

Aug. 14, 1945.

H. S. BEATTIE

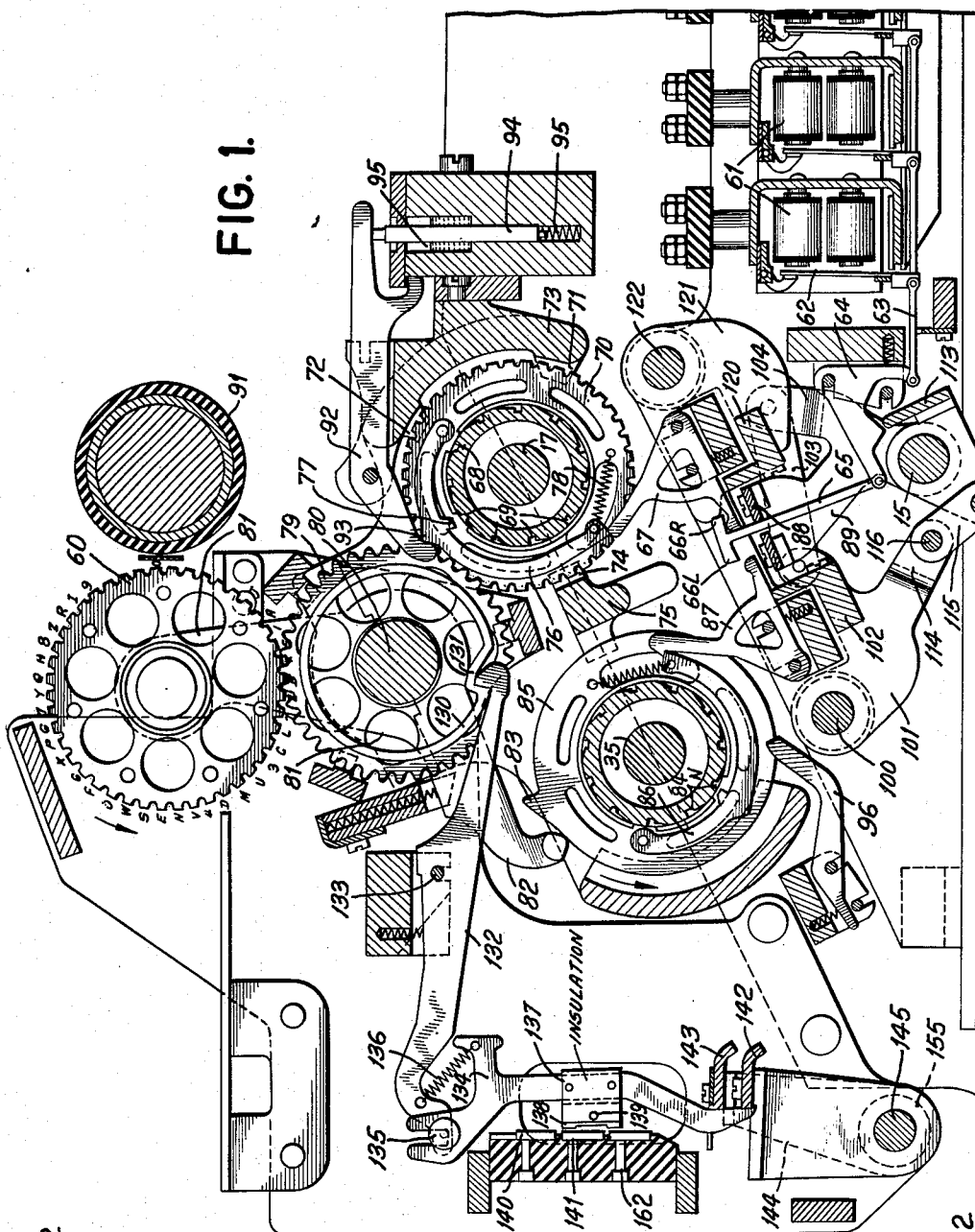
2,381,862

PRINTING MECHANISMS

Filed March 10, 1944

5 Sheets-Sheet 1

FIG. 1.



