Dec. 16, 1941. E. A. GUBISCH 2,266,027

PERMUTATION KEYBOARD APPARATUS

Filed Feb. 5, 1940 6 Sheets-Sheet 1

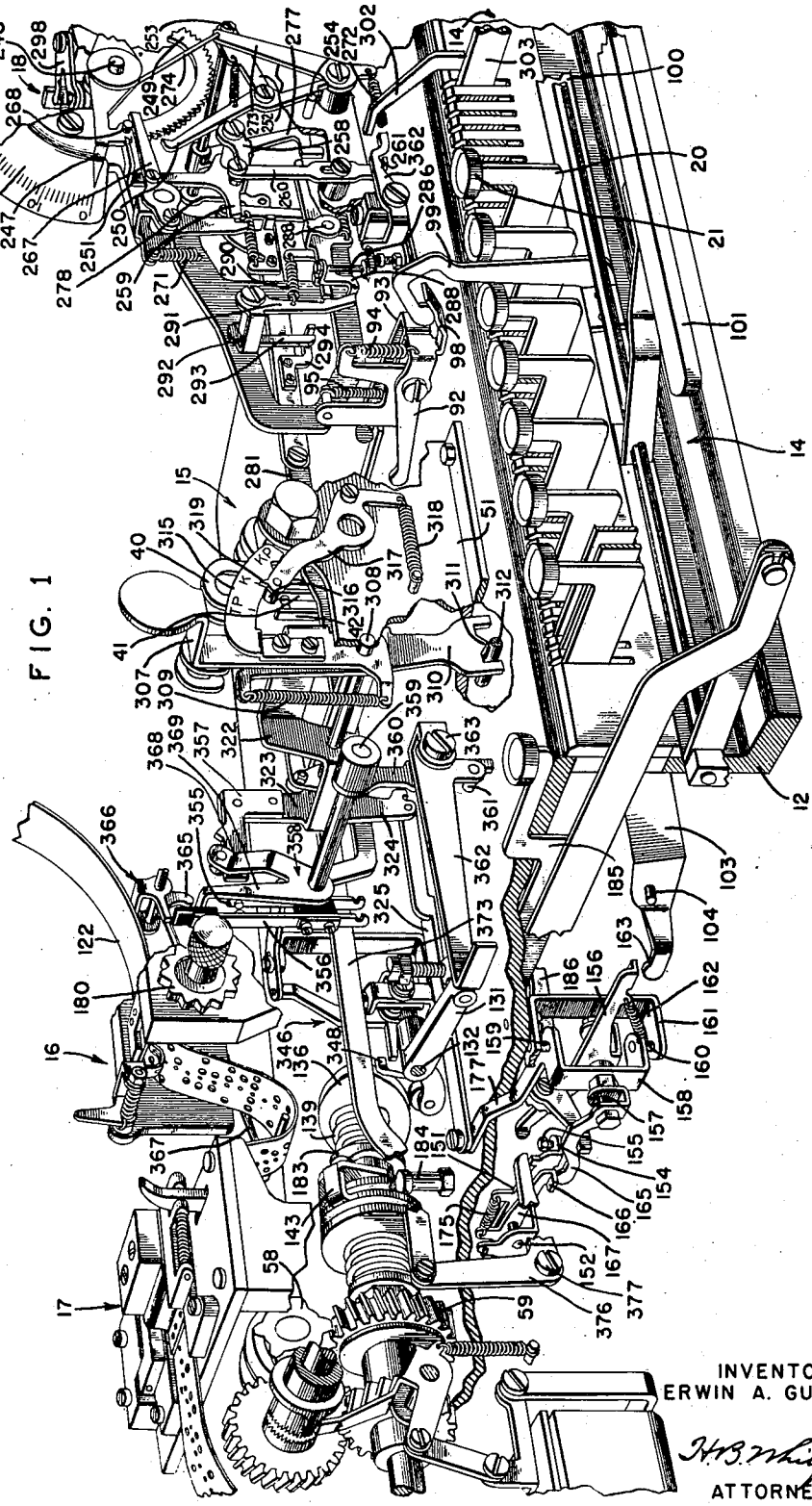

FIG. 1

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PERMUTATION KEYBOARD APPARATUS

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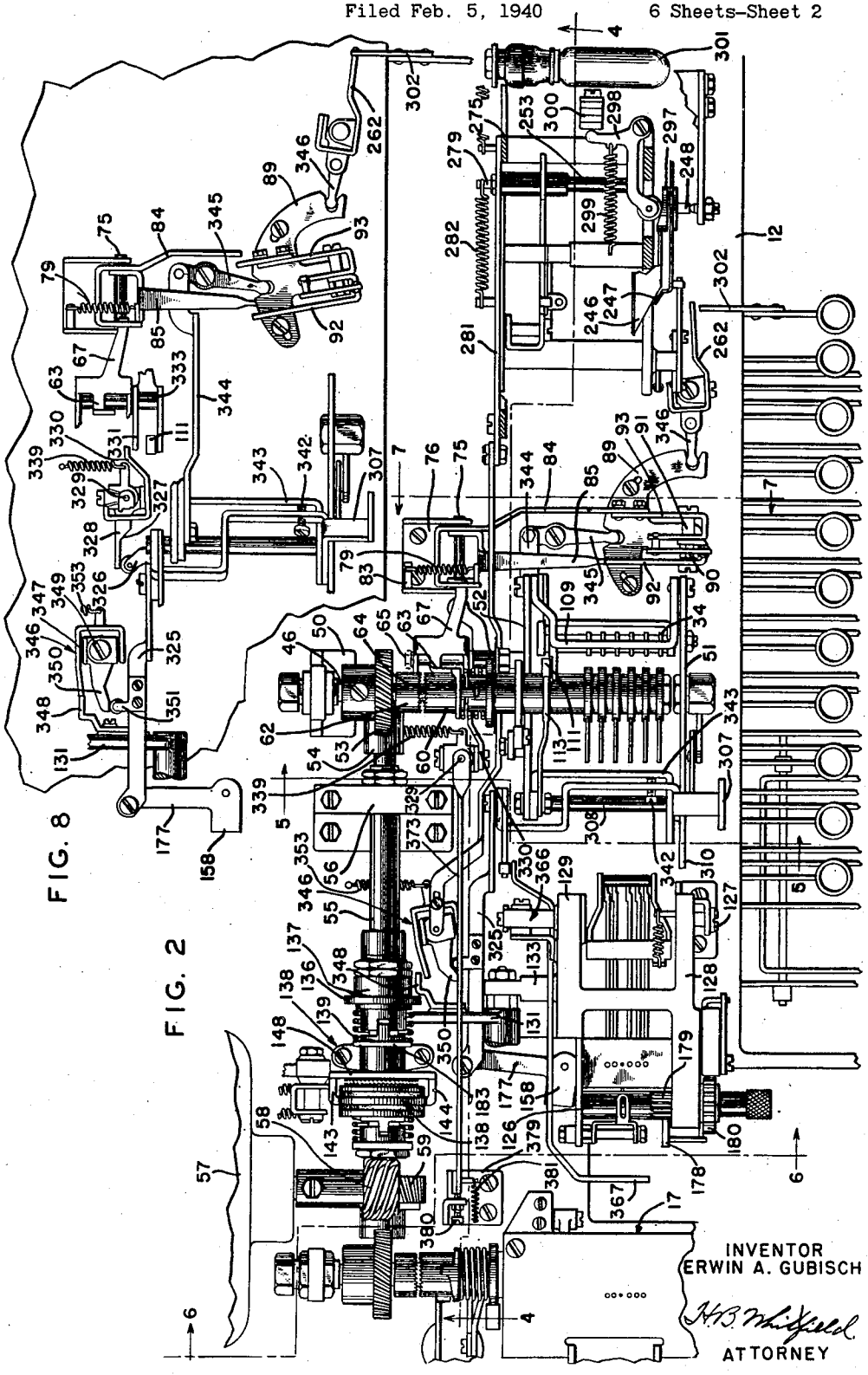

FIG. 8

FIG. 2

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PERMUTATION KEYBOARD APPARATUS

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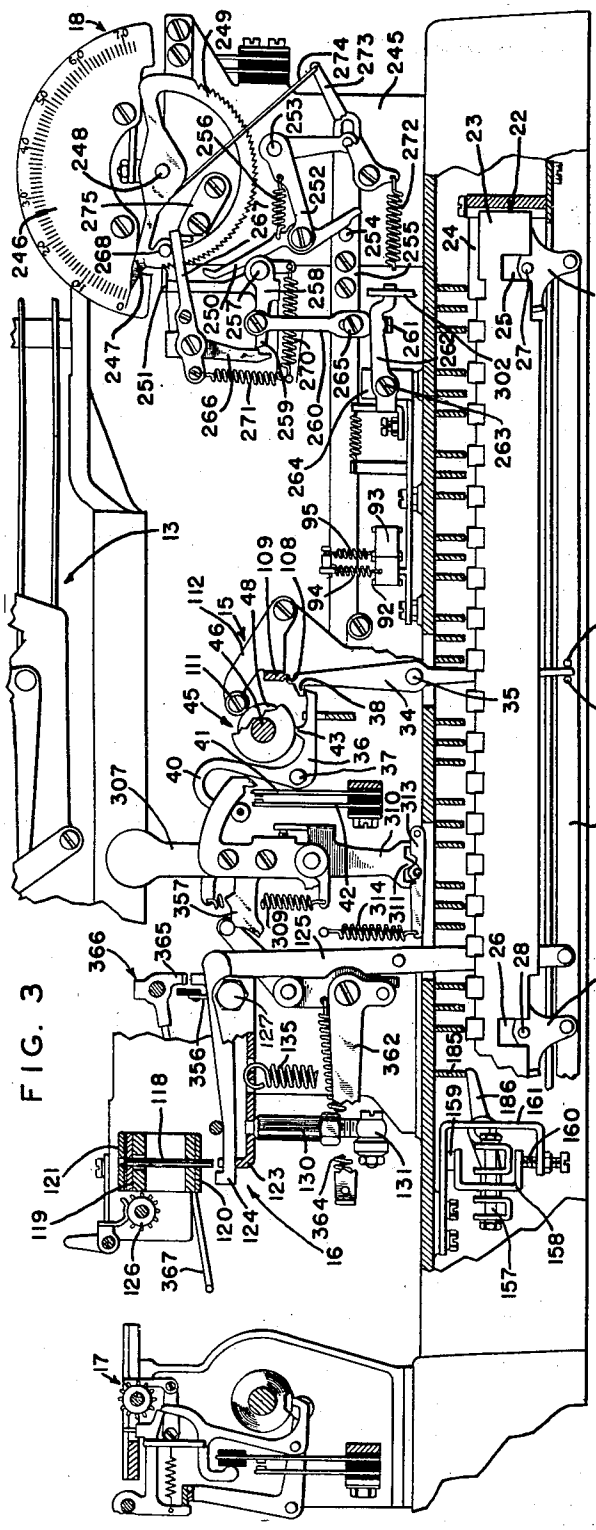

