

Dec. 10, 1935.

H. L. KRUM ET AL

2,024,006

KEYBOARD PERFORATOR AND COUNTER

Filed March 25, 1932

7 Sheets-Sheet 1

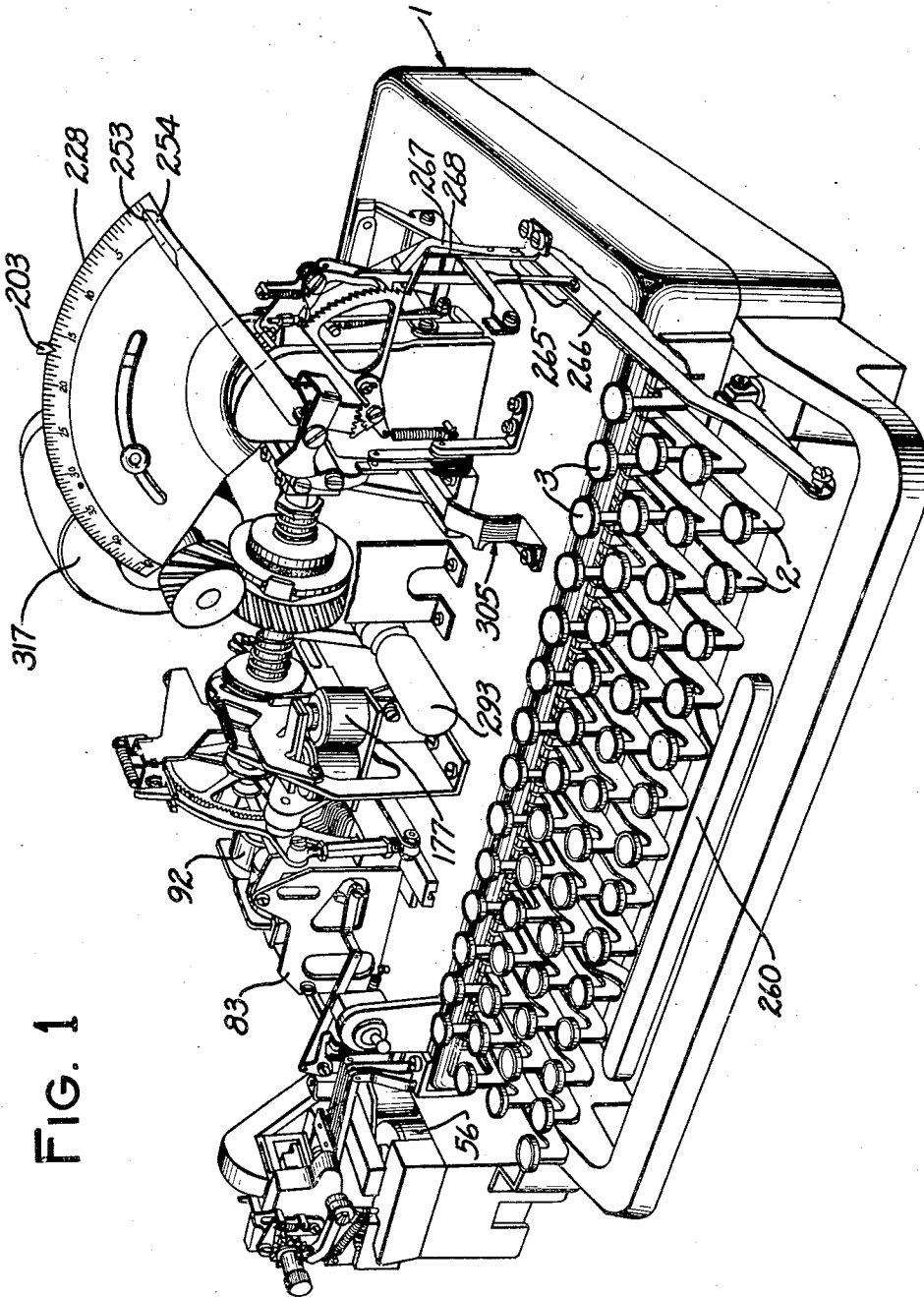


FIG. 1

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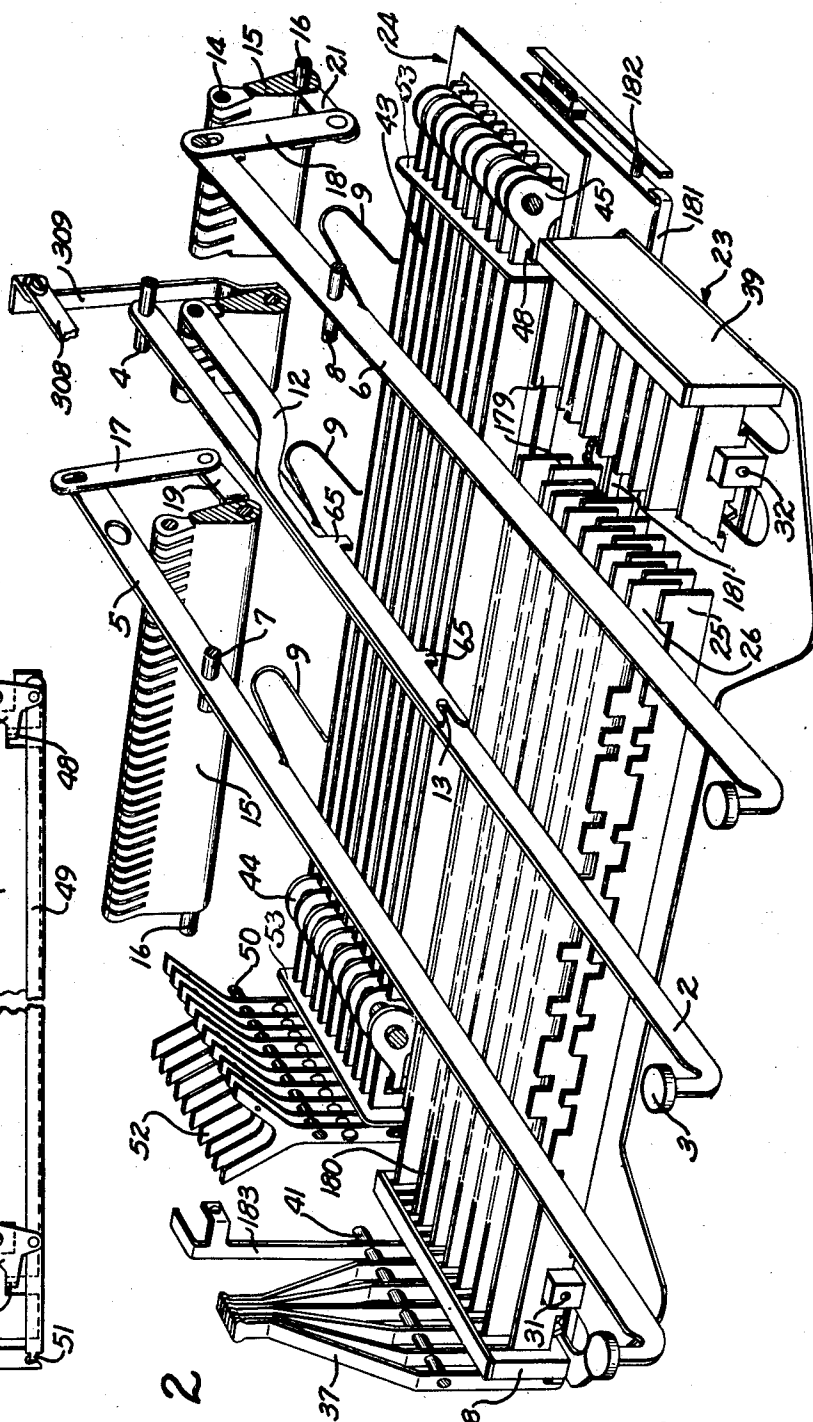
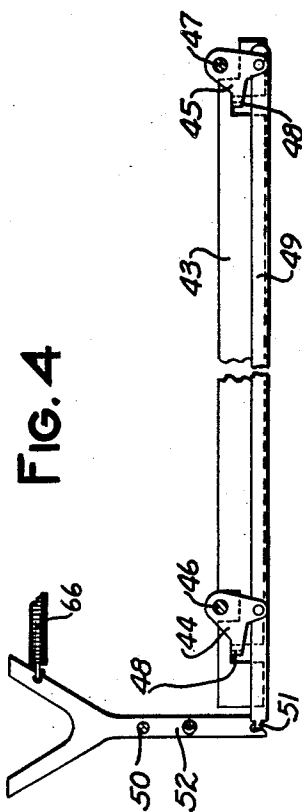
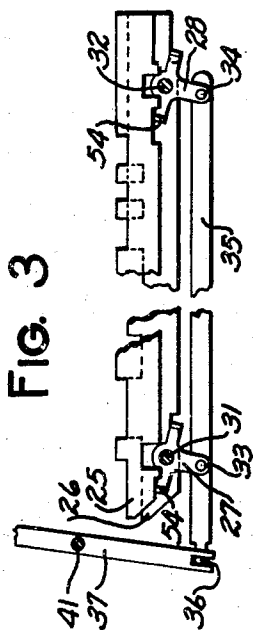
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FIG. 6

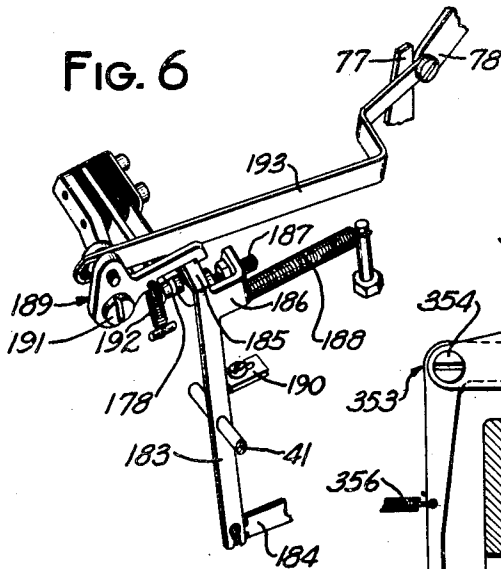


FIG. 7

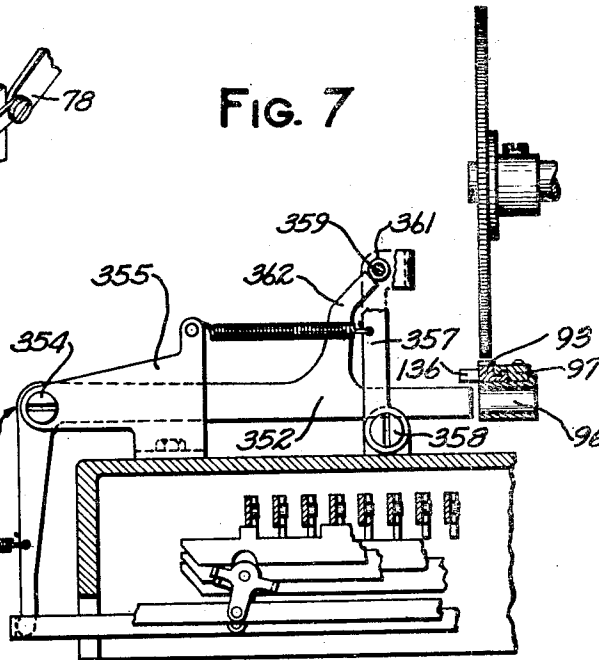
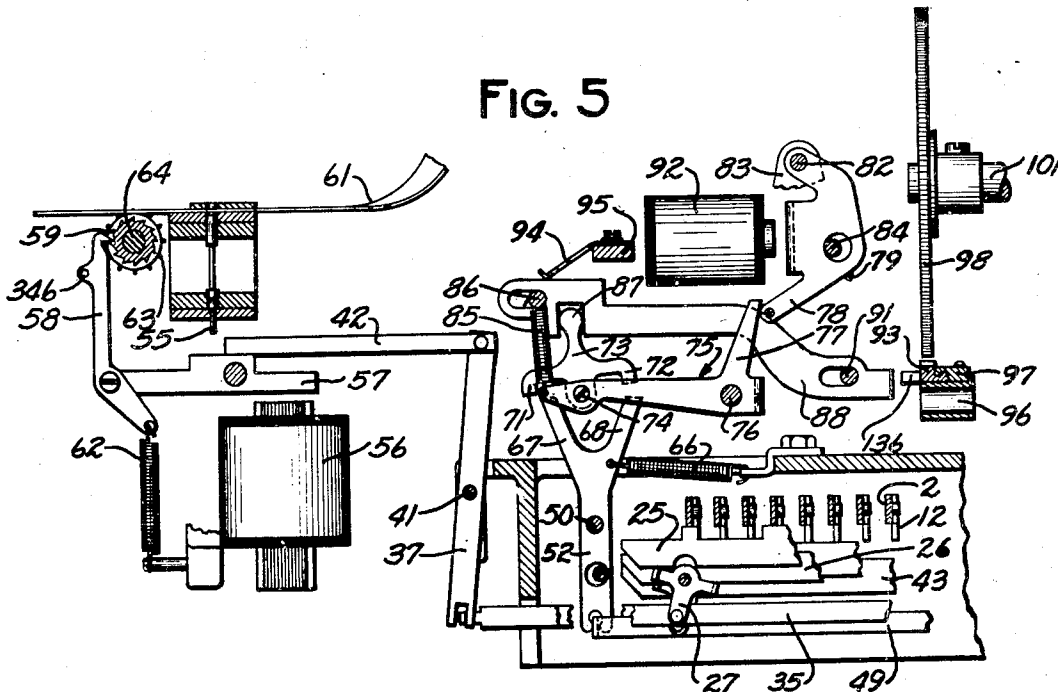


