May 7, 1935. E. E. KLEINSCHMIDT ET AL 2,000,029

KEYBOARD PERFORATOR AND COUNTER

Filed Sept. 4, 1929 6 Sheets-Sheet 1

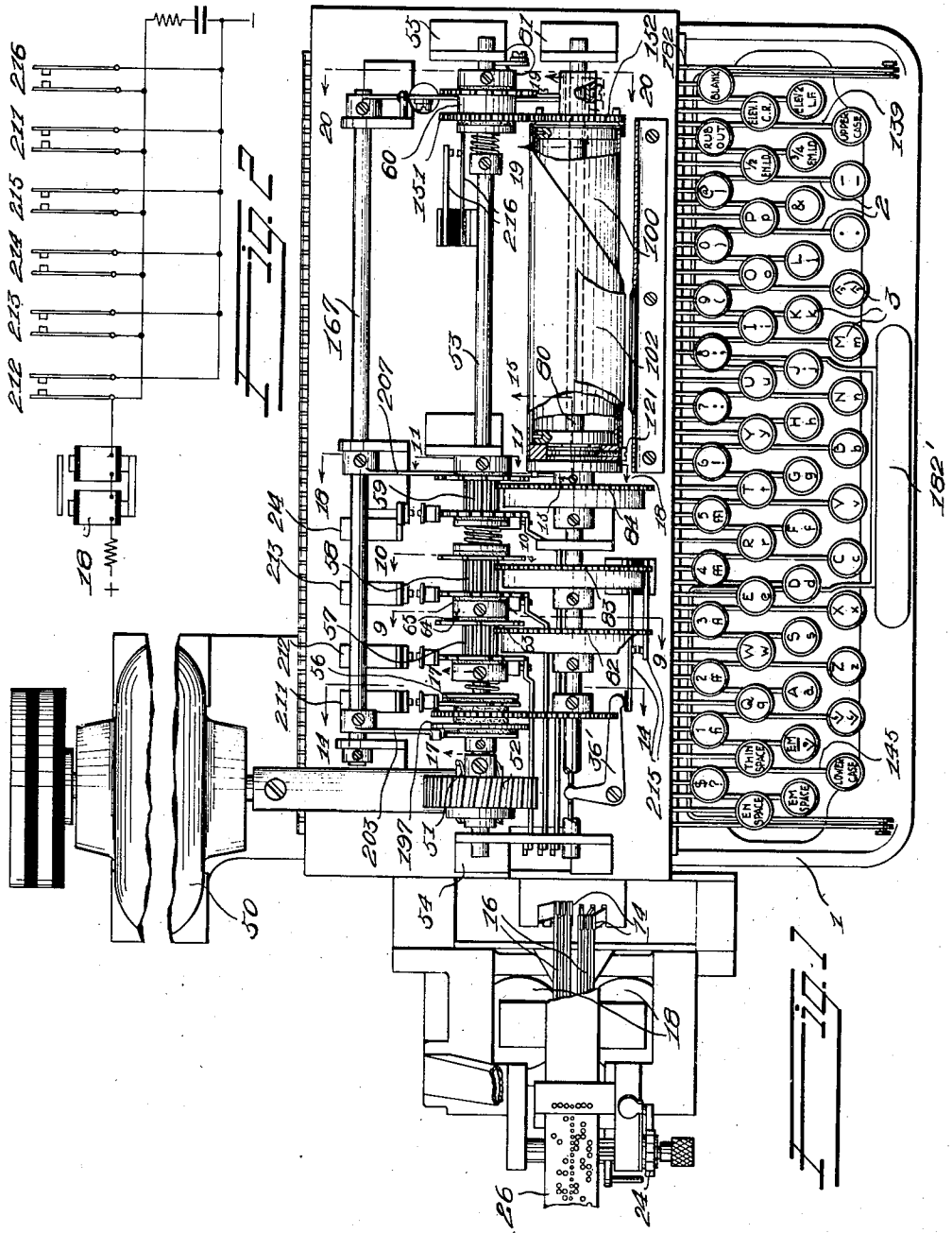

Fig. 1.

Fig. 2.

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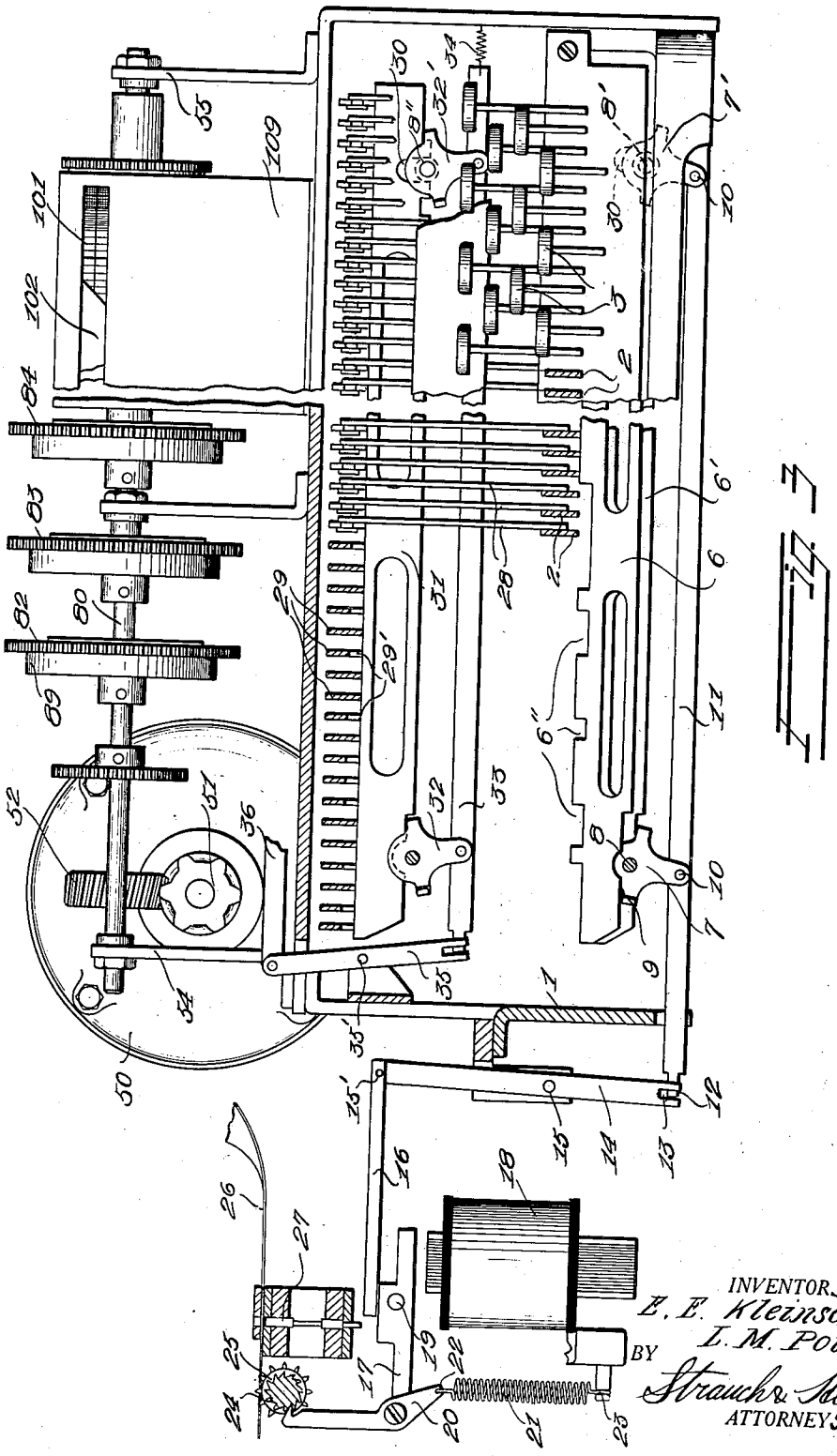
Filed Sept. 4, 1929 6 Sheets-Sheet 2



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KEYBOARD PERFORATOR AND COUNTER