FIG. 3

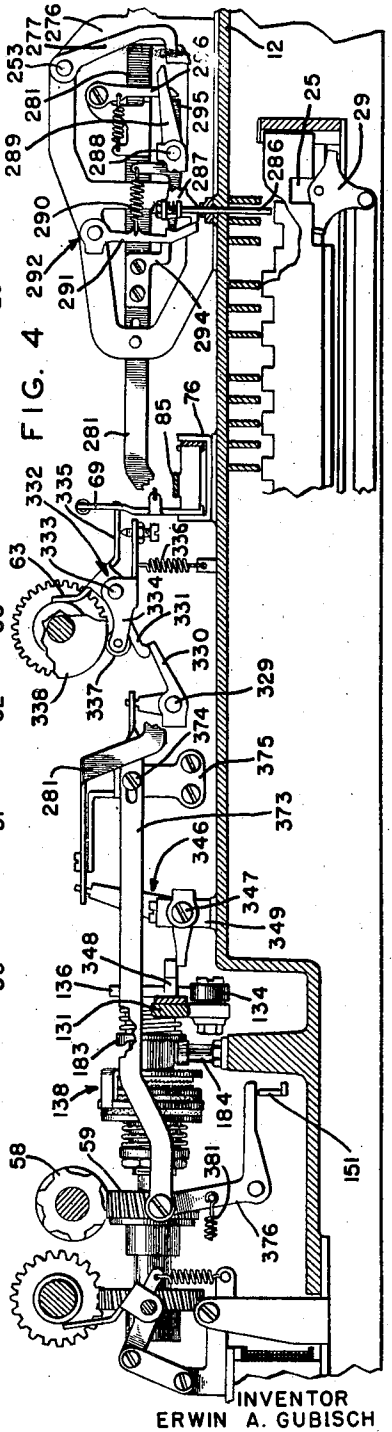

FIG. 4

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PERMUTATION KEYBOARD APPARATUS

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FIG. 5

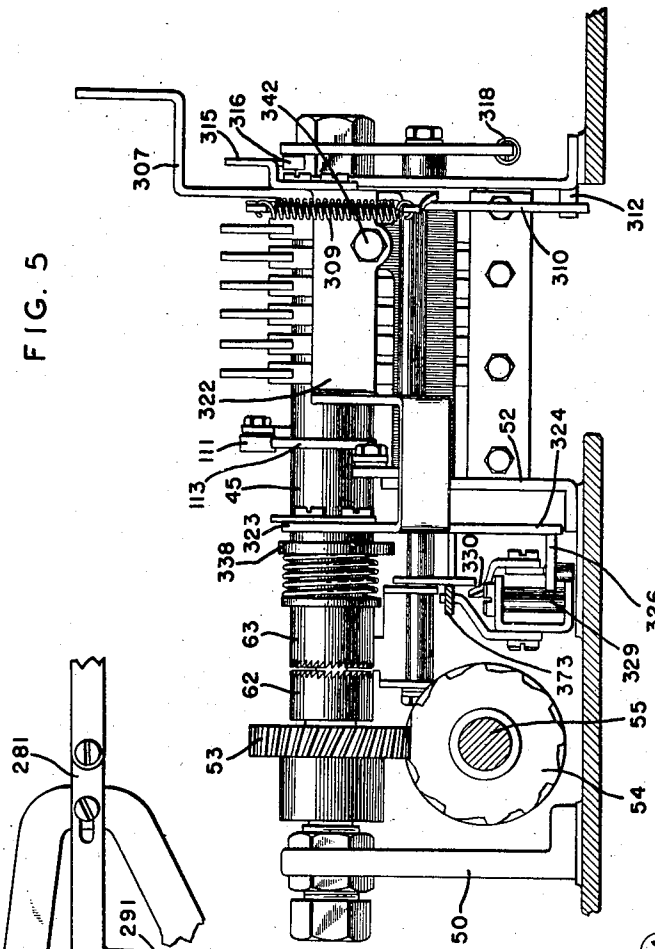


FIG. 9

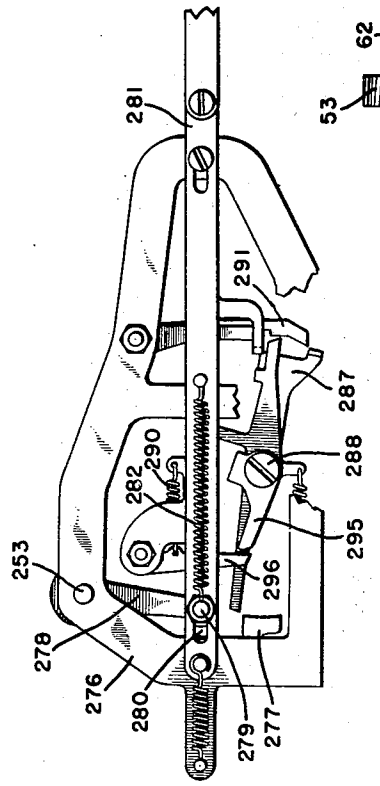
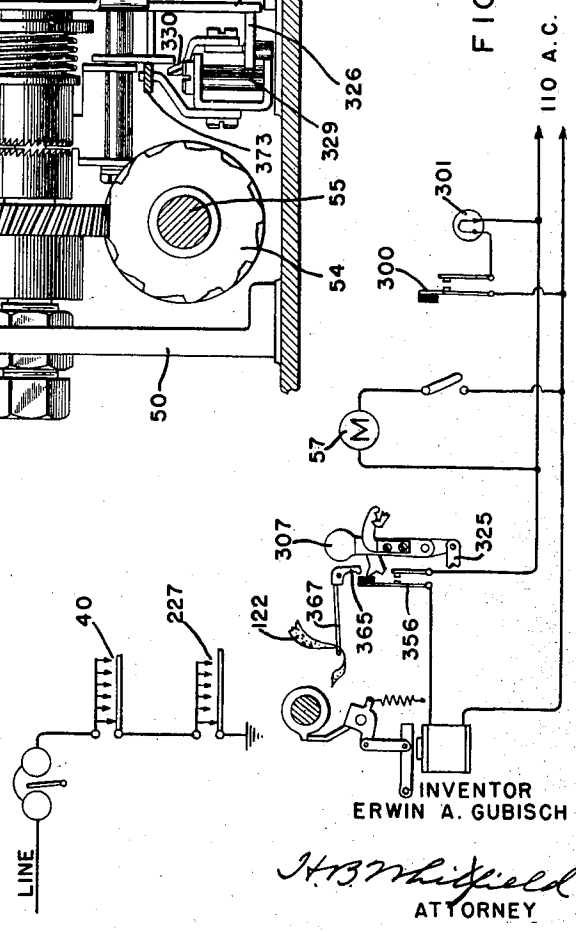


FIG. 10



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PERMUTATION KEYBOARD APPARATUS

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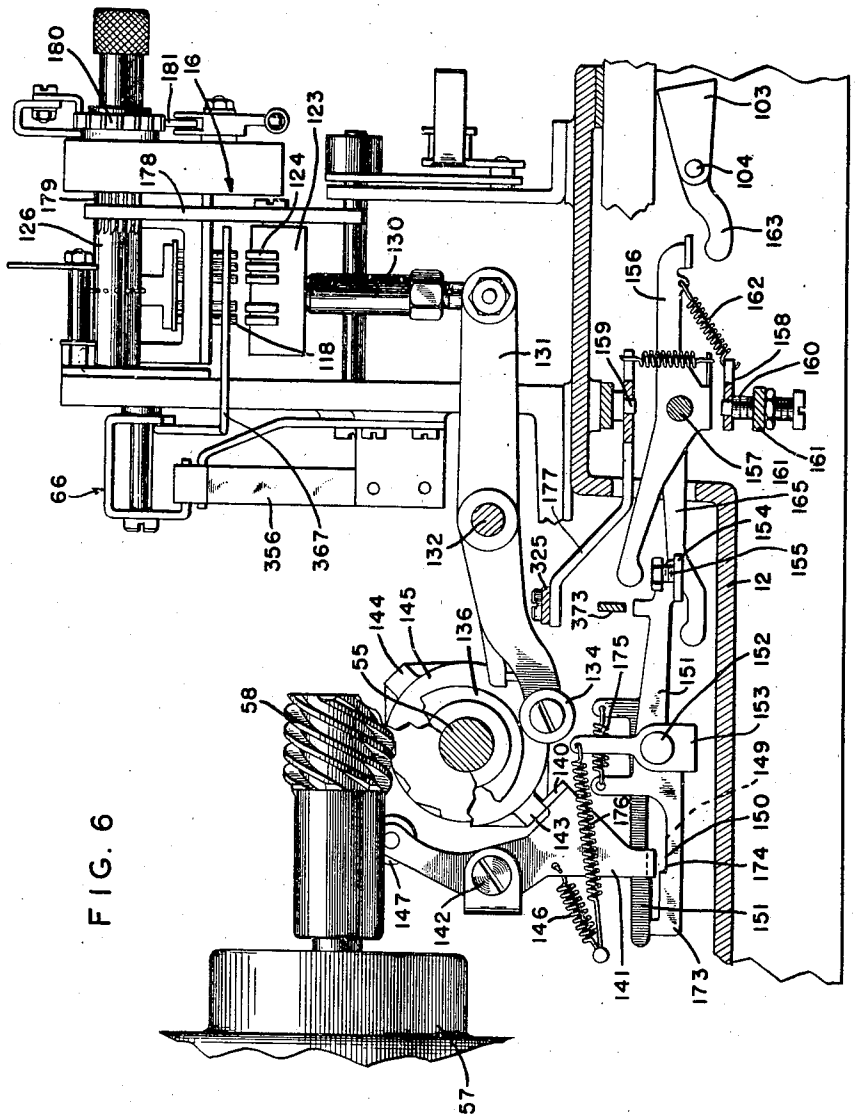

FIG. 6

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PERMUTATION KEYBOARD APPARATUS

