on the lever 380, the slidable bar 392 will be moved to the left as viewed in Fig. 18, thereby camming the slidable plate 472 downwardly as viewed in Fig. 18 shifting the pin 457 downwardly and carrying the portion 458 of the head of the pawl 452 over into engagement with the shoulder 459 on the rack 453.

With the type segment oscillating mechanism set in this position, at a proper time in the cycle of operation of the apparatus, the lever 468 will be moved to the right (Fig. 18) and will draw the rack 453 to the right through the action of the spring 469, the rack of course stopping its movement when the segmental stops described hereinbefore arrest the oscillation of the type segment and the spring 469 being stretched without imparting any further movement to the rack 453. When the apparatus is restored to normal, however, the slidable bar 392 will be restored to its normal or right-hand position and in so doing will set the pawl 452 in the position as shown in Fig. 18 where the portion 455 thereof is in alignment with the shoulder 456 on the rack 454 and the receipt of a spacing signal since it does not result in actuation of the slidable bar 392 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 327 and when in this position serves to restrain the sleeve 325 from rotating with the shaft 305. The right arm of the lever 384 which is of U-shaped configuration as will be apparent by reference to Fig. 11, extends upwardly into 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 363 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 369 associated with the lever 384 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 386 which has its left arm in association with the cam 336 and its right arm in the path of the pawl 352 mounted on the pawl supporting plate 351. Toward the end of the cycle of rotation of the cam sleeve 325, the cam 336 becomes effective to move the lever 386 out of the path of the pawl 352, thereby to permit the pawl supporting plate and the sleeve 354 to be rotated by the ratchet wheel 350. The cams on the sleeve 354 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 354 is a pitman 485 to the other end of which there is connected a lever arm 486 (Figs. 13, 15 and 16). The lever arm 486 forms a part of a

rocker assembly comprised of a sleeve 487, the lever 468 and a bail 491. The sleeve 487 is rotatably supported by a rod 488 suspended from the under side of the plate 399 by posts 489 and 490. The lever 468 and lever arm 486 are rigidly connected to the sleeve 487, whereas the bail 491 is pivotally supported by the rod 488 which also supports the sleeve 487. Formed integrally with the bail 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 494 formed on the shaft 446. The bail 491 has a downwardly extending arm 495 (Fig. 15) to which there is attached a contractile spring 496 for normally urging the bail 491 to rock about the shaft 488 in a clockwise direction. Fixed in the bail 491 is an adjustable abutment screw 497 which engages a horizontally disposed arm of the lever 468, whereby the bail 491 tends to move with the lever 468, sleeve 487, and lever 486 unless the bail 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 as was described in connection with the operation selecting assembly. Also as pointed out in the description of the operation 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 485, 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 rack 453 or the rack 454 whichever had been selected for actuation. The selected rack will move toward the front of the machine, that is, to the right (Fig. 18) as the lever 468 moves in a clockwise direction (Fig. 16) (to the right Fig. 18) thereby to impart rotative 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 elevate the type segment to its uppermost position, the segmental stops 416, 417 and 418 serving to limit the movement of the type segment in its rotary motion and the bell crank levers 436, 437 and 438 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 504 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 a pair of irregularly shaped end plates 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 thereon 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 not only serve to hold the roll of paper 511 on the end plates 509 and 510 but also serve to support the paper feeding mechansim and will be described in detail hereinafter.

Fixed to the base 301, as shown most clearly in Fig. 15, is a support bracket 520 carrying a print hammer arm 521 which is pivoted on it by means of a pivot pin 522 and serving to support 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 507 of the paper supporting basket. The rollers 524 thus guide and support the rear end of the basket 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 507.