Filed Sept. 4, 1929 6 Sheets-Sheet 3

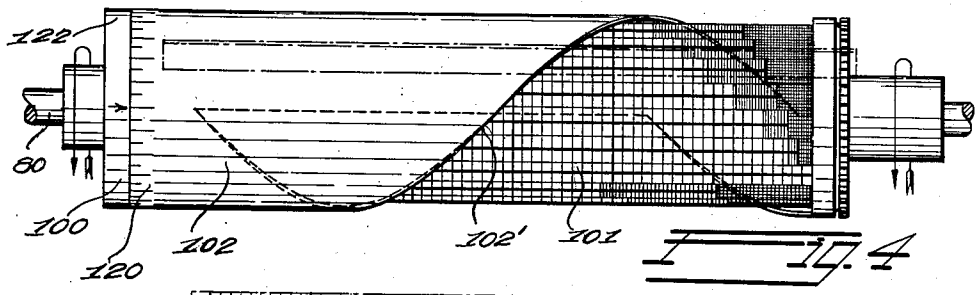

FIG. 4

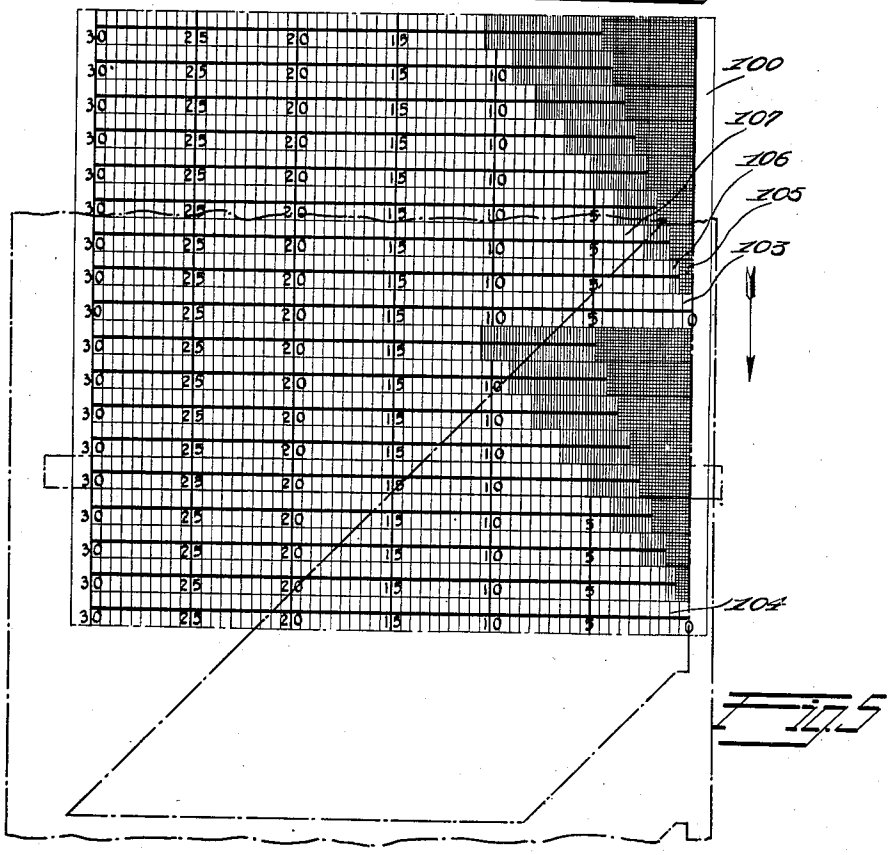

FIG. 5

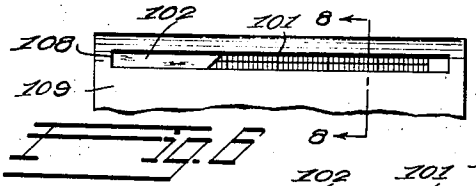

FIG. 6

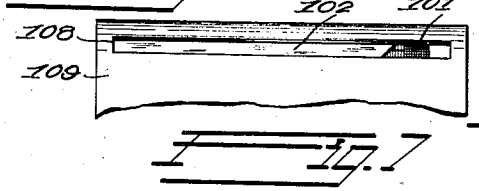

FIG. 7

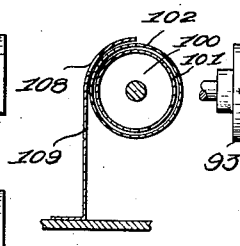

FIG. 8

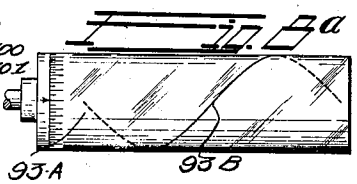

FIG. 8a

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KEYBOARD PERFORATOR AND COUNTER

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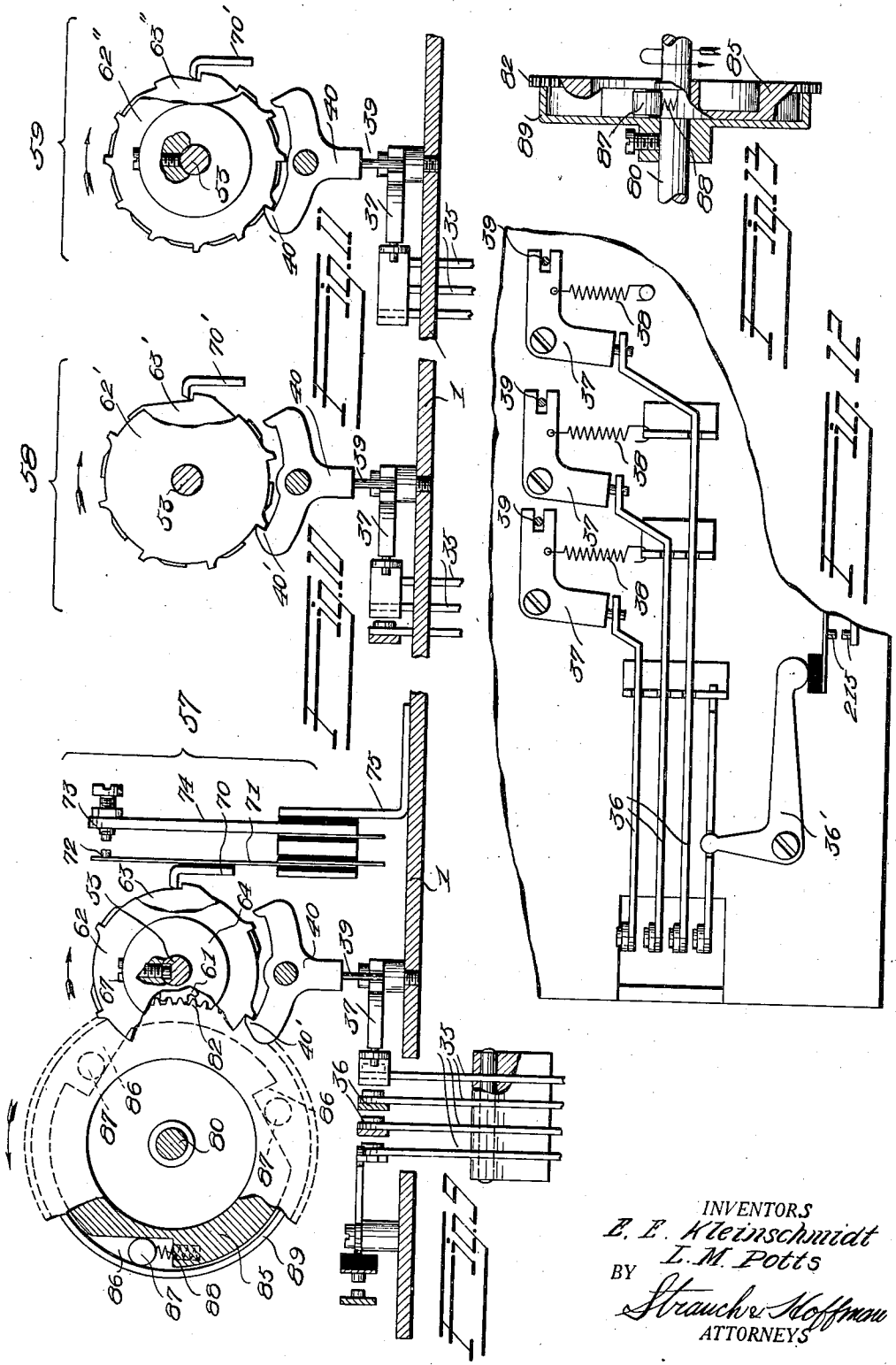

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KEYBOARD PERFORATOR AND COUNTER

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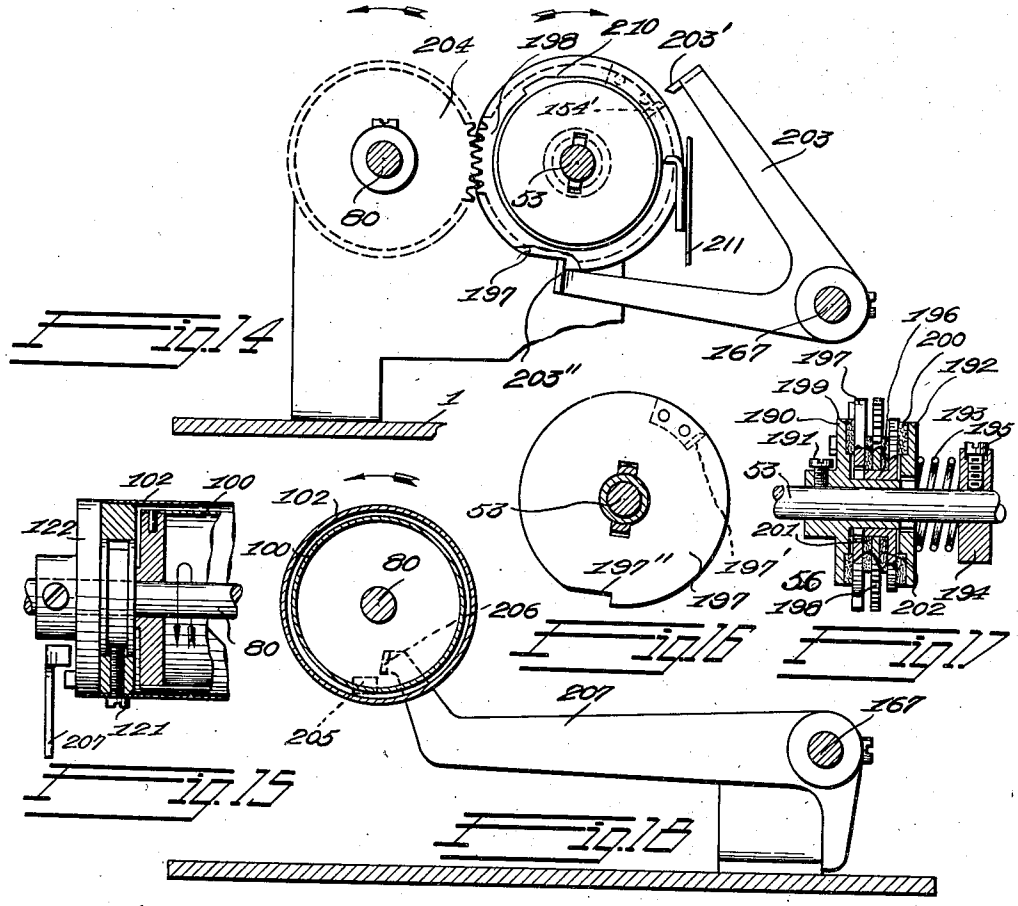