FIG. 5



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FIG. 8

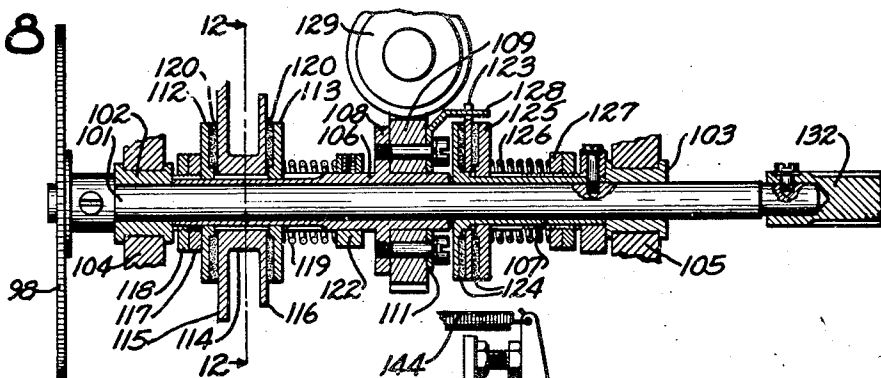


FIG. 10

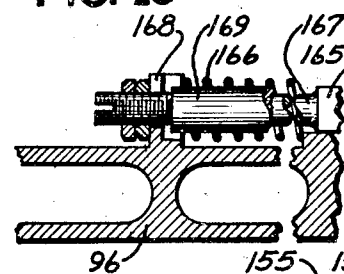


FIG. 9

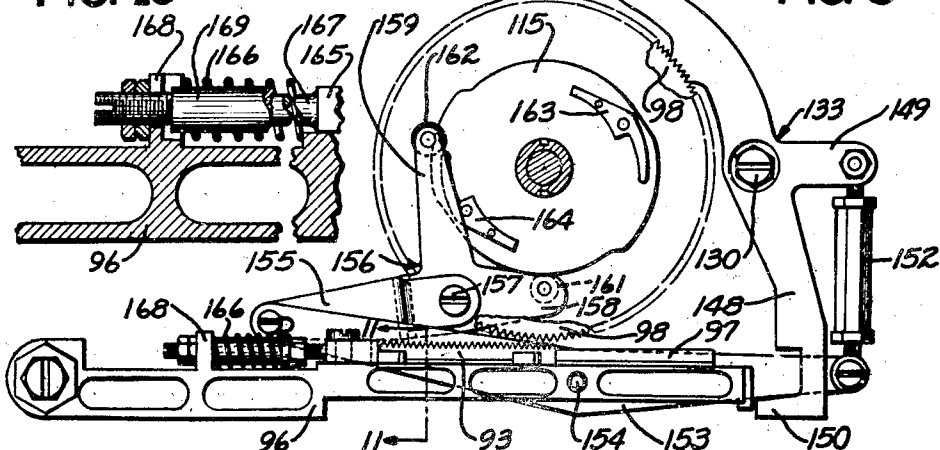


FIG. 11

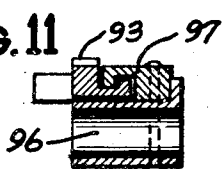


FIG. 12

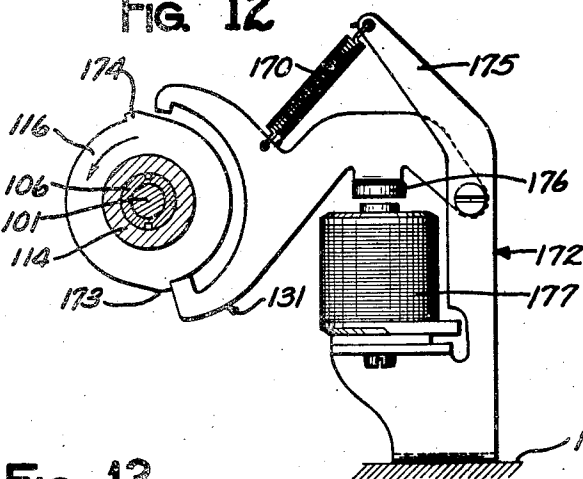
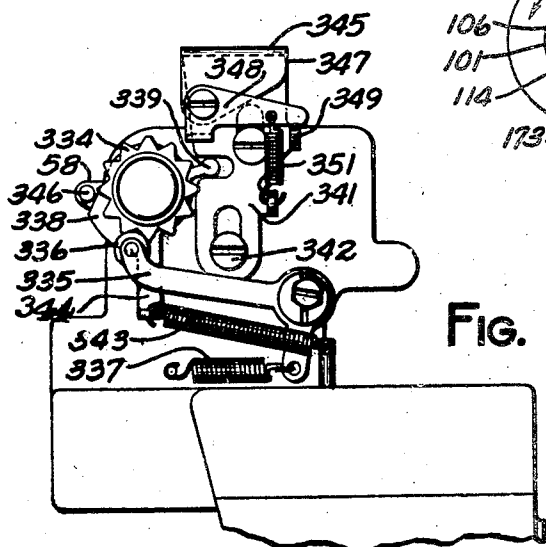


FIG. 13



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KEYBOARD PERFORATOR AND COUNTER

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FIG. 14

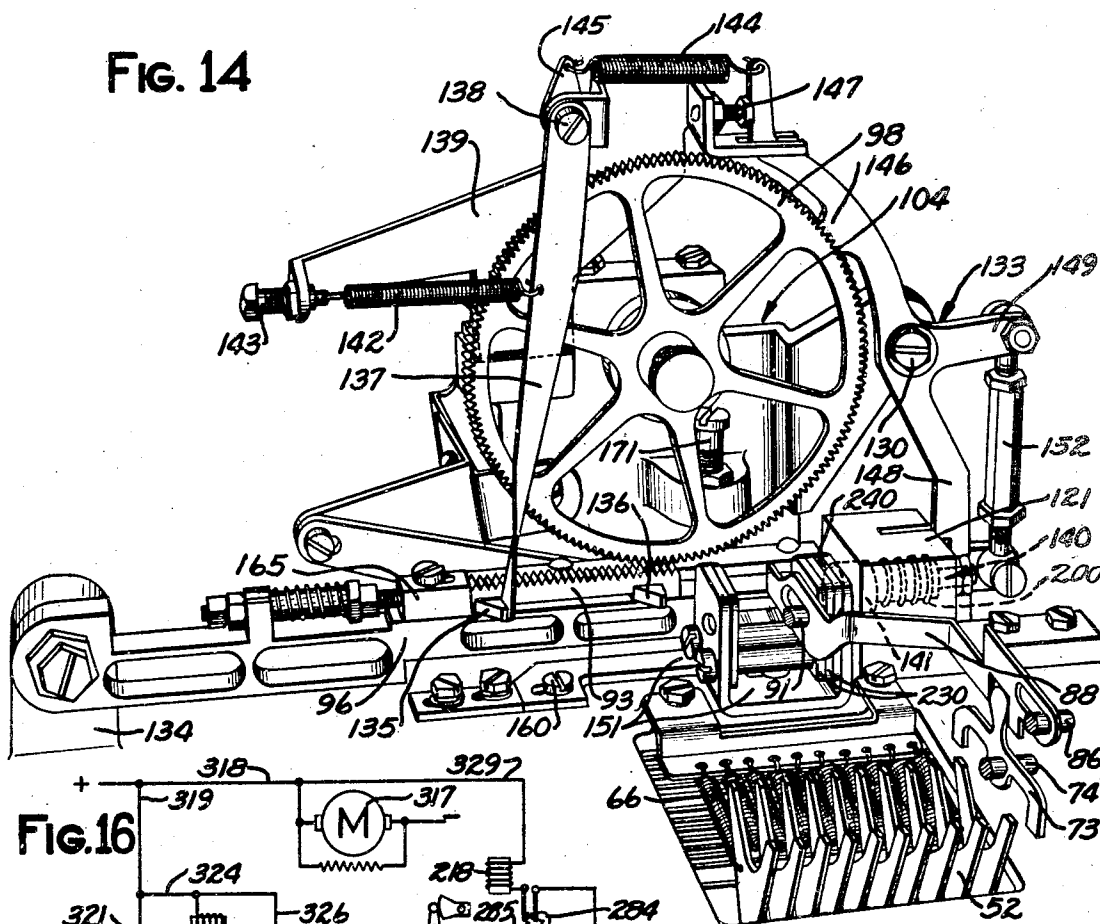


FIG.16

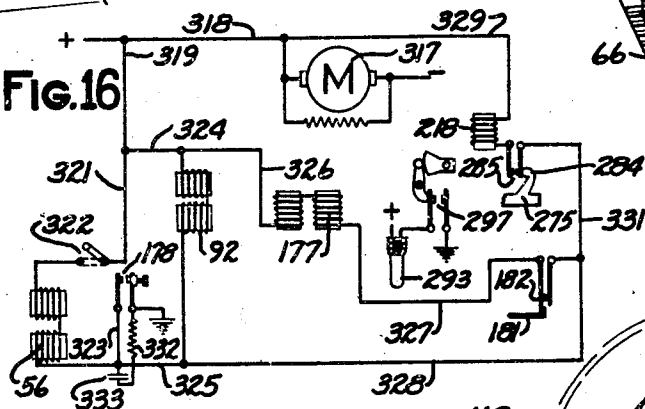
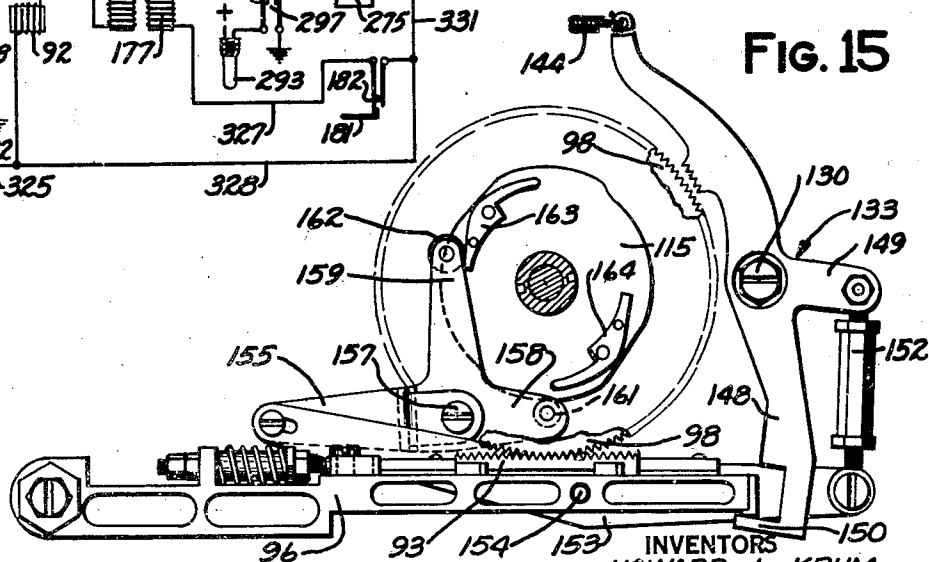


FIG. 15



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KEYBOARD PERFORATOR AND COUNTER

Filed March 25, 1932

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FIG. 17

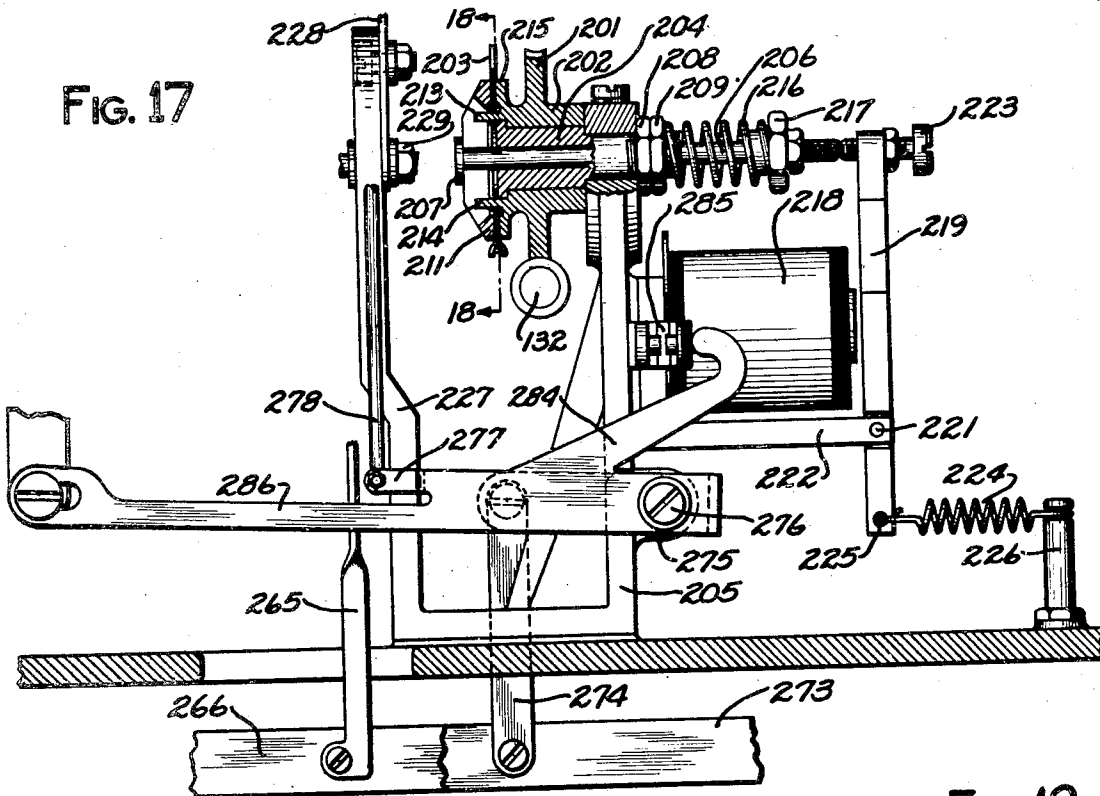


FIG. 18

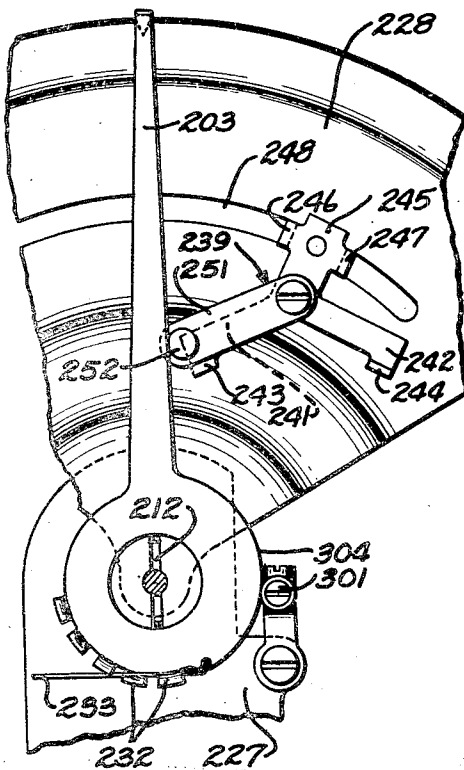
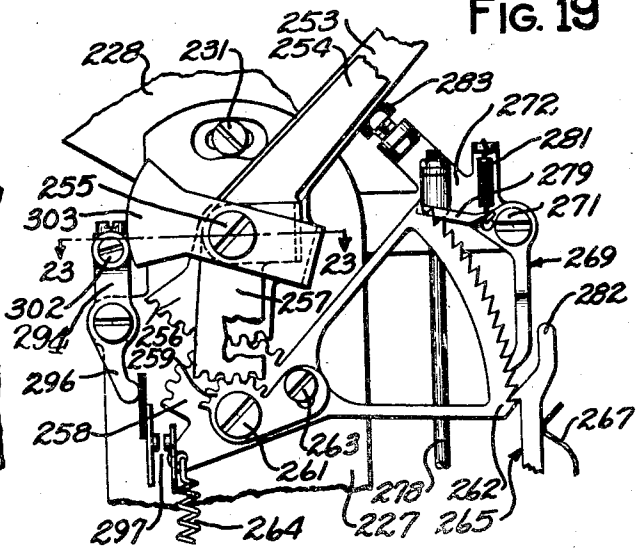