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PRINTING MECHANISMS

2,381,862

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5 Sheets-Sheet 2

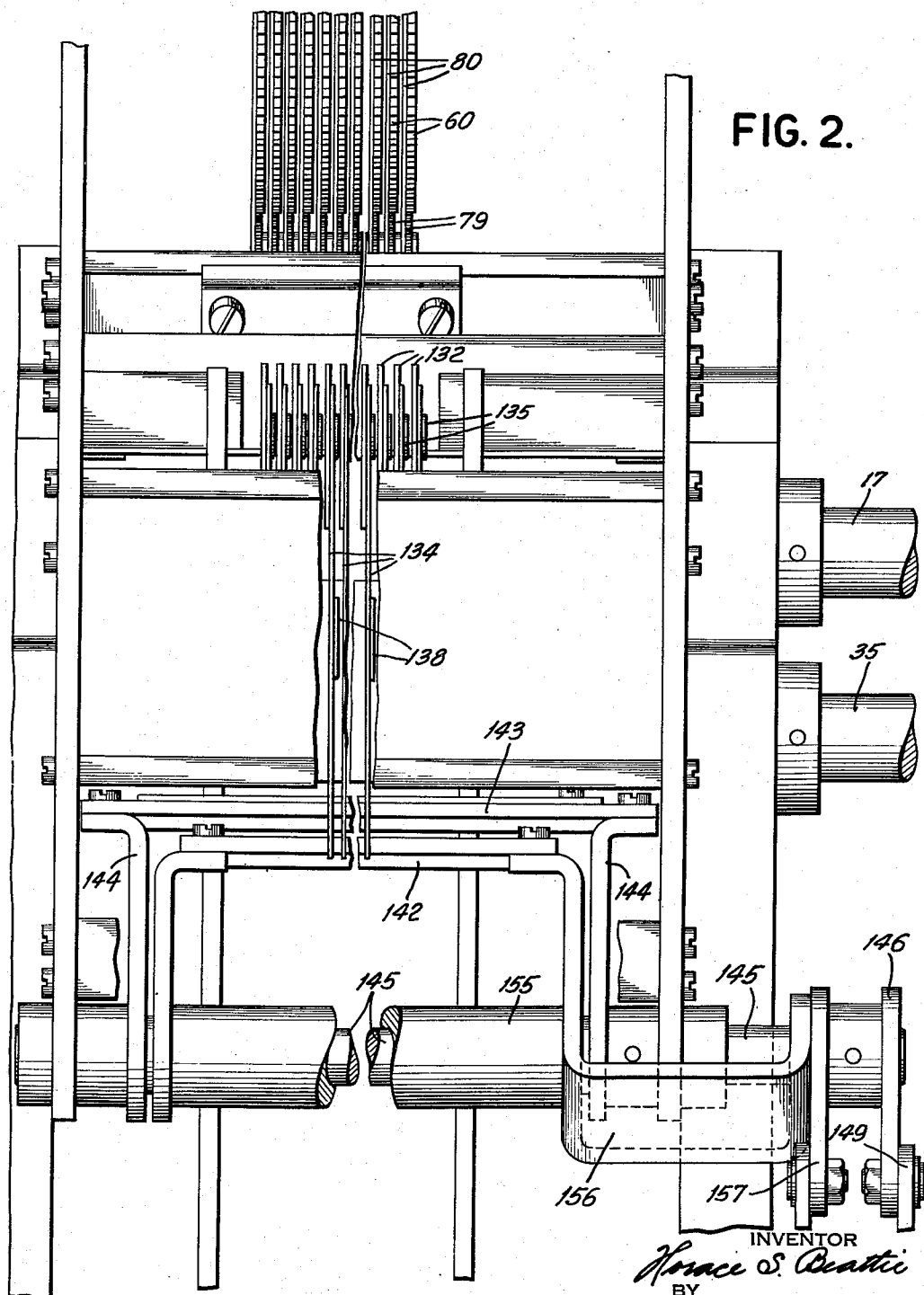


FIG. 2.

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5 Sheets-Sheet 3

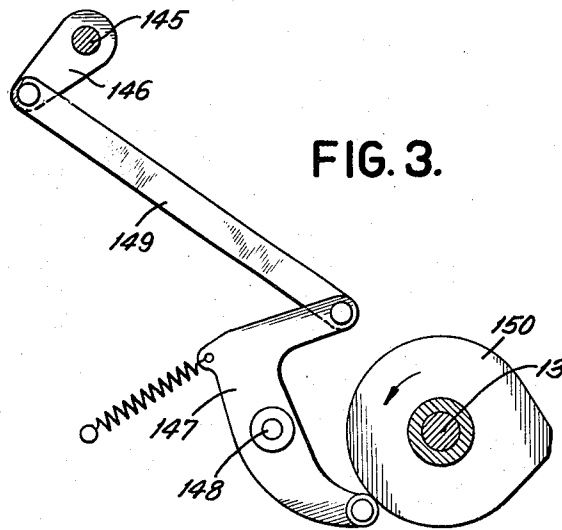


FIG. 3.

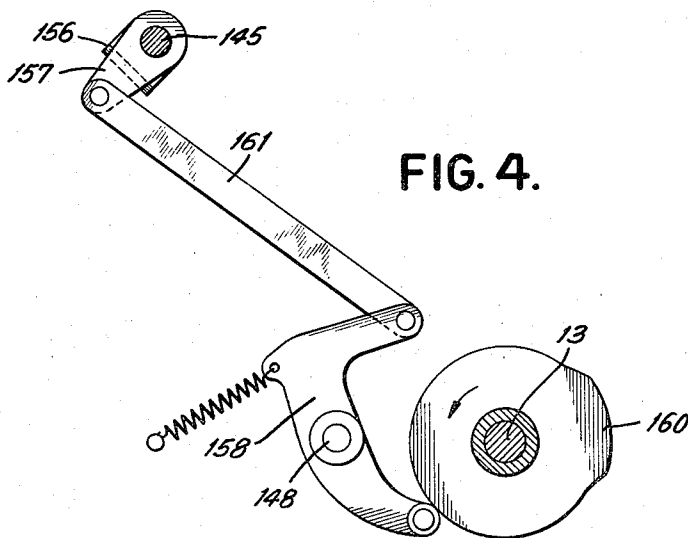


FIG. 4.