FIG. 14

FIG. 16

FIG. 17

FIG. 15

FIG. 18

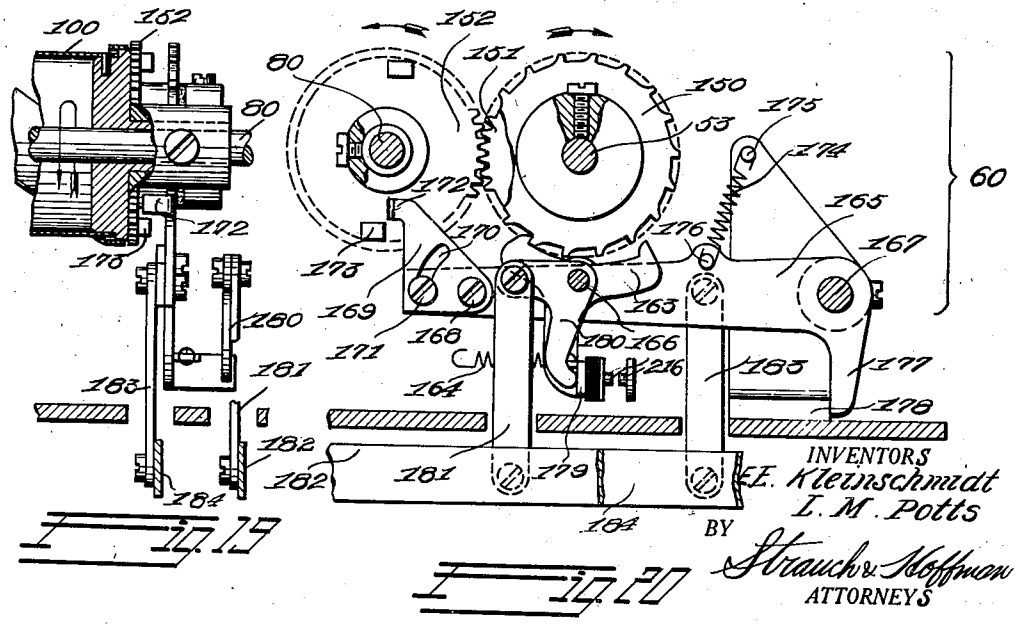

FIG. 19

FIG. 20

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KEYBOARD PERFORATOR AND COUNTER

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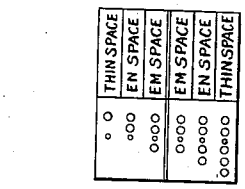

Fig. 4

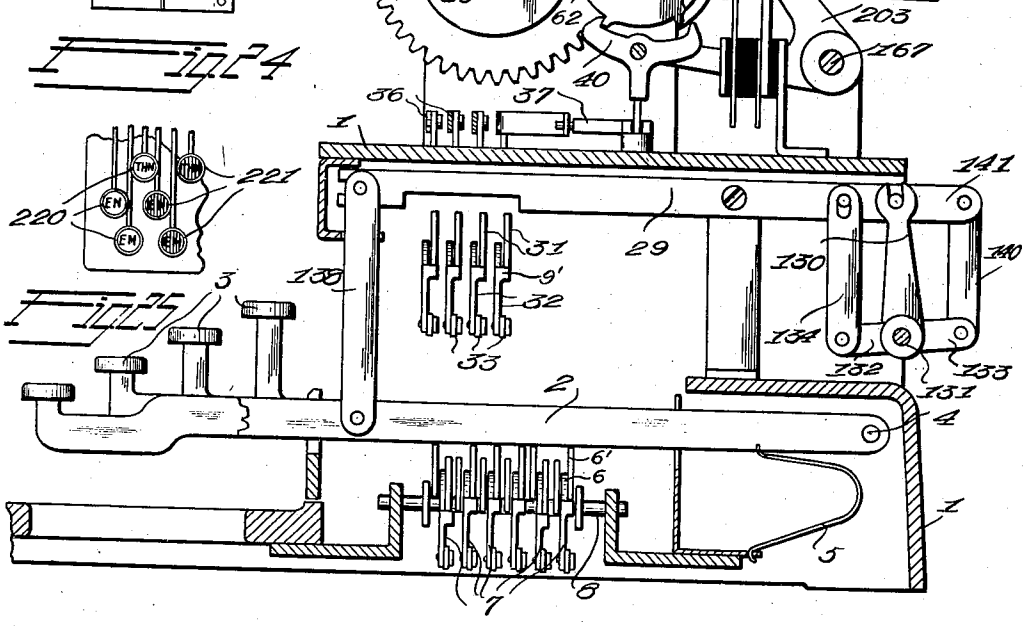

Fig. 5

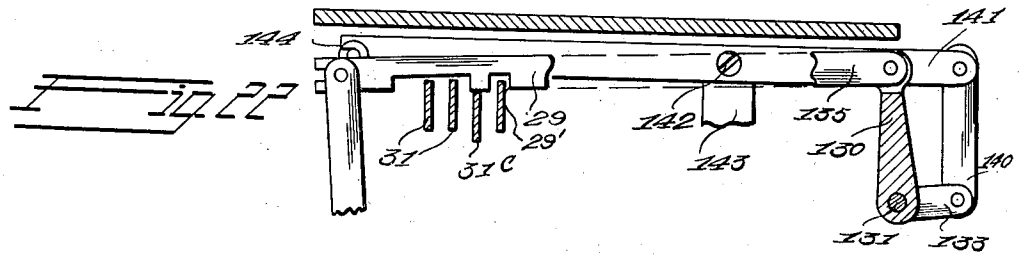

Fig. 7

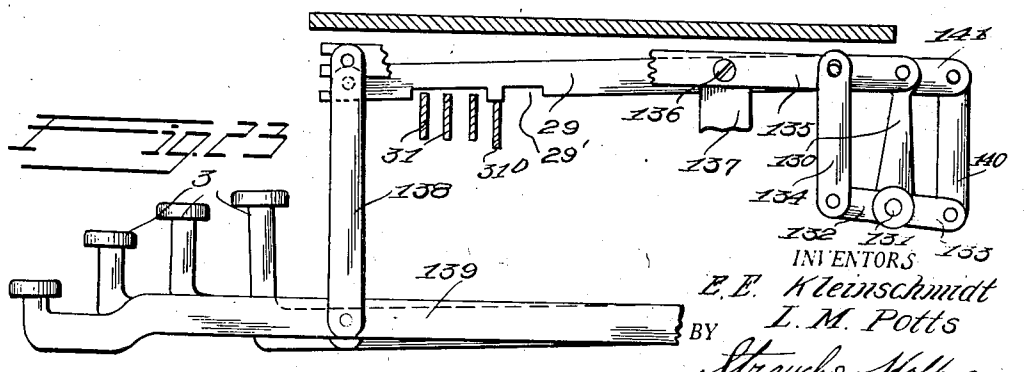

Fig. 3

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Patented May 7, 1935 2,000,029

UNITED STATES PATENT OFFICE

2,000,029

KEYBOARD PERFORATOR AND COUNTER

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Application September 4, 1929, Serial No. 390,352

33 Claims. (Cl. 164—112)

This invention relates to a remote typesetting system and apparatus therefor and more particularly to perforators and counters which may be employed for preparing tapes for remote automatic control of composing machines.

The device is here described with special reference to the preparation of perforated tape to be used in controlling remotely disposed composing machines of the line casting type. In such machines there are matrices for each character, each having a fixed thickness but not necessarily all of the same thickness. There are also justifying matrices (expansible space bands) which are adjusted before casting between certain ranges of thickness. The perforating operator at the transmitting station must accordingly be apprised of the length of the line remaining as each matrix is operated. This is accomplished by a counting device.

