

March 15, 1938.

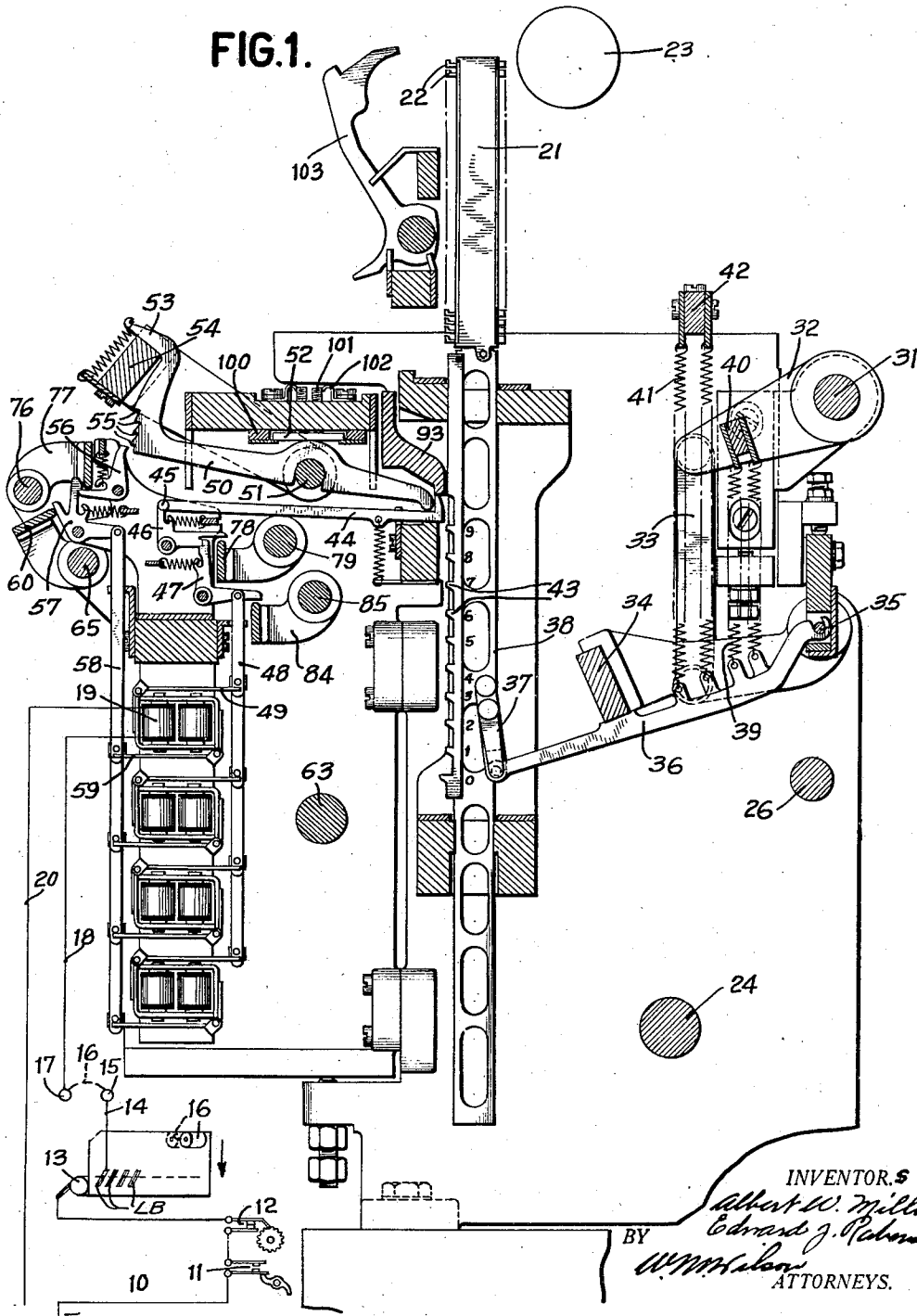
A. W. MILLS ET AL

2,111,122

PRINTING MECHANISM

Filed Dec. 22, 1936

5 Sheets-Sheet 1