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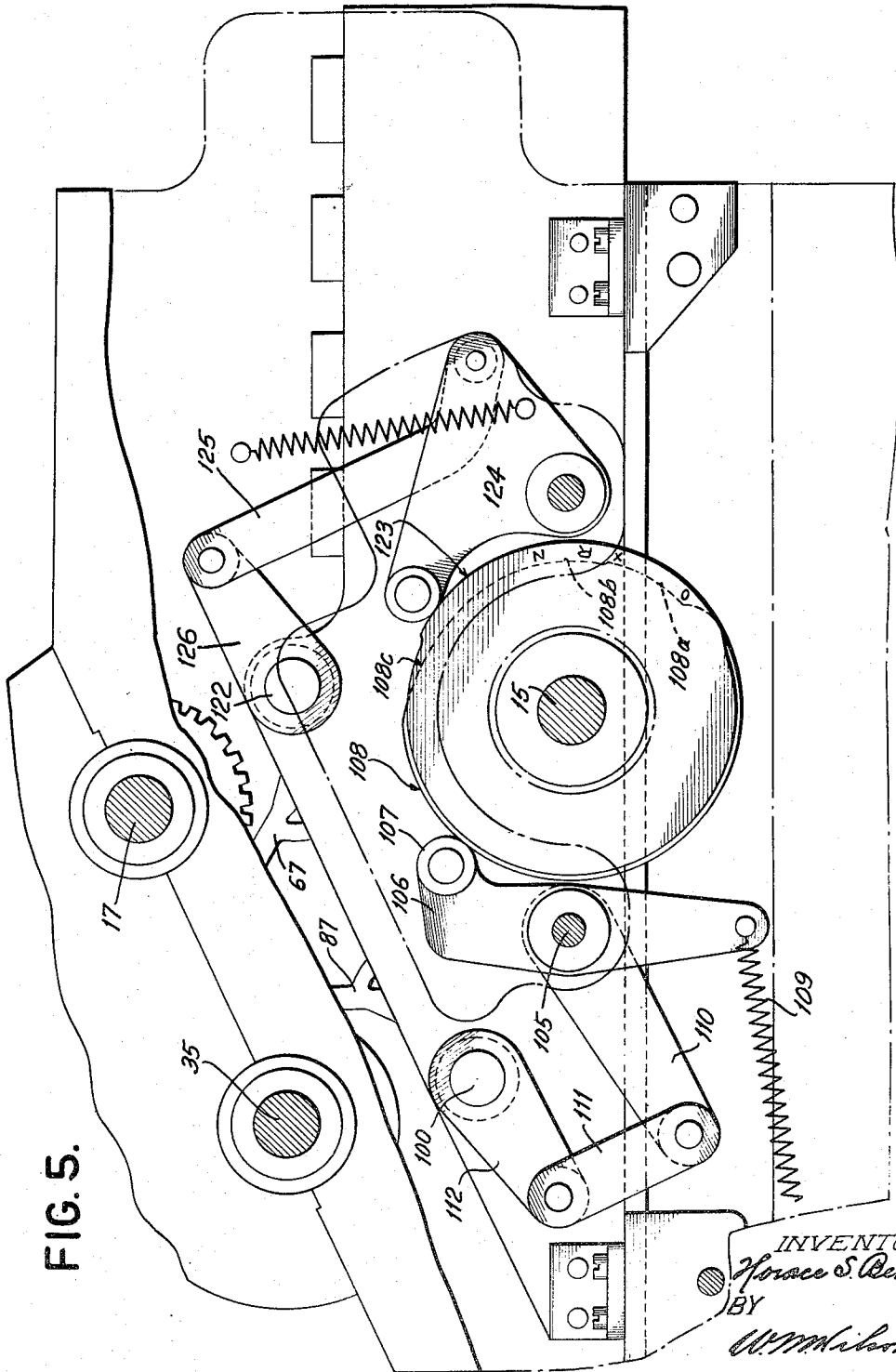
2,381,862

PRINTING MECHANISMS

Filed March 10, 1944

5 Sheets-Sheet 4

FIG. 5.



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PRINTING MECHANISMS

Filed March 10, 1944

5 Sheets-Sheet 5

FIG. 6.