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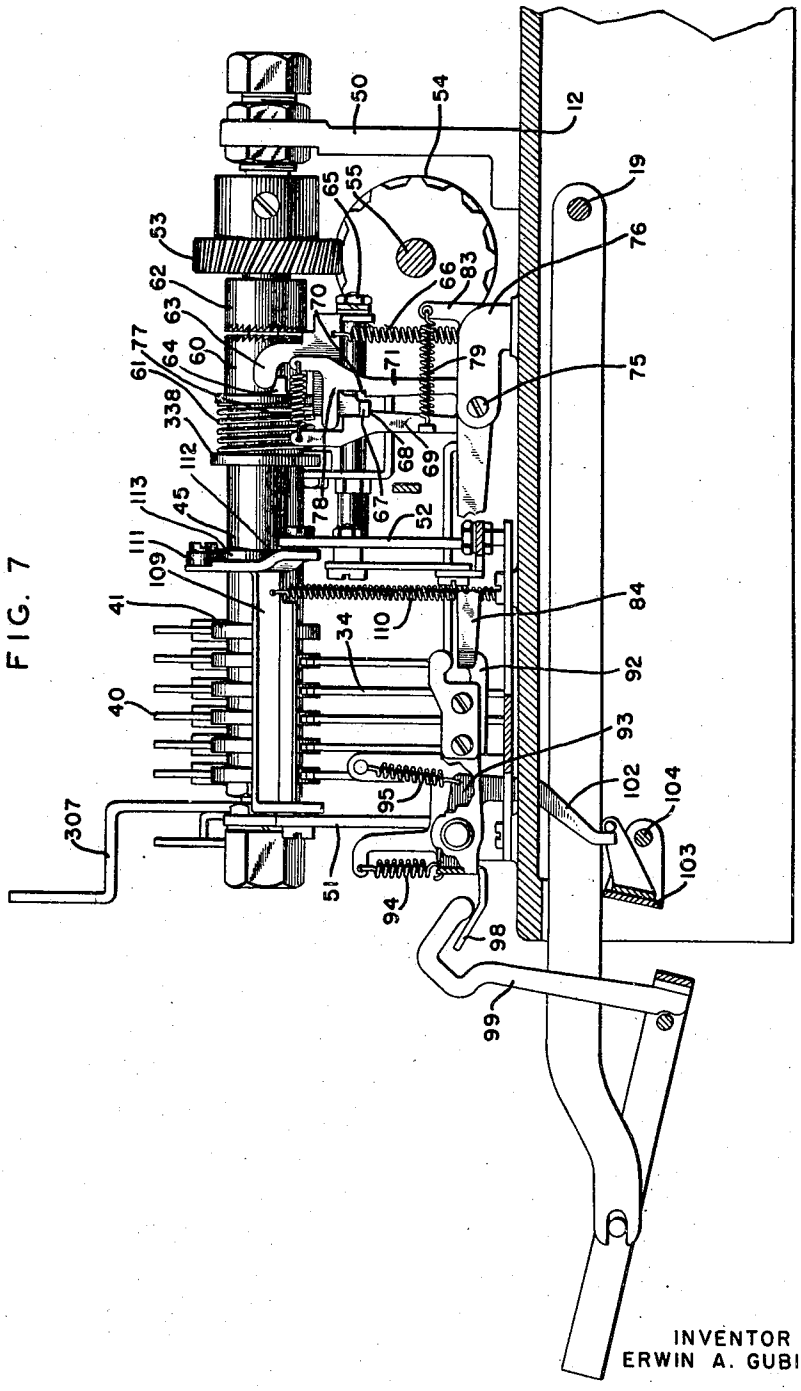
FIG. 7



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Patented Dec. 16, 1941

2,266,027

UNITED STATES PATENT OFFICE

2,266,027

PERMUTATION KEYBOARD APPARATUS

Erwin A. Gubisch, Chicago, Ill., assignor to Teletype Corporation, Chicago, Ill., a corporation of Delaware

Application February 5, 1940, Serial No. 317,309

11 Claims. (Cl. 178—80)

The present invention relates to permutation keyboard apparatus such as employed for transmitting telegraph signals or for perforating tape in accordance with a code comprising permutations of a definite number of two different signaling conditions.

Preparation of a perforated tape in accordance with a code such as represented by transverse rows of perforations for the respective characters for control of printing telegraph receivers for printing a message in page form requires identification to the operator preparing the tape of the exact number and positions of characters in a line of printing to apprise the operator of the approach of the end of a line of printing when the carriage return line feed key of the keyboard apparatus should be depressed. Depression of the carriage return line feed key perforates the tape with a code signal operative on the receiving printer to return the carriage, either the type basket or platen depending upon the particular type of printer involved in the operation, to its beginning-of-line position and advance the page to present an unprinted area to the printing mechanism. Such indication is provided by an indicator operated step by step in response to depression of character keys of the keyboard apparatus and reset upon the depression of the carriage return key of the keyboard apparatus.

In keyboard apparatus adaptable to transmit telegraph signals in response to the depression of key levers and to perforate a tape selectively, operation of the perforator may be suspended pending the transmission of a flash or urgent message through the direct operation of the key levers. Following transmission of the flash or urgent message operation of the perforator may be resumed. Under such circumstances it is desirable that the character indicator remain in its previously set position from which it starts upon resumption of operation of the perforator.

The principal object of invention of the present invention resides in the provision of a character counter for keyboard apparatus which is relatively simple and inexpensive to manufacture and which indicates the exact number of characters in a line of printing under various conditions of operation of the keyboard apparatus.

The above and other objects of the invention are attained through the provision of a character counter which is conditioned for operation when perforating a tape combined with a keyboard transmitter, a tape perforator, and a tape transmitter mounted on a common base casting and constituting a unitary structure. The character counter embodies an arcuate scale marked to indicate the number of characters along which a pointer is advanced step by step to indicate to the operator the number of characters included in the line of printing. Step-by-step advancement of the pointer is accomplished through a pawl and ratchet mechanism operated for each operation of the tape perforator, provided conditions are not established which will be the case upon the depression of function key levers to preclude their operation. Under such circumstances the tape will be perforated to represent the function, such as shift and unshift functions, but the pawl and ratchet mechanism will not be operated. Upon the operation of the carriage return line feed key lever, the pointer will be restored under the action of a spring to its zero or beginning-of-line position. When the keyboard transmitter is operated independently of the tape perforator, the pawl and ratchet mechanism will not be operated, the pointer will not be advanced along the character scale, and the pointer will not be restored to its zero position upon the actuation of the carriage return key lever.

The keyboard mechanism includes a plurality of keys operative on pairs of vertically movable permutation bars through which interference bars of a perforating mechanism are moved selectively to control the operation of punch pins allotted thereto, and correspondingly perforate a tape. The permutation bars, in addition to controlling the position of the interference bars of the perforator, also control the effectiveness of electrical contacts for determining the character of impulses transmitted to a connected line circuit representative of characters to be recorded or reproduced on a receiving printer at the distant end of the line circuit.

A more complete understanding of the invention may be obtained from the following description taken in conjunction with the accompanyings drawings, wherein

Fig. 1 is a perspective view showing the respective units embodied in the invention;

Fig. 2 is a plan view of the keyboard perforator transmitter mechanism of the present invention;

Fig. 3 is a front elevational view with certain parts in section in order to more clearly illustrate the invention;

Fig. 4 is an elevational view taken substantially on the line 4—4 of Fig. 2;

Fig. 5 is an elevational view taken substantially on the line 5—5 of Fig. 2;

Fig. 6 is an elevational view taken substantially one line 6—6 of Fig. 2;

Fig. 7 is an elevational view taken substantially on the line 7—7 of Fig. 2;

Fig. 8 shows certain of the mechanism disclosed in Fig. 2 in its other operative position;

Fig. 9 is a detail view of certain parts of the mechanism employed for operating the character counter; and

Fig. 10 is a circuit diagram showing the electrical connections for the apparatus.

Referring now to the drawings, in which like reference characters are used to indicate similar parts throughout the several figures, there is shown a casting indicated generally by the numeral 12. Mounted on this casting 12 is a receiving printer indicated generally by the numeral 13, Fig. 3, a keyboard 14, a direct keyboard controlled transmitter 15, a perforator 16, a tape transmitter 17, and a character counter 18.

The keyboard 14 includes a plurality of key levers 20 pivotally mounted on a pivot rod 19 (Fig. 7) which extends transversely of and is mounted in the base casting 12. The key levers 20 are normally raised by individual springs (not shown) and are provided at their forward ends with key tops 21.

Beneath the key levers 20 and extending transversely thereof are a plurality of pairs of permutation bars 22. The present invention has been applied to structure for operation on the basis of a five-unit code. Consequently, there are a corresponding number of pairs of permutation bars 22. Each pair of permutation bars 22 comprises a bar 23 and a bar 24. These bars are all provided at each end with vertical slots or notches which fit over guide combs 25 and 26 having shafts 27 and 28. The bars 23 and 24 are thus held against longitudinal movement but are free to be shifted vertically.

Pivotally mounted on shafts 27 and 28 are pairs of rock arms 29 and 30 interposed between each pair of code bars 22. The rock arms 29 and 30 are substantially T-shaped with their free ends formed with offset lugs on opposite sides of the pivot shafts 29 and 30 and spaced some distance therefrom. One of the lugs of each rock arm projects forwardly into a notch on the lower edge of the corresponding permutation bar and its other lug projects rearwardly beneath the lower edge of the corresponding permutation bar. With this arrangement, the depression of either bar of the pair of bars 22 rocks the rocker arm and lifts the associated permutation bar. Connected to each pair of rock arms 29 and 30 is a longitudinally movable permutation bar 31. When the pairs of permutation bars 23 and 24 are moved in accordance with the depression of the key levers 20, the permutation bar 31 will be moved longitudinally in a direction corresponding to the setting of the permutation bars 23 and 24.

Intermediate the ends of the permutation bars 31 and thus between the rocker arms 29 and 30 are pins 32 and 33. Between the pins 32 and 33 of each of the permutation bars 31 is the lower end of a selecting finger 34 which extends upwardly through an opening in the base 12 and are mounted on a common pivot shaft 35 secured to brackets mounted on the base 12. The fingers 34 control a set of switch members 36 which are also mounted on a common pivot shaft 37 suitably secured to upright members 51 and 52, Fig. 2. At the upper end of each of the selecting fingers 34 a projecting portion 38 is formed which, in accordance with the movement of the permutation bar 31 individual thereto will be moved into and out of operative relationship with the horizontal arm of the switch controlling members 36 which are in the form of bell crank levers, as clearly shown in Fig. 3. The fingers 34 and the bell crank levers 36 are held in proper spaced position on their respective pivot shafts 35 and 37 by washers or spacers.

Each of the bell crank levers 36 has a hook 40 which cooperates with a contact spring 41 and normally holds the contact spring 41 out of electrical contact with its associated contact spring 42. The contact spring 41 is of such a character that it normally tends to engage its contact spring 42 but is held out of engagement therewith due to the fact that its bell crank lever has a projection 43 which cooperates with a cam drum 45. Cam drum 45 is mounted on a horizontal shaft 46 extending transversely of bell crank levers 36 and has cut in its periphery six notches or slots arranged in a helical series so that as the cam drum 45 rotates, the slots will successively cooperate with projections 43 and, provided the bell crank lever 36 is at that moment free to move, will allow its movement and will permit the closure of contacts 41 and 42 through the medium of which impulses are transmitted to a connected line circuit, as will be subsequently described. In the normal rest position of cam drum 45, one of the slots is positioned with respect to projection 43 on its bell crank lever 36 to allow the contacts 41 and 42 associated therewith to be engaged. This results in normally having the line circuit closed through these contacts, which establishes a condition in the receiving printer to arrest its rotary elements and condition it for subsequent operation.

Shaft 46 on which the cam drum 45 is loosely mounted is journaled in brackets 50 and 51, Fig. 2, and has secured to it a gear 53 which is meshed with a gear 54 mounted on a pilot shaft 55 which is journaled in two bearing brackets, one of which is indicated by the numeral 56. Power for driving pilot shaft 55 is communicated from a motor 57 through a pinion gear 58 mounted on its shaft which meshes with a gear 59 also mounted on pilot shaft 55. Shaft 46 and pilot shaft 55 rotate continuously with the operation of motor 57.

Cam drum 45 has secured to it a collar 60, a portion of which is serrated as shown in Fig. 7 and is normally urged along shaft 46 by a spring 61. Secured to shaft 46 and arranged to cooperate with collar 60 is a similarly machined collar 62. As previously described, shaft 46 rotates continuously. However, due to the arrangement of collars 60 and 62, which constitute a clutch between shaft 46 and cam drum 45, the latter may be selectively rotated.

Spring 61 tends to move collar 60 along shaft 46 and into engagement with collar 62, but this action of spring 61 is normally prevented by means of a pivoted arm 63 which is latched into the path of a shoulder 64 formed on collar 60, Fig. 7, and which is spring-urged out of the path of shoulder 64. Shoulder 64 is also formed with a gradual camming surface so that as the collar 60 rotates it will cooperate with the associated portion of the stop arm 63 and cause collar 60 to be moved along the shaft 46 against the action of spring 61 to disengage the serrated portions of collars 60 and 62 and stop collar 60 with its associated cam drum 45.