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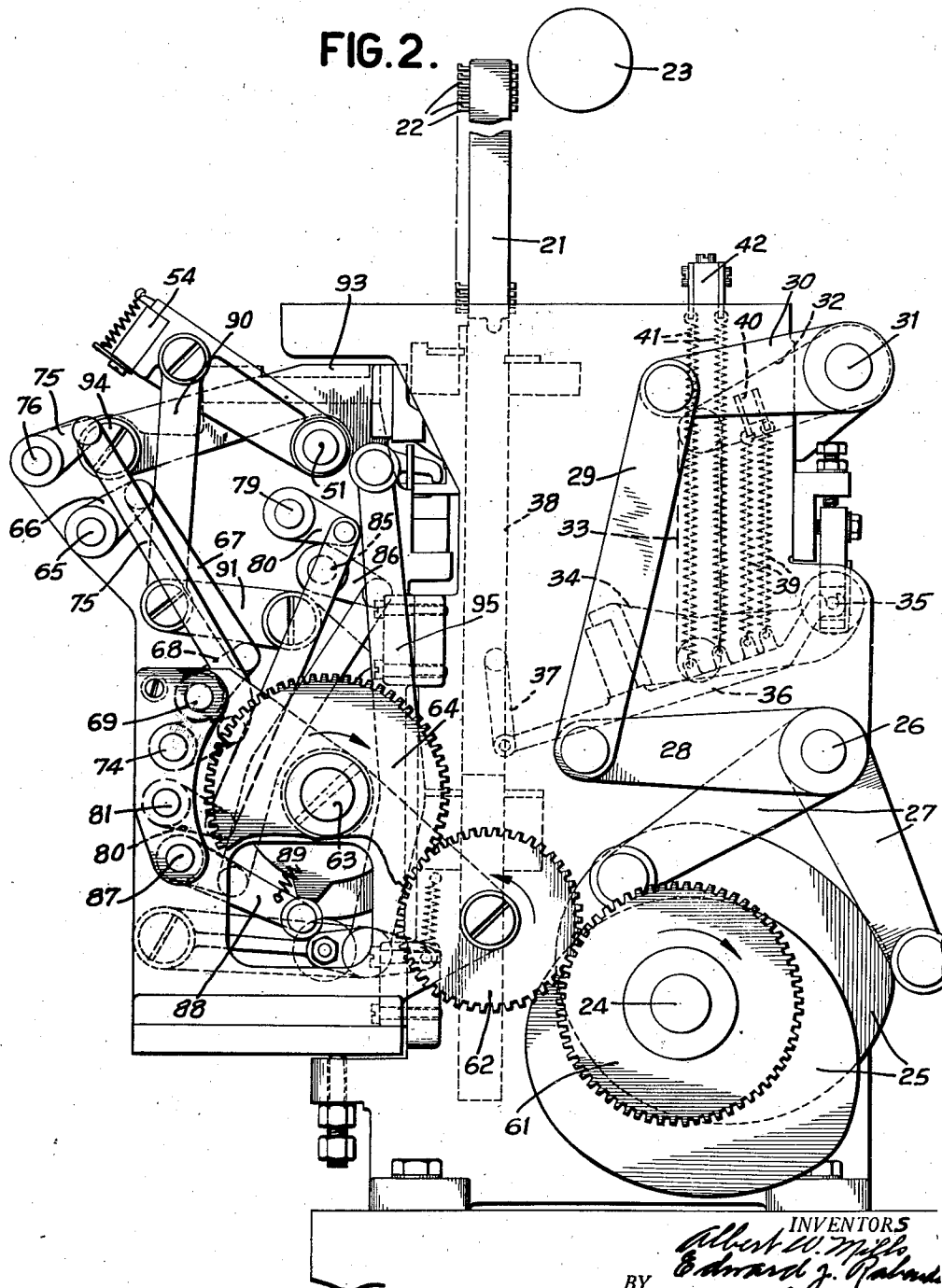
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FIG. 2.