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 all the way across 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 527 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 528, 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 the feed roller 526 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 539 shown in Fig. 9 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 a 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 horizontally extending arm of a line feed bail **545** which has a transverse arm extending across the carriage and held in engagement with a roller **546** 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 hereinbefore will be 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, 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**. The printing hammer **449** is supported 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 **558** fixed to it and to a projection on the print hammer actuating lever **521**. However, when the print hammer actuating lever **521** is snapped forward due to the action of its actuating means to be described hereinafter until projection **559** on the print hammer actuating lever engages a bumper plate **560**, 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 hereinbefore is pivoted on the pin **522** 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 urged into engagement with the printing cam **358** 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 **566** on the link **563** strikes an obstruction which will prevent the link from moving forward to its ultimate position. An obstruction is placed in the path of the abutment **566** when it 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 may be performed selectively upon the selection of one of the function code bars **400**, **401**, **402**, **403**, or **404** which control in part the case shifting, line feeding, spacing, carriage returning, and blanking functions, respectively. The function bars **400** to **404**, inclusive, are pivotally supported on a pivot rod **567** suitably supported above the plate **399** and they are urged to rock about their pivots in a clockwise direction by springs **568** individual to them, as most clearly seen in Fig. 17. Adjacent the right-hand ends of the function bars **400** to **404**, inclusive, as viewed in Fig. 17, there is provided a function bar restoring lever **569** 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 **569** 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 counterclockwise 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 **569** moves down and releases the function code bars **400**, **401**, **402**, **403**, and **404** for actuation by their springs **568**, one of the bars **400** to **404**, 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 **313** is a function signal. If any function is to be performed then, of course, there should be no printing 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 over finger **570** formed on a print blocking slide **571** (Fig. 16). The print blocking slide is normally urged upwardly by a spring **572** (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 plate **399** and serves to support the print blocking slide as well as three other slides to be described more in 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 **568** 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 **568** 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 **571**, the spacing cut-out slide **575**, and a line feed slide **576** downwardly against the action of their respective springs **577** and **578**.

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 its spring will rock it about its pivot 567 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 spacing 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 402 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, 575, 576, and 579 are cut out in such a manner that they will be actuatable 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 356 has a lever associated with it which is normally urged 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 forked 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 502. 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 guide bar 504 secured to the underside of the paper carrying basket 506.

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 392 to 396 will be set up to permit the spacing or 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 into the path of the abutment 566 on the print actuating link 563 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 392 to 396. 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 outermost or left end (Fig. 17) of the spring 595 is fixed to the carriage assembly as shown at 596 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 urged 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 392 to 396 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 579, thus to block printing and spacing and to effect a carriage return by releasing the retaining pawl 597 and the spacing pawl 591. It should be noted at this time that the link 563 carries a pin 605 which extends across in front of the print blocking slide 571, spacing cut-out slide 575, line feed slide 576, and carriage return slide 579 so that each time the link 563 is actuated, the pin 605 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 as seen most clearly in Fig. 16, for engagement with a square bar 607 whereby when any one of the slides is moved downwardly it will be locked in position engaging the square bar 607 until the printing link 563 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 606.

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 301. The lever 610 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 358 is such that the printing link 563 will not carry its pin 605 into engagement with the slides 571, 575, 576 and 579 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 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 vertical plane to engage a shoulder 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. When the carriage return 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

(Fig. 13) which is in turn suitably supported on the underside of the rail 502. The latch 615 is normally urged to rotate in a counterclockwise direction (Fig. 13) by a spring 617 and when the upwardly extending end of the carriage return latch tripping lever 611 moves to the right (Figs. 13 and 16) it will be caught by the latch 615 and held until the carriage moves to its extreme right-hand position at which point a pin 618 on the underside of the bar 504 will engage the latch 615 and rock it clockwise thereby to release the latch tripping lever 611.

Upon the receipt of a blank signal, the function bar 400 will be actuated to block printing and to block spacing by forcing the print blocking slide 571 and spacing cut-out slide 575 downwardly (Fig. 17).