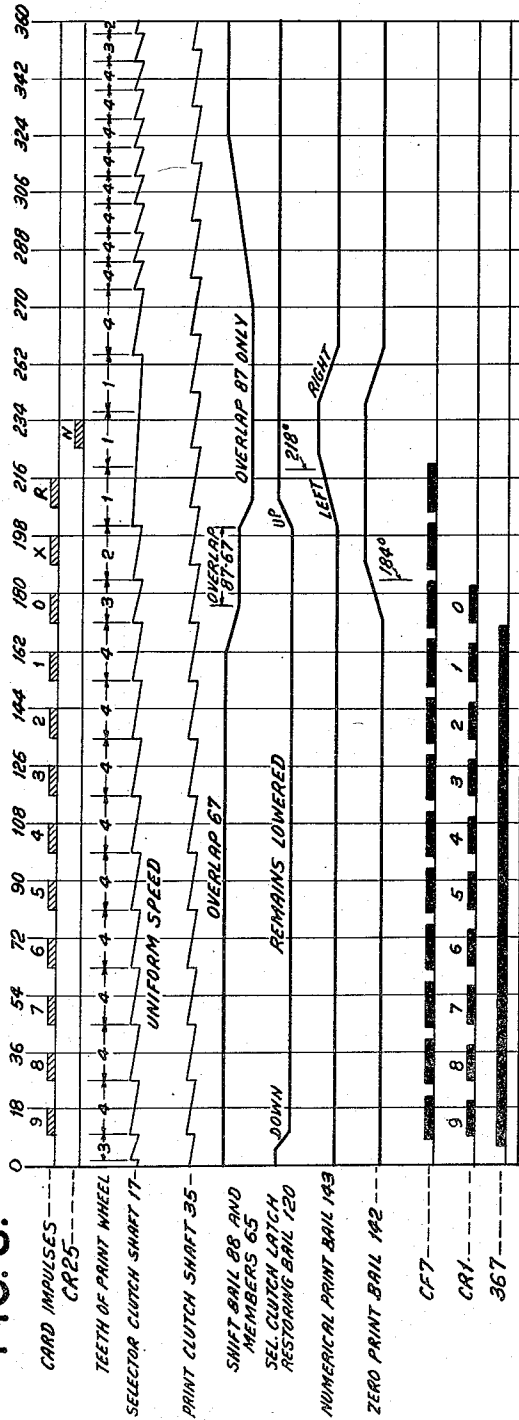
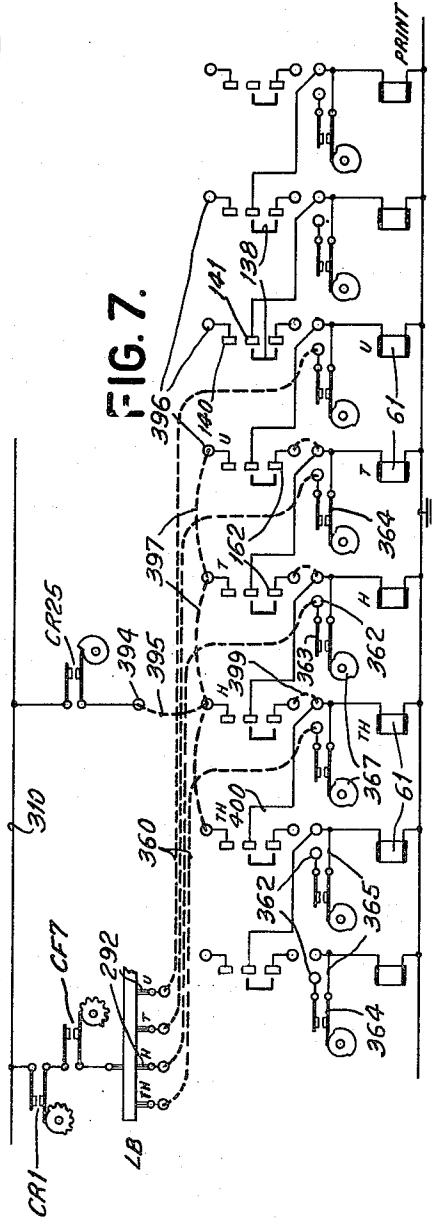


FIG. 7.



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UNITED STATES PATENT OFFICE

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PRINTING MECHANISM

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Application March 10, 1944, Serial No. 525,839

8 Claims. (Cl. 101—93)

This invention relates to printing machines and more particularly to the type in which the items entered in the machine are listed.

The main object of the invention resides in the provision of an improved zero printing mechanism. It is the custom in punching record cards for card controlled machines to place a perforation in each card column to minimize the risk of inadvertently omitting a significant digit and any column in which no significant digit occurs is punched in the zero position. These zero perforations occur to the left of the first significant digit at the left of a number as well as to the right of it but in printing numbers consisting of digits of plural denominations, it is desirable to suppress the printing of all digits to the left of the first significant digit while automatically enabling the printing of all zeros to the right of this significant digit.

With this requirement understood, it will be seen that the main object of the invention relates to automatic mechanism for eliminating zero printing in orders to the left of the significant digit and effecting zero printing for orders to the right of the significant digit where such orders represent zero.

A more specific object of the invention is to provide an improved electrical control mechanism for zero printing which is flexible in its arrangement for enabling printing at different places on the record strip, such flexibility being preferably obtained by plugging connections.

A more specific object of the invention is to provide a zero printing mechanism in the type of printing mechanism in which the printing carrier is bodily impressed against the platen for digit printing. In the preferred embodiment the 0 digit is normally at the printing line. The invention is shown incorporated in the form of printing mechanism in which the printing control magnet causes, upon the card impulse directed thereto, the differential movement of the type carrying member to select a digit type. The second impulse directed to the printing magnet effects the printing impression by causing the printing member to be bodily moved against the platen.