FIG. 19



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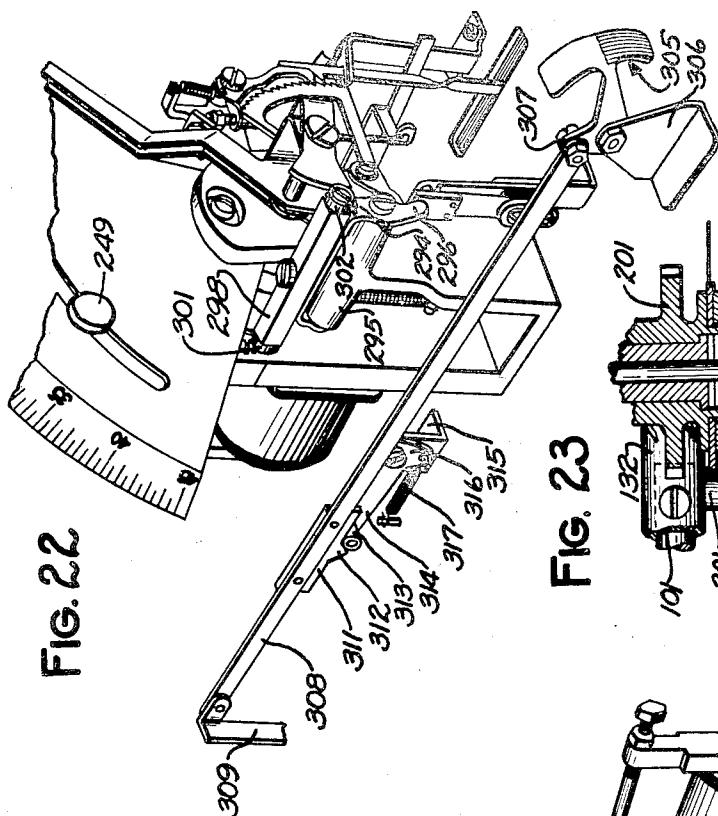


FIG. 22

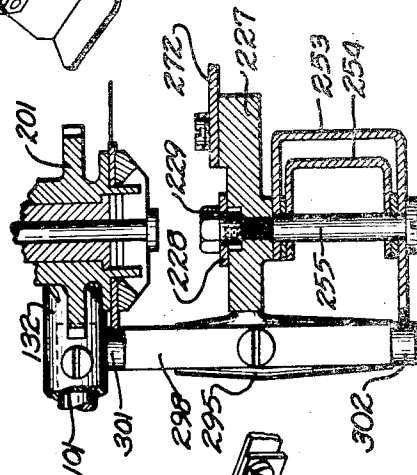


FIG. 23

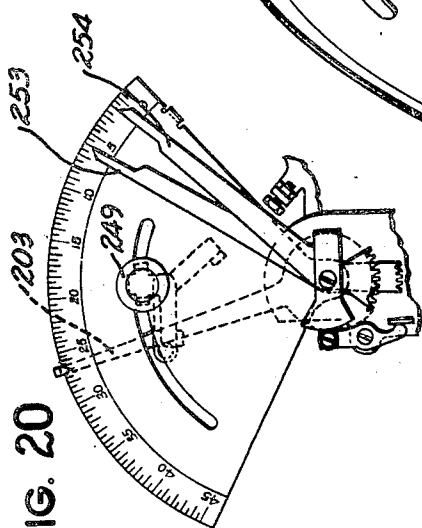


FIG. 20

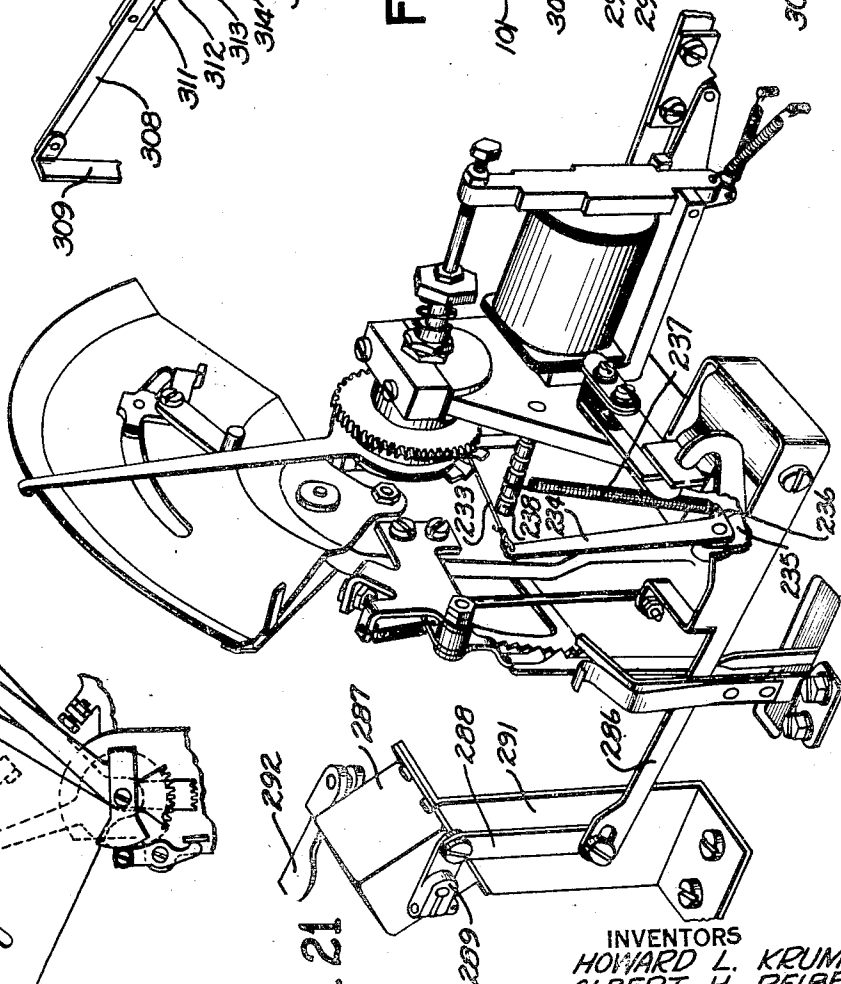


FIG. 21

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UNITED STATES PATENT OFFICE

2,024,006

KEYBOARD PERFORATOR AND COUNTER

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Application March 25, 1932, Serial No. 601,172

28 Claims. (Cl. 164—113)

This invention relates to type setting systems and apparatus therefor and more particularly to perforators and counters which may be utilized for preparing a perforated tape for the automatic control of composing machines of the line casting type.

As is commonly known in the typographical art, composing machines of the line casting type are provided with matrices which consist of small brass units carrying indented characters in their edges and which are of different thicknesses due to the fact that the characters vary in width. Thus, when these matrices are assembled into a line of predetermined, definite length the number of matrices necessary to complete the line varies with the particular matrices used; the length of the line, therefore, is dependent, not upon the number of characters in the line, but rather upon the thicknesses of the characters or matrices making up the line. Consequently, it is necessary during the preparation of a perforated tape representing lines of composed matter to totalize the various thicknesses of matrices corresponding to the code perforations made in the tape, so that the operator will be apprised at all times of the length of line remaining as each key is operated and can thus judge of the justifiability of the line.

Besides the usual character matrices, composing machines of the particular type to which the present invention relates are also provided with expansible space bands or justifying matrices which comprise a portion analogous to and having the contour of a character matrix and which is positioned in the line of matrices usually between each series of character matrices comprising a word, and this portion has slidably articulated thereto and depending therefrom a wedge portion. By means of these wedge portions the justifying matrices are adjusted between certain ranges of thickness before the casting operation is performed. Under these circumstances a counting device to indicate to the operator the totalized thickness of matrices in a line during the process of composition, and the number as well as the minimum, maximum and variable thickness of the justifying matrices in the line is highly desirable.

Heretofore, character widths in type faces in the various fonts of type employed in line casting machines were designed with no attempt at grouping; that is, a letter, as "a" would not be of the same proportionate thickness in one font of type as in another font, and manifestly, grouping was not even intended. The present tendency

in the design of new fonts of type, either to supersede prior designs or to afford new designs, is to assign each character to a certain definite group. For example, it has been found desirable to divide the widest characters into eighteen (18) units, and to establish eleven definite groupings on the basis of the following unit sizes: 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 18. In this system 18 units are equivalent to the set or em quad size of the font. The lower case "a" would, for example, be assigned to group 11 regardless of the font or style of type, signifying that a lower case "a" is eleven units in width; a unit being not an actual dimension but merely a proportion of the quad size in the particular font of which it is a part.

To accomplish the accurate counting or totalizing of the matrices in the composed line the apparatus according to the present invention is adapted to count proportions, expressed in eighteenthths of the set or quad size, and not actual dimensions. Thus, the apparatus can be used for any size of type provided only that the characters in the various fonts have the same unit grouping, and an interchangeable space band segment be chosen to suit the set size of the font of type.

A primary object of the present invention is the provision of a keyboard perforator and counter in which the counting operation is performed with extreme accuracy, and which is flexible to such a degree that it may be used for any font of type, regardless of size, with the characters arranged in similar unit groups.

Another object of the present invention is the provision of a keyboard perforator and counter which is simple in construction, reliable and efficient in operation at all speeds, particularly at high speeds, and inexpensive to manufacture.

Primarily, the present invention is a keyboard device intended to be employed in the preparation of perforated tapes, the perforations in which represent lines of composed matter; and also to take account of the number of characters or matrices composed so that in a line of predetermined length the amount or length of a line remaining to be filled or completed will always be ascertainable. The device is provided with a keyboard having its keys arranged similar to the familiar typewriter keyboard. Within the base of the device are contained two selector mechanisms, one of which controls a perforator and the other controls a counting function; the latter is the function of totalizing the thicknesses of the characters or matrices making up the line

and includes the feature of indicating to the operator the approach of said totalization to a predetermined length of line.

Both selector mechanisms are operable by the key levers to arrange in proper combinations a set of punch interference bars in the perforator and simultaneously to select one of a series of stop bars in the counting mechanism to control the movement of a unit wheel. A single operating shaft is provided on which are mounted the unit wheel and other operating parts necessary to control the various functions of the device. Electromagnetically controlled means are provided to release the various parts for operation and these electromagnetic means are controlled through a common contact operable by each one of the keys.

An escapement means has also been provided to control the movement of the unit wheel in varying amounts to correspond to the thicknesses of the characters composing the line. The indicating means comprises a sectoral or fan shaped indicator, the indications on which are controlled by the unit wheel as well as by the space key, the cooperative effect of which indicates to the operator the approach of the end of the line.

A better understanding of the invention may be had from the following description, taken with the accompanying drawings, wherein:

Fig. 1 is a perspective view of a keyboard perforator and counter according to the invention.

Fig. 2 is a perspective representation of the key lever and selector mechanism arrangement.

Fig. 3 is a longitudinal elevational view of the perforating selector bar unit.

Fig. 4 is a longitudinal elevational view of the counter selector bar unit.

Fig. 5 is a diagrammatic sectional view showing the perforator and the transfer mechanism.

Fig. 6 is a perspective view of the positive contact control.

Fig. 7 is a sectional view showing a modified form of stop bar arrangement.

Fig. 8 is a longitudinal sectional view of the operating cam shaft.

Fig. 9 is an elevational view showing the matrix thickness counting mechanism in the normal, unoperated position.

Fig. 10 is a longitudinal sectional view of the unit rack stop.

Fig. 11 is a cross sectional view taken on line 11—11 of Fig. 9.

Fig. 12 is a sectional view taken on line 12—12 of Fig. 8 illustrating the escapement mechanism adjacent thereto.

Fig. 13 is an elevational view of the tape back spacing mechanism.

Fig. 14 is a perspective view of the matrix thickness counting mechanism.

Fig. 15 is an elevational view showing the counting mechanism in one of its operated positions.

Fig. 16 is a schematic diagram of the electrical circuits for operating the device of the present invention.

Fig. 17 is a partial cross-sectional view of the device taken adjacent to the indicating mechanism.

Fig. 18 is a fragmental rear view of the indicator dial.

Fig. 19 is a fragmental front view of the indicating mechanism.

Fig. 20 is a front elevational view of the indicator dial.