Line feeding may be effected upon the receipt of a proper signal in the selector magnet assembly 313 by setting the slidable bars 392 to 396 in such a manner that the line feed function bar 403 may be actuated downwardly. When the line feed function bar 403 is moved downwardly, as pointed out hereinbefore, spacing will be blocked by operating the spacing cut-out slide 575, printing will be blocked by operating the print blocking slide 571, and in addition the line feed slide 576 will be moved downwardly. Movement of the line feed slide downwardly will carry an adjustable eccentric 625 downwardly and move the line feed link 626 down into the path of a shoulder 627 (Fig. 16) on the lever 585. The line feed link 626 is held in engagement with the eccentric 625 by a spring 628 and is normally held up out of the path of the shoulder 627 on the lever 585. As the lever 585 in its normal cycle of operation rocks to the left under the impetus of its associated cam, the line feed link 626 as it is pushed down into the path of the shoulder 627 will be carried to the left (Fig. 16) to rock the line feed lever 547 about its pivot 629 the rear end of the link 626 being bifurcated (Fig. 12) to engage a pin 629 extending upwardly from the lever 547. In this manner, line feeding will be accomplished by actuating the line feed bail 545 and in turn transmitting rotary movement to the feed roll 526, as described hereinbefore in connection with the description of the paper feeding portion of the carriage assembly.

The only function remaining to be described is the case shift function; that is, the shifting to either figures or letters case on the type segment 447. By reference to the showing of Fig. 23, it will be seen that the type segment 547 has four horizontal levels of type thereon and that these typing faces are arranged in sixteen vertical rows. The selection of any one of thirty-two places on the type segment for presentation to printing position has been explained. This selection is effected by shifting the type segment to any one of its four levels and then selecting the amount of rotation to be imparted to the type wheel by setting the segmental stops 416, 417 and 418 to select any one of four places in which the segment will stop in its rotation in each direction.

The type segment as described hereinbefore, will, under control of the segmental stops 416, 417 and 418, move in steps of two vertical lines of characters for each separate selection; that is, the various positions to which the segmental stops may be stepped will position vertical rows 1, 3, 5, 7, 9, 11, 13 and 15 in alignment with the printing hammer 449 when the group of segmental stops are in one case position whereas if they are in the other case position the vertical rows 2, 4, 6, 8, 10, 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 a sleeve 421 which has a gear 462 either formed on it or fixed to it. At the upper end of the sleeve 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 wheel 447 to the sleeve 421, a pair of projections 632 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. The 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 thereby to carry all of the segmental stops 416, 417 and 418 with the segmental stop of supporting plate 419. Extending upwardly from the plate 399 (Figs. 19 and 20) are a pair of brackets 635 and 636 on which are pivoted a pair of locking levers 637 and 638, respectively. The levers 637 and 638 are irregularly shaped bell cranks and their substantially horizontal arms are urged downwardly by springs 639. 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 638 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 thereby locks the segmenta stop plates 416, 417 and 418 and 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 uppermost position and rocked to its farthest clockwise position, thereby to bring the projection 632 under the lever 638 to disengage the horizontal arm of the lever 638 from the shoulder 641 and oscillate the entire group of segmental stop plates and the supporting plate 419 in a clockwise direction to permit the horizontal arm of the lever 637 to drop back of the shoulder 640. Stop pins 700 and 701 are mounted on plate 399 for engagement with plate 419 to limit the oscillatory movement of the type segment 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 adjacent the end of a typewriter ribbon. The pawl 648 is urged into engagement with whichever ratchet it may be associated with by an overcentering 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 468 (Fig. 15). When a slidable 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 retaining 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 embodiment of the present invention is quite similar to the operation of the tape printing embodiment thereof in that the selection of the type on the type segment for printing is performed by selectively operating the slidable bars 392 to 396 to bias the type segment for movement in one direction 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 controlled by two slidable bars which will interpose stops in the path of the type segment, as shown, to limit its movement upwardly under the impetus of its actuating lever. Furthermore, the page printing apparatus is similar to the tape printing apparatus in that the selection of functions for performance is effected by setting the code bars 400 to 404, inclusive, by the positioning of the slidable bars 392 to 396. The selection of functions for operations as pointed out more 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 operation 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 operation from taking place during line feed.

Similarly, if the carriage return slide 579 is selected for operation by its associated function code bar, printing will be blocked by the operation 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 pawls 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 selection 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 rotation, and that when such a function is to be performed, the spacing cut-out slide 575 and the print blocking silde 571 will both be operated.