The incorporation of the present improvement enables the printing impulse to be selectively transmitted to the desired lower denominational orders for zero printing, such impulse being under control of contact members of the order representing the significant digit and the next lower order in which zero printing is to be automatically effected. Hence, in the present arrange-

ment the printing impulse is concurrently transmitted to those orders in which zero printing is to be automatically effected, thereby enabling concurrent printing of zero digits and the significant digits 1-9.

A still further object of the invention relates, particularly, to the improvements in the contact making mechanism controlled by the type members. In the present embodiment the position of the type carrying member shifts such contact member to one or two positions, depending upon whether the related order is to have digit printing 1-9 or 0 printing. After such setting, a positively operated mechanism shifts such contact members in whatever position they may be so as to make firm and positive electrical contact with the associated contact members. This improved mechanism provides for efficient positive or electrical contact, eliminating faulty operations which may have occurred by provision of past electrical contact control mechanisms. In connection with the automatic zero elimination, the electrical arrangement is such that the printing impulse cannot be directed to orders at the left of the order printing the highest significant digit, due to the position of the contact member controlled by the related type carrying member. This breaks the printing impulse circuit for one or more orders to the left of the significant digit, thus suppressing zero printing.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

The invention is illustrated by way of example in the accompanying drawings in which:

Fig. 1 is a sectional view showing one order of the digit printing mechanism with the associated zero printing control.

Fig. 2 is a view in front elevation taken on the line 2—2 of Fig. 1.

Figs. 3 and 4 are both detail views showing the operating mechanism for certain parts of the machine.

Fig. 5 is a view in side elevation showing certain operating cams and associated devices operated thereby.

Fig. 6 is a timing diagram of the machine illustrating the timing of mechanical and electrical parts associated with the present invention.

Fig. 7 is a wiring diagram of the electrical in-

strumentalities involved in the present invention.

Printing mechanism

The machine in which the present improvements are incorporated also includes an alphabetic printing mechanism with means for selecting letters making up words or abbreviations. The alphabetic printing mechanism is fully shown and described in the patent to F. L. Fuller and H. S. Beattie, No. 2,199,561, dated May 7, 1940, and application of T. J. Watson et al., Serial No. 494,820, filed July 15, 1943.

Since the present invention relates only to the numeral printing mechanism, it is explained that the printing wheel 60 carries the alphabet type and has interspersed numeral printing type for printing the digits 1-9 and 0. Under control of the perforations in the card column, these numeral type will be selected for printing the digits and printing is effected at the N point in the machine cycle to concurrently effect printing from the selected digits 1-9 and the 0 digit where required.

The card is perforated with holes to represent the digits 0-9 and is passed by the analyzing brushes 292 (Fig. 7) by a card feeding mechanism of any suitable design to analyze the index points in the order 9, 8, 7 . . . 1, 0, X, Z.

When the analyzing brush senses a hole at any of the index point positions 9-1, a circuit is closed to the printing control magnet 61 (Fig. 1) and for each card column analyzed there is a printing control magnet 61. When a printing control magnet 61 is energized its armature 62 (Fig. 1) is attracted to pull a call wire 63 which rocks a bell crank 64. Pivoted to the bell crank 64 is a T-shaped member 65 and its head portion is provided with projections 66R and 66L, the extension 66R normally engaging an extension of a clutch release arm 67. The engagement of extension 66R and the clutch release arm 67 is retained in the relationship shown in Fig. 1 during the time the holes 9, 8, 7, 6, 5, 4, 3, 2 and 1 are analyzed to thereby cause the clutch release arm 67 to be rocked at a differential time when magnet 61 is energized.

Shaft 17, it will be seen from Fig. 6, is driven at a uniform speed during the time the index point positions 9-1 are analyzed and has secured thereto a tube 68 which is fluted transversely along its periphery so as to provide clutch notches 69. Tube 68 constitutes the driving clutch member. Encircling the clutch tube 68 are gears 70, there being one gear 70 for each order of the printing mechanism. To provide for the lateral spacing between the gears 70 the gears are guided by slots 71 and 72 formed in a casting 73 as well as by guide slots 74 in a casting 75. By such spacing members the gears 70 are separated to allow independent movement and also to cause a clutch pawl 76 which is pivoted on the related gear 70 to cooperate with the clutch release arm 67. The clutch release arm 67 normally holds the clutch pawl 76 in such position that its clutch tooth 77 is out of engagement with any of the clutch notches 69 of the clutch tube 68. When the clutch release arm 67 is rocked as a result of the first energization of the magnet 61, the clutch is engaged because a spring 78 attached to the clutch pawl 76 will rock the latter in order that the clutch tooth 77 will engage the clutch notch 69 determined by the time the printing control magnet 61 is energized. The above described clutch is the printing type se-

lecting clutch and causes the differential rotation of the printing wheel 60. To rotate the type wheel 60, the gear 70 meshes with an idler gear 79 loosely mounted on a shaft 80 and the gear 79 meshes with the type carrying gear wheel 60 carrying the digit and alphabet printing type.