The counting device here described indicates to the transmitting operator the totalized thickness of the matrices in a line during the process of composition and it separately indicates the number and the minimum, maximum and variable thickness of the justifying matrices. It performs also a function of subtraction by which the totalized thickness of the fixed matrices and the minimum thickness of the justifying matrices are subtracted jointly from a predetermined length of the line and the net results is shown upon a scale, and by which also, at the same time the totalized thickness of the fixed matrices and the maximum thickness of the justifying matrices (expanded space bands) are subtracted jointly from a predetermined length of line; and the net, either plus or minus, is shown upon a scale.

Heretofore in counting mechanism associated with a keyboard the perforating and counting operation have been initiated in parallel. For example, depression of a key closes a contact to operate a perforating magnet and also operates mechanically a counter. In such a device it is necessary to so adjust the mechanism that its two devices operate simultaneously, but this is not commercially practicable, so that under many conditions the mechanism will count but not perforate, or perforate but not count, depending largely upon the touch of the operator. In the present device, when a key is depressed a clutch is released and as the clutch rotates, both perforating and counting operations must take place. The device is so arranged that a single depression of a key can cause only one perforating and counting operation. By this method of operation, the duration of the energization of the perforating magnet is uniform, regardless of the fingering of the keys. Chattering of the contact, a common fault when the contact is closed directly by the keys, is also prevented.

Inasmuch as the thicknesses of the matrices are different for different characters, the counting mechanism must count not only the number of matrices but also must operate variably in accordance with the particular matrices operated. Furthermore a character in the upper case may be of different thickness than a character in the lower case, which must also be taken into account.

An object of the present invention is to provide means for remotely controlling a composing machine.

A further object is to provide means for integrating or totalizing the width of characters and justifying members.

Another object is to provide means whereby the amount counted for a particular key will be different for the upper and lower case positions of the key.

A further object of the invention is to provide a chart comprising a plurality of scales, each scale being for a different number of justifying elements, and a shutter to cover portions of the scale representing matter already composed.

A still further object of the invention is to provide means whereby depression of a key will result in both a perforating and a counting operation.

Another object is to provide means whereby depression of the carriage return key will result in a complete return operation regardless of the fingering of the key.

Still a further object of the invention is to provide means whereby the counter mechanism operates invariably and only when the perforating mechanism operates.

There are other objects of the invention which together with the foregoing will appear in the detailed description to follow.

In the drawings:

Figure 1 is a plan view of the invention.

Figure 2 is a diagram showing the electric circuits and switches for controlling the perforating control magnet.

Figure 3 is a front elevation of the invention with portions in section.

Figure 4 is a plan view showing the chart and index.

Figure 5 is a view showing the justifying chart developed.

Figures 6 and 7 are fragmentary views showing the slotted cover member with the chart visible through the slot.

Figure 8 is a sectional view through the chart and cover member on line 8—8 in Figure 6.

Figure 8a shows a modification of the shutter.

Figures 9, 10 and 11 are part sectional, and part elevational views showing portions of the counter escapement mechanism, the sections being taken along lines 9—9, 10—10, 11—11, respectively of Figure 1.

Figure 12 is a plan view of the release mechanism for the escapements.

Figure 13 is a sectional view of the roller clutch.

Figure 14 is a section taken along lines 14—14, Figure 1.

Figure 15 is a section taken along lines 15—15, Figure 1.

Figure 16 is a section through shaft 53 showing one of the cam plates.

Figure 17 is a section taken along lines 17—17, Figure 1.

Figure 18 is a section taken along lines 18—18, Figure 1.

Figure 19 is a section taken along lines 19—19, Figure 1.

Figure 20 is a section on line 20—20, Figure 1 showing the line spacing escapement mechanism.

Figure 21 is a side elevation, partly in section showing the case-shift mechanism.

Figures 22 and 23 are fragmentary sectional views showing the case-shift mechanism in a different position.

Figures 24 and 25 are fragmental views disclosing modified space key arrangements.

The machine comprises a frame 1 having at its front the usual keyboard comprising key levers 2 operable by keys 3. Each key lever is pivoted to the frame as shown at 4, Figure 21 and is provided with a return spring 5 near its pivot for returning the lever to its normal position after it has been operated. Each spring 5 has one of its ends attached to the frame 1 and its other end connected with a lever 2.

Arranged underneath the key levers is a plurality of pairs of permutation bars 6 and 6', Figure 3, the upper edges of which are provided with notches 6''. Each pair of bars 6 and 6', rests upon a pair of rocking members 7 and 7' which are mounted upon pins 8 and 8' respectively, Figures 3 and 21. Each rocking member 7 has an ear 9 extending forward to support a bar 6 and another ear, shown in Figure 21, extending backward to support the companion bar 6'. Similarly, each rocking member 7' has one ear for supporting a bar 6 and another for supporting the companion bar 6'.

The rocking members 7 and 7' are pivotally connected at 10 to a horizontal bar 11. This bar has at its end, an ear 12 engaging a slot 13 formed in one end of a lever 14 which is pivoted at 15 and has pivotally connected to its other end 15' a link 16. It will be understood that there are a plurality of bars 11, one for each pair of permutation bars 6, 6' and that each bar 11 is operatively connected with a link 16 by a lever 14.

The links 16 are slidable in slots (not shown) in armature 17 of electromagnet 18. The armature 17 is pivoted at 19 and has pivotally mounted on its end a pawl 20. A spring 21 has one of its ends connected to one end of the pawl at 22 and its other end connected to a fixed point at 23. The other end of the pawl cooperates with a ratchet 24 which is secured to a feed wheel 25.

The teeth of the feed wheel 25 cooperate with the feed perforations in the tape 26 for feeding the tape. A plurality of punch pins 27 are arranged for perforating the tape in accordance with the operation of the keys on the keyboard which operation will now be described. It will be understood that a punch to perforate the feed hole is also provided and operated each time a group of perforations is made.

When a key 3 is depressed its lever 2 will engage the upper edges of combinations of the permutation bars 6, 6' and these bars will be depressed. It will be understood that for each key depressed a different combination of permutation bars will be operated.

When a permutation bar 6 is depressed, its lower edge engages with ears 9 of rocker members 7, 7' causing the latter to rock on their pivots 8 producing at the same time an upward movement of the other ears of the rocker members and consequent upward movement of the companion permutation bar 6'. This upward movement of the bar 6' is permitted by reason of the fact that the upper edge of bar 6' is notched at points where the upper edge of bar 6 is not notched and vice versa. The permutation bars, when moving downward, are guided to move vertically by the guide slots 30 which span a collar 8' mounted on the pin 8.

The permutation bars which have been depressed by the key lever 2 rock their rocker members 7 and 7' to swing their bars 11 to the right, rotating their levers 14 counterclockwise and their links 16 to the left positioning the links beneath the punch pins 27. The magnet 18 will then be energized by mechanism which will be described hereinafter. Energization of the magnet rocks the armature 17 clockwise forcing the links 16 upwardly against the punch pins 27 to perforate the tape. Simultaneously with the perforating operation, the pawl 20 will move up to engage the next tooth on the ratchet 24. When the magnet is deenergized, the spring 21 draws the pawl down rotating the ratchet one step and feeding the tape to position it for the next perforating operation. In this manner the tape is perforated in accordance with the operation of the key levers 2. The elevated bars 6' will be returned by the next key operated provided the corresponding hole is not to be perforated, as that key lever will engage a high part of bar 6'. If the corresponding hole is to be perforated the bar 6' will remain elevated.

The connections leading from the key levers 2 to the counting mechanism will now be described. Each key lever 2 is connected by means of a link 28 with a lever 29 as shown in Figure 3. The levers 29 are arranged side by side and run parallel with the key levers 2. Underneath the levers 29 and running parallel with the permutation bars 6, 6' are four bars 31 similar in construction to the bars 6', except that they do not have notches in their upper edges. The levers 29, however, are provided with notches 29' in their lower edges. These notches are so cut that when a lever 29 is depressed its lower edge engages only one of the bars 31, the notches 29' providing clearance for the other bars 31. The arrangement is such that depression of a key to transmit a wide letter such as the letter M will result in the depression of one of the bars 31, depression of a key to transmit a letter of medium width such as

the letter S will result in the depression of a second bar 31 and depression of a key to transmit a narrow letter such as the letter I will result in depression of a third bar 31.

Each of these bars 31 rests on the ears of two rocker members 32 and 32' similar to rocker members 7 and 7'. For each bar 31 there is provided a bar 33 which has connected to one end a spring 34 for returning the bar 33 to its normal position. Each bar 33 is connected to one end of a lever 35 which is pivoted at 35' and has its other end connected by a link 36 with one arm of a bell crank lever 37 (see Figure 12). The other arm of each bell crank lever has connected thereto one end of a spring 38, the other end of which is connected to a fixed point on the frame of the machine. The bell crank levers 37 have slot connections with pins 39 which are secured to escapement pawls 40 (see Figures 9, 10 and 11).

The fourth bar 31 is operated whenever a key such as "blank" or "rubout" which do not operate the counter is depressed as will be described later. Operation of this fourth bar moves the associated rocking members 32 and 32', bar 33, lever 35, link 36 and bell crank lever 36' to bring contacts 215 into engagement with each other. This closes one of a plurality of parallel circuits (see Figure 2) to energize magnet 18 to perforate the tape in accordance with the key operated, but does not operate any part of the counting mechanism.