Fig. 21 is a rear perspective view of the indicating mechanism.

Fig. 22 is a front perspective view of the indicating mechanism.

Fig. 23 is a sectional view taken on line 23—23 of Fig. 19.

The present apparatus comprises essentially a base 1 which is provided at its front with a keyboard of the usual form, and which is adapted to house the key levers and the selector mechanisms operated thereby. Mounted on the base portion are the auxiliary devices, viz: the perforator, the counter, and the indicator, which are selectively controlled by the aforesaid selector mechanisms. The motor for driving all of these auxiliary devices, except the perforator which is electrically operated, is also appropriately mounted on the base in position to effect the rotation of a single operating shaft. All parts are thus suitably supported in such a manner to form a compact self-contained unit.

Having reference to Fig. 1, the base 1, as mentioned, is provided at its front with a keyboard comprising key levers 2 operated by keys 3. The key levers 2 extend interiorly of the base 1, and as illustrated in Fig. 2, are pivotally carried on a common pivot rod 4 appropriately mounted therein. A shift lever 5 and an unshift lever 6 are not carried by the common pivot rod 4, but are independently mounted in the base 1 on pivots 7 and 8, respectively. Each of the key levers 2 is provided with a return spring 9 for returning the associated lever to its normal position after it has been operated.

Juxtapositioned to each of the key levers, except the function key levers including the shift and unshift key levers, is a code bar 12 slidably supported at its forward end on stud 13 integral with the key lever. The rear end of each code bar 12 is pivotally carried on a common pivot rod 14 mounted in a rocker member 15 which is carried on a pivot shaft 16 suitably journaled in the base 1.

To the rear end of key levers 5 and 6 are pivotally connected links 17 and 18, respectively, which in turn are pivotally connected to brackets 19 and 21 affixed to the rear and front, respectively, of rocker member 15. Thus, member 15 is rendered rockable towards the front and rear alternatively by the levers 5 and 6, respectively. As member 15 is rocked, all of the code bars 12 are shifted simultaneously, the purpose of which is to constitute a shift mechanism to effect a change in the operation of the counting mechanism to correspond to upper or lower case characters, as will hereinafter appear.

The forward portion of the bottom edge of each of the code bars 12 is provided with projections which, as will be seen, co-act with a series of selector bars arranged underneath the key levers and disposed transversely thereof. These selector bars form a part of selector units 23 and 24. Selector unit 23 comprises a plurality of pairs of permutation bars 25 and 26, the upper edges of which are provided with notches. Each pair of permutation bars 25 and 26 rests upon a pair of rocker members 27 and 28, Fig. 3, which are mounted upon common rods 31 and 32, respectively. Each rocking member 27 and 28 has an ear extending forward to support a bar 25 and another ear extending backward to support the companion bar 26. The rocking members 27 and 28 are pivotally connected at 33 and 34, respectively, to a horizontal bar 35 which is provided at its left hand end, Fig. 3, with an ear 36 adapted 75

to engage a notch in an associated lever 37. Permutation bars 25 and 26 are adapted to be guided against lateral movement in suitable slots in end members 38 and 39 (Fig. 2). Levers 37 are pivotally mounted on common pivot 41 (Figs. 2 and 5) carried in the base 1 and are adapted at their upper ends to engage notches in punch interference bars 42.

Selector unit 24 comprises a series of bars 43 each of which is carried by a pair of bell cranks 44 and 45 (Figs. 2 and 4), which are pivotally carried on pivot rods 46 and 47, respectively. Each member 44 and 45 is provided with an ear 48 extending backward on which the bars 43 are carried. If desired bell cranks 44 and 45 may be positioned relative to bars 43 similarly to the positionment of members 27 and 28 relative to bars 25 and 26 in Fig. 3. The ends of the depending arms of each bell crank 44 and 45 are pivotally connected to a horizontal bar 49 which extends beyond the left hand connection, and the end of which is provided with an ear 51 adapted to fit into a notch in an associated Y-shaped lever 52, a series of which is mounted on a common pivot shaft 50 supported in the base 1. The bars 43 are maintained in spaced relation and are slidably held in guide combs 53 mounted on the base of the selector unit 24 (Fig. 2).

A description of the operation of the key lever 30 and selector mechanisms will now be given. Upon depression of a key 3 its key lever 2 will be caused to rotate about the pivot shaft 4 against the action of spring 9 and will engage the upper edges of permuted combinations of the permutation bars 25 and 26, which will thereby be depressed. It will be understood that for each key depressed a different combination of permutation bars will be operated. When a permutation bar 25, for example, is depressed, its lower edge engages with ears 54 of rocker members 27 and 28 causing the latter to rock on their pivots 31 and 32 producing at the same time an upward movement of the other ears of the rocker members and consequent upper movement of the companion permutation bar 26. This upward movement of the bar 26 is permitted by reason of the fact that the upper edge of the bar 26 is notched at points where the upper edge of bar 25 is not notched and vice versa. The permutation bars 50 are guided to move vertically by the guide members 38 and 39, previously mentioned.

The permutation bars 25 which have been depressed by the key lever 2 rock their associated rocker members 27 and 28 to swing in turn the associated bar 35 to the right thereby rotating the associated levers 37 counterclockwise and the interference bars 42 to the left, positioning the interference bars beneath punches 55, Fig. 5.

An electromagnet 56 will then be energized by establishing a circuit, as indicated in Fig. 16, from positive battery over wires 319 and 321, through contact 322 (when closed), through winding of magnet 56, over wire 323, through contact 178, thence to ground. Energization of magnet 56 rocks armature 57 clockwise, forcing the interference bars 42 upward against the punches 55 to perforate the tape 61. Simultaneously with the perforating operation, pawl 58 will move up to engage the next tooth on a ratchet 59. When the magnet is deenergized spring 62 draws the pawl down, rotating the ratchet 59 and feed roller 63 (both of which are affixed to the same shaft 64) one step in a well known manner, thus feeding the tape to position it for the next perforating operation. In this manner the tape is per-

forated in accordance with the operation of the key lever 2. The previously depressed bars 25 will be returned to their upward position by the next key operated, provided the corresponding hole is not to be perforated, since the operated key lever will engage the high part of a bar 26. If the corresponding hole is to be perforated the bar 25 will remain in its downward position.

Simultaneously with the operation of a key lever 2 occurs the rotation of its associated code bar 12 about the pivot rod 14 which is effected by means of the slot and pin connection 13 between bar 12 and key lever 2, as previously described. This movement of code bar 12 brings one of the projections or teeth 65, which is in register with a corresponding selector bar 43, into contact therewith to cause a selector bar to be depressed, thereby effecting the rotation of bell crank levers 44 and 45 in a counter-clockwise direction (Fig. 4) to move bar 49 to the right, which movement is imparted to the associated Y-lever 52 to rotate it in a counterclockwise direction against the action of its spring 66.

As indicated in Fig. 5 arms 67 and 68 of each Y-lever 52 are adapted to operatively engage with projections 71 and 72, respectively, of a transfer lever 73 associated with each Y-lever 52. Each transfer lever 73 is in vertical alignment with the Y-lever 52 below it and is pivotally mounted on a common pivot shaft 74 carried by a transfer ball 75 pivotally mounted on shaft 76. The transfer ball 75 is provided at one end with an upwardly directed arm 77 which cooperates with arm 78 of armature lever 79 which is pivoted at 82 to the transfer magnet frame 83. The movement of the armature lever 79 is limited by a pin 84 which operates within a larger hole in the armature lever 79. The transfer ball 75 normally tends to rotate in a clockwise direction by means of a spring 85 attached to one end of the ball 75, the other end of the spring being secured to a rod 86 mounted in the frame 83. This rotation of the transfer ball 75 tends to impart through arm 77 movement in an opposite direction to armature lever 79, thus holding lever 79 against the stop pin 84.

Each of the transfer levers 73 is provided with a head 87 projecting into a slot of a stop bar 88 individual thereto, one such stop bar being provided for each of the transfer levers 73. Stop bars 88 have a normal position, as indicated in Fig. 5, and are adapted to be slidably mounted upon rods 86 and 91. In their operative position the projections 71 or 72 of the transfer levers 73 are disposed directly above the arms 67 or 68, respectively, of the Y-levers 52. Thus, when the transfer magnet 92 is energized, armature lever 79 is attracted and through arm 78 imparts counterclockwise rotation to the transfer ball 75. The transfer levers 73 accordingly are brought into engagement with the Y-levers 52. The projections 72 of the transfer levers engage the arms 68 of the Y-levers and cause the transfer levers to rotate about their projections 72 as a fulcrum in a counterclockwise direction, and cause the stop bars 88 to be urged to the left.

Now, when a Y-lever 52 has been selected and caused to rotate in a counterclockwise direction against the action of spring 66, the transfer magnet 92 is caused to be energized simultaneously, thus imparting counterclockwise rotation to the transfer ball 75, as previously described. However, the arm 67 of the selected Y-lever will now engage projection 71 of its associated transfer lever 73 and the continued movement of the

transfer ball 75 will cause the transfer lever to rotate in a clockwise direction about its projection 71 as a fulcrum, causing its associated stop bar 88 to be moved toward the right so that its right hand end will be projected into the path of a unit wheel rack 93, (Fig. 9), the effect of which will hereinafter appear. The stop bars are adapted to be maintained in their right or left positions by means of the pressure exerted upon them by individual detent springs 94 suitably carried on the bar 95 of the frame 83.

The unit rack 93 is slidably mounted on a unit rack slide 96 and adapted to be interlocked in slidable relation therewith by guide member 97, more clearly indicated in Fig. 11. Disposed above the unit rack 93 (Fig. 5) is a unit wheel 98 which is rotatably fixed on an operating shaft 101 (Figs. 5 and 8). As indicated in Fig. 8, the operating shaft 101 is suitably journaled in bearings 102 and 103 carried in brackets 104 and 105 mounted on the base portion 1. There is loosely mounted on shaft 101 adjacent to bracket 104 a sleeve member 106. Thus in the present embodiment the bracket 104 is disposed between the unit wheel 98 and the sleeve member 106. Between the sleeve member 106 and bracket 105 and fixedly mounted on the shaft 101 is a flanged sleeve 107.

Sleeve member 106 is provided near its right end (as viewed in Fig. 8) with a flange 108 to which are secured, by means of screws, a gear 109 and a disc 111 which are also carried on the sleeve member 106. Member 106 is also arranged with a pair of diametrically disposed key ways extending from its left end approximately to the flange 108, which are adapted to receive corresponding projections in a pair of disc members 112 and 113 slidably mounted on said sleeve member, whereby the disc members are rendered rotatable therewith. A member 114 provided with two integral portions; namely, cam 115 and stop disc 116, is interposed between the disc members 112 and 113. The functions of the cam member 115 and stop disc 116 will hereinafter appear. Between member 114 and each of the adjacent disc members 112 and 113 is disposed a disc of friction material 120. That part of the sleeve member 106 adjacent to disc 112 is threaded to receive a nut 117 and locknut 118. Adjacent to disc 113 is a helical spring 119, the compression of which is adjustable by means of a collar 122 screwed to sleeve 106. With this arrangement it is seen that the member 114 is adjustably carried and frictionally connected to sleeve 106.

The flange of the sleeve 107 forms a part of a friction clutch composed of a drive disc 123, discs of friction material 124, and disc 125. Pressure is imparted to this friction clutch by means of a helical spring 126, which is adjustable by means of a nut 127 carried on the sleeve 107. A drive connection is provided between the gear 109 and the clutch just described by means of the interengagement of the lug 128 integral with disc 111 with a corresponding notch in the disc 123.

Continuous rotation is imparted to the gear 109 by means of a motor through a pinion 129, and similar rotation is thereby imparted to the sleeve member 106 and drive disc 123. The member 114, however, is held from rotation by means of an escapement pawl 131 shown in Fig. 12. Sleeve member 107 and shaft 101 which constantly tend to rotate are restrained therefrom by the cooperation of the escapement means which is associated with the unit wheel 98. When the escapement means, which comprises rack 93 and pawl 133 (Fig. 9) is operated, as will presently

appear, the unit wheel 98 is permitted to rotate variable amounts depending upon which one of the stop bars 88 is operated. The shaft 101 extends to the right beyond the bracket 105 and carries at its right end a pinion 132 affixed thereto which controls the operation of the indicator as will hereinafter appear.

Matrix thickness counting mechanism

As already noted, the matrices utilized in line casting machines are of different thicknesses since the characters corresponding thereto vary in width; therefore, the number of characters which will fit in any portion of a line varies with the thicknesses of the individual characters. The device for counting or totalizing the thicknesses of the matrices composed in the line will now be described. By reason of its relation to gear 109, the unit wheel 98 constantly tends to rotate. However, its rotation is controlled normally by a pawl member 133 and unit rack 93, one or the other of said members being in engagement with the unit wheel during the counting operation.

Briefly, during the counting operation the pawl 133 and rack 93 are operated so as to bring rack 93 into engagement and pawl 133 out of engagement with unit wheel 98 substantially simultaneously (a slight overlap being provided to prevent the escape of the unit wheel), the effect being to permit the unit wheel 98 to carry the unit rack 93 toward the right (as viewed in Fig. 14) until it is arrested by a selected one of stop bars 88, at which time pawl 133 is again brought into engagement and rack 93 out of engagement with unit wheel 98 substantially simultaneously, thus preventing further rotation of unit wheel 98 while unit rack 93 returns to its original position.

Having reference to Figs. 9, 14 and 15 it will be noted that the rotation or escapement of unit wheel 98 is controlled by the aforementioned unit rack 93 and the pawl member 133. As previously described the unit rack 93 is slidably carried on the unit rack slide 96 which is pivotally carried on bracket 134 integral with the base 1. The unit rack is provided with a pair of lugs 135 and 136. The right hand lug 136, as viewed in Fig. 14, cooperates with the stop bars 88 while the left hand lug 135 coacts with a spring actuated return lever 137 pivotally mounted at 138 to a bracket 139. The tension of a spring 142 which actuates the return lever 137 is adjustable by means of a screw 143 mounted in bracket 139.