Arm 63 is pivotally mounted on a shaft 65

supported by bracket 52 and is urged in a clockwise direction about its pivot, as viewed in Fig. 4, by a spring 66, Fig. 7, which has one end secured to arm 63 and the other end secured to a spring post formed in the upper surface of base 12. Spring 66 tends to urge arm 63 out of the path of shoulder 64 formed on collar 60 but is prevented from doing so due to the engagement of an extension 67, Figs. 2 and 7, of arm 63 either with shoulder 68 or shoulder 70 of vertically extending levers 69 and 71, respectively.

Levers 69 and 71 are pivotally mounted on a shaft 75 mounted in a substantially U-shaped bracket 76 secured on the upper surface of base 12. Levers 69 and 71 are normally urged toward each other by a spring 77 which has its ends secured to the free ends of levers 69 and 71. Movement of the levers 69 and 71 toward each other is limited by an arm 78 formed near the upper end of lever 71.

Lever 69 is further urged about its pivot in a clockwise direction, as viewed in Fig. 7, by a spring 79 which has one end secured to a spring post formed in lever 69 and a spring post 83 secured to an ear formed on bracket 76 which supports pivot shaft 75. Integral with arm 69 is an arm 84 and integral with arm 71 is an arm 85, Fig. 2. Operation of arms 69 and 71 to move shoulders 68 and 70 free of extension 67 of arm 63 to permit spring 66 to move arm 63 free of shoulder 64 on collar 60 is accomplished through the rotation of arms 84 and 85, respectively, in accordance with functions of the keyboard mechanism to be described later.

Pivotally mounted on shoulder screws secured to base 12 is an arcuately shaped plate 89, Fig. 8, which has a vertically extending ear 90, Fig. 2, which supports a pivot rod 91. Pivotally mounted on rod 91 are levers 92 and 93 arranged with springs 94 and 95, respectively, as shown in Fig. 1. These springs serve to maintain the levers 92 and 93 in their proper operative position. One arm of lever 92 extends beneath arm 85 of arm 70, whereas an arm of lever 93 is positioned above arm 84 of arm 69.

As shown in Fig. 1, lever 92 has an extension 98 engageable by the free end of an arm 99 secured to and operated by bail 100 which has arms secured to a space bar 101. Consequently, when the space bar 101 is depressed, arm 99 will be moved downwardly and through extension 98 lever 92 will be rotated counterclockwise, as viewed in Fig. 7, against its spring 94 to rotate arm 85 upwardly about its pivot shaft 75 and thus rotate arm 71 clockwise to move its shoulder 70 free of extension 67 of arm 63. Because spring 77 has one end secured to arm 69 and its other end secured to arm 71, arm 71 will, upon the counterclockwise rotation of arm 69, tend to follow its movement. Projection 78 integral with arm 71 determines a fixed minimum space between arms 69 and 71.

As shown in Fig. 7, lever 93 has an arm 102 which projects downwardly through an opening in base 12 and which has its free end aligned with the upper edge of a universal bail 103 pivotally mounted on pivot studs such as 104, shown in Fig. 1. In accordance with usual practice in telegraph keyboards, universal bail 103 responds to the depression of each of the key levers 20 and the space bar 101. Upon its operation, arm 102 will be engaged to rotate lever 93 in a clockwise direction, as viewed in Fig. 7, to depress arm 84 of arm 69 to move thereby shoulder 68 of arm 69 free of extension 67 of arm 63 and thus permit spring 66 to rotate arm 63 about pivot shaft 65 free of shoulder 64. Under such circumstances spring 61 moves collar 60 to the right along shaft 46, whereby its serrated portion engages the serrated portion of continuously driven collar 62 to impart rotation to cam drum 45.

Shoulder 68 of arm 69 is in a plane slightly lower, as viewed in Fig. 7, than the plane of shoulder 70 of arm 71. Normally, extension 67 engages shoulder 68. When arm 84 is rotated about its pivot 75 by lever 93, arm 69 is rotated to move its shoulder 68 free of extension 67. Rotation of cam drum 45 is thus effected due to the engagement of collar 60 with continuously rotating collar 62. Due to the connection between arms 69 and 71 through spring 77, arm 71 will follow the counterclockwise rotation of arm 69 and thus its shoulder 70 will tend to assume a position in the path of extension 67 under the influence of spring 77 and will be engaged by extension 67 should a key lever or the space bar be held depressed for a period longer than that required for cam drum 45 to complete one cycle of rotation, for under such circumstances shoulder 68 of arm 69 will be held out of the path of extension 67 of arm 63. When the key lever or the space bar is released, arm 69, by the action of its spring 79, rotates about its pivot 75 to the position shown in Fig. 7, and arm 71, through projection 78 engaging arm 69, will assume its normal position whereupon extension 67 will move free of shoulder 70 and will engage shoulder 68 of arm 69.

When it is desired to rotate cam drum 45 through a plurality of cycles, space bar 101 is held depressed, and since its depression through arm 99 rotates lever 92 to in turn rotate arms 85 and 71 and through universal bail 103 rotates lever 93 in turn to rotate arms 84 and 69, shoulders 68 and 70 of arms 69 and 71, respectively, will be moved free and out of the path of extension 67 of arm 63. Consequently, as long as shoulders 68 and 70 remain out of the path of extension 67, collar 60 continues its engagement with continuously rotating collar 62 to cause the corresponding rotation of cam drum 45. Upon the release of the space bar 101, arms 69 and 70 return to the position shown in Fig. 7 and extension 67 engages shoulder 68 of arm 69, whereupon arm 63, due to its engagement with the cam portion of shoulder 64 on collar 60, will cause collar 60 to be moved along shaft 46 to the left, as viewed in Fig. 7, to effect its disengagement with continuously rotating collar 62.

Each of the selecting fingers 34 is provided at its upper end with upwardly projecting portions 108, Fig. 3, having beveled upper edges which cooperate with a beveled edge rib on a locking bail 109, pivotally mounted on shoulder screws secured to brackets 51 and 52, Figs. 2 and 7. A spring 110 which has one end secured to lock bail 109 and the other end secured to a spring post fastened in base 12 tends to depress lock bail 109 and hold a roller 111 fastened to an arm 112 integral with the lock bail 109 in contact with a high portion of a cam 113 on cam drum 45 when the cam drum is in its normal arrested position. Shortly after the cam drum 45 is released for rotation and the high portion of cam 113 has been moved from under roller 111 on arm 112, lock bail 109 under the action of spring 110 is moved about its pivot to bring the beveled rib into cooperation with the beveled portions of projections 108 and consequently lock the selecting fingers 34 in the position in which they were set through the operation of permutation bars

31. With such a construction, the permutation bars 31 cannot be operated during the transmission portion of the cycle of rotation of cam drum 45 or until the lock bail 109 is moved by the high part of cam 113 to free the beveled rib from the beveled portions of projections 108 on the selecting fingers 34.

The perforator comprises a set of punch pins 118, Fig. 3, movable through openings in upper and lower guide plates 119 and 120 and cooperating with a die plate 121 to perforate a tape 122. The plates 119 and 121 are spaced apart to form a tape guide. The punches 118 are selectively operated by an actuating member or hammer 123 and a set of interponents 124 corresponding in number to punches 118 and permutation bars 31. Operatively associated with each of the interponents 124 is a pivoted member 125 which has its lower end connected to its permutation bar 31. Thus, upon the permuted setting of the permutation bars 31 the interponents 124 will be set correspondingly through the movement of pivoted members 125. Interponents 124 thus will be positioned either in alignment with or out of alignment with the punches 118 to perforate correspondingly tape 122 upon the actuation of hammer 123.

Also associated with code punches 118 is a feed hole punch, not shown, which is operated invariably for each operation of hammer 123 to perforate the feed holes which are engaged by the pins of a pin wheel 126, Fig. 3, operated step by step for each operation of hammer 123 to present an unperforated area in alignment with the code punches 118.

Hammer 123 oscillates on pivot screws 127 secured to brackets 128 and 129, Fig. 2, and supports at its forward edge, as viewed in Fig. 6, the free end of each of the interponents 124.

Oscillation of punch hammer 123 about its pivot is through arm 130 secured to one end of a lever 131 pivoted on a rod 132 secured in a projection 133 formed in the side wall of bracket 129, as shown in Fig. 2. To the free end of lever 131 a cam follower roller 134 is secured. Connection between hammer 123 and arm 130 is by means of a reduced portion of arm 130 projecting through an opening in the horizontal wall of hammer 123. Upon each oscillation of lever 131, arm 130 and the hammer 123 will be reciprocated under the tension of a spring 135, Fig. 3, which has one end secured to hammer 123 and the other end secured to a spring post mounted in bracket 129.

As shown in Figs. 2 and 6, cam roller 134 engages the periphery of cam 136 formed on a sleeve 137 to which power is communicated from motor pinion 58 and shaft 55 through a combination friction and toothed clutch 138 which includes a driving and a driven portion. The former portion is secured to shaft 55 whereas the latter portion is fastened to sleeve 137 and normally tends to engage the driving portion by the action of a spring 139, but is unable to do so when stop projection 140 formed on lever 141 pivoted at 142 lies in the path of stop lugs 143 and 144 formed in member 145. Member 145 tends to rotate by power communicated through the friction elements of clutch 138 but is held against rotation due to the fact that either stop lug 143 or 144 engages stop projection 140 on lever 141, which is held in the path of the stop lug 143 or stop lug 144 by the action of spring 146 which has one end secured to a fixed spring post and the other end secured to a lever 141 below its pivot 142. Spring 146 thus tends to urge lever 141 in a clockwise direction about its pivot 142, as viewed in Fig. 6. Also secured to lever 141 is a cam roller 147. This roller engages cam 148 (Fig. 2) following the movement of lever 141 in a clockwise direction, as viewed in Fig. 6, whereupon stop projection 140 is moved free or out of the path of stop lug 143 or 144, depending upon the rotative position of member 145.

As cam 148 rotates, it engages roller 147 carried by lever 141 and rotates such lever counterclockwise about its pivot 142 against the action of spring 146 while it is unlatched by a horizontal projection 149 on the lower end of lever 141, engaging shoulder 150 of lever 151 pivoted at 152 in a bracket 153 secured to base casting 112. The right-hand end of lever 151, as shown in Figs. 1 and 6, is formed with a horizontal projecting portion 154 which carries an adjustable screw 155 engageable by one end of a lever 156 pivotally mounted on a rod 157 mounted in a U-shaped member 158 cooperating with pivots 159 and 160 formed in a U-shaped member 161 secured to the underside of base 12. Lever 156 is under the tension of spring 162 and is engageable by the end of arm 163 integral with universal bail 103, as shown in Fig. 1. Also pivotally mounted on pivot rod 157 is an arm 165 which engages the lower surface of a horizontal projection 166 formed in member 167 which, like lever 151, is pivoted on pivot rod 152. As shown in Fig. 6, the left-hand end of lever 167 is in the same vertical plane as the corresponding end of lever 151, and near its end 173, which engages the underside of lever 151, has a shoulder 174 formed which is offset slightly with respect to shoulder 150 of lever 151 and engaged by projection 149 of lever 141.