Escapement pawls 40 control three friction mechanisms 57, 58 and 59 mounted upon a shaft 53 which is journaled in brackets 54 and 55 mounted on the frame 1. The shaft 53 is driven at a suitable speed by a motor 50 through gears 51 and 52. In addition to members 57, 58 and 59 there are two other friction driven mechanisms 56 and 60 mounted on shaft 53. The construction of these other mechanisms 56 and 60 will be described later.

Mechanism 57, see Figure 9, is composed of a pinion 61, a six-tooth ratchet wheel 62 and a six-tooth cam disc 63, all rigidly connected together and loosely mounted on shaft 53. A collar 64 is secured to the shaft 53 by means of the screw 67, the tip of which extends into a slot in shaft 53, so that the collar rotates with the shaft but can slide longitudinally along the shaft. Between the collar 64 and the cam disc 63 there is a friction washer 65, see Figure 1.

As shown in Figure 1, there is supported in parallel relation with shaft 53 another shaft 80 journaled in the brackets 54 and 81. The shaft 80 has three gears 82, 83 and 84 loosely mounted thereon, these gears cooperating with the pinions of the friction driven mechanisms 57, 58 and 59, respectively. Thus, as shown in Figure 9, gear 82 cooperates with pinion 61 of friction driven mechanism 57. Attached to gear 82 is a cam disc 85 which has three notches 86, each notch carrying a roller 87 which is pressed by a spring 88 against the rim of a drum 89 which in turn is secured to the shaft 80. Each of the gears 83 and 84 is provided with a cam disc having notches, a roller, a spring and a drum similar in construction to that described in connection with gear 82.

When gear 82 is rotated counter-clockwise the cam disc 85 wedges the roller 87 between the cam disc and the drum 89 and accordingly the drum 89 and the shaft 80, to which it is secured, will rotate with the gear 82. On the other hand, if the shaft 83 is being operated in the counter clockwise direction by gear 83 or gear 84 the drum 89 of gear 82 will rotate with the shaft producing an idle rotation of the rollers 87, the gear 82 remaining stationary. Thus it will be noted that the shaft 80 may be operated by any one of the gears 82, 83 or 84 and that when one of these gears is operating the shaft the other two gears remain stationary.

The cam disc 63 is adapted to engage a lug 70 on a contact spring 71 carrying a contact 72 adapted to cooperate with a contact 73 on a contact carrier 74, the contacting mechanism being suitably insulated and carried on a bracket 75 secured to the frame of the machine.

Mechanisms 58 and 59 are similar in construction to the mechanism 57 except that the number of teeth in the ratchet wheels 62' and 62'' and cam discs 63' and 63'' of these mechanisms is not the same as in the ratchet wheel 62 and cam disc 63 of mechanism 57. Thus, in mechanism 58, the ratchet wheel 62' and cam disc 63' each have eight teeth, and in mechanism 59, the ratchet wheel 62'' and cam disc 63'' each have 12 teeth.

For the purpose of effecting the counting operation by the present device the character matrices comprising a font of type have been divided into three groups, and one of the mechanisms 57, 58 or 59 has been assigned to each group to effect the counting thereof. It is understood, of course, that the character matrices may be divided into any number of groups, and that the number of mechanisms 57 to 59, will be increased correspondingly; but for the purposes of disclosure of the present embodiment three such groups and mechanisms have been chosen. The character M and other characters of approximately the same width have been assigned to one of the groups, so that when a key representing a character in this group has been depressed it will effect the operation of escapement mechanism 57 to cause the advancement of shutter or indicator 102 one space or graduation on the scale. Also, when a key representing a character in the second group is depressed the friction mechanism 58 will be operated which will cause the index or shutter to move three fourths of a space on the scale. Lastly, when a key representing a character in the third group is depressed, it will effect the operation of friction mechanism 59 to move the shutter 102 one-half space. Furthermore, each of the 18 scales are exactly the same with the exception of the widths of the lightly and heavily shaded portions at the right ends thereof, which portions are representative of the number as well as the minimum and maximum thicknesses and expansibility of the spacebands in the line.

It will now be clear that mechanism 57 moves 60 degrees for one step, mechanism 58 moves 45 degrees for one step and mechanism 59 moves 30 degrees for one step. These mechanisms operating the shaft 80 through their respective gears 82, 83 and 84 are adapted to rotate the shaft through three different cycles depending upon which one of the mechanisms is operated. Since the thickness of the character being transmitted determines the selection of the mechanism 57, 58 and 59, it will be obvious that the thickness of the character being transmitted will determine the angle of movement of the shaft 80. The shaft 80 is arranged to operate an indicator which will now be described.

The indicator, Figure 4, comprises two main parts, a chart comprising a series of scales 101 and a spiral shutter 102. The chart is divided

into 18 spaces, see Figure 5. In each space there is drawn along the length thereof a graduated scale which is divided into spaces representing what are known as keyboard ems, that is, if the key for the character M is depressed the indicator will advance one space on the scale irrespective of the character or the size of the type to be used. It will be noted that the scales are graduated from the right so that the reading represents the amount of space left in the line rather than the amount which has already been set. It will be noted further that at the right end of each of the scales, except scales 103 and 104, there is a heavily shaded portion 105 and a lightly shaded portion 106. The portion 105 has a width which corresponds to the thickness of the thin end of the space band used and the portion 106 has a width corresponding to the difference in thickness between the thin and thick end of the space band so that the portion 106 represents the amount of justification possible in a line containing one space band. Scale 107 has a heavily shaded portion, proportionate to the thickness of the thin end of two space bands and a lightly shaded portion of a width equal to the difference between the thick and thin ends of two space bands, or the amount of justification possible in a line containing two space bands.

The chart 101 is mounted upon a drum 100 as shown in Figure 8. The drum 100 is located to the rear and adjacent to a slot 108 in a part of the cover 109 of the machine, so that as the drum is rotated into the different positions only one of the scales will show through the slot. See Figures 3 and 8.

It will be noted that the chart 101 has two similar halves, each half comprising nine scales. The top scale in each half has provision for eight space bands. The bottom scale in each half provides for no spacebands and is called the zero scale and is that point to which the chart is returned for the beginning of a new line. These series of scales are used alternately, thus, after one of the series of scales has been used, the chart will be rotated so that the zero position of the other series of scales will assume the beginning-of-line position. The advantage of this arrangement of scales will become apparent when it is seen that it is necessary to rotate the chart only one-half revolution or less to the zero position instead of twice that amount, thus saving considerable time and enhancing the speed of operation of the apparatus. As will presently appear, the scale is rotated step-by-step upon the depression of the space key through the medium of the friction driven member 60 (Fig. 20) which comprises an escapement wheel 150 having 18 teeth, or the same number as the number of scales on the chart 101. Thus, it is obvious that each time the space key is operated representative of the insertion of a spaceband in the line of composed matrices a perforation will be made in the tape and at the same time the chart 101 will be rotated through one angular step.

The helical shutter 102 is secured to the shaft 80 so as to rotate therewith and is located between the chart 101 and the cover 109 so that as the shutter rotates it will gradually cover the scale which happens to be exposed through the slot 108. In the middle of each scale there is a heavy black line and by noting the position where the edge 102' of the helical shutter crosses this line the amount of space left in the line to be filled may be determined. If the end of the line signal is perforated before the edge of the shutter reaches the lightly shaded portion of the scale the line will be too short to cast. If the edge of the shutter is in the lightly shaded portion, the line will cast properly and if the edge has passed beyond the lightly shaded portions into the heavily shaded portion, the line will be too long to cast.

On the left hand end of shutter 102 is a series of graduations 120 cooperating with a series of graduations on the collar 122. By loosening the screw 121 (Figure 15) the shutter can be rotated with respect to the collar 122 so that the position of the shutter can be changed with respect to the stopping position of the other parts of the mechanism and as all parts of the indicator are returned for the beginning of a new line the shutter may be set for any length of line by merely rotating the shutter with respect to the collar.

The mechanism for producing a case shift will now be described in connection with Figures 21, 22 and 23.

The code bars 29 which determine which one of the bars 31 is operated, or in other words how much the shutter rotates upon the depression of each key, are pivoted in a carrier 130 which in turn is pivoted to the frame at 131. The carrier 130 has two extensions 132 and 133. Extension 132 is connected by a link 134 (Figure 23) to a lever 135 pivoted at 136 to support 137 and connected by a link 138 to the key lever 139 which controls the transmission of the upper case shift signals. When the key lever 139 (Figure 23 and Figure 1) is depressed lever 135 is rocked about its pivot 136 and through link 134 carrier 130 is rotated clockwise and all of the code bars 29 assume their back position as indicated in Figure 23.

Extension 133 is connected by a link 140 (Figure 22) to lever 141 which is pivoted at 142 on bracket 143 and connected by a link 144 to a key lever 145, (Figure 1) which controls the transmission of the lower case shift signals. When key 145 is depressed lever 141 is rocked counterclockwise around its pivot 142 and through link 140, carrier 130 is rocked to its forward position and the code bars 29 assume the position shown in Figure 22.