Although only two embodiments of the invention 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 including 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 previously 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 movement of said type segment at predetermined positions.

2. In a printing telegraph apparatus, a type segment, selectively actuatable bars for controlling the oscillatory and axial movement of said type segment, function bars associated with said selectively actuatable 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, selector bars responsive to received signals for controlling the operation of said type segment, function bars associated with said selector bars for selection thereby, and means controlled by said function bars for performing printing functions, spacing 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 actuatable bars responsive to received signals for controlling the position of said type segment, means controlled by said selectively actuatable bars including function bars for selection by said selectively actuatable bars, means controlled by said function bars for performing printing, spacing, 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.

6. 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 movement of the type segment, means responsive to the character of two impulses of said code for controlling the amount of movement of the segment, and means responsive to the character of two impulses of said code for controlling the amount of shifting of the segment.

7. In a telegraph printer responsive to a five-unit code of marking or spacing impulses, a type segment oscillatable in opposite directions, and character printing ridges on the type segment arranged with the characters responsive to a marking impulse in the third impulse on one-half of said type segment and with characters responsive to a spacing impulse in the third impulse on the other half of the type segment.

8. In a printing telegraph apparatus, an oscillatory and axially movable type segment, selectively settable means for controlling the axial and oscillatory movements of said type segment, said type segment being provided with alternate vertical rows of letters and figures and miscellaneous characters whereby case shifting is accomplished by shifting the segment one vertical row, said segment also being provided with case shift tripping abutments, means for aligning said segment to print letters, and means for aligning said segment to print figures, both of said aligning means being operable under control of said tripping abutments.

9. In a printing telegraph apparatus, a type segment rotatable in both directions from a zero position, means for limiting the extent of rotation of said type segment in either of said directions, means for moving said type segment axially, means for limiting the amount of movement of the type segment axially, a figures case shift lever, a letters case shift lever, and means on said type segment for cooperation with either of said levers in the uppermost position of the type segment and in its outermost position of rotation to effect case shifting.

10. In a printing telegraph apparatus, an oscillatory and axially movable type segment, means responsive to a marking or spacing signal for controlling the direction of oscillation of the type segment, means responsive to said last mentioned means for biasing the type segment to rotate in a selected direction, means on the type segment to control case shifting operations, and case shifting means operable by said biasing means under control of the means on the type segment to effect case shifting.

11. In a printing telegraph apparatus, an oscillatory and axially shiftable type segment, means on said type segment for controlling case shifting operations, signal responsive stop members positionable to stop oscillation of the type segment, a support for said signal responsive stop members, and case shift controlling levers operable by the means on the type segment for controlling the positioning of said support.

12. In a printing telegraph apparatus, an oscillatory type segment, means responsive to a received signal for biasing the type segment to rotate in one direction, stop members for stopping the oscillation of the type segment, and means controlled by the type segment in one of its selected positions and operable by the type segment biasing means for effecting case shifting operations of said type segment.

13. 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.

14. 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 oscillatable 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.

15. 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.

16. 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 permutatively 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.

17. 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 actuatable by the print hammer for bodily shifting the group of stop members to effect case shifting.

18. 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 segment, and means responsive to received signals for determining the level to which the segment will be shifted.

19. In a printing telegraph apparatus, a type carrying member rotatable in two directions, selectively actuatable 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 of 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 shiftable to various planes and oscillatable to present 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 invariably, 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 invariably, a slidable actuator associated with each follower for actuation thereby, and 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 invariably, a slidable actuator associated with each follower for actuation thereby, and 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, of character representing means actuated by the slidable actuators.

25. In a printing telegraph apparatus, a combination with a selector comprising a plurality of selectable elements, a cam shaft having a cam individual to each selectable 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 a 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 directional 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 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.

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 certain of said elements to variably limit the movement of said type segment in a predetermined direction of movement, 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-

lect 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.

34. In a printing telegraph apparatus, a type segment rotatable in two directions, selectively actuatable 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 actuatable bars and selected directly by and through the setting of said selectively actuatable bars, and function mechanisms controlled by the selection and operation of said function bars.

35. 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.

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