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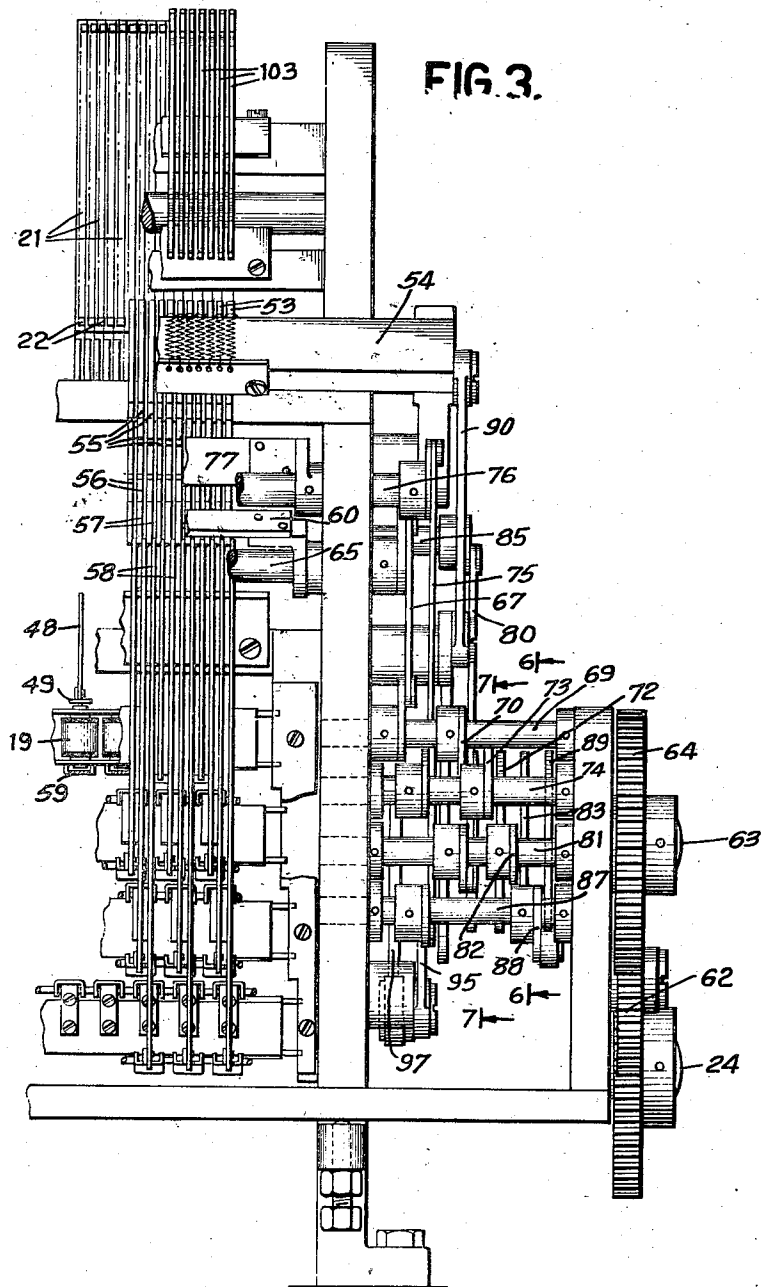
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PRINTING MECHANISM

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5 Sheets-Sheet 3



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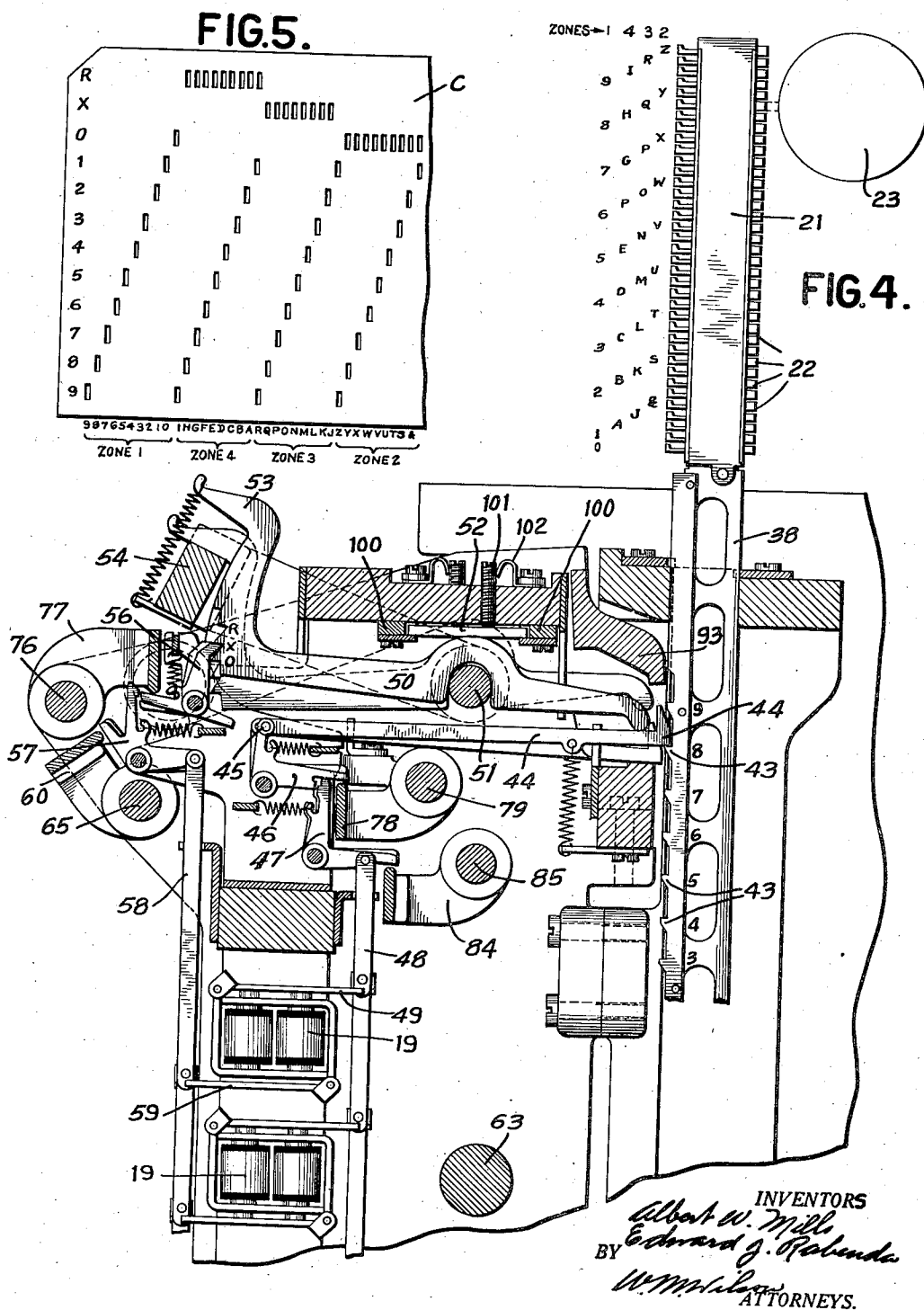
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FIG. 6.