The code bars 29 which are connected to keys in which the upper and lower case characters are of the same width, are arranged to operate the same one of the bars 31 regardless of whether the bars 29 are in the shift or unshift position. This is accomplished by properly shaping the projections on the code bars 29. But the code bars 29, which are connected to keys in which the upper case character is of a different width from the lower case character are arranged to operate different bars 31 depending upon whether the bars 29 are in the shift or unshift position. This has been illustrated in Figures 22 and 23. The bar 29 shown in these figures is connected to a key (not shown) in which the lower case character is of an "en" width and the upper case character is of an "em" width.

It will be noted that in Figure 22 the lower case shift lever 145 is depressed and therefore depression of a bar 29 will result in depression of bar 31C and movement of the shutter through a distance corresponding to an "en" space. In Figure 23, the upper case shift lever 139 is depressed and therefore depression of a bar 29 will result in depression of bar 31D and move-

ment of the shutter through a distance corresponding to an "em" space.

Links 134 and 140 have elongated holes in their upper ends where they are connected with levers 135 and 141, respectively. This permits either of the shift keys to be depressed and to return to normal position without affecting the other shift key. Carrier 130 is held in either position by a jockey roller (not shown).

Friction driven member 60 (Figure 20) is composed of an escapement wheel 150 having 18 teeth, or the same number as the number of scales on the chart 101. It also comprises a gear 151 which meshes with a gear 152 rigidly attached to the drum 100 so that whenever the escapement wheel 150 moves the drum 100 will be moved a corresponding amount. The friction driven escapement wheel 150 tends to turn clockwise but is prevented by pawl 163 which is normally held in engagement with the ratchet wheel 150 by a spring 164. The lever 165 is secured to a rockable shaft 167 pivoted in the frame as shown in Figure 1. Mounted at 168 on the long arm of lever 165 is an adjustable stop piece 169 having an arcuate slot 170 therein. A screw 171 extends through slot 170 and into lever 165. Loosening of the screw 171 permits adjustment of the stop piece 169 after which the screw may be tightened to maintain the adjustment. The stop piece should be so adjusted that when lever 165 is held in its normal position, or that shown in Figure 20, lug 172 of stop piece 169 will be out of the path of movement of stop projection 173 carried on gear 152, and drum 100 will be free to rotate when permitted by the escapement mechanism 60.

A spring 174, having one of its ends connected to a fixed point 175 and its other end connected to the lever 165 at point 176, normally tends to maintain lever 165 in the position shown with its short arm 177 against a stop 178. Escapement pawl 163 has a projection 179 which engages the tip of bell crank 180, pivoted on pin 166 and connected by a link 181 with a key lever 182 which is the space band or justifying key lever operated from space bar 182'. Lever 165 is connected by a link 183 with a key lever 184 which is the carriage return or elevator key lever.

When key lever 182 is depressed, escapement pawl 163 is operated through bell crank 180 and link 181 to release escapement wheel 150 which will operate one step. Through the gear connections the drum 100 carrying the chart 101 will be permitted to move a corresponding amount from power furnished through friction clutch 60.

The mechanism 56, shown in detail in Figure 17, will now be described. It comprises two friction clutches, one within the other. The outer friction clutch comprises the outer sleeve and flange member 190 fixed to the shaft 53 by a screw 191 and cooperating with the splined cam plate 192 which is pressed toward member 190 by the spring 193 abutting against the collar 194 which is fixed to the shaft 53 by means of a screw 195. The members 190 and 192 thus may move toward each other to compress the friction washers 199 and 200 while both of the members 190 and 192 revolve positively with the shaft 53. The inner sleeve and flange member 196 and its companion splined cam plate 197 are mounted loosely upon the sleeve of the member 190. By reason of the splined connection, the two members 196 and 197 may move toward each other to compress the friction washers 201 and 202. The two members 196 and 197 must turn together as a clutch unit. Between the members 196 and 197 and sleeved upon the member 196 is the gear wheel 198. The members 190 and 192 turn continuously with the shaft 53 and through the friction washers 199 and 200 operate to turn the members 196 and 197 when these members are not restrained. The members 196 and 197 when turning operate through the friction washers 201 and 202 to turn the gear wheel 198 when that gear wheel is not restrained.

The spring 193 supplies a pressure to all of the friction washers of the member 56 by reason of the splining of the several parts. The member 197 is restrained by the double dog escapement pallet 203 (Figure 14) which is carried by the rocking shaft 167 operated through lever 165 and link 183 by the lever 184 of the elevator key. The gear 198 meshes with the gear 204 fixed to the shaft 80 to turn the shutter 102 and is restrained when the stop 205 upon the shutter 102 engages the tip 206 of the arm 207 which also is carried by the rocking shaft 167.

The function of the elevator key is to restore the shutter 102 and the drum 101 to their respective normal positions and also to control the punching of code perforations in the tape. When the elevator key is depressed it operates arm 165 and rocks the shaft 167 thereby operating arm 207 and double dog 203. Dog 203 removes the restraint from clutch members 196 and 197 which, then are driven by the shaft 53 and drive gear wheels 198 and 204 to turn shaft 80 until stop 205 engages the lug 206 of arm 207.

The arm 207 stops the shutter and restrains the gear wheel 198. The clutch parts 196 and 197 continue to turn until the attached plate 197' engages the upper tooth 203', of the double dog 203 after which all parts are restrained until the release of the elevator key. Upon the release of the elevator key the arm 207 releases the shutter and dog 203 releases the plate 197 and all parts of the double clutch turn until the lower tooth 203'' of dog 203 engages the notch 197'' in plate 197, when, again, all parts of the clutch stop except 190 and 192. The shutter has been turned through its unused angle to its normal position of rest and is in readiness for the work of the next line.

While the elevator key has been depressed the lever 165 has withdrawn the dog 163 from the wheel 150 and has moved the stop 172 into the path of the stop 173. The clutch member 60 now operates to drive the drum 101 until the stop 173 engages the stop 172. Upon release of the elevator key, the stops 172 and 173 are disengaged and the pallet 163 engages the wheel 150 to restrain the drum 101 which now is in its normal position in readiness for the work of the next line.

Friction discs 201 and 202 are smaller than friction discs 199 and 200 so that when the shutter reaches its initial position, a slip will occur at discs 201 and 202 and not at discs 199 and 200 thus permitting the disc 197 and associated parts to complete their operation. The double friction discs also perform another function. When the shutter is moving forward slippage occurs at the small diameter discs 201 and 202 while the disc 197 and associated parts remain in their normal position. This action also provides a braking effect which prevents overthrow due to the inertia of the moving parts.

The punching of the code perforations in the tape is effected by the cam 210, Figure 14, which closes contact points 211, Figure 1. The punch magnet 18 is energized to operate selected punches 27 to perforate the tape 26 by closing the circuit shown in Figure 2, some one pair of points

being closed by a member in the selecting devices.

When mechanism 56 is operated, the points 211 are closed. When mechanism 57 is operated the points 212 are closed. When mechanism 58 is operated the points 213 are closed. When mechanism 59 is operated the points 214 are closed. When the spacing mechanism 60 is operated the points 216 are closed.

A modified form of shutter is shown in Figure 8a. This shutter is in the form of a transparent cylinder 93A, with a helical line 93B drawn upon it. The reading is made at the intersection of the line of the scale and the line 93B of the shutter.

The operation of the entire apparatus will now be described.

Depression of a character key 3 operates the associated key lever 2 to engage and depress a combination of the permutation bars, 6 and 6'. The depressed bars 6 and 6' rock members 7 and 7' to move bars 11 and the latter bars rock levers 14 to shift the corresponding links 16 into position beneath punch pins 27.

In addition to depressing the permutation bars 6 and 6' the key lever 2 simultaneously operates a lever 29 through the associated link 28. Lever 29 depresses one of the bars 31, the selection of the bar 31 depending upon the thickness of the matrix, for which a code combination is to be transmitted, and through rockers 32 and 32', a bar 33 is operated. This bar operates through a lever 35, link 36 and bell crank 37 the corresponding escapement pawl 40. The pawl releases its friction driven mechanism (57, 58 or 59) which rotates one step, operating through its associated gear mechanism, the shaft 80 and shutter 102. During the movement of the friction driven member, a contact 72—73 is closed for energizing the magnet 18 to perforate the tape and to feed the tape one step.

As various character keys are depressed in succession, the shutter 102 is rotated through varying angles, the angle of rotation depending upon the thickness of the matrix, for which a code combination is to be transmitted. As the shutter rotates, its edge 102' moves to the right along the slot 108 and the scale exposed through the slot is gradually covered up. At any point in the operation of the keys, if the operator wishes to determine how much space is left in the line being cast, he has only to observe the point where the edge 102' of the shutter 102 intersects the heavy horizontal line of the scale.

When the operator depresses the bar 182' the lever 182 is depressed operating pawl 163 through bell crank 180 and link 181 to release escapement wheel 150 which will operate one step. Gear 151 rigidly connected to wheel 150 will rotate gear 152 to move the drum 100 carrying the chart 101 a sufficient amount to bring the next scale into position opposite the slot 108 in the cover member 109. At the same time contacts 216 are closed and the space perforation is made in the tape and the tape is advanced one step. Thus, every time the bar 182' is depressed, the chart will be rotated to bring the succeeding scale into position opposite the slot, the tape is perforated and advanced one step.