According to Fig. 1, each of the levers 151 and 167 has a vertically extending spring post intermediate which is a spring 175 which rotates the levers 151 and 167 about their pivot rod to hold the left-hand ends of such levers normally in engagement. Lever 151 has an additional spring post to which is secured one end of a spring 176, the other end of which is secured to a fixed spring post. Spring 176 serves to rotate lever 151 counterclockwise, as viewed in Fig. 6.

Upon the operation of a key lever 20 or the space bar 101, universal bail 103 is rotated about its pivots 104 to cause its arm 163 to engage lever 156 and rotate it against the action of its spring 162, whereupon screw 155 is engaged to rotate lever 151 to remove shoulder 150 from the path of projection 149, formed in lever 141. By the action of spring 175, lever 167 tends to follow the movement of lever 151 to move shoulder 174 into the path of projection 149 on lever 141. Consequently, if the depressed key lever or the space bar 101 is held depressed for a period longer than that required for shaft 55 to complete a half cycle of rotation, projection 149 will engage shoulder 174 of lever 167 and prevent the further rotation of cam 148 as well as cam 136 and thus preclude repeat operation of the perforator. Upon the restoration of the key lever or the space bar 101, lever 151 is restored to its normal position by spring 176 and through the end 173 of lever 167 this latter lever is rotated about its pivot 152 to remove shoulder 174 from the path of projection 149 of lever 141, which snaps into engagement with the shoulder 150 of lever 151, in which position lever 141 remains until a succeeding key lever or space bar 101 is depressed.

The withdrawal of shoulder 150 from the path of projection 149 permits spring 146 to perform

two functions; first, the withdrawal of projection 140 from the path either of stop lug 143 or 144 and, secondly, to move roller 147 into contact with cam 148. Upon the release of cam 148 for rotation through the friction element of clutch 138, the teeth of the clutch engage and cause the rotation of cam 136, whereupon arm 131 is operated to move hammer 123 upwardly and cause the operation of the punches 118 in accordance with the position of the interponents 124 which are guided by the forward end of punch hammer 123 in accordance with the permuted setting of permutation bars 31, as determined by the position of permutation bars 23 and 24 operated upon the depression of the key levers 20 or the space bar 101.

U-shaped member 158 is, as previously described, pivotally mounted on pivots 159 and 160 and has an arm 177 through which it may be rotated to swing lever 156 and arm 165 out of the path of projections 154 and 166 on levers 156 and 167, respectively. When so positioned, lever 156 will not be operated upon the operation of universal bail 103 and the clutch 138 will not be tripped through such an operation.

Also secured to hammer 123 is a pawl 178 engageable with teeth 179 formed on pin drum 126. For each reciprocation of punch hammer 123, pin drum 126 will be rotated a distance equal to the space between two of the teeth 179, for when the punch hammer moves upwardly, pawl 178 engages the next succeeding tooth, and when the punch hammer 123 is moved downwardly by spring 135, pawl 178 is moved correspondingly and the pin drum 126 rotates. Pin drum 126 has a ratchet wheel 180, Figs. 1 and 6, engageable by a holding pawl 181 in its advanced position.

As is customary in keyboard perforators, mechanism is provided for rotating pin drum 126 clockwise, as viewed in Fig. 1, to bring the previously perforated areas in alignment with the punch pins 118 for modification or cancellation.

Clutch 138 is of a type arranged to be stopped following the completion of each cycle of operation. In the present structure, for each half revolution of cam 136, the perforator is operated to perforate the tape 122 with a transverse row of perforations. Spring 139 normally tends to effect engagement between toothed portions of the clutch 138, but in the rest position of cam 148 is prevented from effecting such engagement due to the provision of a cam 183 mounted on sleeve 137. Cam 183 cooperates with a post 184 fixed in casting 12 and arranged for each revolution of cam 136 to move the splined portion of sleeve 137 along shaft 55 and thus disconnect the driven portion of the toothed clutch from the driving portion thereof. Cams 136 and 183, however, tend to rotate due to the fact that power is communicated thereto through the friction portion of the clutch 138. Immediately upon the removal of projection 140 from the path of either stop lug 143 or 144, cam 183 is rotated sufficiently to move its high portion from engagement with post 184 whereupon spring 139 moves the driven portion of the toothed clutch to the left, as viewed in Fig. 2, to effect its engagement with the driving portion of the clutch.

Under certain conditions of operation it is desired to effect a continuous rotation of cam 136 and thus cause the repeated step-by-step advancement of tape 122 through the perforating mechanism. With normal operation, cam 136 makes a half revolution for each depression of a character key 20 or a depression of space bar 101, due to the fact that shoulder 174 of lever 167 is held in the path of projection 149 of lever 141 when lever 151 is rotated clockwise about its pivot 152 to remove shoulder 150 from the path of projection 149. Such a condition has been classified as a non-repeat operation.

Repeat operation with the mechanism disclosed may be accomplished through the depression of a key lever 185 allocated to such function. Key lever 185 has a key top and is pivotally mounted similarly to key levers 20. Key lever 185 does not operate either permutation bars 23 and 24 or universal bail 103, but it does operate a lever 186 pivoted in a bracket mounted on the underside of casting 12, as clearly shown in Fig. 1. The opposite end of lever 186 lies beneath arm 165 which, as previously described, operates lever 167. When key lever 185 is depressed, lever 186 is rotated about its pivot to rotate arm 165 and likewise lever 167 to move shoulder 174 out of the path of projection 149 of lever 141. Now, if a key lever 20 or the space bar 101 is operated, universal bail 103 will be operated to rotate lever 156 and, in turn, lever 151 to move shoulder 150 of lever 151 free of projection 149 of lever 141. Projection 140 will be moved free of either stop lug 143 or 144 and the toothed portions of clutch 138 will be engaged and cam 136 will rotate, causing the operation of lever 131 and the reciprocation of punch hammer 123. The punches 118 will be operated in accordance with the key lever 20 or the space bar 101 which may be depressed. As long as a key lever 20 or the space bar 101 and key lever 185 are depressed, cam 136 will rotate through a number of cycles of operation, notwithstanding the fact that cam 183 engages post 184 and temporarily disengages the driven portion of the toothed clutch from its driving portion. However, since cam 183 operates continuously by power communicated thereto through the friction portion of the clutch 138, the toothed portions thereof merely disengage and engage immediately to render cam 136 continuously operative to perforate tape 122 in accordance with the position of the interponents 124 under the control of permutation bars 31.

Tape 122, following its perforation in accordance with the operation of key levers 20, passes to the tape senser or tape transmitter 17. The structural details of the tape senser and the method of their operation are fully disclosed in copending application Serial No. 317,310, filed Feb. 5, 1940, of Erwin A. Gubisch and Albert H. Reiber. Reference is made to such copending application for a full and complete disclosure of the tape senser 17.

Character counter

It was previously indicated that when operated to prepare the perforated tape, it is necessary to indicate to the operator the length of the line of printing to apprise the operator of the end of the line in order that the carriage return signal may be perforated in the tape. To achieve this object, the structure includes what has been referred to as a character counter operated upon the depression of each character key for indicating to the operator the number of characters included in the line of printing and thus notify the operator when the line has been filled, when the carriage return key should be depressed, which includes in the tape a carriage return signal and returns the counter to its zero position.

Referring now to Figs. 1, 3, and 4, the character counter embodies a supporting bracket 245 to which is secured an arcuate scale 246 marked in

accordance with character numbers and over which a pointer 247 moves in response to the operation of the character keys to indicate to the operator the number of characters perforated in the tape 122. Pointer 247 is secured to shaft 248 journaled in bracket 245 and provided with a toothed section 249 which is engageable by a stepping pawl 250 and a holding pawl 251. Stepping pawl 250 is secured to one end of a lever 252 secured to shaft 253 journaled in bearings formed in bracket 245. The lower end of pawl 250 slidably engages a pin 254 secured integral with an adjustable plate 255 also supported by bracket 245. A spring 256 tends to move the upper end of pawl 250 toward the ratchet teeth of segment 249 but is prevented in the normal position of the pawl, the position shown in Fig. 3, due to the cooperation of its lower end with pin 254. The lower end of pawl 250, however, is cut away so that upon elevation of pawl 250 due to the rotation of arm 252, spring 256 will be effective to bring the upper end of pawl 250 into engagement with the ratchet teeth of segment 249. Holding pawl 251 is pivoted on a shoulder screw 257 threaded in bracket 245 and has arms 258 and 259. To arm 258 a link 260 is connected which, in its lower end, has a horizontal projection 261 engageable by lever 262 pivotally mounted at 263 in a bracket 264 pivotally mounted on the upper surface of base casting 12. The lower end of link 260 is guided by a shoulder screw 265. Arm 259 of holding pawl 251 cooperates with a latch 266 pivotally mounted on bracket 245 and provided with an arm 267 engageable by a pin 268 mounted in the forward portion of segment 249. Latch 266 serves to latch holding pawl 251 free of the ratchet teeth in segment 249. Holding pawl 251 is tensioned by means of a spring 270, and latch 266 is tensioned by means of a spring 271.

For each operation of stepping pawl 250, pointer 247 will be advanced a distance representative of one character where it will be held by holding pawl 251 pending subsequent operation of the stepping pawl 250 or the withdrawal of holding pawl 251. Advancement of pointer 247 along the scale on the arcuate member 246 is under the tension of a spring 272 which has one end secured to a fixed spring post and the other end secured to an arm of a pivoted lever 273 which has its other arm fastened to a cord 274 having its other end fastened to a grooved disc integral with pointer 247. As the pointer 247 is stepped for each operation of stepping pawl 250, the cord 274 will be wound on the grooved disc and the spring 272 will be extended so that upon the withdrawal of holding pawl 251, the pointer 247 under the tension of spring 272 will be returned to its zero position as shown in Fig. 3, wherein pin 268 engages arm 267 and moves latch 266 free of arm 259 of holding pawl 251. A stop 275 limits the return of pointer 247.

Rod 253 to which arm 252 is secured extends rearwardly of bracket 245 and has its other end journaled in a plate 276 mounted on the rear surface of bracket 245. Also secured to rod 253 are two arms 277 and 278. Arm 278 carries at its free end a pin 279, Figs. 2 and 9, slidably mounted in a slot 280 formed in a bar 281 and having one end of a spring 282 secured thereto, the other end of which is fastened to a spring post extending from the back side of bar 281. Such a construction permits the operation of bar 281 even though lever 278 is held against movement because spring 282 merely extends upon the reciprocation of bar 281 under such conditions of operation.

For each transverse row of perforations perforated in tape 122, bar 281 is reciprocated, as will be described later, and regardless of the significance of the transverse rows of perforations. On certain functional operations such as shift, unshift, line feed, and carriage return, it is not desired that the pointer 247 be advanced since it is intended to indicate merely the number of characters included in a line of printing. Consequently, it is necessary when the key levers for the recited functions are depressed to block the operation of the mechanism through which stepping pawl 250 is operated. According to one embodiment of the invention, this blocking is accomplished through a series of levers rendered effective upon the depression of the function key levers.