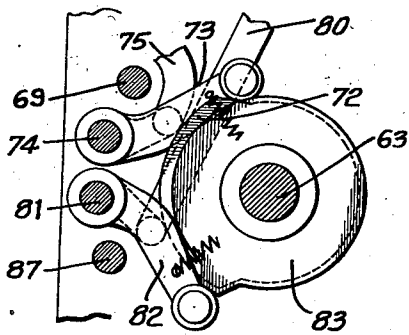


FIG. 7.

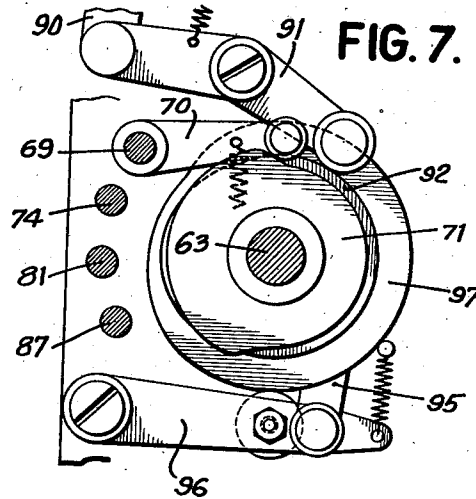
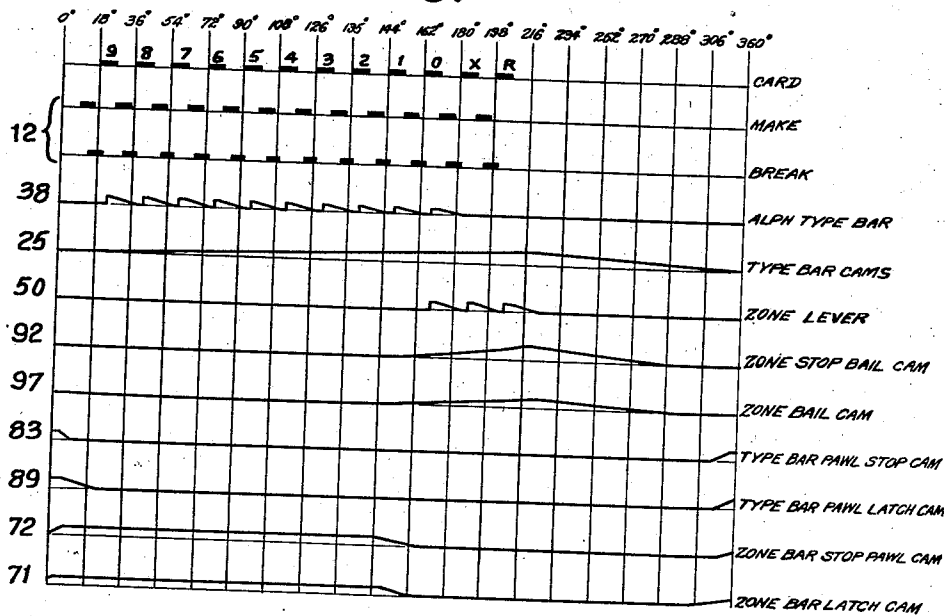


FIG. 8.