To operate the case shift mechanism, key lever 139 is depressed. This operates link 138 to rock lever 135 about its pivot 136 and raise link 134 thereby rocking member 130 clockwise. Levers 29 are thus moved rearwardly and depression of a character key will result in the operation by levers 29 of different bars 31 than would be operated if the case shift mecahnism had not been operated. Thus, when the bars 29 are in the unshift position, as shown in Figure 22, depression of a character key will result in operation of bar 31C and movement of the shutter through a distance corresponding to an "en" space. On the other hand, when the bars 29 are in the shift position, as shown in Figure 23, depression of the same character key will result in operation of bar 31D and movement of the shutter through a distance corresponding to an "em" space. Depression of key lever 139 also sets the permutation bars 6 and 6' for the shift combination, closes contacts 215 and cause the shift perforation to be made in the tape, but no operation of the counting mechanism takes place.

The unshift key performs similar operations.

To begin a new line, the elevator key is depressed. This operates arm 165 and rocks the shaft 167 thereby operating arm 207 and double dog 203. Dog 203 removes the restraint from clutch members 196 and 197 which then are driven by the shaft 53 and drive gear wheels 198 and 204 to turn shaft 80 until stop 205 engages the lug 206 of arm 207. This stops the shutter and restrains the gear wheel 198. The clutch parts 196 and 197 continue to turn until the attached plate 197' engages the upper tooth 203' of the double dog 203 after which all parts are restrained until the release of the elevator key.

The elevator key also sets the bars 6, 6' in the proper permutation to perforate the elevator signal hole in the tape and closes contacts 215 to energize the perforating magnet to make the perforations and advance the tape.

Upon the release of the elevator key, the arm 207 releases the shutter and dog 203 releases the plate 197 and all parts of the double clutch turn until the lower tooth 203'' of dog 203 engages the notch 197'' in plate 197, when, again, all parts of the clutch stop except 190 and 192. The shutter has been turned through its unused angle to its normal position of rest and is in readiness for the work of the next line.

When the elevator key is depressed, the lever 165 withdraws the dog 163 from the wheel 150 and moves the stop 172 into the path of the stop 173. The clutch member 60 then operates to drive the drum 101 until the stop 173 engages the stop 172. When the elevator key is released the stops 172 and 173 are disengaged and the pallet or dog 163 engages the wheel 150 to restrain the drum 101. The drum is then in its normal position in readiness for the work of the next line.

Figures 24 and 25 illustrate a method by which the space intervals may be changed or corrected. Two different combinations of perforations are provided for thin space and for "en" space, and the keyboard is provided with two sets of space keys. The set of keys 220 is used ordinarily and corresponds to the 1, 1—2, and 1—2—3 combinations, and the set of correcting keys 221 corresponds to combinations 1—2—3—4—5, 1—2—3—4, and 1—2—3. Referring to Fig. 1, it is noted that there are provided at the left side of the keyboard, three keys; namely, the "thin-space" key, the "en-space" key, and the "em-space" key. The em-space key is representative of the em-quad or spacing matrix of fixed thickness employed in the typographical art. Similarly, the en-space and thin-space keys are representative of the en-quad and thin-space, respectively, which are also of fixed thicknesses,

thus differing from the expansible spacebands. When the em, en and thin-space keys are operated, their effect is to produce a code combination of perforations in the tape, and to actuate the counting mechanism. It frequently occurs that when the composed line of matrices is ready for justification, it is necessary in order to properly justify the line to change one or more of these em, en or thin-spaces to either of the others, but the perforated tape having been already prepared it is apparent that means must be provided to alter or change the perforations in the tape correspondingly.

A method shown in Figs. 24 and 25 has been provided whereby these space intervals may be changed or corrected, thus avoiding the necessity of rewriting the line of composed matter. The effect of employing this arrangement of keys would require the addition of three more keys to the keyboard shown in Fig. 1, which would be so disposed as to correspond to the arrangement shown in Fig. 25. Thus, there would be three pairs of keys as shown in Fig. 25, one pair for each of the thin, en and em spaces.

Furthermore, as indicated in Fig. 24, a code combination is provided for each of these keys; however, the two em-space keys are adapted to effect the perforation of the same code combination; viz, the 1—2—3 combination. It is obvious that one em-space key could be employed, but for practical purposes two have been provided so as to provide these keys in pairs for the reason that in performing the altering or correcting operation or function the operator need only concern himself with the correcting keys, regardless of the code combinations perforated thereby. Therefore, to distinguish between the two sets of keys and to permit of their quick identification, the keys **221** may be of different color from the keys **220**. The set of keys marked **220** are the keys normally used and correspond to the code combinations represented in the left half of the table shown in Fig. 24. The correcting keys **221**, Fig. 25, correspond to the code combinations shown in the right half of the table, Fig. 24. Thus, in the normal preparation of a perforated tape the em, en and thin-space code combinations shown in the left side of Fig. 24 are perforated. Therefore, when the perforated tape is being prepared and it is found necessary or desirable to change the thicknesses of some of the spaces in the line so as to properly justify the line, any of the space code combinations shown at the left hand portion of Fig. 24 can be readily changed to any of the combinations shown at the right hand portions by first back-spacing the tape in known manner so that the code combination to be altered is positioned above the punches and thereupon depressing the desired correcting key, the effect of which is to increase the number of perforations in the tape to produce one of the code combinations shown at the right hand side of Fig. 24; the ultimate effect of this operation being to increase or decrease the spacing or space thickness between characters to insure that the corresponding line of matrices when set up in the line casting machine will be of proper length to be properly cast.

What I claim is:

1. In a keyboard perforator, a perforating mechanism, a magnet adapted to operate the perforating mechanism, a plurality of contacts, any one of which is adapted to control the energization of said magnet, a group of keys corresponding to one kind of operation, a second group of keys corresponding to a different kind of operation, one of said contacts corresponding to one group of keys and controlled thereby and another of said contacts corresponding to the second group of keys and controlled thereby.

2. In a machine for perforating a tape to be used to control composing machines of the casting type; means for making perforations in the tape to represent successive lines made up of characters of different widths; means for indicating the amount of space left in a line; a constantly rotating shaft; a plurality of keys controlling said perforating means; and a unidirectional unit wheel system controlled by said keys to connect said constantly rotating shaft to said indicating means and acting to operate through said system said indicating means variably according to the key depressed.

3. In combination, an indicating mechanism, a perforating mechanism, motor driven means operating said indicating mechanism and controlling said perforating mechanism, a plurality of keys, and means controlled by each of said keys operative to initiate the operation of the motor driven means, said motor driven means acting to selectively control the operation of both said indicating mechanism and said perforating mechanism according to the key actuated.

4. In combination, an indicating mechanism, a perforating mechanism, motor driven means operating said indicating mechanism and controlling said perforating mechanism, a plurality of keys, and permutation mechanism controlled by said keys operative to initiate and control the operation of the motor driven means, said motor driven means acting to selectively control the operation of said indicating mechanism and said perforating mechanism according to the key actuated.

5. In a keyboard perforator, perforating mechanism, indicating mechanism, a single electro-magnetic device for operating said perforating mechanism, a constantly rotating shaft, connecting mechanism between said shaft and said indicating mechanism comprising a series of clutch mechanisms, and a plurality of keys for controlling through said clutch mechanisms said perforating mechanism and said indicating mechanism.

6. In a keyboard device, a perforating mechanism, a single magnet to operate the perforating mechanism, a contact to control the magnet, means to operate said contact, a constantly rotating motor for driving said means, and key controlled means to control the functioning of said means.

7. In a keyboard device, perforating mechanism, a magnet to operate said perforating mechanism, a contact controlling the energization of said magnet, a plurality of keys, means operated by each of said character keys to control the closure of said contact, and cam means operative independently of the length of time said keys are actuated to control the duration of the closure of said contact.

8. In a keyboard device, a perforating mechanism, means to operate said perforating mechanism, a plurality of keys, means controlled by each of said keys to initiate the operation of said operating means, and cam means operative independently of the length of time said keys are actuated to control said operating means after its initiation into operation.

9. In a keyboard device, a perforating mechanism, indicating mechanism, a plurality of keys,

means controlled by each of said keys to initiate the operation of one of said mechanisms, and means carried by said operated mechanism acting subsequently to initiate the operation of the other of said mechanisms.

10. The method of preparing a perforated tape for the control of type-casting machines and the like which comprises the steps of making perforations in a tape to represent characters and word spaces in accordance with a predetermined code, said code including a plurality of combinations of perforations for each different width of word spaces, and justifying the perforated matter by altering the code combinations of perforations representing the word spaces to one of said plurality of code combinations allotted to each different width of word spaces.

11. The method of preparing a perforated tape for the control of type-casting machines and the like which comprises the steps of making perforations in a tape to represent characters and word spaces in accordance with a predetermined code, said code including a plurality of different combinations of perforations for each different width of word spaces, indicating the amount of justification necessary as the perforations are made, and justifying the perforated matter by altering the code combinations of perforations representing the word spaces to one of said plurality of different code combinations allotted to each different width of word spaces.