Operative from the code bars 23 and 24 in response to the depression of the function key levers such as shift, unshift, line feed, and carriage return key levers is a rod 286 which extends through an aperture formed in base casting 12. When rod 286 is elevated and since it has its upper end adjustably aligned with an ear formed in lever 287 having an adjusting screw, which is pivotally mounted on rod 288, it will, through its engagement with a projection formed in lever 289, rotate the latter lever about its pivot rod 288 into blocking relationship with the lower end of arm 277 secured to rod 253. A spring 290 having one end secured to a spring post projecting from lever 289 tends to rotate lever 289 counterclockwise, as viewed in Fig. 4. The other end of spring 289 is fastened to an arm 291 of a U-shaped member 292 which cooperates with the opposite arm of lever 289 to hold the lever in its clockwise position to which it is rotated upon the elevation of rod 286. The other arm 293 of U-shaped member 292 is engageable by a hook bar 294 secured to the forward side of bar 281. Consequently, upon the movement of bar 281 to the left, as viewed in Fig. 1, hook bar 294 engages arm 293 of U-shaped member 292 to rotate arm 291 against the tension of spring 290 free of the end of lever 289, whereupon such lever tends to restore to the position shown in Fig. 4.

With the end of lever 289 in blocking relation with arm 277, rod 253 will not be rotated upon reciprocation of bar 281 with the result that the pointer 247 will not be advanced along the character scale. Even though bar 281 is reciprocated, it will not cause movement of arm 278, but its free movement will be permitted through an extension of spring 282.

In order to prevent false or incorrect operation of the counter should a function key be depressed with a staccato action, lever 289 is held in blocking relationship to arm 277 by latch 291 until bar 281 has been moved to the left sufficiently to allow pawl 296 to free rear extension 295 of lever 289 and has returned to the right, as viewed in Fig. 4. The following operations are as previously described. Upon the next succeeding operation of bar 281, provided a function key lever has not been depressed, arm 278 will be moved to rotate rod 253 and cause stepping pawl 250 to engage a tooth on ratchet sector 249 and move the pointer 247 a distance equal to the space between adjacent teeth or a distance representative of one character.

Also, in order to insure that blocking lever 289 will not be released prematurely, it is provided with an arm 295 engageable by a spring pressed

pawl 296 pivotally mounted to a plate secured to rod 281. When lever 289 is moved into blocking relationship to arm 277, its arm 295 will be positioned below the free end of pawl 296. Now, when bar 281 is moved to the left, as viewed in Fig. 4, pawl 296 is above arm 295 and even though latch 291 may be released, lever 289 will not assume its normal position due to the engagement between pawl 296 and its arm 295. Just before bar 281 reaches its extreme right-hand position or the position shown in Fig. 4, pawl 296 moves clear of arm 295 so that if latch 291 has been released, lever 289 may assume the position shown in Fig. 4 to permit rotation of rod 253, the movement of stepping pawl 250, and the advancement of pointer 247 along the scale on member 246.

The approach of the end of printing for a page printer is indicated by a signal device operative in response to a predetermined movement of the pointer 247. This device embodies a cam 297 mounted on shaft 248 to which pointer 247 is fixed. Operatively associated with cam 297 is a roller carried by one arm of a bell crank lever 298 pivoted to bracket 245 and normally urged by a spring 299 to bring its roller into engagement with the surface of cam 298. The other arm of bell crank lever 298 operates contacts 300 which are normally open and which are included in the energizing circuit of a signaling lamp 301. Normally, contacts 300 are open. However, when pointer 247 has moved to a predetermined position or a position where cam 297 rotates bell crank lever 298 clockwise about its pivot, as viewed in Fig. 2, contacts 300 will be closed and the circuit for signal lamp 301 will completed. The illumination of lamp 201 notifies the operator of the approach of the end of printing for a page printer and also that shortly thereafter the carriage return key lever should be depressed.

As previously described, pointer 247 is held in its advanced position by a holding pawl 251 engaging the teeth on segment 249. Withdrawal of holding pawl 251 from engagement with the indicated teeth is achieved through the clockwise rotation of lever 262, as viewed in Fig. 1, upon the downward movement of hook bar 302 which is integral with key lever 303 identified with the carriage return function. When this key lever is depressed, hook bar 302 is moved downwardly, engaging the free end of lever 262 and, due to its relation with link 260, holding pawl 251 is rotated counterclockwise, as viewed in Fig. 3, against the action of its spring 270. Upon the removel of the holding pawl 251 from engagement with the teeth of segment 249, spring 272 operative on lever 273 and pointer 247 through cord 274 is effective to rotate pointer 247 to its zero position where pin 268 engages arm 267 and moves its associated arm 266 to a position where its shoulder is free of extension 259 of holding pawl 251. Holding pawl 251 may then assume a position operative with the teeth of segment 249.

The apparatus previously described may be operated independently of the perforator, the perforator may be operated independently of the keyboard transmitter, and the keyboard transmitter and perforator may be operated simultaneously. Under certain conditions the tape transmitter may also be operated. To determine these selective conditions, the apparatus embodies mechanism for rendering the respective devices operative; for example, in one position of the mechanism the keyboard transmitter may be operated, in another position the keyboard transmitter and the tape perforator may be operated, whereas in the third position the keyboard perforator and the tape transmitter may be operated simultaneously. With the mechanism set for keyboard transmission and perforator operation, the counting device need not be operated. Consequently, the mechanism is arranged to preclude the operation of the counting device when the switch mechanism is in either the keyboard transmission or keyboard transmission-perforator operation position. The counting device, therefore, will be operated only when the switch mechanism is in the perforator operation and tape transmission position. However, if the switch mechanism is in the latter described position and should it be changed to its keyboard transmission position for the transmission of an urgent or flash message, the counting device will not be disturbed; that is, the pointer 247 will remain in its advanced position. When the switch mechanism is restored to its former position, the counting device will be operated to continue the indication of the number of characters in the line as perforated in the tape 122.

The switch mechanism includes elements for rendering the respective devices operative and embodies, as shown in Figs. 1, 3, and 5, a lever 307 pivotally mounted on a rod 308 extending between brackets 51 and 52, Fig. 2, and capable of being rotated against the action of a spring 309 which has one end secured to a spring post integral with lever 307 and the other end secured to a spring post formed on lever 310 which, like lever 307, is pivotally mounted on rod 308. Spring 309 serves as a connection between levers 307 and 310. The lower end of lever 310 is bifurcated and has centrally of its projections a knife-edge 311. The projections and the knife-edge 311 cooperate with a detent pin 312 secured to a lever 313 pivoted to bracket 51 and urged upwardly, as viewed in Fig. 1, by a spring 314 which has one end secured to a fixed spring post and the other end secured to the free end of lever 313. Spring 309 tends to move lever 307 clockwise with respect to lever 310, as viewed in Fig. 1. Secured to lever 307 is an arcuate member 315 which has on its front surface the letters TP, K, KP, which represent the several positions of the switch mechanism for the several operations; namely, tape transmission-perforator operation, keyboard transmission, and keyboard transmission-perforator operation, respectively. Cooperating with the lower edge of member 315 is a roller 316 secured to one end of pivoted lever 317 urged clockwise about its pivot by a spring 318 and also carrying at its free end an index finger 319 serving to indicate, in cooperation with the letters TP, K, and KP, the respective positions of the switch mechanism for the particular operation. Member 315 also has near its extreme right-hand end a notch engageable by roller 316 to hold the member 307 in its extreme left-hand position against the action of spring 309.

Integral with lever 307 is an arm 322 which has an upwardly extending projection 323 and a downwardly extending projection 324. Projection 324 is connected with lever 177 by a link 325 whereby lever 177 is moved to rotate U-shaped member 158 about its pivots 159 and 160 to move lever 156 into or out of the path of projection 154 of lever 151. At the lower end of projection 324 is a horizontally projecting arm 326, Fig. 5, which carries a roller operative on a cam surface 327 formed in a lever 328 pivoted

to the upper surface of base casting 12 at 329 for rotation in a horizontal plane and provided with an arm 330 also pivoted at 329 for oscillation in a vertical plane, Fig. 8.

When the lever 307 is in a position where the index 319 is opposite the letter K, link 325 is moved to the right, as viewed in Fig. 1, to rotate the U-shaped member 158 to move lever 156 out of the path of projection 154 of lever 151. Under such conditions, when a key lever is depressed, universal bail 103 will be operated but there will be no action on lever 151 and consequently the perforator will not be operated even though interponents 124 do follow the movement of the permutation bars 31, because the clutch through which power is communicated to cam 136 is not released. Also, with lever 307 in the indicated position, arm 330 is out of the path of an arm 331 of a lever system 332, Fig. 4, which is pivoted at 333 and has arms 334 and 335 with a spring 336 tending to rotate the lever system clockwise about pivot rod 333. On arm 334 is a roller 337 engaging a cam 338 mounted on cam drum 45 which, in rotating, functions to restore stop arm 63 against the tension of its spring 66 into the path of stop lug 64, Fig. 7, to effect disengagement between the driven portion 60 and the driving portion 62 of the positive clutch through which power is communicated to cam drum 45 and also functions through arm 331 to oscillate lever 330 about its pivot 329 when arm 328 has been moved by the roller on arm 326 to its extreme clockwise position, as viewed in Fig. 8. However, with lever 307 in the position where the index 319 is opposite the letter K engraved on member 315, arm 330 is held out of the path of arm 331 by spring 339, Figs. 2 and 8, and even though arm 331 is operated cyclically for each rotation of cam drum 45, no operation of arm 330 will be performed.

With the operation of the key levers 20, when the lever 307 is in the position just referred to, the permutation bars 31 will be set permutably to set correspondingly selecting fingers 34 and operate through the universal bail projection 102 and lever 84, arm 69 to free arm 67, whereupon stop arm 63 is removed from the path of stop lug 64. Connection between the driven and driving portions of the positive clutch is thereby effected and the cam drum 45 rotates to operate the contact levers 40 successively in accordance with the position of selecting fingers 34 and, in turn, contacts 41 and 42 for transmitting a signal combination indicative of the permuted setting of the selector fingers 34. As cam drum 45 continues its rotation, cam 338 operates on roller 337 to depress arm 334 and move stop arm 63 into the path of stop lug 64 and thus arrest cam drum 45 at the completion of one cycle of rotation, when it may again be released through the depression of another key lever operating on the universal bail or bar, as previously described.

With the lever 307 in the position just described, the repeated operation of cam drum 45 may be desired, and when the space bar is depressed, hook bar 99, due to its connection with bail 100, will be moved downwardly, as viewed in Fig. 1, and will, because of its engagement with projection 98, move the opposite end of lever 92 upwardly against the action of its tension spring 94 to rotate lever 85 and move arm 71 to a position where its projection for its shoulder 70 is out of the path of arm 67. Concurrently with the rotation of lever 92, universal bail 103 is operated and, through its connections, lever 84 is operated whereby arm 69 is rotated against the tension of spring 79 to move its shoulder 68 free of arm 67. Stop arm 63 will, under such circumstances be held by its spring 66 free of stop lug 64 to insure repeated operation of cam drum 45. For each rotation of cam drum 45, a signal combination will be transmitted indicative of the space signal condition. Upon the release of the space bar 101, arms 69 and 71 return to the position shown in Fig. 7, whereupon arm 67 engages shoulder 68 and stop arm 63 is held against the tension of its spring 66 in the path of stop lug 64.