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PRINTING MECHANISM

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7 Claims. (Cl. 101-93)

This invention relates to accounting machines and more particularly to the printing mechanisms thereof. The printing mechanisms of tabulating machines as presently developed are usually provided with type carriers which have arranged thereon a plurality of type elements, one for each of the digits and one for each of the letters of the alphabet, and such other symbols as it may be desirable to print upon a record.

In machines in which type carriers of the reciprocating type are employed, the provision of alphabet type elements increases the mass which must be reciprocated for each operation of the machine and also necessitates a longer stroke of the type carrier in order to cause each type element to pass the printing position with the result that the speed of operation and the general efficiency of an alphabetic printing machine are considerably less than a machine designed to print only the digits.

It is the main object of the present invention, therefore, to provide an improved construction and arrangement of alphabetic printing mechanisms of a tabulating machine whereby the efficiency of the machine may be improved and the rate of operation considerably increased over that of previously constructed machines of this character.

A further object of the invention resides in the provision of an improved type bar positioning mechanism wherein a single selecting magnet is utilized and which will select the digit type in response to a single energization of the magnet and will select an alphabetic type upon repeated energization.

According to the present system, alphabetic characters are represented on the well known Hollerith tabulating card by two perforations located in different index point positions of a single column of the record card. One of these perforations is known as the digit perforation and the other as the zone perforation. The record cards are passed through the usual card feeding and sensing devices so that the index point positions pass a set of sensing brushes in succession in such manner that the digit perforations are first sensed and the corresponding digit type are selected. Subsequently, the zone perforations pass the same sensing brushes and the presence of a zone perforation will cause the selection of the appropriate alphabetic type to supersede the initial selection of the digit type.

A further object of the invention is to provide improved mechanism for reciprocating the type bars. Usually, machines are constructed

with a spring arrangement to resiliently elevate the type bar in which one end of the spring is operatively connected to the type bar and the other end is connected to a member which has an invariable movement so that upon interruption of the advance of the type bar, the spring will yield. With such arrangement it has been found that at relatively high speeds there is a so-called "whip" brought about by the high frequency at which the spring is compressed and expanded. In the present arrangement, a second spring is provided of which one end is operatively connected to the type bar and the other end is anchored to a fixed support and the two springs, operating jointly, maintain a more exact control over the reciprocation of the type bar.

A further object of the invention resides in the provision of a type bar selecting magnet in which two separate armatures are provided, one at each pole of the magnet, of which one armature is operated to effect digit type selection and the second armature is operated to effect alphabetic type selection.

A still further object of the invention is to provide an improved type bar positioning arrangement whereby manual adjustment of the ultimate printing position may be made separately for each type carrier so that slight variations in the proportioning of the parts when manufactured may be compensated for when the parts are assembled into the complete machine.

Various other objects and advantages of the invention will be obvious from the following particular description of one form of mechanism embodying the invention or from an inspection of the accompanying drawings; and the invention also constitutes certain new and useful features of construction and combination of parts hereinafter set forth and claimed.

In the drawings:

Fig. 1 is a central section of the printing mechanism showing the improved construction.

Fig. 2 is an outside view of the mechanism showing the operating instrumentalities.

Fig. 3 is an end view of part of the printing mechanism, the view looking from the left in Figs. 1 and 2.

Fig. 4 is an enlarged position view of the type bar positioning mechanism.

Fig. 5 is a fragment of a record card showing the combinational arrangement of perforations to represent the alphabetical characters and also the usual digit perforations.

Fig. 6 is a section taken on lines 6-6 of Fig. 3.

Fig. 7 is a section taken on lines 7—7 of Fig. 3; and

Fig. 8 is a timing chart showing the timing of the various operating cams.