Fig. 1 shows the arrangement of the printing devices for a single order and the machine is preferably provided with duplicate devices for printing a plurality of characters. (See Fig. 2.)

If the 9 hole was analyzed the clutch tube 68 would rotate the extent of one notch before the clutch engagement is effected by the energization of the printing control magnet 61. With the clutch retained engaged the printing wheel 60 will thereafter continue to rotate. The differential time at which the printing control magnet 61 is initially energized determines the extent of counterclockwise rotation of the printing wheel 60 necessary to select a digit type. After the variable rotation of the printing wheel 60 has been effected and the printing impression effected, with the clutch still engaged the printing wheel 60 will continue to rotate until the free end of clutch pawl 76 strikes the clutch release arm 67 which, in the meantime, has been brought to its normal position. When such disengagement is effected the printing wheel 60 is at the normal position shown in Fig. 1.

Each printing wheel 60 is carried by an arm 81 loosely pivoted on the shaft 80 and provided with a rearwardly extending follower arm 82 which is operated by a cam projection 83 of a cam disk 85 which constitutes a driven member of a printing clutch.

Shaft 35 rotates a clutch tube 84 fixed thereto and which is similar to the clutch tube 68 and likewise encircling the clutch tube 84 is the driven clutch disk 85 upon which is pivotally mounted a clutch pawl 86. Associated with the clutch pawl 86 is a clutch release arm 87. When the clutch engagement is effected between the clutch pawl 86 and the N clutch notch of the clutch tube 84, the disk 85 will be rotated in a counterclockwise direction whereby the cam projection 83 will co-operate with the follower arm 82 to rock arm 81 about the shaft 80 to effect the digit printing impression. The engagement of the clutch now being described is effected at the N printing time in the cycle for concurrently printing selected digits 1-9 and 0.

The T-shaped members 65 are guided between guide plates 88 and said guide plates are carried by a pair of arms 89 loosely pivoted upon shaft 15 to form a ball to shift T-shaped members 65. After all of the index points 9-1 have been analyzed and by means to be subsequently described, the ball comprising the side arms 89 and transverse plates 88 is rocked counterclockwise about the shaft 15, first positioning the T-shaped member 65 so that extensions 66R, 66L overlap both the clutch release arm 67 and clutch release arm 87. Further movement to the left is subsequently effected so that the extension 66L will be engaged with the clutch release arm 87 and completely disengaged from the clutch release arm 67.

When the printing clutch engagement has been effected each cam 83 will cooperate with the related follower arm 82 to rock the associated printing arm 80 to force the printing wheel 60 against the usual inking ribbon and platen 91 around which platen is positioned a paper strip to be imprinted. As each arm 80 is rocked, the printing wheel 60 is being rotated counterclockwise but

since the printing wheel is now rolling over the gear 79 this rolling action will cause an equal and simultaneous rotation in a clockwise direction. Both of these opposite rotations will, in effect cause the printing wheel 60 to be immobile with respect to its rotation when it moves to the right to strike the platen 91, the type striking the platen squarely and firmly to cause a legible impression.

After the printing operation, since the type selecting clutch is still engaged, the printing wheel 60 continues to rotate as previously stated until the clutch pawl 76 strikes the clutch release arm 67 which, in the meantime, has been positioned to normal, thereby disengaging the type selecting clutch when the printing wheels are at normal position.

The clutch which causes the rotation of the cam disk 85 to effect the imprint continues its engagement for a complete rotation of the cam 85 and the clutch disengagement is effected by the engagement of the clutch pawl 86 with the clutch release arm 87.

It has been found in practice that when the disengagement of the pawl 76 for the type selecting clutch is effected by striking the clutch release arm 67, there was a tendency of the clutch pawl 76 to rock clockwise about its pivotal point, unduly stretching the associated spring 78. To prevent this action, a cushioning arrangement is provided to hold the clutch pawl 76. In a preferred arrangement this constitutes for each type selecting clutch a double arm 92. One arm cooperates with a cam portion 93 of the clutch pawl 76 and the other arm bears against a spring pressed plunger 94 inserted in apertures 95 partially filled with oil. As the clutch pawl 76 comes around to its normal position, it will strike the clutch release arm 67, forcing its clutch tooth 77 out of the clutch tooth 69 it previously engaged and the cam portion 93 of the clutch pawl 76 will strike one arm of the double arm 92, forcing the opposite end downwardly to press the plunger 94. This will compress the oil at the bottom of the recess 95, thus providing a cushioning action on the arm 92 to restrain the clutch pawl 76 so that it cannot move too far outwardly.

In order to retain the cam disks 85 at their normal position and also to prevent rebound, associated with each cam disk 85 is a spring pressed detent 96.