Secured to arm 322 is an adjustable screw 342, Fig. 5, engageable with an arm 343 of lever 310 so that when lever 307 is moved to a position where index 319 is opposite the letters TP engraved on member 315, arm 343 will be rotated about rod 308 in a clockwise direction, as viewed in Fig. 1. To arm 343 a link 344 extending to an arm 345 pivoted on a shoulder screw secured to base casting 12 is connected. Lever 345 has a ball shaped end, as viewed in Figs. 2 and 8, engageable in a correspondingly shaped slot in plate 89, which, as previously described, pivotally carries arms 92 and 93 through which levers 85 and 84, respectively, are operated. When the switch lever 307 is in the position identified by the letters TP engraved on member 315, plate 89, through link 344 and lever 345, is rotated to the position shown in Fig. 8 wherein arms 92 and 93 are moved free of levers 85 and 84, respectively. Also, through lever 346 lever 262 which is capable of rotation in a horizontal plane and which is movable in a vertical plane is moved into the path of hook bar 302 so that upon the operation of hook bar 302 through the depression of key lever 303, its allocated operation, as will be subsequently described, will be performed. Through the movement of arms 92 and 93 out of the path of levers 85 and 84, respectively, arms 69 and 71 will not be operated upon the operation of the universal bail and the space bar to release arm 67 and withdraw stop arm 63 from engagement with stop lug 64. Under such circumstances, even though the universal bail and the space bar may be operated, cam drum 45 will be held against rotation.

With lever 307 in the position indicated by the letters TP, lever 330 remains out of the path of arm 331 of the lever system 332, but through link 325 and arm 177, U-shaped member 158 will be rotated about its pivots 159 and 160 to position lever 156 directly above projection 154 of lever 151. Now, when a key lever or the space bar is depressed, universal bail 103 will be rotated about its pivots 104, arm 163 will be elevated as viewed in Fig. 1, lever 156 will be rotated, and lever 151 also rotated to remove shoulder 150 from the path of projection 149 of lever 141. Spring 146 of lever 141 thus withdraws projection 140 from the path either of stop lug 143 or 144, depending upon the previous stop position of cam 145, whereupon cam 183 is rotated to permit engagement of the positive portion of clutch 138, whereupon power is communicated to cam 136.

Through the operation of a key lever, permutation bars 31 are set permutably to set the interponents 124 correspondingly. With cam 136 rotating, lever 131 will be rotated and through arm 130 operate punch hammer 123 against the tension of its spring 135 to move the correspondingly selected punches 118 upwardly to perforate tape 122 with a transverse row of perforations corresponding to the setting of the per-

mutation bars 31 identified with the particular key lever depressed. As cam 136 continues its rotation and just before it has completed its half cycle of rotation, spring 135 is effective to restore punch hammer 123 to the position shown in Fig. 3 and in so doing operates the pin drum 126 through pawl 178 and ratchet teeth 179 to advance the tape 122 to present an unperforated area in alignment with the punch pins 118. Lever 151 will have been restored to its normal position upon the release of the depressed key lever so that projection 149 engages shoulder 150 and rotation of cam 136 is arrested. However, if the key lever be held depressed, projection 149 will engage shoulder 174 of lever 173 and thus assure that stop arm 140 will be moved into the path of stop lug 143 or 144 to arrest the rotation of cam 136. Now, when the depressed key lever is released, lever 151 will be restored to the position shown in Fig. 6 and projection 149 will snap from shoulder 174 of lever 173 to shoulder 150 of lever 151. For each succeeding key lever depressed the operation just described will be repeated.

With the switch lever 307 in the tape transmission-perforate position, it is desired to operate the counting device 18; that is, for each operation of the perforator the pointer 247 is advanced along the scale 246 step by step. To so operate the counter, link 281 through the movement of which shaft 253 is rotated to operate feed pawl 250 and thus rotate pointer 247 an appropriate distance is provided. Reciprocation of link 281 is accomplished through a lever 346, Fig. 4, pivoted at 347 and having one end fitted in an aperture in the extreme left-hand end of link 281, as viewed in Fig. 4, and having its other arm engageable by an arm 348 carried by arm 131 which, as previously described, is operated by cam 136. Lever 346 has its pivot 347 carried in a U-shaped member 349 pivoted on a vertical axis formed in the upper surface of casting 12 and provided with an arm 350, Fig. 2, engageable by a roller carried in one arm of an L-shaped member 351 secured to link 325 which, as previously described, is secured to projection 324 of arm 322 which is integral with lever 307 and which is set in accordance with the set positions of lever 307. With lever 307 in the position for tape transmission and perforator operation, the roller on member 351 will engage arm 350 and rotate U-shaped member 349 clockwise against the tension of spring 353, as viewed in Fig. 2, to position the lower arm of lever 346 in the path of arm 348 carried by arm 131 which is operated by cam 136. Now, for each half revolution of cam 136, arm 348 will be depressed to rotate lever 346 and thus move link 281 to the left, whereupon rod 253 is rotated and pawl 250 engages a tooth in segment 249 to advance pointer 247 where it is held by holding pawl 251. For each half revolution of cam 136, link 281 will be reciprocated and pointer 247 will be advanced along the scale carried by member 246.

As pointer 247 is advanced, cam 297, Fig. 2, is also advanced to rotate bell crank lever 298 against the tension of spring 299. When cam 297 has been advanced to a predetermined point, contacts 300 will be closed and the energizing circuit for signal lamp 301 will be closed. The illumination of lamp 301 indicates to the operator the approach of the end of a line of printing and also that the carriage return key which perforates the tape correspondingly and which withdraws holding pawl 251 from engagement with the teeth of segment 249 free thereof to permit the restoration of pointer 247 to its zero position should be operated. This is possible due to the fact that plate 89 is in a position where lever 262 is in the path of hook bar 302 secured to lever 303 identified with the carriage return function.

When perforated tape is being advanced from the perforator 16 due to its operation, the tape transmitter 17 may or may not be operating simultaneously with the operation of the perforator 16 as fully described in the cited copending application of Erwin A. Gubisch and Albert H. Reiber.

As shown in Fig. 1, an arm 369 of a lever 358 secured to a rod 359 cooperates with the insulated end of contact 356 to move such contact out of engagement with contact 355 and thus break the circuit of electromagnet 218 to arrest the operation of tape transmitter 17. Rod 359 is suitably journaled in brackets secured to base casting 12 and has secured to its forward end a depending arm 360 bifurcated at its lower end to cooperate with a pin 361 secured to an arm of a bell crank lever 362 rotatably mounted on a shoulder screw 363 and held in either of two positions by an off-center spring 364. By moving bell crank lever 362 to either of its two extreme positions wherein it will be held by spring 364, depending arm 360 will be rotated either counterclockwise or clockwise, as viewed in Fig. 1, to cause corresponding rotation of rod 359 and, in turn, lever 358, whereupon its arm 357 either moves spring 356 free of spring 355 or allows these springs to engage and thus complete a circuit to cause resumption in the operation of tape transmitter 17.

With the provision of lever 362, operation of tape transmitter 17 may be selectively controlled by the operator, for with the lever 362 in its extreme lowermost position, as viewed in Fig. 1, contacts 355 and 356 are open and operation of transmitter 17 is precluded. With operation of tape transmitter 17 arrested and with switch member 307 in the keyboard perforate position, the perforator 16 may be operated for perforating tape 122 prior to the transmission of signals indicative of the transverse rows of perforations in tape 122. Such an arrangement enables an operator prior to transmission from perforated tape 122 to determine the accuracy of the message to be transmitted by examining the printed copy of the message as recorded on the receiving printer 13 in response to the operation of the keyboard transmitter including the selectable fingers 34, cam drum 45, and contacts 41 and 42. When the accuracy of the message to be transmitted has been determined, lever 362 may be thrown to its uppermost position to close contacts 355 and 356 whereupon tape transmitter 17 will operate in a manner well understood for transmitting signal combinations indicative of the perforations in tape 122.

Also, cooperating with the insulated end of spring 356 is an arm 365 of a lever system 366 which has an arm 367 extending toward the transmitter 17, as viewed in Fig. 1, and having a section bent transversely of tape 122 located between the perforator 16 and the tape transmitter 17. When the section of tape 122 intermediate perforator 16 and tape transmitter 17 becomes taut, arm 367 of lever system 366 will be raised and arm 365 will be rotated in a clockwise direction, as viewed in Fig. 1, to move spring 356 free of spring 355 and thus arrest operation

of the transmitter or senser 17. As the tape 122 intermediate perforator 16 and tape transmitter 17 loses its tautness or forms a loop therebetween, arm 267 will drop sufficiently to rotate lever system 366 and move arm 365 free of contact 356 whereupon contacts 355 and 356 are again in electrical connection to complete a circuit, when transmission through the operation of the tape transmitter 17 will be resumed. Of course, the effectiveness of lever system 366 on spring 356 is contingent upon lever 362 being in its uppermost position wherein contacts 355 and 356 are in engagement.

In order to prevent the operation of tape transmitter 17 when switch member 307 in is its direct keyboard transmission position, contact 356 is moved free of contact spring 355 through rotation of lever 358 counterclockwise, as viewed in Fig. 1, due to cooperation of its arm 368 with a horizontal projection 369 fastened to projection 323 of arm 322. Horizontal projection 369 has a vertical projection which engages a pin carried by arm 368 of lever 358 and rotates lever 358 sufficiently to remove contact spring 356 for engagement with contact spring 355 and thus open the energizing circuit of the control electromagnet of transmitter 17 to arrest or prevent operation of such transmitter when switch member 307 is in either of the two indicated positions.

It will be apparent from the previous description that the apparatus embodied in the present invention is capable of a variety of selective operations; that is, it may be used for direct keyboard transmission, keyboard transmission and perforator operation, or for tape transmission and perforator operation depending upon the position of switch member 307. When the switch member 307 is in its tape transmission-perforator operation position, counting device 18 is effective for indicating to the operator, as the composition of the message proceeds, the exact location of each character in the line of printing and informs the operator of the approach of the end of the line of printing when the carriage return key should be depressed for perforating in the tape a carriage return signal and for restoring the counting device 18 to its zero or beginning of line position. When the switch member 307 is in its tape transmission-perforator operation position, tape transmitter 17 operates in accordance with the transverse rows of perforations appearing in tape 122. If, during such operation the transmission of a flash or urgent message is desired, switch member 307 may be moved to its direct keyboard transmission position which will establish a condition to arrest tape transmitter 17 and rotate plate 389 to bring levers 92 and 93 into operative relation with levers 85 and 84, respectively, to place the transmitting drum 45 under the control of the key levers, and do render the counting device 18 inoperative either in response to the operation of the character key levers or the operation of the carriage return key lever. Under such conditions the indicator 247 of the indicating device 18 will remain in its previously advanced position pending the transmission of the flash or urgent message through the operation of the key levers and the rotation of cam drum 45. When transmission of the flash or urgent message has been completed, switch member 307 may be restored to its tape transmission keyboard operation position wherein the tape transmitter 17 will resume its operation and indicating device 18 will be placed under the control of the perforator 16 and will continue its operation from the point reached in the message when the switch member 307 was moved from its tape transmission perforator operation position to its direct keyboard transmission position for the transmission of the flash or urgent message. By retaining the indicating pointer 247 of the indicating device 18 in its advanced position during transmisson of the flash or urgent message, the operator will know the exact position of the line of printing, as represented in tape 122, when perforator operation is resumed.

The switch member 307 has a third position for the control of the apparatus; namely, the keyboard-perforate position. When in this position, the keyboard transmitter 15 and the tape perforator 16 will be operated. The tape transmitter may also be operated due to the fact that contacts 355 and 356 may be closed, which controls operation of tape transmitter 17. This position of the switch member 307 is represented by KP on semi-circular member 315.