Pawl member 133 is pivotally mounted at 139 on the bracket 104 and tends to rotate in a counterclockwise direction due to the action of a spring 144, one end of which is secured to the upper extremity of the pawl member 133, and the other end being attached to a spring clip 145. Pawl member 133, which is provided with a toothed portion 146, thus is held in engagement with the teeth on the unit wheel 98 by means of spring 144. An adjustable stop 147 however is provided whereby the degree of engagement between the toothed portion 146 and the unit wheel 98 may be controlled; that is, it is desirable to prevent the teeth in the pawl member 133 from bottoming when they engage with the teeth in the unit wheel 98 to preclude damage thereto from wedging.

Depending from the pawl member 133 is a portion 148 which is provided with a laterally disposed end 150 (Figs. 9 and 15) adapted to cooperate with the extremity of the unit rack slide 96. The pawl member 133 is also arranged with 75

an arm 149 to the outer end of which is pivotally connected one end of link 152, the other end of which is pivotally connected to the end of lever 153 which in turn is pivoted at 154 to the slide member 96. The opposite end of lever 153 is pivotally connected to arm 155 of operating lever 156 which is supported pivotally at 157 to the bracket 104. Operating lever 156 is also provided with two arms 158 and 159. At the extremity of arm 158 is carried a follower roller 161 which co-acts with the cam 115. A follower roller 162 is also carried at the extremity of arm 159 of the operating lever 156 and is adapted to cooperate with a pair of cam portions 163 and 164 diametrically opposed to each other and which are secured to the face of the cam 115. Cam 115 is provided with two similar cam surfaces since two complete operations are performed during one complete revolution of the cam; that is, for one complete operation the shaft and cam are permitted to rotate one-half revolution, thus enhancing the speed of operation of the apparatus.

Upon the initiation of the rotation of cam 115 the follower roller 161 is acted upon by the periphery of the cam 115 so as to impart clockwise rotation to the operating lever 156. Arm 155 of the operating lever 156 thus is raised and in so doing lever 153 is caused to rotate about its pivotal connection with link 152 thus elevating the pivot 154 between the lever 153 and the unit rack slide 96. Slide 96 thus is elevated so as to bring the unit rack 93 into engagement with the unit wheel 98. The continued rotation of the operating lever 156 in a clockwise direction causes the lever 153 to rotate about its pivot 154 as a fulcrum in which event the link 152 is given a downward movement which in turn imparts clockwise rotation to the pawl member 133 about its pivot 130 against the action of spring 144. The lateral portion 150 of the pawl member 133 is now disposed beneath the end of the unit rack slide 96 as indicated in Fig. 15, to insure, during the ensuing operation of the escapement means, the engagement of pawl 133 with unit wheel 98 prior to the disengagement of rack 93 to preclude the undue escapement or movement of unit wheel 98 which would otherwise be liable to occur. In effect, the portion 150 performs the function of a safety device.

The unit wheel, which constantly tends to rotate by virtue of being fixed to shaft 101, is thus released for rotation and the unit rack being free to move is carried toward the right until the lug 136 is intercepted by one of the stop bars 88. At this point the cam portion 163 acts upon the follower roller 162 so as to suddenly reverse the direction of rotation of the operating lever 156. The unit rack slide 96 cannot at this time be lowered because of the engagement of its forward extremity with the lateral portion 150 of the pawl member 133. Therefore, lever 153 is caused to rotate in a counterclockwise direction about the pivot 154 thus causing the link 152 to be elevated which in turn permits pawl member 133 to rotate in a counterclockwise direction, due to the action of its spring 144, into engagement with the unit wheel 98, simultaneously causing the withdrawal of lateral portion 150 from engagement with slide 96.

The continued rotation of the operating lever 156 in a counterclockwise direction now causes the lever 153 to rotate about its pivotal connection to link 152 in a counterclockwise direction to withdraw the unit rack 93 from engagement

with the unit wheel 98. The unit rack 93 is thereupon placed under the influence of the spring actuated return lever 137 and is carried toward the left thereby to its stop 165. The stop 165 is adapted to be cushioned by a compression spring 166 as indicated in Figs. 9, 10, 14 and 15.

The cushioning means is more clearly shown in Fig. 10 wherein it is seen that the stop 165 is provided with a cylindrical stem portion 167 threaded at its extremity and which is adapted to extend through and beyond a vertical lug 168 of slide 96. Mounted on the stem 167 between the lug 168 and the stop 165 is a sleeve member 169, and encircling said sleeve member is the helical compression spring 166. Thus it is seen that any pressure exerted against the stop 165 in an axial direction will be resisted by the compression spring 166. The motion of sleeve member 169, and hence stop 165, is adjustably controlled by a nut and locknut mounted on stem 20 portion 167.

A limiting means 171 is provided for the unit rack slide 96, whereby the upward movement of the slide is restricted to the extent of preventing the teeth in the unit rack 93 from bottoming in the teeth of the unit wheel. The utility of the limiting means 147 and 171 will become apparent when it is understood that the operation of the mechanism is very rapid and the movements of the individual parts are very sudden and consequently there is a possibility that the teeth in the unit rack and pawl member might wedge into the teeth in the unit wheel, the smallness or fineness of the teeth in these various members being necessary due to the precision required in the counting operation. Furthermore, the stop 171 by its limiting action on unit rack slide 96 plays an important part in the operation of the unit rack 93 by eliminating the friction of the unit rack 93 on the slide 96 which would otherwise be present if rack 93 were permitted to be pressed into engagement with unit wheel 98, and which would render the mechanism either sluggish or even inoperable if the pressure were too great.

Likewise, due to the rapid movement of the rack 93 and the sharp impact of its lug 136 against a selected stop bar 88, a cushioning means is provided which is housed in the member 121. The primary function of this cushioning means is to prevent the rebound of the rack 93 when it strikes against the stop members 88, the shock being absorbed by a helical compression spring 200 carried on a plunger 140, having an enlarged end 141 and a threaded end carrying a nut and locknut, the spring 200 being compressed between the end 141 and the wall of the housing 121, and the movement of the plunger 140 being constrained by the nut thereon. The stop-bar support 151 is guided by screws 160 engaging slotted holes therein and is thus adapted to cooperate with the cushioning means. The use of the cushioning means also precludes the possibility of deforming, or even shearing off, the ends of the stop bars 88.

Escapement mechanism

To enhance the speed of operation of the apparatus herein described an escapement mechanism has been provided whereby the amount of rotation of the operating cam 115 to effect a complete operation is limited to 180° or one-half revolution; thus, as previously alluded to, the cam 115 is provided with two similar cam surfaces.

The rotation of the shaft 101 is controlled by the electromagnetically operated escapement

means shown in Figs. 1 and 12. As will be remembered the member 114 is provided with an integral cam portion 115 and an integral stop disc 116. The stop disc 116 is provided on its periphery with two diametrically opposed teeth since two complete operations are performed for each complete revolution of the member 114.

As indicated in Fig. 12 there is associated with the stop disc 116 an escapement member 131 which is pivotally secured to the bracket 172 mounted on the base portion 1. The stop disc normally tends to rotate in a counterclockwise direction as viewed in Fig. 12 and the escapement member 131 is normally held in engagement with the lower tooth 173 of the stop disc by the action of spring 170, one end of which is secured to the escapement member 131 and the other end being attached to the extension 175 of the bracket 172.

Integral with the escapement member 131 is an armature portion 176, associated with which is the electromagnet 177 also suitably mounted on the bracket 172. When magnet 177 is energized, armature 176 is attracted thereto, causing the escapement member 131 to rotate slightly in a counterclockwise direction to effect the disengagement of the lower arm of the escapement member from the tooth 173 of the stop disc 116 whereupon the stop disc and cam 115 is permitted to rotate as indicated by the arrow until tooth 173 is intercepted by the upper arm of the escapement member. When magnet 177 is deenergized, the escapement member returns again to its clockwise position under the action of spring 170 to release the upper arm from the tooth 173 and to introduce the lower arm into the path of the companion tooth 174 on the disc member. The electromagnet 177 is caused to be energized by the closing of a contact 178 (Fig. 16) controlled by each one of the key levers 2.

Thus, the initiation of the rotation of member 114 is controlled by each one of the keys, and the amount of rotation of the member (namely, one-half revolution for each operation) is controlled by the escapement mechanism just described. However, a means is provided to interrupt the circuit for the escapement magnet 177 during certain operations—for example, functions, which in the present application pertain to those operations other than counting—in which event the counting operation is not required. The key levers that control the functions operate an additional pair of selector bars 179 (Fig. 2) which control the horizontal bar 181. The right end of bar 181 is laterally disposed to cooperate with a normally closed contact 182 appropriately mounted in the base. So, when a function key is depressed the contact 178 (which is invariably operated) is closed, but the contact 182 is opened substantially simultaneously or slightly previous, so that the escapement mechanism is rendered inoperative, while the remaining operations controlled by the operated function key proceed uninterruptedly.

Positive contact control

To insure the energization of the various operating magnets notwithstanding the speed of operation of the keys by the operator, a positive latch control has been provided for the main operating contact, which latch is adapted to be automatically released only upon the complete or effective energization of the magnets.

Each one of the key levers controls a single selector bar 180 (Fig. 2) which is invariably operated each time a key lever is depressed. Having

reference to Fig. 6 a lever 183 associated with a selector bar 180 is shown mounted on the pivot shaft 41. The lower extremity of this lever is pivotally articulated to a horizontal bar 184 similar to bars 35 shown in connection with levers 37 in Fig. 3. The upper extremity of lever 183 is provided with a lateral portion 185 and an angular portion 186. A contact screw 187 is adjustably carried on the angular portion 186 to co-act with the spring contact 178 suitably carried on the frame 83. Lever 183 normally tends to rotate in a clockwise direction as viewed in Fig. 6 under the action of spring 188 and is held thereby against a stop 190 mounted on the selector bar frame; thus, contact 178 is normally open. A latch member 189 is provided to cooperate with the lateral portion 185 of the lever 183. This latch member is rotatably carried on the stud 191 and tends to rotate in a clockwise direction due to the action of a spring 192. Latch member 189 is also provided with a vertical arm to which is pivotally articulated one end of link 193, the other end of which is pivotally connected to the arm 78 of the armature lever 79.

Whenever a key lever is depressed the lever 183 is caused to rotate in a counterclockwise direction against the action of spring 188 to effect the closing of contact 178. Lever 183 is maintained in its counterclockwise position and contact 178 is held closed by means of the engagement of latch 189 with lateral portion 185. The reason for this detention is to insure the energization of the perforating magnet 56, the transfer magnet 92, and the escapement magnet 172 in case the key lever should be released too quickly. It is obvious, therefore, that the duration of energization of these magnets is independent of the operation of the key lever. When the transfer magnet is energized, however, the consequent attraction of armature lever 79 will cause the link 193 to be actuated toward the left as viewed in Fig. 6, which movement will be imparted to the latch member 189 rotating it in a counterclockwise direction to effect the release of the latch-arm thereof from the lateral portion 185, thus releasing lever 183 which will thereupon be urged to its normal clockwise position by the spring 188.

Indicating mechanism

A novel indicator has been provided which indicates the relation between the totalized thicknesses of the matrices in a line and the aggregate amount of expansion provided by the spacebands. This indicator does not totalize or sum up the actual dimensions of the matrices but rather it counts proportions, and thus a single dial can be used for any size of type provided the characters have the same unit groupings, as will be presently explained.

The indicating mechanism is illustrated in Figs. 17 to 23. In Fig. 17 the pinion 132 hereinbefore alluded to is shown in mesh with gear 201 which is provided with a hub 202. The rotation of pinion 132 is variably controlled by the counting mechanism and the rotation thereof in varying amounts is transmitted through gear 201 to an index hand or pointer 203. The gear 201 is rotatably mounted on a stud shaft 204 fixedly mounted on a bracket 205. Stud shaft 204 carries axially therethrough a rod 206, the left extremity of which (as viewed in Fig. 17) is provided with an integral flange 207, and the opposite end is provided with a threaded portion. The stud shaft 204 is flanged at its outer end to form a suitable

journal for the gear 201, and is securely attached to the bracket 205 by means of a nut 208 and a lock nut 209. A friction disc 211 is carried at the end of rod 206 adjacent to the flange 207, which disc is provided with a slot 212 (more clearly shown in Fig. 18) adapted to receive a pair of diametrically opposed ears 213 and 214 integral with the hub 202. The disc 211 is thus rotatable with the gear 201. Interposed between the disc 211 and a flange 215 integral with the hub 202 and adapted to fit over the ears 213 and 214 is the index hand or pointer 203. Pointer 203 is normally held clamped between the disc 211 and flange 215 by the distending action of a helical compression spring 216 carried on the rod 206, the pressure exerted by the spring being varied by the adjusting nut 217. In this manner the pointer 203 is adapted to be rotated correspondingly with gear 201.

A magnet 218 suitably mounted on the bracket 205 is provided with an armature lever 219 pivoted at 221 to magnet mounting 222. The armature 219 carries at one end an adjusting screw 223 which is arranged substantially in axial coincidence with the rod 206. The screw 223 is normally held in abutting relation with the rod 206 by means of a spring 224 secured to an extension 225 of the armature, the other end of the spring being attached to a spring post 226. The adjustment just described is provided so that when the electromagnet 218 is energized by establishing a circuit, as shown in Fig. 16, from positive battery over wires 318 and 329, through winding of magnet 218, through contact 235 (when closed), over wires 331, 328, 325, and 323, thence through contact 178 to ground, the attraction of the armature 219 caused thereby will effect the movement of the rod 206 against the action of the spring 216 an amount sufficient to insure the relaxation of the pressure between disc 211 and flange 215 to permit the pointer to return to its beginning-of-line position, as will presently more clearly appear.