Reference has been made to the bail which comprises the guide plates 88 and the side arms 89 and which bail is loosely pivoted on the shaft 15 and is rocked about such shaft to position the T-shaped interposers 65. Secured to a shaft 100 is a pair of arms 101 which carry a transverse bail bar 102 directly underlying the series of clutch release arms 87 to normally lock them against accidental movement. One arm 101 has a link connection 103 to an extension 104 of one of the arms 89. The means for reciprocating the rock shaft 100 is shown in Fig. 5 and it will be seen that secured to a rod 105 is a follower arm 106 carrying a roller 107 cooperating with a profile cam 108 secured to a drive shaft 15. A spring 109 attached to an extension of the follower arm 106 urges the roller 107 against the cooperating cam 108. Attached to the rod 105 is an arm 110 connected by a link 111 to an arm 112 secured to the rock shaft 100.

During the time that the 9-1 index points are being analyzed, the parts now being described and shown in Fig. 1 are retained in the position shown and bail rod 102 will underlie the clutch release arms 87. After the 1 index point position has

been analyzed, roller 107 drops to a low part 108a of the cam 108, rocking the shaft 105 clockwise and the arm 110 connected thereto in the same direction, forcing the link 111 upwardly to rock the arm 112 and the shaft 100 in a clockwise direction. This will move ball 102 below the clutch release arms 87 to unlock them and by drawing the link 103 to the left it will be observed that the bail for shifting the T-shaped interposer 65 will be moved slightly to the left so that extension 66L now cooperates with the related clutch release arm 87, nevertheless retaining the positioning of the extension 66R over the extension of the related clutch release arm 67. Having moved the interposers 65 in such position the formation of the cam part 108a is such that the interposers will remain in this position during the analysis of the 0 and X index point positions. (See timing diagram—Fig. 6.)

After the 9-1 index point positions have been analyzed and the first impulses have been directed to the printing control magnets 61 it is desirable that their armatures 62 be positively retracted from the cores of the magnets in the event that residual magnetism retains the attraction. To this end, there is loosely pivoted upon the shaft 15 a bail 113 underlying the bell cranks 64. One of the side arms 101 and one of the side arms of the bail 113 are interconnected by a toggle connection which consists of an extension 114 of a related arm 101 and a link 115 pivoted to an arm of the bail 113, said members 114 and 115 being interconnected by a pivot rod 116. Members 114 and 115 at their juncture 116 provide a toggle system. When the clockwise movement is given to the bail 102 to shift the T-shaped interposers 65 after the analysis of the 9-1 index points it will be observed that during this clockwise movement the toggle system passes through and beyond its midcenter position. In passing from the normal offcenter position to the other offcenter position of the toggle system, the bail 113 will be reciprocated, thereby rocking the bell cranks 64 and through the call wires 63 positively retracting the armatures 62 if they should remain attracted to the cores of the related magnets. Hence, means is provided to positively retract the armatures, insuring that the next impulse directed to the printing control magnet 61 will have the proper effect. When the toggle system is in the other offcenter position the bail 113 will be in a position shown in Fig. 1, permitting the rocking of the bell cranks 64 by the second impulse directed to the related printing control magnet 61.

After the analysis of the X index point position, cam 108 is effective by a still lower cam part 108b (Fig. 5) to cause a still further clockwise rotation of the shaft 100, and by pulling link 103 (Fig. 1) to the left still further it will be seen that the bail plates 88 shift the interposers 65 so that the extensions 66R are now completely disengaged from the clutch release arms 67, nevertheless retaining the extensions 66L over the clutch release arms 87. This position is maintained during the analysis of the R index point position and also at the time that an electrical impulse is sent by a cam controlled contact at the N impulse time and which from the timing diagram (Fig. 6) is initiated at about 225° of the machine cycle. Hence, the clutch release arms 87 will be operated when the printing control magnets 61 are energized at the N point in the machine cycle.

It is desirable, of course, that the clutch release arms 87 be positively retracted to their normal positions to be in a position to disengage the printing clutches. This is effected after the N impulse transmission time by means of the bail 102 when it is returned to normal. By means of the operation of the cam part 108c (Fig. 5) on the follower arm 106 shaft 100 is rocked counterclockwise and bail 102 will rock the clutch release arms 87 to normal position if they have not been moved to such position by their associated springs. When bail 102 is restored to normal the toggle system 114-115 again passes through midcenter to reciprocate bail 113 to positively retract armatures 62.

It is, of course, desirable that likewise the clutch release arms 67 be urged to normal positions if they have not been moved to such positions by their associated springs. This is effected by means of a bail 120 (Fig. 1) which is carried by a pair of arms 121 secured to a rock shaft 122. The means for rocking the shaft 122 is shown in Fig. 5 wherein it will be seen that a cam 123 driven by shaft 15 cooperates with a follower arm 124 and said follower arm has a link connection 125 to an arm 126 secured to the rock shaft 122.

From the timing diagram (Fig. 6) it will be seen that for the timing of bail 120 at the initial part of the cycle the cam 123 enables, through the operating connections to the shaft 122, the rocking of the shaft 122 counterclockwise to draw bail 120 downwardly, releasing the clutch release arm 67 for operation during the analysis of the index point positions 9-1, 0 and X. After the analysis of the X index point position and when the interposers 65 have been moved fully to the left so that their extensions 66R are disengaged from the clutch release arms 67, the cam 123 is effective through the operating connections shown in Fig. 5 to rock the shaft 122 clockwise, moving the bail 120 upwardly and by coaction with the clutch release arms 67 moving the latter to their normal positions.