With the switch member 307 in the position indicated KP, arm 322 will be rotated to its extreme left-hand position, as viewed in Fig. 1, wherein arm 369 causes lever 358 to be rotated to a position where contacts 355 and 356 are separated. The control circuit for the tape transmitter is thereupon opened. Also, with switch member 307 in its extreme left-hand position, link 325 is moved to the right, as viewed in Fig. 1, whereupon through link 177 U-shaped member 158 is rotated about its pivots 159 and 160 to a position where lever 156 lies out of the path of arm 163 of the universal bail 103 so that the depression of key levers 20 and the space bar 181 will not operate lever 156 and thus control the operation of clutch 138 through which power is communicated to cam 136 for operating the perforator 16. Also, with link 325 in its extreme right-hand position, arm 326 will have engaged lever 328 to rotate arm 330 in the path of 331 which, as previously described, is operated by cam 338 mounted on cam drum 45 which is driven through the toothed members 62 and 63. In addition, the movement of link 325 to its extreme right-hand position permits spring 353 to rotate lever 346 out of the path of arm 349, which is operated by lever 131 of the perforator 16 so that even though lever 131 is operated by its cam 136, lever 346 will not be operated when the link 325 is in its extreme right-hand position, as viewed in Fig. 1. Consequently, bar 281 through which the counting mechanism is operated will not be reciprocated for each cyclic operation of the perforator.

Operatively associated with and operated by lever 330 is a bar 373, Figs. 1, 2, and 4, which has one end supported by a shoulder screw 374, Fig. 4, fastened to a bracket 375 mounted on the upper face of base 12. As shown in Fig. 4, bar 373 is slotted at the location of screw 374 which permits limited reciprocation. The other end of bar 373 is fastened to one end of a bell crank lever 376 rotatably supported by a shoulder screw 377, Fig. 1, supported by a bracket 379, Fig. 2, secured to the upper face of base 12 and provided with an adjustable screw 380 to limit the leftward travel of bar 373 and thus control the extent of counterclockwise rotation of bell crank lever 376. Bracket 379 also carries a spring post to receive one end of a spring 381 which has its other end secured to an arm of lever 376. Thus, it is seen that bar 373 is moved to the right, as viewed in Fig. 4, against the tension of spring 381.

As illustrated in Figs. 1 and 4, the free arm

of bell crank lever 376 is positioned above pivoted lever 151 so that upon clockwise rotation of bell crank 376, lever 151 will be rotated against the tension of its spring 175 to render clutch 138 effective, whereupon cam 136 rotates to operate punch hammer 123 through arm 131 and its associated apparatus. It is thus apparent that for each operation of cam drum 45 cam 338 is effective to operate arm 330 through arm 331, whereupon bar 373 is moved to the right, as viewed in Fig. 4, against the tension of its spring 381. Bell crank lever 376 is rotated clockwise, as viewed in Fig. 1, and lever 151 is rotated to release clutch 138, as previously described in connection with the detailed description of the perforator and its operation. When cam 338 has rotated to a position where its apex clears the cam follower roller 337, spring 381 will restore bar 373 and arm 330 to their normal or unactuated position.

When switch arm 307 is in the position indicated by the letters KP, the keyboard and the cam drum 45 are operated to transmit to the connected line, provided the line circuit has been closed, and to the receiving printer, signals in accordance with the operation of the key levers 20 and to perforate tape 122 correspondingly. Inasmuch as receiving printer 13 responds to the operation of the key levers 20 and since such a printer prints the characters or the message in page form, the character counter 18 is not required in such operation because the receiving printer 13 serves to indicate to the operator the end of a line of printing, whereupon the operator depresses the carriage return key which transmits a signal to restore the carriage to its beginning of line position and to perforate in tape 122 through the corresponding setting of the interponents 124 a signal combination indicative of the carriage return function. For each operation of cam drum 45 in response to the depression of each of the key levers 20 and the space bar 101, cam 338 operates arm 331 to in turn operate arm 330. Through the operation of arm 330 bar 373 is moved to the right to rotate bell crank 376 in a clockwise direction to depress lever 151 through which clutch 138 is released.

It is apparent from the previous description that with the switch member 307 in its extreme left-hand position, the cam drum 45 will be operated in the same manner as previously described, when the switch member 307 was in its keyboard position; that is, the position indicated by the letter K. However, with the switch member 307 in its extreme left-hand position, bar 373 will be operated through arms 331 and 330 for each cycle of rotation of cam drum 45 so that the perforator, instead of being controlled from the key levers 20 and the space bar 101, is controlled from and is operated in timed relation with the operation of cam drum 45.

If after the tape 122 has been prepared with the switch member 307 in its extreme left-hand position it is desired to transmit the signals represented by the transverse rows of perforations, the perforated tape 122 is inserted in transmitter 17 and contacts 355 and 356 are closed through the appropriate operation of lever 362. Under such circumstances, the transverse rows of perforations will be sensed and signals will be transmitted through the corresponding operation of contact springs, as described in detail in the cited copending application.

While the invention has been described as applied to a particular form of apparatus, it is apparent that it is applicable to other forms of apparatus without departing from the spirit and scope of the present invention.

What is claimed is:

1. In combination with a telegraph transmitter and tape perforator including a cyclically operated member responsive for each operation of the perforator, key levers for controlling said transmitter and said perforator, a tabulation indicator including a scale, an index pointer cooperating with said scale to indicate the number of operations, a ratchet and pawl mechanism for operating said pointer step by step, a bar reciprocated by and for each operation of said cyclically operated member, and means operated by said bar for operating said pawl to rotate said ratchet and said pointer.

2. In combination with a telegraph transmitter and tape perforator including a cyclically operated member responsive for each operation of the perforator, key levers for controlling said transmitter and said perforator, a tabulation indicator including a scale, an index pointer cooperating with said scale to indicate the number of operations, a ratchet and pawl mechanism for operating said pointer step by step, a bar reciprocated by and for each operation of said cyclically operated member, means operated by said bar for operating said pawl to rotate said ratchet and said pointer, and means responsive to the operation of certain of said key levers for restoring said ratchet and pointer to their zero or normal position.

3. In combination with a telegraph transmitter and tape perforator including a cyclically operated member responsive for each operation of the perforator, key levers for controlling said transmitter and said perforator, a tabulation indicator including a scale, an index pointer cooperating with said scale to indicate the number of operations, a ratchet and pawl mechanism for operating said pointer step by step, a bar reciprocated by and for each operation of said cyclically operated member, means operated by said bar for operating said pawl to rotate said ratchet and said pointer, and means actuated upon depression of certain of said key levers for rendering the movement of said reciprocated bar ineffective on said pawl whereby said ratchet and pointer are not stepped under such conditions.

4. In combination with a telegraph transmitter and tape perforator including a cyclically operated member responsive for each operation of the perforator, key levers for controlling said transmitter and perforator, means for rendering said transmitter and perforator operative selectively from said key levers, a tabulation indicator including a scale, an index pointer cooperating with said scale to indicate the number of operations, a ratchet and pawl mechanism for operating said pointer step by step, a bar reciprocated by and for each operation of the cyclically operated member, means operated by said bar for operating said pawl to rotate said ratchet and said pointer, and means actuated by said first recited means for precluding the operation of said pawl by said bar from said cyclically operated member.

5. In combination with a telegraph transmitter and tape perforator including a cyclically operated member responsive for each operation of the perforator, key levers for controlling said transmitter and perforator, means for rendering said transmitter and perforator operative selectively from said key levers, a tabulation indicator including a scale, an index pointer co-

operating with said scale to indicate the number of operations, a ratchet and pawl mechanism for operating said pointer step by step, a bar reciprocated by and due to each operation of the cyclically operated member, means operated by said bar for operating said pawl to rotate said ratchet and said pointer, means actuated by said first recited means for precluding the operation of said pawl by said bar from said cyclically operated member, and means responsive to the operation of certain of said key levers for restoring said ratchet and pointer to normal or zero position.

6. In combination with a telegraph transmitter and tape perforator including a cyclically operated member responsive for each operation of the perforator, key levers for controlling said transmitter and perforator, means for rendering said transmitter and perforator operative selectively from said key levers, a tabulation indicator including a scale, an index pointer cooperating with said scale to indicate the number of operations, a ratchet and pawl mechanism for operating said pointer step by step, a bar reciprocated by and due to each operation of the cyclically operated member, means operated by said bar for operating said pawl to rotate said ratchet and said pointer, and means actuated by said first recited means for precluding the operation of said pawl by said bar from said cyclically operated member and the restoration of said ratchet and pointer to normal when certain of said key levers are depressed.

7. In combination with a telegraph transmitter and tape perforator including a cyclically operated member responsive for each operation of the perforator, character and function key levers for controlling said transmitter and said perforator, a tabulation indicator including a scale, an index pointer cooperating with said scale to indicate the number of operations of the character keys, means for operating said pointer step by step, means reciprocated by and due to each operation of said cyclically operated member upon the depression of each of said key levers, and means operated by said reciprocated means for operating the pointer operating means for the depression of each of said character key levers.

8. In combination with a telegraph transmitter and tape perforator including a cyclically operated member responsive for each operation of the perforator, key levers for controlling said transmitter and said perforator, a tabulation indicator including a scale, an index pointer cooperating with said scale to indicate the number of operations, a pawl and ratchet for operating said pointer step by step, a bar reciprocated by and due to each operation of said cyclically operated member, and means effective upon the reciprocation of said member for allowing said pawl to engage said ratchet and for moving said pawl after such engagement to rotate said ratchet whereby said pointer is moved along said scale.

9. In combination with a telegraph signal transmitter and a tape perforator including key levers for controlling said transmitter and said perforator, a cam operated for each key lever depressed when said perforator is effective for perforating a tape in accordance with telegraph signals, a tabulation indicator for indicating the number of character key levers depressed including a scale, an index pointer cooperating with said scale to indicate the number of operations, means for operating said pointer step by step, means operated by said cam for operating said pointer operating means, and means for precluding the operation of said cam operating means by said cam during the operation of said signal transmitter.

10. In combination with a telegraph transmitter and tape perforator including a cyclically operated member responsive for each operation of the perforator, key levers for controlling said transmitter and perforator, means for rendering said transmitter and perforator operative selectively fom said key levers, a tabulation indicator including a scale, an index pointer cooperating with said scale to indicate the number of operations, a ratchet and pawl mechanism for operating said pointer step by step, a bar reciprocated by said cyclically operated member, means intermediate said bar and said cyclically operated member through which said bar is reciprocated, means operated by said bar for operating said pawl to rotate said ratchet and said pointer, and means for rotating said intermediate means whereby said bar will not be reciprocated by said cyclically operated member.

11. In combination with a telegraph transmitter and tape perforator including a cyclically operated member responsive for each operation of the perforator, character and function key levers for controlling said transmitter and said perforator, a tabulation indicator including a scale, an index pointer cooperating with said scale to indicate the number of operations of the character keys, means for operating said pointer step by step, means reciprocated by and due to each operation of said cyclically operated member upon the depression of each of said key levers, means operated by said reciprocated means for operating the pointer operating means for the depression of each of said character key levers, and means for precluding the operation of said pointer operating means upon the depression of a function key lever notwithstanding the operation of said reciprocated means.

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