The arrangement of the perforations in the record card will first be explained. Referring to Fig. 5, the record card C has the usual perforations for indicating numerical values as shown in the left end of the card. The alphabetical characters from A to I are combinations of one of the numerical characters from 9 to 1, plus a perforation in the R index point position. The characters J to R each comprises a perforation in one of the numerical positions 9 to 1, plus a perforation in the X index point position. The remaining letters of the alphabet, namely, S to Z, each comprises a combination including one of the perforations 9 to 2, plus a perforation in the zero index point position. The record cards are placed in the card feeding mechanism of the machine, which is not shown but which may be of the type fully shown and described in Patent No. 1,827,259, granted to J. R. Peirce, October 13, 1931.

In Fig. 1 there is shown, in a diagrammatic manner, the analyzing brushes LB past which the cards are traversed in succession under the control of feed rollers 16. The circuit for any card column may be traced from the negative side of line 16, through the usual card lever contacts 11, circuit breaker 12, common contact roller 13, perforations in the record card C, sensing brush LB, wire 14, to plug socket 15, thence through a suitable plug connection 16 to socket 17 and from there through a wire 18 to the selecting magnet 19 to positive side of line 20.

The cards traverse the brushes LB with the 9 index point positions leading so that for any column in which an alphabetic character is entered, the digit perforation will first complete the circuit to energize magnet 19 and thereafter when the zone hole arrives at the brush, the circuit will again be completed to energize the magnet a second time.

In Fig. 4 is shown the type head 21 which is provided with a plurality of type elements 22 upon which the digits and alphabetic characters are arranged as indicated. For the purposes of explanation, the various characters are arranged and labelled in accordance with a particular zone. Thus, the digits are included in zone 1; the letters Z to S, in zone 2; J to R, in zone 3; and A to I, in zone 4. Reference to Fig. 5 will show that the letters I, R, and Z, each contains a perforation in the 9 index point position, but has a different zone perforation R, X, and O. Similarly, the letters H, Q, and Y, each contains the perforation 8 and a different zone perforation.

The type head 21 is arranged to be moved to pass the printing position opposite platen 23 in synchronism with the movement of the card by the brushes LB and as the 9 index point positions traverse the brushes, the Z type element 22 will be approaching the printing position; as the 8 index point positions traverse the brushes, the Y type element 22 will be approaching printing position, and so on.

Referring now to Fig. 2, the main operating shaft 24 of the printing mechanism, from which the card feeding mechanism may also be driven, carries a pair of complementary cams 25 which are arranged to oscillate a shaft 26 through follower arms 27. Secured to shaft 26 is an arm 28 which has link connection 29 to an arm 30 se-

cured upon a shaft 31. Shaft 31 (see also Fig. 1) carries arms 32 which have depending link connection 33 with a bail 34 which is pivoted at 35. Also pivoted at 35 are type carrier actuating arms 36 which are connected at their free ends through links 37 to the type bars 38 upon which the type heads 21 are fixed. Each arm 36 is urged in a clockwise direction by a spring 39 connected at its upper end to a cross bar 40 extending between the arms 32. In addition, there is connected to each arm 36 a second spring 41 whose upper end is connected to a fixed bar 42. Thus, as the arms 32 and bail 34 are rocked in a clockwise direction through the action of cams 25, the springs 39 will rock the arm 36 in the same direction assisted by the spring 41. During this movement, the spring 41 will contract and the tension accordingly lessened, whereas spring 39 will maintain its initial tension. The arm 36 will accordingly cause elevation of the type carrier 38 which is suitably mounted for vertical reciprocation.

Each carrier 38 is provided with a series of teeth 43 which, as seen in Fig. 1, are labelled 9 to 0 and which represent corresponding index point positions on the record card C. As the type bar 38 is moved upwardly, the teeth 43 move to pass a stopping element 44. The element 44 is pivoted at 45 to a bell crank 46 which is normally held in the position shown by a bell crank latch 47 which has connection through a link 48 to the pivoted armature 49 of magnet 19.

Upon the energization of magnet 19 in response to the sensing of a digit perforation, armature 49 will be rocked clockwise, drawing downwardly on link 48 to cause clockwise rocking of latch 47 to release bell crank 46 whose spring will thereupon shift stopping element 44 toward the left from the position shown in Fig. 1 to that of Fig. 4 into the path of the tooth 43 corresponding to the perforation whose sensing caused energization of the magnet. Further upward movement of the type bar is thus interrupted at this time. The stopping element 44 is held against upward movement by a bail 53 which later, as the zone holes are sensed, rocks counterclockwise to permit resumption of the upward movement of the type bar. During such movement the element 44 may be stopped by a lever 50 which loosely straddles the rod 51 and has its upper curved edge against a bar 52. The left end of the lever has an extension 53 resting upon the bail 54 which occupies the position shown in Fig. 1, during the analysis of the digit representing positions of the card. The member 50 is provided with teeth 55 which, under control of the bail 54, move downwardly to pass the toe of a stopping pawl 56 during the time that the zone perforations O, X, and R pass the brush LB. The pawl 56 is normally held in the position shown with its toe out of the path of the teeth 55 by a bell crank latch 57 which has link connection 58 with the lower armature 59 of magnet 19.