12. The method of preparing a perforated tape for the control of type-casting machines and the like which comprises the steps of making perforations in a tape to represent characters and word spaces in accordance with a predetermined code, said code including a plurality of combinations of perforations for each different width of word spaces, indicating the range of minimum and maximum justification in a given length of line continuously as the perforations are made, and justifying the perforated matter when necessary by altering the code combinations of perforations representing the word spaces to one of said plurality of code combinations allotted to each different width of word spaces.

13. In a keyboard perforator, a perforating device, a counting device including a constantly rotating shaft and a plurality of unit wheels mounted on said shaft, a first permutation device directly controlling said perforating device, a second permutation device adapted to control through the instrumentality of said unit wheels said counting device, and key operated means to simultaneously control both of said permutation devices.

14. In a keyboard perforator, a perforating device, a counting device, selector mechanisms indivdual to each of said devices, a series of keylevers, a corresponding series of code bars disposed parallel to said keylevers and adapted to operate the selector mechanism individual to the counting device, 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 is operated in either of two different manners each time a keylever is depressed.

15. In combination with a keyboard perforator suitable for the production of perforated tape representing successive lines made up of characters of different widths, a perforating device, means for indicating the amount of space left in a line, a plurality of keys, a constantly rotating shaft, a plurality of clutch mechanisms, said clutch mechanisms adapted for variably connecting said shaft to said means to variably operate said means according to the key depressed, and means whereby said perforating device is simultaneously operated variably according to the key operated.

16. The method of preparing a perforated tape for the control of type-casting machines and the like which comprises the steps of making perforations in a tape to represent characters and non-expansible word spacers in accordance with a predetermined telegraphic code, said telegraphic code including two different combinations of perforations for each width of said word spacers, and justifying the perforated matter by altering the code combination of perforations representing the non-expansible word spacers to different code combinations allotted to the widths of said word spacers.

17. In an apparatus for preparing a record to be used to control line composing machines, a plurality of character keys, a shift key, indicating mechanism, means to operate said indicating mechanism according to the character key actuated, permutation mechanism variably operated by said character keys simultaneously with the operation of said means, and means controlled by said shift key to render said indicating mechanism operable differently while the permutation mechanism is operated invariably in the same way upon the actuation of the same character key subsequent to the actuation of said shift key.

18. In an apparatus for preparing a record to be used to control line composing machines, a selector mechanism, a clutch mechanism, a perforating mechanism and a counting mechanism operated through the instrumentality of the selector mechanism, said counting mechanism including a unidirectional counting organ, the incremental progressive movement of which is controlled by said clutch mechanism.

19. In an apparatus for preparing a record to be used to control line composing machines, a perforating mechanism, a counting mechanism, a group of transversely superpositioned keylevers and combination bars for controlling said perforating mechanism, the combination of another group of levers and bars for actuating the counting mechanism, and means for effecting a relative shifting movement between the last mentioned levers and bars whereby the counting mechanism may be operated variably while the perforating mechanism is operated invariably in the same manner.

20. In an apparatus for preparing a record to be used to control line composing machines, a perforating mechanism, a counting mechanism, a group of transversely superpositioned keylevers and combination bars for controlling said perforating mechanism, the combination of another group of transversely superpositioned levers and bars for actuating the counting mechanism, and means for effecting a longitudinal shifting movement of the last mentioned levers whereby the counting mechanism may be operated variably while the perforating mechanism is operated invariably in the same manner.

21. In an apparatus for preparing a record to be used to control line composing machines, a perforating mechanism, a counting mechanism, a group of transversely superpositioned keylevers and combination bars for controlling said perforating mechanism, the combination of another group of elements provided with coded projec-

tions and bars for actuating the counting mechanism, and means for effecting a relative shifting movement between the coded elements and the bars whereby the counting mechanism may be operated variably while the perforating mechanism is operated invariably in the same manner.

22. In an apparatus for preparing a record to be used to control line composing machines, a series of primary bars, a corresponding series of secondary bars, a plurality of mechanisms, selector mechanisms individual to each of said mechanisms, one of said selector mechanisms actuated directly by said primary bars and another of said selector mechanisms actuated indirectly by said primary bars through the instrumentality of said secondary bars, and means for effecting the relative movement between said secondary bars and their selector mechanism to vary the intercontrol thereof.

23. In an apparatus for preparing a record to be used to control line composing machines, a series of primary bars, a series of secondary bars, a plurality of mechanisms, selector mechanisms individual to each of said mechanisms, one of said selector mechanisms actuated directly by said primary bars and another of said selector mechanisms actuated indirectly by said primary bars through the instrumentality of said secondary bars, and means whereby said secondary bars may be collectively shiftable longitudinally to vary their effect upon the appurtenant selector mechanism.

24. In an apparatus for preparing a record to be used to control line composing machines, a series of keys, a first group of transversely superpositioned levers and combination bars, a perforating mechanism operated thereby, a second group of transversely superpositioned levers and bars, a counting mechanism operated thereby, means to operate both groups in accordance with the key depressed, and means to shift said last recited levers collectively to vary the effect thereof on their appurtenant bars.

25. In an apparatus for preparing a record to be used to control line composing machines, a perforating device, a counting device including a constantly rotating shaft and an incrementally operable mechanism having a unidirectional movement operatively associated with said shaft, a first permutation device directly controlling said perforating device, a second permutation device adapted to control through the instrumentality of said mechanism said counting device, and key operated means to control simultaneously both of said permutation devices.

26. In an apparatus for preparing a record to be used to control line composing machines, a series of keys, a perforating device, a counting device, selector mechanisms individual to said devices one superposed over the other and operatively connected therewith, said superposed selector mechanism adapted to be conditioned for operation in either of two different manners while the other selector mechanism is operable invariably in the same manner each time a key is operated.

27. In an apparatus for preparing a record to be used to control line composing machines, a plurality of character keys, a shift key, indicating mechanism, means to operate said indicating mechanism according to the character key actuated, permutation mechanism variably operated by said character keys simultaneously with the operation of said means, means controlled by said shift key to render said indicating mechanism operable differently while the permutation mechanism is operated invariably in the same way upon the actuation of the same character key subsequent to the actuation of said shift key, and a perforating mechanism controlled by said permutation mechanism.

28. In a machine for perforating a tape to be used to control composing machines of the casting type, means for making perforations in the tape to represent successive lines made up of characters of different widths, means for indicating the amount of space left in a line, a constantly rotating shaft, a plurality of keys controlling said perforating mechanism, and clutch mechanism comprising a power driven clutch individual to each width of character to be cast controlled by said keys to connect said constantly rotating shaft to said indicating means and acting to operate said indicating means variably according to the key depressed.

29. In a keyboard device for perforating tape for controlling linecasting and composing machines of individual matrix type, means for producing perforations representative of consecutive characters and word spacers, means for indicating the free space left in a line, a series of keylevers, two independently responsive sets of selector bars, one set for controlling said perforating means and the other set for controlling said indicating means, said sets being arranged transversely of the keylevers, means whereby said selector bars are moved simultaneously and independently of other bars of their set for indicating through said indicating means the cumulative thickness of the characters and perforating a tape in accordance therewith, and means included in said indicating means for indicating the cumulative expansibility of the word spacers, said indicating means also provided with means cooperative with said last mentioned means to determine the justifiability of a line of matrices.

30. In a keyboard device for perforating a tape for controlling linecasting and composing machines of individual matrix type, means for producing perforations representative of consecutive characters and word spacers, means for indicating the free space left in a line, a series of keylevers, two independently responsive sets of selector bars, one set for controlling said perforating means and the other set for controlling said indicating means, said sets being arranged transversely of the keylevers, means whereby said selector bars are moved simultaneously and independently of other bars of their set for indicating through said indicating means the cumulative thickness of the characters and perforating a tape in accordance therewith, and a spacer key which is adapted to produce a perforation in the tape and simultaneously to effect a change in the indicating means to correspond to the increment of expansibility provided by a word spacer.

31. In an apparatus for preparing a record to be used to control line composing machines, a series of keys, a first group of transversely superpositioned levers and combination bars, a perforating mechanism controlled thereby, a second group of transversely superpositioned levers and bars, a counting mechanism controlled thereby, means to operate both groups of levers and bars in accordance with the key depressed, the bars of the second group being operated indirectly by the levers of the first group through the instrumentality of the levers of the second group, and solely mechanical means actuated upon the operation of said second group of bars for effecting

the operation of the counting mechanism in accordance with their actuation.

32. In an apparatus for preparing a record to be used to control line composing machines, a series of keys, a first group of transversely superpositioned levers and combination bars, a perforating mechanism operated thereby, a second group of transversely superpositioned elements provided with coded projections and bars, a counting mechanism operated thereby, means to operate both groups in accordance with the key depressed, and means to shift said last cited elements collectively to vary the effect thereof on their appurtenant bars.

33. In an apparatus for preparing a record to be used to control line composing machines, a series of keys, a first group of transversely superpositioned levers and combination bars, a perforating mechanism controlled thereby, a second group of transversely superpositioned elements provided with coded projections and bars, a counting mechanism controlled thereby, means to operate both groups in accordance with the key depressed, the bars of the second group being operated indirectly by the levers of the first group through the instrumentality of the elements of the second group, and solely mechanical means actuated upon the operation of said second group of bars for effecting the operation of the counting mechanism in accordance with their actuation.

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