Having further reference to Fig. 17 it is seen that bracket 205 is provided with a vertical portion 227 on which is adjustably supported a sectoral or fan-shaped indicator dial 228, more clearly shown in Figs. 20, 21 and 22. The dial 228 is pivotally held by a collar nut 229 about which it is slightly rotatable, the amount of movement of which is limited by a slot and screw adjustment 231 (Fig. 19). As indicated in Figs. 18 and 21, the pointer 203 is provided at its outer extremity with a reverted portion adapted to fit over and move along the arcuate edge of the dial 228. The annular pivotal portion of the pointer 203 (as clearly shown in Fig. 18) is provided on a part of its peripheral edge with a series of projections 232, adjacent ones of which are oppositely deflected to form a pulley-like groove to receive the flexible cord 233, one end of which is attached to the pointer and the other end being secured to the extremity of a pointer return lever 234 (Fig. 21). This lever 234 is pivotally mounted on a bracket 235 integral with the base 1 and is provided with a short arm 236 to the extremity of which is attached one end of a pointer return spring 237, the other end of which is secured to a spring support 238.

It is obvious, therefore, that when the magnet 218 is energized to effect the removal of the pressure of spring 216 from disc 211, the pointer 203 will be free to rotate in a clockwise sense (as viewed in Figs. 18 and 21) due to the urge of return spring 237 until it is arrested by an adjust-

able stop 239. The stop 239 in the present embodiment comprises a substantially Y-shaped portion, the ends of the arms 241 and 242 of which are provided with laterally disposed lugs 243 and 244, respectively. The stem portion 245 is provided near its extremity with a pair of laterally disposed portions 246 and 247 adapted to fit snugly into an arcuate slot 248 in the dial 228. The stem portion is also provided intermediate the lugs 246 and 247 with a threaded hole to receive a thumb screw 249, (Fig. 20), the shoulder of which is adapted to span the slot 248 so that the tightening of the screw 249 will effect a clamping means for the stop member and permit its adjustability.

At the fork of the Y-portion formed by the arms 241 and 242 there is pivoted a stop member 251 adapted to swing between the limiting lugs 243 and 244. Stop member 251 is provided with the integral stud 252 against which the pointer 203 is adapted to strike. The purpose of providing a stop such as just described is to permit of a wide range of adjustability with a minimum length of slot 248, thus preserving the rigidity of the dial 228.

In order that the counting may be accurate and the number of different thicknesses of matrices may be a minimum, each em, the unit of type measure, is divided into eighteen equal sub-units; eighteen having been found by experience to be a suitable number. Matrices of certain numbers of sub-units in thickness are not used; that is, no matrices as thin as one, two, three, four or five sub-units are used, and eleven different thicknesses have been found to be a practical number. To compensate for the gap resulting from the omission or non-use of groups corresponding to widths of 16 and 17 sub-units, fillers 230 (Fig. 14) are provided. A fixed stop member 240 is provided for the 18 sub-units group. Each tooth on the unit wheel corresponds to one unit of these sub-units.

It is well known in the typographical art that the amount of possible justification in any assembled line of matrices is determined by the number of spacebands contained in it. As previously mentioned, a spaceband comprises a matrix-shaped portion in which is slidably carried a wedge portion. The expansibility of the spaceband is determined by the difference between the thin end and the thick end of the wedge portion. Thus in order that the spaceband may be effective to justify a line, the difference between the aggregate or totalized thicknesses of the matrices in the line and the predetermined length of line must be equal to or less than (preferably the latter) the aforementioned difference in thickness, or expansibility of the spaceband; so that, when the wedge portion is slidably moved along the matrix-shaped portion, which is held in alinement with the rest of the matrices in the line, it will tend to "fill up", as it were, the space left between the last matrix and the limiting gauge representing the length of line. So, too, a similar result will be obtained when two or more spacebands have been included in the line; in which event the spacebands will be effective to justify the line when the difference between the totalized thicknesses of the matrices and the length of line is less than the sum of the differences in thickness, or expansibility of the spacebands.

In the manual operation of a composing machine, the keyboard operator may watch the assembly of the matrices and spacebands in the assembling elevator, and thus personally determine

the justifiability of the line. However, in the automatic operation of a composing machine by means of perforated tape the justification must be predetermined, and accordingly the present invention has provided a device which will at all times indicate with exactitude the relation between the totalized thicknesses of the matrices in a line and the aggregate amount of expansion provided by the spacebands.

- 10: As shown in Fig. 20, the dial 228 is provided adjacent its arcuate edge with a scale or series of graduations representing the number of ems in a line of maximum length. As previously noted, the reverted end of the pointer 203 moves along this edge of the dial from left to right, toward zero, in response to the totalization of the matrix thicknesses by the counting mechanism. Thus, the distance from the pointer 203 to zero indicates the amount of space left in the line to be filled with matrices, when the line contains no spacebands. However, when spacebands are inserted in the line, the space remaining to be filled varies with the number of spacebands inserted. So, to indicate the justifiability of the composed line a pair of pointers 253 and 254 are provided, the distance between the pointers 253 and 254 indicating the amount of expansibility of the spacebands. Since the distance from zero on the scale to pointer 254 represents the sum of the thin edges of all the spacebands (whether one or more) in the line, and the distance from zero to pointer 253 represents the sum of the thickest ends of the spacebands, it is manifest that the distance between the pointers 253 and 254 represents the difference between these sums, which is the amount of expansion, or expansibility, of the spacebands contained in the line. Therefore the space left in the line to be filled, when spacebands are inserted, is represented by the distance between the pointer 203 and any point between pointers 253 and 254.

- To effect the differential movement of pointers 253 and 254 toward the left (from the zero position) the mechanism indicated in Fig. 19 is provided. Rotatably carried on a stud shaft 255, which is mounted on the portion 227 of bracket 265 in axial coincidence with rod 206 (Fig. 23), are the pointers 253 and 254. As shown in Fig. 23, the pointers 253 and 254 are U-shaped at their pivotal ends to provide a substantial bearing on shaft 255. Directing attention again to Fig. 19, pointers 253 and 254 are provided with segmental gear portions 256 and 257, which are adapted to mesh with segmental gears 258 and 259, respectively, pivoted on the stud 261 mounted in the bracket portion 227. Integral with the gear 258 is a ratchet segment 262. Gear 259 is provided with a slot and screw adjustment 263 and is constrained thereby to move with the gear 258. Gears 258 and 259 and ratchet 262 normally tend to rotate in a counterclockwise direction (as viewed in Fig. 19) due to the action of spring 264 distended between the gear 258 and the base 1.

- The ratchet 262 cooperates with a pawl 265 pivotally attached to the space keylever 266 (Figs. 1 and 17). Keylever 266 is pivotally articulated to the space bar 260, similar to that used on ordinary typewriters, as shown in Fig. 1. The depression of the space keylever 266 causes a corresponding downward movement to pawl 265, which is yieldingly held into engagement with the ratchet 262 by a spring 267 secured to a suitable guide member 268. Each time the space keylever is operated or depressed the ratchet 262 is actuated against the action of spring 264 a dis-

tance equal to one ratchet tooth, and a corresponding movement is imparted to pointers 253 and 254. The gearing 256 to 259, inclusive, (Fig. 19), is so chosen as to impart a differential movement to pointers 253 and 254, such that each time the ratchet 262 is stepped one tooth, pointer 253 will be moved a distance corresponding to the thin end of the spaceband and pointer 254 will be moved a distance corresponding to the thick end of the spaceband. Furthermore, the pitch of the teeth of ratchet 262 is chosen to suit the size of spaceband employed with the set size of the font of type used, and hence members 258, 259 and 262, being integral, may be rendered interchangeable.

A detent 269 pivoted at 271 to bracket 272, secured to portion 227, cooperates with ratchet 262 and pawl 265 to prevent the ratchet from slipping back when the pawl 265 is moved into engagement with a succeeding tooth, thus maintaining the pointers 253 and 254 in their newly selected position. Referring to Fig. 17, the end-of-line or elevator keylever 273 is connected by a link 274 to the auxiliary lever 275 pivotally carried at 276 on bracket 205. Lever 275 is provided with a laterally disposed arm 277 at the extremity of which is pivotally carried the release rod 278, the upper end of which is adapted to have a ball and socket connection with arm 279 of the detent lever 269. When the keylever 273 is operated, the effect of which, as will appear, is to restore the entire apparatus to its original or beginning-of-line position, downward movement is imparted to rod 278 to rotate lever 269 (Fig. 19) in a counterclockwise direction against the tension of spring 281. Detent 269 thus is disengaged from the ratchet 262 and in turn co-acts with the extension 282 of pawl 265 to cause also the release or disengagement of the pawl. While the pawl 265 and detent 269 are thus momentarily released, the ratchet 262 is free to rotate in a counterclockwise direction due to the action of spring 264 to impart motion in the opposite direction to pointers 253 and 254 which are thus returned to their zero position against an adjustable stop 283 mounted on bracket 272. Lever 275 is provided with an arm 284 which cooperates with a pair of contacts 285 in the circuit which controls magnet 218, which circuit has been previously described. An extension 286 is also provided on the lever 275 to permit of the operation of a line counter 287, shown in Fig. 21.

Line counter

It is desirable that the operator in the preparation of perforated tape for use in composing machines be apprised of the number of lines of type of printed matter he has prepared in the tape. This is important in order that the reels of tape may be of the same size, and also to apprise the operator that enough perforated tape has been prepared to provide a sufficient number of slugs or lines of type to fill the galley. It is especially important in magazine work where the illustration cuts into the printed matter in which event the operator is usually given written instructions as to how long to make each line in order to avoid the illustration.

In the present invention automatic means has been provided whereby the operator will be informed at all times of the number of lines he has prepared. Thus, a link 288 pivotally mounted at the extremity of the extension arm 286 of lever 275 is adapted to operate a lever 289 of the counting device 287, which may be one of 75-

any of the well known standard makes. The counting device 287 preferably is adapted to be mounted on a suitable bracket 291 adjacent to the indicating device. When the keylever 273 is operated, clockwise rotation is imparted to the lever 275 which through link 288 (Fig. 21) imparts clockwise rotation to the lever 289 fixed to the operating shaft of the counter 287 to operate the indicators therein in the usual manner. It is thus clear that every time an elevator or end-of-line key is operated a record thereof is made in the counter 287. As is customary, the counter 287 is provided with a lever 292, the function of which, when actuated, is to restore the indicators in the counter to their zero position.

Signal mechanism

Since the amount of line to be filled with characters varies with the number of spacebands used in the line, and since the number of spacebands in the line governs the amount of justification required, it is apparent that as more spacebands are used in a line less characters can be placed in the same line so that it becomes necessary in this event to apprise the operator sooner of the arrival of a justifiable line; that is, that the line is reaching a suitable length to permit automatic justification, provision for which is made to indicate this arrival by lighting a signal lamp 293. In other words, the lighting of a signal lamp 293 apprises the operator when the matrix pointer or index hand 203 is about to move over that portion of the scale indicated by the spaceband pointers 253 and 254 the range of justification of the line. Since this range varies with the number of bands in the line, the point at which the signal operates must also vary.

The mechanism for operating the signal lamp 293 is shown in Figs. 19, 22, and 23, and comprises a substantially U-shaped member 294 pivotally mounted on a boss 295 integral with the bracket portion 227. Member 294 is provided with a depending arm 296 which is adapted to operate a pair of contacts 297 in the signal lamp circuit. Pivotally mounted on member 294 is a swinging member 298 at each end of which is carried cam follower rollers 301 and 302. Referring to Figs. 19 and 22 it is noted that pointer 253 is provided with a cam portion 303 which co-acts with follower roller 302. It is also noted in Fig. 18 that the pointer or index hand 203 is provided with a cam portion 304 which cooperates with the cam follower roller 301. Thus, it is observed that the amount of rotation of member 295 is dependent upon the combined action of cam portions 303 and 304 upon the swinging member 298, the contours of the cams being cooperatively related.

Shift mechanism

Referring to Figs. 2 and 22 a device has been shown for indicating the shifted condition of the keyboard; that is, whether the keyboard is prepared to perforate and count upper case or lower case characters. In Fig. 22 a target 305 is shown pivotally carried on a bracket 306 mounted on the base 1. The target comprises essentially an arcuate portion bearing two colors, preferably red and white, one color to indicate the shift and the other to indicate the unshift condition of the apparatus. A cover (not shown) is provided to cover the mechanism mounted on the base portion of the apparatus with the exception of the indicator dial 228, which is permitted to protrude through the cover to render the dial visible to the operator. An opening is provided in the cover

adjacent to the target 305 so that only a portion thereof can be seen therethrough by the operator. The target is adapted to be swung into either of two positions by the shift mechanism shown in Fig. 2.

Referring particularly to Fig. 22, there is shown pivotally connected to arm 307 of the target 305 a link 308, the other end of which is pivoted to the outer extremity of arm 309 which, as is shown in Fig. 2, is fixed to the rocker member 15. When the rocker member is actuated into either its shift or unshift position the target 305 will be correspondingly actuated.

To move the rocker member 15 into the shift or rearward position, the keylever 6 is operated and is thus rotated about its pivot shaft 8 in a counterclockwise direction (as viewed in Fig. 2) to impart through link 18 and bracket 21 opposite rotation to the rocker member 15 and likewise to arm 309. This movement of arm 309 causes link 308 to move to the left, in Fig. 22, to impart in turn counterclockwise rotation to target 305, thus presenting the red portion (for example) of the target behind the aforementioned opening or aperture in the cover. The operator is thus apprised that the code bars 12 have been shifted to effect the counting of upper case characters or matrix thicknesses.

Now, to move or return the rocker member 15 to the unshift or frontward position the keylever 5 is actuated and is thus rotated about its pivot shaft 7 in a counterclockwise direction (Fig. 2) to impart through link 17 and bracket 19 counter rotation to the rocker member 15 and also to arm 309. Due to this movement of arm 309, link 308 is caused to move to the right (Fig. 22) to impart clockwise rotation to target 305 to present the white portion thereof to the aperture or sight hole in the cover, thus indicating to the operator that the apparatus is in condition to count or totalize the thicknesses of lower case characters or matrices.

In the present embodiment, each code bar 12 is provided with two teeth or projections 65 (Fig. 2) so arranged that when one of the teeth is in operative relation with its associated selector bar 43 the companion tooth will be disposed above and to one side of its associated selector bar so as not to be in operative relation therewith until the respective code bar is shifted to the alternate position. Thus, when the code bars 12 assume their forward or unshift position (as viewed in Fig. 2) the tooth on each code bar which corresponds to the thickness of the lower case character will be operative; and, when the code bars 12 assume their rearward or shift position the companion teeth thereon will become operative, which teeth correspond to the thicknesses of the upper case characters.