Extending across the latches 57 is a bail 60 which occupies the position shown in Fig. 1 during the sensing of the digit positions, preventing tripping of these latches during this portion of the sensing operation. While the zone perforations are passing the brushes, however, the bail 60 is rocked slightly counterclockwise so that energization of magnet 19, due to the sensing of a zone perforation, will rock its armature 59 clockwise to elevate link 58 and rock bell crank 57 counterclockwise to release pawl 56 which will engage the first tooth 55 if the zone hole is zero; 75

the second tooth, if it is in the X hole; the third tooth, if it is an R hole. If no zone hole is present, the lever 50 will rock an additional step to cause the last extended tooth 55 to engage the pawl 56.

Referring now to Fig. 2, the shaft 24 carries a gear 61 which through an idler 62 drives the shaft 63 through a gear 64. The shaft 63 carries the various cams for operating the stopping mechanism. The bail 60 is carried by a shaft 65 which in Fig. 2 has an arm 66 connected by a link 67 to an arm 68 on a shaft 69. As shown in Fig. 7, this shaft carries a follower arm 70 in cooperation with cam 71 on shaft 63. In Fig. 6 is shown a cam 72 cooperating with a follower arm 73 on shaft 74 which shaft has arm and link connection 75 (see also Fig. 2) with a shaft 76 which carries a bail 77 which serves to re-latch the pawls 56. Bell cranks 46 are re-latched by bail 78 carried by shaft 79, which, in Fig. 2, has arm and link connection 80 with a shaft 81. In Fig. 6, this shaft is shown as having a follower arm 82 controlled by a cam 83 on shaft 63. The bail 84, which restores bell cranks 27 and the connected armatures 49, is carried by a shaft 85 which has arm and link connection 86 (Fig. 2) with a shaft 87 whose follower arm 88 is operated by a cam 89 on shaft 63. The bail 54 has connected thereto a link 90 (Fig. 2) which, in Fig. 7, is connected to a lever 91 which is operated by a cam 92 on shaft 63. A further bail 93 (Figs. 1 and 2) which is pivoted at 94 is connected by a link 95 (see Fig. 7) to a follower arm 96 operated by a cam 97 on shaft 63. The timing of the various bails and their operating cams is indicated in Fig. 8.

A particular example will now be traced to explain the complete operation for a single column and the sequence in which the several contributing operations take place. The operation will be explained in connection with the sensing of a column in which perforations are made in the 8 and X positions representing the letter Q.

At the commencement of the cycle of operations during which the card is analyzed, the parts will be in the position as shown in Fig. 1, in which the pawl 56 and latch 57 are held against operation by their bails 77 and 60, respectively, and bail 93 is positioned against the stopping member 44. As the type bar rises, the teeth 43 pass the end of the lever 44 as the corresponding index point positions pass the brush LB. When the 8 hole is at the brushes, the 8 tooth 43 will be at the element 44 and at this instant a circuit will be completed, as traced above, to energize the magnet 19 which will release element 44 for movement toward the right into engagement with the 8 tooth 43. The type bar, through tooth 43, will press upwardly against the free end of element 44 and the load will be taken by bail 93. Operating bail 34 will continue its movement and the type bar will be held in this position by the increasing tension of spring 40 and by the spring 41.

After the remaining digit positions 7 through 1 have passed the brush, bails 60 and 77 will both be rocked counterclockwise to release their latch and pawl respectively for operation. At the same time, the bails 93 and 54 will commence to rock counterclockwise and the type bar pressing upwardly against bail 93, through the free end of element 44, will move upwardly under control of the bail 93. During this movement, the teeth 55 will pass the toe of pawl 56 as the zone positions pass the brush. Upon sensing the second perforation in the X position, the circuit through magnet

19 is again completed and this time both armatures 49 and 59 will be attracted; however, since armature 49 has already been operated, this second operation is idle since the bell crank 46 is already unlatched. The armature 59 will cause unlatching of pawl 56 to engage the X tooth 55 to interrupt the tooth as shown in Fig. 4. This will result in interruption of the movement of the type bar as the bail 93 continues its counterclockwise movement. As the bail continues to move, the tooth 43 will bear against the free end of element 44, urging it against the right end of lever 50 of which the X tooth 55 will now serve as a pivot and the upper curved edge will be stopped by the bar 52. The parts will ultimately be in the position shown in Fig. 4 with the Q type element 22 in printing position.

The bar 52 is freely supported in guides 100 and has a width substantially that of the cooperating element. Each bar has a cooperating adjusting screw 101 with a locking member 102. By effecting the adjustment of screw 101 the ultimate printing position of the type bar may be varied slightly to compensate for wear of the parts.

Where a column contains only a digit perforation, the operation is such that on the first energization of magnet 19, the type bar will be interrupted by element 44 and held by the bail 93. The parts are so constructed that the upward pressure of the type bar is not transmitted at this time to the lever 56; all of the strain being taken up by the relatively heavy bail 93. As the zoning positions pass the brushes, the bail 93 will permit further advance of the type bar until the last tooth 55 of lever 50 engages the pawl 56. At this time, the upward pressure of the type bar is transmitted to the lever 50 which serves to effect the final positioning of the selected type element.

After all the type bars have been positioned, the usual printing hammers 103 of Fig. 1 are tripped to take an impression from all the bars concurrently. Thereafter, the bails 93 and 54 are restored as well as the various other operated parts. During the downward or restoring movement of bail 34, arm 36, which may occupy one of a number of different positions due to the selective setting of the type bar, will be engaged by the bail and moved counterclockwise therein. At the time of engagement, the spring 40 will have been contracted to its initial length and the second spring 41 will, upon movement of arm 36, extend and increase its tension thereon. In former machines, only spring 40 was provided. In the present arrangement, the provision of the second spring 41 serves to resist any tendency of the arm 36 to overthrow at the end of the downward stroke as a result of the momentum developed when operated at speeds in excess of 200 cards per minute. With the spring arrangement shown, there is a balanced spring tension for both directions of operation; that is, as the type bar rises, there is a decrease in tension on spring 41 and a uniform tension on spring 40 until the type bar has been interrupted whereupon the tension on spring 40 increases. On the return stroke, there is a decrease in tension on spring 40, which decreases to normal tension at the time the type bar is picked up, at which time the tension on spring 41 increases, attaining its maximum tension at the end of the downward stroke.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions

and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is as follows:

1. A printing mechanism having a plurality of groups of type, group selecting mechanism and individual type selecting mechanism, an electromagnet having an armature at each pole thereof, means for repeatedly energizing said electromagnet to energize the same at different times, means controlled by one armature upon one energization to select a group of type and means controlled by the other armature upon another energization to select an individual type within said group, said selections being in accordance with the time of energization of said electromagnet.
2. A printing mechanism having a type bar with a plurality of groups of type, a movable stopping element for the bar, a second stopping element for the said movable stopping element, a controlling magnet having a pair of armatures operated thereby, means controlled by one of said armatures for operating said movable stopping element and means controlled by the second armature for controlling said second stopping element.
3. In a printing mechanism, in combination, a movable type bar, a movable stop for said bar, means for moving said stop into engagement with the bar for movement therewith, a second stop for the first stop, movable with the same, a third stop for limiting the movement of the second stop and means for effecting an adjustment of said third stop to vary the limiting position thereof.
4. In a printing machine, a type bar mounted

for vertical movement, a pair of springs operatively connected to said bar to urge it upwardly into printing position, the end of one of said springs being fixed and the end of the other attached to a movable member, means for interrupting the upward movement of the type bar whereupon the spring with its end fixed will hold the bar in position with decreased tension and the spring with its end movable will increase its tension on the bar.

5. In a machine of the class described, a sensing element for sensing a column of a record card, a type carrier having numerical and alphabetic type thereon, a single magnet, a pair of armatures moved by the magnet in opposite directions, means controlled by said sensing element to repeatedly operate said magnet, means for causing said magnet to operate one armature on the first operation and the second armature on the second operation, means controlled by said first armature to select a numerical type and means controlled by the second armature to supersede said selection and select an alphabetic type.

6. In a machine of the class described, a type bar, means for moving the same, a movable stop for the bar, a pivotable stop for said first stop and adjustable means for varying the pivoting position of said second named stop to adjust the ultimate stopping position of the type bar.

7. In a printing mechanism, a type bar, means for moving the same, means for stopping the bar including a lever mounted for rotation, means for differentially rotating the lever to select a stopping position for the type bar and adjustable means for varying the point of rotation of the lever.

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