A detent member has been provided to maintain the shift mechanism including the target in either the shift or unshift position. Referring to Fig. 22 this detent means comprises a member 311 secured to the link 308 which member is provided with a V-shaped projection 312 which co-operates with a roller 313 carried on the end of a detent lever 314 pivotally carried on a suitable bracket 315 mounted on the base 1. Lever 314 is provided with an arm 316 to the end of which is attached one end of a spring 317, the other end of which is secured to a suitable spring post. As viewed in Fig. 22 the detent lever normally tends to rotate in a clockwise direction so that the roller 313 constantly exerts pressure against the detent member 311 thus holding the shift

mechanism against accidental movement and rendering it movable only upon the operation of shift keylevers 5 or 6.

Electrical circuit

The electrical circuit to control the various functions of the apparatus is shown in Fig. 16, in which the various elements are located substantially as they would appear in a plan view of the device. The circuit for the motor 317 extends from positive battery over wire 318, through the winding of motor 317 to negative battery. The circuit for the perforator electromagnet 56 extends from positive source of current over wires 319 and 321, through the manually operated contact 322, thence through the winding of the electromagnet 56, over wire 323, through contact 178 to ground. The utility of the manually operated contact 322 will presently be described. The circuit for the transfer electromagnet 92 extends from positive battery over wires 319 and 324, through the winding of electromagnet 92 over wires 325 and 323, thence through the contact 178 to ground. The circuit for the escapement electromagnet 177 extends from positive battery over wires 319, 324 and 326, through the winding of the electromagnet 177, then over the wire 327 through the normally closed contact 182, over wires 328, 325 and 323, through contact 178 to ground. The circuit for the signal lamp 293 extends from positive battery through lamp 293 and contact 297 (when closed) to ground. Lastly, the circuit for the index hand release magnet 218 extends from positive battery over wires 318 and 329, through the winding of electromagnet 218 through contact 285 (when closed), thence over wires 331, 328, 325 and 323, through contact 178 to ground.

The usefulness of the manually operated contact 322 will become apparent when it is understood that at times the operator finds it necessary to count out the remaining portion of the line he is composing to determine if the matter will fit therein. To do this he wishes to disable the perforator without affecting the counting mechanism. Therefore, when he desires to perform the operation of thus counting out the line he merely breaks or opens the contact 322 and proceeds as if to compose the line, and if he discovers that the line will properly justify, he closes the contact 322 and repeats the latter operation, which at this time will affect the perforator. This will, of course, also actuate the counting mechanism; but, since the possibility of justification of the line is already determined, the duplicate operation of the counting mechanism is in this event merely incidental.

In the operation of the apparatus herein described there is a slight time interval provided between the closing of contacts 182 and 284 and the main operating contact 178 so that the circuits controlled by contacts 182 and 284 may be first prepared and thereafter established by the closing of contact 178. The main operating contact 178 is provided with a resistance 332 and a condenser 333 for spark protection. The contact 182, as previously described, is operated by the bar 181 in the selector mechanism also shown in Fig. 2. This bar 181 is actuated only upon the operation of a function key at which time the escapement mechanism, which initiates the operation of the counting device, is disabled, due to the breaking of the circuit which energizes the escapement magnet 177. The contact 285 is operated by the lever arm 284, shown in Fig. 17 upon

the depression of the elevator or end-of-line key 273, in which event the magnet 218 is energized to release the pressure applied to the index hand 203 by the spring 216, thus permitting the index hand to return to its initial or beginning-of-line position.

Backspacer

It is at times desirable to reverse the direction of the tape in order to effect a correction thereof. This operation is performed manually and a novel device as shown in Fig. 13 has been provided for effecting this operation. The feed roll 63 and ratchet 59 as shown in Fig. 5 are mounted on the same shaft 64, which carries at its outer end a star wheel 334 (Fig. 13) affixed thereto. Cooperating with the star wheel 334 is a detent lever 335, one arm of which is provided at its extremity with a roller 336, the other arm having secured thereto a spring 337 which normally tends to rotate the lever 335 in a clockwise direction. Loosely mounted on the shaft 64 is a cam member 338 which is provided with the arm 339 adapted to fit into a notch in a member 341.

Member 341 is provided with slots and is adapted to be slidably mounted on a pair of screws 342 and is normally held in its upward position by means of the spring 343, which being attached to the depending arm 344 of cam member 338 tends to urge member 338 in a counterclockwise direction to impart, through arm 339, upward movement to member 341. Member 341 is also provided with a thumb portion 345, which when depressed causes the cam portion 338 to rotate in a clockwise direction thus camming out the pin 346 integral with the pawl member 58, shown in Fig. 5. A forwardly presented depending portion 347 is also provided on member 341, on which is pivotally carried a pawl 348 adapted to co-act with the star wheel 334 to effect the step-by-step rotation, thereof each time member 341 is depressed. Pawl 348 is spring held against a stop 349 by spring 351, such that when member 341 returns to its upward position after being once depressed, the pawl 348 will yield so that the star wheel 334 will remain in its thus stepped position. Thus, simultaneously with the camming-out action of cam 338 upon pin 346 to effect the disengagement of pawl 58 from ratchet 59, the edge of member 348 co-acts with one of the points 50 of the star wheel to rotate the star wheel in a clockwise direction. Each time the member 341 is thus depressed the feed shaft 64 is adapted to rotate one step in the reverse or clockwise direction to effect the reverse movement or back-spacing, so called, of the tape.

Modification

In Fig. 7 is indicated a modified form of the stop bar arrangement in which stop bars 352, analogous to stop bars 88, form a part of bell crank levers 353 which are operated directly by the keylevers instead of through a transfer mechanism. As shown in Fig. 7 the bell crank levers 353 are carried on a pivot shaft 354 suitably mounted in brackets 355. To the depending arm of each bell crank there is secured one end of an individual spring 356, the other end of which (not shown) is attached to the frame. The bell crank 353 thus normally tends to rotate in a clockwise direction due to the action of spring 356. Thus, when a keylever is depressed, one of the bell crank levers 353 is caused to rotate in a counterclockwise direction against the action of spring 356 to

bring the right end of the horizontal arm 352 into the path of the stop lug 136 on the unit rack 93. The bell crank levers are held against displacement by spring actuated detent member 357 which is a substantially U-shaped lever pivotally mounted on a pair of pivots 358. This member 357 is also provided with a shaft 359 on which are mounted anti-friction rollers 361 individual to and adapted to cooperate with a laterally disposed arm 362 integral with each bell crank 353. The detent member 357 is normally biased against the arms 362 by its spring the tension of which is such as to overcome the tension of an individual spring 356. Thus, when a stop bar is selected it will be held in the selected position by the detent 357 until some other stop bar is selected.

General operation

The details of the apparatus having been described, a better understanding of the general operation thereof may now be obtained from a description of particular key selections and the various operations incident thereto.

Referring to Fig. 1, the key tops 3 are provided with indicia (not shown) analogous to the well known typewriter keyboards, wherein two sets of designations are provided, one for the lower case and the other for the upper case. Assuming that the code bars 12 (Fig. 2) are in their forward or lower case position, and that a character key-lever 2 has been operated, a permuted combination of bars 25 and 26 in selector mechanism 23, and one of the bars 43 in selector 24 will be simultaneously depressed. The selection of bars 25 and 26 will effect through rocking members 27 and horizontal bars 35 the selection of levers 37 and punch interference bars 42 in corresponding permuted combinations.

At the same time, one of the projections 65 of the selected code bar 12 will cause the depression of that bar 43 in selector mechanism 24 which represents the thickness of the matrix corresponding not only to the key operated, but also to the shift condition of the code bars 12; that is, each key represents two characters (except function keys), one in the lower case and one in the upper case, which characters may possibly be of different thicknesses and thus require a different counter bar 43 to be selected so as to operate the counting mechanism differently. The depression of bar 43 will effect through levers 44 and 45 and horizontal bar 49 the oscillation of associated Y-lever 52. Simultaneously, with the depression of selected bars 25, 26 and 43 will occur the depression of universal bar 180 (Fig. 2), which near the completion of the key stroke effects the closing of the main operating contact 178 (Fig. 6). The time of closure of contact 178 is so regulated by the adjusting screw 187 as to insure the prior selection of levers 37 and 52 and punch interference bars 42.

The closing of contact 178, as noted in Fig. 16, effects substantially simultaneously the energization of perforator magnet 56, transfer magnet 92 and escapement magnet 177. (Of course, it is understood that the closing of the manually operated contact 322 is a condition precedent to the operation of the apparatus). The energization of electromagnet 56 effects the perforation and feeding of the tape, by rocking armature 57 clockwise, forcing the interference bars 42 upward against the punches 65 to perforate the tape 61. Simultaneously with the perforating operation, pawl 58 will move up to engage the next tooth on

ratchet 59. When the magnet is deenergized spring 62 draws the pawl down, rotating the ratchet 59 and feed roller 63 (both of which are affixed to the same shaft 64) one step in a well known manner, thus feeding the tape to position it for the next perforating operation. Thus, the tape is perforated in accordance with the operation of the keylever 2. The energization of electromagnet 92 effects the transfer of the selection of Y-lever 52 to the stop bars 88 in the following manner. The operation of electromagnet 92 causes, by its attraction, the clockwise rotation of armature lever 79 (Fig. 5) to in turn impart opposite rotation to transfer ball 75. Since the selected Y-lever 52 has been oscillated to the left, its arm 67 is disposed below arm 71 of the transfer lever 73. Thus, the operation of ball 75 causes arm 71 to engage arm 67 and consequently lever 73 is rotated about the end of arm 71 as a fulcrum to effect the movement of the associated stop bar 88 toward the right into the path of lug 136 on the unit rack 93.

The energization and subsequent deenergization of escapement magnet 177 permits the member 114 by virtue of stop disc 116 and pawl 131 to revolve 180°, thus imparting to cam 115 like rotation. Upon the initiation of the rotation of cam 115 the follower roller 161 is acted upon by the cam 115 so as to impart clockwise rotation to the operating lever 156, arm 155 of which will thus be raised and in so doing lever 153 is caused to rotate about its pivotal connection with link 152, thus elevating the pivot 154 between the lever 153 and the unit rack slide 96. In this manner slide 96 is elevated so as to bring the unit rack 93 into engagement with the unit wheel 98. The continued rotation of the operating lever 156 in a clockwise direction causes the lever 153 to rotate about its pivot 154 as a fulcrum whereby the link 152 is given a downward movement to impart clockwise rotation to pawl member 133 about its pivot 130 against the action of spring 144. The lateral portion 150 of pawl member 133 is thereupon moved beneath the end of the unit rack slide 96 to insure during the ensuing operation of the escapement means the engagement of pawl 133 with unit wheel 98 prior to the disengagement of rack 93 to prevent the uncontrolled escapement of unit wheel 98.

The unit wheel, which constantly tends to rotate by reason of being fixed to shaft 101, is thus released for rotation and the unit rack being free to move is carried toward the right until the lug 136 is intercepted by one of the stop bars 88. At this point the cam portion 163 acts upon the follower roller 162 so as to reverse suddenly the direction of rotation of the operating lever 156. The unit rack slide 96 cannot at this time be lowered because of the engagement of its forward extremity with the lateral portion 150 of pawl member 133. Lever 153, therefore, is caused to rotate in a counterclockwise direction about the pivot 154, thus causing the link 152 to be elevated which in turn permits pawl member 133 to rotate in a counterclockwise direction, due to the action of its spring 144, into engagement with the unit wheel 98, causing simultaneously the withdrawal of lateral portion 150 from engagement with slide 96.

The continued rotation of the operating lever 156 in a counterclockwise direction now causes the lever 153 to rotate about its pivotal connection to link 152 in a like direction to withdraw the rack 93 from engagement with the unit wheel 98. The unit rack 93 is thereupon

placed under the influence of the spring actuated return lever 137 and is carried toward the left thereby to its stop 165. This rotation of unit wheel 98 is imparted through shaft 101, pinion 132 and gear 201 to matrix pointer 203. As succeeding character keys are depressed the index hand or matrix pointer will be advanced along the dial in amounts varying with the thickness of the matrices corresponding to the key depressed.

Now, if it is desired to perforate and count an upper case character it is first necessary to depress the shift keylever 6, in which event the member 15 (Fig. 2) will be rocked rearwardly and the code bars 12 will assume their rearward position. Since the shift operation is what is termed a "function", no counting operation is necessary because there is no matrix corresponding thereto. Therefore, since the perforating operation proceeds as usual, it becomes necessary to disable the counting mechanism.

To do this, an additional pair of permutation bars 179 is provided which are operable only by "function" keylevers, which are those keylevers that initiate the operations other than counting, in which case the counting operation is not required. Thus, when a function keylever (as in the present instance, the shift keylever 6) is operated, it effects through its associated horizontal bar 181 (analogous to bars 35 and 49), Figs. 2 and 16, the opening of the normally closed contact 182. Consequently, the closing of the main operating contact 178 (which is operated invariably) will, in this event, establish the circuits for the perforating magnet and transfer magnet only. The energization of the perforating magnet effects the perforating operation to thereby punch and feed or step the tape in the regular manner. It will be recalled that the purpose of always operating the transfer magnet simultaneously with the perforating magnet is to effect the unlatching of the operating contact 178, Fig. 6.

Thus, the depression of character keys following the operation of the shift key will affect the various devices in a manner similar to their operation prior thereto, except that the counting and indicating mechanism will be operated to different extents or amounts for the same keylever.

When the space key 260 is depressed the space keylever 266 is actuated and a permuted combination of bars 25 and 26 are operated to set the punch interference bars 42 correspondingly. Since the space operation is a function, no code bar 12 is necessary as the counting mechanism is not actuated. However, as the effect of the perforation in the tape, corresponding to the space function, on the line casting machine is to release a spaceband for insertion into the composed line of matrices, evidence of this fact must be made on the indicator of the keyboard device.

For this purpose the pair of pointers 253 and 254 are employed, which are moved differentially, through the instrumentality of ratchet 262 and differential gears 256 and 259, according to the number of spacebands used in the line and according to the aggregate amount of expansibility of the spacebands. It has also been noted how the pair of pointers 253 and 254 cooperate with the pointer 203 to apprise the operator by means of the signal lamp 293 of the approach of a justifiable line.

Now, upon the arrival of a justifiable line it is necessary to restore the entire apparatus to its original or beginning-of-line position. To ac-

complish this the elevator or end-of-line key is depressed which, as already seen actuates keylever 273 (Fig. 17) to effect through lever 275 the closing of contact 285, and operation of rod 278. The closing of contact 285 permits the electromagnet 218 to become energized, the effect of which is to relieve the pressure on the index hand or pointer 203 to permit its return to its initial position. The operation of rod 278 effects the release of pawls 269 and 265 from ratchet 262 to permit the return of the pointers 253 and 254 to their original position.

Since the elevator key is also a function key, no code bar 12 is associated therewith and hence the counting mechanism is not affected thereby. However, a perforation is made in the tape, the effect of which upon the line casting machine is to initiate the operation of the elevator mechanism, thus causing the loaded assembly elevator to be raised to the line delivery position, whereupon the composed line of matrices and spacebands is delivered to the casting position, in a manner well known in the art to which the present invention pertains.

Although the present invention has been disclosed in connection with line casting machines, it is, of course, understood that the invention is capable of embodiment in many and widely varied forms other than that specifically disclosed without departure from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. In a keyboard perforator, a counting device, a scale, an index hand and spring return means therefor, a series of keys, mechanism including friction means to move said index hand with respect to said scale in accordance with the operation of said counting device as determined by the key operated, and electromagnetically operated means invariably controlled by one of said keys to render said friction means ineffective to move said index hand to enable said return means to restore said index hand to its initial position.

2. In a keyboard device, a plurality of keys, a shaft, a scale, an indicator, motive means constantly tending to govern the incrementally progressive movement of said shaft, means invariably controlled by said keys to release said shaft for rotation, means to transfer the movement of said shaft to said indicator, a special key, and electromagnetic means controlled by said special key to render said last mentioned means ineffective to move said indicator.

3. In a keyboard device, a plurality of keys, a counting device comprising a single unit wheel, means to rotate said unit wheel variable amounts according to the keys depressed, an indicator dial, an index hand, said index hand operable variably to correspond with the operation of the unit wheel, a special key, a pair of pointers, and means controlled by said special key to move said pointers proportionally each time said special key is depressed, and the relative actuation of said index hand and said pointers indicating at all times the justifiability of the line being composed.

4. In a keyboard perforator, a perforating device, a counting device, selector mechanisms individual to each of said devices and arranged in the same plane, a series of keylevers, a corresponding series of code bars juxtapositioned to said keylevers, and means to move said code bars in unison to either of two positions so that said perforating device is operated invariably in the same manner and said counting device can be operated in either of two different manners each time a keylever is depressed.

5. In a keyboard perforator, a counting device comprising a single unit wheel, a pawl member, a rack member, cam operated means to render said members alternately engageable with said unit wheel, means associated with said pawl member to maintain the engagement of said rack with said unit wheel, and auxiliary cam means to effect a sudden reversal of action of said cam operated means to insure through the cooperation of said second recited means the engagement of said pawl and said unit wheel prior to the disengagement of said rack from said unit wheel.

6. In combination with a keyboard perforator suitable for the production of perforated tape representing lines of composition, a scale, a pointer movable variably with respect to said scale to indicate the cumulative widths of characters, an additional pair of pointers, and differential gearing for rotating said pair of pointers different distances for each effectiveness thereof for indicating a different condition.

7. In a keyboard perforator, a perforating device, a counting device, selector mechanisms individual to each of said devices and arranged in the same plane, a series of key levers, a corresponding series of code bars juxtapositioned to said key levers, a pair of special keys, means controlled by the alternate operation of said special keys to move said code bars simultaneously to either of two positions whereby said perforating device is operated invariably in the same manner and said counting device can be operated in either of two different manners each time a key lever is depressed.

8. In a keyboard perforator, a perforating device, a counting device, selector mechanisms individual to each of said devices, a series of key levers, a corresponding series of code bars individual to said key levers, a rockable member, each of said code bars having a pivotal connection with said rockable member and a slidable connection with its associated key lever, a pair of special keys, the alternate operation of said special keys being effective to actuate said rockable member to move said code bars simultaneously on their slidable connections to either of two positions whereby said perforating device is operated invariably in one way and said counting device is operated in either of two different ways each time a key lever is depressed.

9. In a keyboard apparatus, a counting device, a perforating device, a plurality of auxiliary devices, selector mechanisms for controlling said devices variably, and a common bar associated with said selector mechanisms adapted to be invariably operated to initiate simultaneously selected ones of said devices to be operated.

10. In a keyboard perforator, a single shaft, a counting device including a single unit wheel secured to said shaft, motive means carried on said shaft, frictional connection between said means and said shaft whereby said means tends to impart a constant torque to said shaft, a first escapement means to control through said unit wheel the amount of rotation of said shaft, and a second escapement means to control the cyclic operation of said first escapement means.

11. In a keyboard apparatus, a series of keys, a single shaft, a counting device, a constantly movable element mounted on said shaft, an intermittently movable member frictionally mounted on said element, frictional connection between said shaft and said element, uniformly stepped escapement means for said member, variably stepped escapement means for said counting de-

vice, and means controlled by said keys to actuate said first mentioned escapement means step by step to effect the operation of said last mentioned escapement means variably according to the key depressed to operate said counting device correspondingly.

12. In a keyboard perforator, an indicating device including a scale, an index hand, a counting device including a unit wheel, a detent member, a rack member, means to render said members alternately engageable with said unit wheel, a series of stop bars adapted to cooperate with said members to control the escapement of said unit wheel in varying amounts to actuate correspondingly said index hand with respect to said scale, and electromagnetic means to render said counting device ineffective to actuate said index hand to control the return of said index hand to its normal position.

13. In a keyboard perforator, a counting device including a unit wheel constantly tending to rotate, an indicating device including a scale, an index hand, mechanical interconnection between said devices, a detent member, a rack member, means to render said members alternately engageable with said unit wheel, a series of stop bars adapted to cooperate with said members to control the escapement of said unit wheel in varying amounts to actuate correspondingly said index hand with respect to said scale, and electromagnetic means to disable said interconnection to control the return of said index hand to its normal position.

14. In a keyboard perforator, a counting device, an indicating device, mechanical interconnection between said devices including a single shaft, motive means mounted on said shaft, frictional interconnection between said means and said shaft whereby a constant torque is imparted to said shaft by said means, selector mechanism individual to said counting device, escapement means cooperative with said motive means and said mechanism to effect the selective operation of said counting device to actuate said indicating device correspondingly, and means to disable said interconnection.

15. In combination with a keyboard perforator suitable for the production of perforated tape representative of consecutive characters and word spacers, a series of keys, a scale, a pointer movable variably with respect to said scale in response to the operation of said keys to indicate the cumulative widths of characters, an additional pair of pointers, means for operating said pair of pointers differentially to indicate the cumulative expansibility of the word spacers, a special key, said key when operated adapted to effect a relative change in said pair of pointers to correspond to the increment of expansibility provided by a spacer.

16. In a keyboard apparatus, a counting device comprising a single unit wheel constantly tending to rotate, a pawl member, a rack, a rack carrier, a biasing member for said rack, a series of selectable elements, a first pivot, a second pivot, a lever including said pivots, cam operated means to actuate said lever about said first pivot to effect the engagement of said rack and said unit wheel thereupon to actuate said lever about said second pivot to effect the disengagement of said pawl member from said unit wheel, means associated with said pawl member to maintain through the instrumentality of said rack carrier the engagement of said rack and said unit wheel whereby said unit wheel is permitted to rotate an amount

predetermined by the interaction of said rack and a selected one of said elements, and auxiliary cam means to effect a sudden reversal of action of said cam operated means to insure through the cooperation of said second recited means the actuation of said lever in the opposite direction about said second pivot to effect the reengagement of said pawl and said unit wheel and simultaneously to release said second recited means from said rack carrier to permit the actuation of said lever about said first pivot to disengage said rack from said unit wheel whereby said rack is returned to its initial position by said biasing member.

17. In a keyboard apparatus, a counting device comprising a single unit wheel constantly tending to rotate, a translation lever, a detent member, a measuring member and carrier therefor, a biasing member for said measuring member, a series of selectable elements, cam operated means to rotate said lever in a first angular sense to effect the engagement of said measuring member with said unit wheel and thereupon to move said lever in a second angular sense to effect the disengagement of said detent member from said unit wheel, means associated with said pawl member to maintain through the instrumentality of said carrier the engagement of said measuring member with said unit wheel whereby said unit wheel is permitted to rotate an amount predetermined by the interaction of said measuring member and a selected one of said elements, and auxiliary cam means effectual to cause a sudden reversal of action of said cam operated means to insure the actuation of said lever in a manner reverse to said second angular sense to effect the reengagement of said detent member and simultaneously to release said second recited means from said carrier to permit the further actuation of said lever in a manner reverse to said first angular sense to disengage said measuring member from said unit wheel whereby said measuring member is returned to its initial position by said biasing member.

18. In a keyboard perforator, a counting device comprising a single unit wheel constantly tending to rotate, a floating lever, a detent member for said unit wheel, a measuring member and carrier therefor, a biasing member for said measuring member, a series of selectable elements, a cam operated means to control said floating lever to effect in order the interaction of said measuring member and said unit wheel and the disengagement of said detent member whereby said unit wheel is rotated an amount predetermined by the relation between said measuring member and a selected one of said elements, means coactive with said carrier to constrain said floating lever, and auxiliary cam means to effect a sudden reversal of action of said cam operated means to insure substantially simultaneously the reengagement of said detent member and the liberation of said constraint to enable the disengagement of said measuring member and the return thereof to its initial position by said biasing member.

19. In an apparatus for preparing a control record, character selecting elements, a space selecting element, mechanism for indicating cumulatively widths of characters individual respectively to the character selecting elements including a scale and a pointer, power driven mechanism for moving said pointer relative to said scale in varying amounts upon each actuation of said character selecting elements, and additional mechanism comprising elements, operable

differentially with respect to each other, effective upon the actuation of said space selecting element to cooperate with said pointer to indicate the justifiability of a line.

20. In an apparatus for preparing a control record, character selecting elements, a space selecting element, mechanism for indicating cumulatively widths of characters individual respectively to the character selecting elements including a scale and a pointer, power driven mechanism for moving said pointer relative to said scale in varying amounts upon each actuation of said character selecting elements, a pair of pointers, and differential gearing effective upon the actuation of said space selecting elements for rotating said pair of pointers different distances for each effectiveness thereof to cooperate with said pointer to indicate the justifiability of a line.

21. In an apparatus for preparing a control record, character selecting elements, a space selecting element, mechanism for indicating cumulatively widths of characters individual respectively to the character selecting elements including a driven shaft, a driving shaft, a friction clutch through which power is communicated from said driving shaft to said driven shaft, a unit wheel on said driven shaft, means for rendering said clutch effective, and means for determining by said elements the cumulative rotation of said unit wheel, a scale, a pointer movable through the instrumentality of said mechanism, and a pair of other pointers operative independently of said mechanism and movable differentially upon each actuation of said space selecting element to cooperate with said first recited pointer to indicate the justifiability of a line.

22. In an apparatus for preparing a control record, character selecting elements, a space selecting element, mechanism for indicating cumulatively widths of characters individual respectively to said elements including a scale and a pointer movable relatively to said scale in accordance with the operation of said elements, and a pair of other pointers movable simultaneously over said scale in proportionate amounts for indicating a different condition, all of said pointers cooperating to indicate the justifiability of a line.

23. In combination with a keyboard perforator suitable for the production of perforated tape representing lines of composition, a scale, a pointer movable variably with respect to said scale to indicate the cumulative widths of characters, an additional pair of pointers, and means for indicating the cumulative expansibility of spacebands including a ratchet member, a pawl member, and differential gearing, whereby the stepped actuation of said member by said pawl effects through said gearing the movement of said pointers proportionally to cooperate with said first recited pointer to indicate the justifiability of the lines being composed.

24. In combination with a keyboard perforator suitable for the production of perforated tape representing lines of composition, a scale, a matrix pointer movable variably with respect to said scale to indicate the cumulative widths of characters, an additional pair of pointers operative independently of the matrix pointers, and means for rotating said pair of pointers proportionally to indicate the cumulative expansibility of spacebands, whereby said pair of pointers operates with the matrix pointer to indicate at

all times the justifiability of the line being composed.

25. In combination with a keyboard perforator suitable for the production of perforated tape representing lines of composition, a member movable under certain operating conditions, and a pair of other members operable differentially under other operating conditions to cooperate with said first recited member to indicate at all times the justifiability of the line being composed.

26. In combination with a keyboard perforator suitable for the production of perforated tape representing lines of composition, a scale, a pointer movable variably with respect to said scale to indicate the cumulative widths of characters, an additional pair of pointers, and means for moving said pair of pointers differentially, said means including a removable and interchangeable instrumentality which is one of a plurality of interchangeable instrumentalities, each of which is individual to a different set size of type and which is arranged to control the movement of said pair of pointers to cooperate

with the first recited pointer to indicate at all times the justifiability of a composed line of any set size of type.

27. In combination with a keyboard perforator for the production of perforated tape representing lines of composition, a scale, a pointer movable variably with respect to said scale to indicate the cumulative widths of characters, an additional pair of pointers, and means for moving said pair of pointers different distances for each effectiveness thereof for indicating a different condition.

28. In a keyboard device, a plurality of keys, a shaft, a scale, an indicator, motive means constantly tending to govern the incrementally progressive movement of said shaft, means invariably controlled by said keys to release said shaft for rotation, means to transfer the movement of said shaft to said indicator, a special key, and means controlled by said special key to render said last mentioned means ineffective to move said indicator.

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