1-9 digit printing control

Referring to Fig. 1, each gear 79 is provided with a flange portion 130 formed to provide a cam portion 131 cooperating with one arm of a double arm 132 pivoted at 133. Whenever a printing wheel is rotated to select any numeral 1-9 for printing, the rotation of the associated gear 79 clockwise will rock the arm 132 in a similar direction. A contact carrying member 134 is bifurcated at its upper end to receive a headed stud 135 carried at one end of the double arm 132. A spring 136 is interposed between said arm and an extension of the contact carrying member 134. The contact carrying member carries plates 137 of insulating material and since these are attached to each side of the member 134 they are spaced so as to receive a metallic contact member 138 which is pivoted at 139 between the insulating plates 137. Whenever a printing wheel 60 is variably rotated to select one of the digits 1-9, the rocking of the double arm 132 clockwise will, through the spring 136, elevate the related contact carrying member 134 so that the contact member 138 is now coordinated with contact blocks 140 and 141 but spaced therefrom. During such movement the lower portion of the contact carrying member 134 moves out of engagement with a zero printing

bail 142 but retains an operative engagement with the numeric printing bail 143.

By circuit connections to be subsequently described at 225° of the machine cycle or at the N time, an electrical impulse is directed by cam controlled contacts and at this time bail 143 has moved to the left to cause the contact member 138 to shunt the contact plates 140, 141. Hence, through contact plates 140, 141 and contact member 138, the N impulse is directed to the printing control magnet 61 and at this time in the machine cycle each interposer 65 has been shifted so that only extension 66L is in cooperation with the clutch release arm 87. This will effect the engagement between the clutch pawl 86 and the N notch of the clutch tube 84, causing the rocking of the printing arms 81 so that the selected numeral type 1-9 are thereafter impressed against the platen 91 in the manner previously described.

It is understood, therefore, that for printing the numerals 1-9 printing operations are made after all the perforations are analyzed and at a single point in the operating cycle.

The means for rocking the bail 143 to cause the elevated contact carrying members 134 to be rocked so that their contact plates 138 make contact with the contact plates 140 and 141 to transmit the N impulse to the printing control magnets 61 will now be explained. The numerical printing bail 143, as shown in Fig. 2, is carried by a pair of arms 144 secured to a rock shaft 145. At one end of the rock shaft there is attached an arm 146 also shown in Fig. 3. A follower arm 147 which is pivoted on a rod 148 has a link connection 149 to the arm 146 and said follower arm 147 cooperates with a profile cam 150 driven by a drive shaft 13.

Understanding that the elevated contact carrying members 134 only cooperate with the bail 143 under the conditions now assumed, cam 150 will be effective through the operating train shown in Fig. 3 to rock the shaft 145 counterclockwise, thereby urging the bail 143 to the left as shown in Fig. 1. This will force the contact carrying members 134 to the left so that their contact members 138 make firm electrical contact with the contact plates 140 and 141. As contact member 138 strikes contact plates 140, 141, bail 142 will rock the contact carrying member 134 about the pivot 139 to stretch spring 136 permitted because stud 135 is smaller than the bifurcation in arm 132. Tensioned spring 136 will urge contact member 138 firmly against contact plates 140, 141.

From the timing diagram (Fig. 6) it will be seen that for the timing of bail 143 the cam 150 is effective to rock the bail 143 to make the desired electrical contact at 218° of the machine cycle. Such electrical contact is retained during the time that the N electrical impulse is directed at 225° of the machine cycle. After the impulse has been directed, the bail 143 is restored to the right to its normal position and, of course, after the gears 79 come to their normal position, shown in Fig. 1, the contact carrying members 134 are restored to normal, as shown in this figure.

Zero printing

In printing multid denominational numbers such as 309 or 300, it is necessary to insert the intermediate zero or any zeros to the right of the highest significant figure. In designation of numbers in a field comprising a plurality of card columns, if the number of digits is less than the

number of card columns, zeros are perforated at the left of the highest significant digit. It is undesirable that such zeros be printed and by the zero printing mechanism, the printing of such zeros from the controlling card columns is suppressed and only the intermediate zeros, or zeros to the right of the first significant digit, are printed.

In selecting the zero type on the printing wheel 60 for printing intermediate zeros or zeros at the right, the type selecting clutch is not engaged and only the printing clutch is engaged to rock the printing wheel carrying arms 80 so that rolling of the type wheel 60 over the now stationary gear 79 will bring the zero type to the printing line and impressed against the platen 91. As will be more clearly described later on when the operation of the machine is described in connection with the wiring diagram, the cam operated contact which controls the impulses directed to the printing control magnets under control of the analyzing devices does not close at the zero index point position when the machine is plugged up for numeric printing. Hence, since such impulses are not directed to the printing control magnets 61 the 0 holes in any of the controlling columns are ineffective and obviously for card columns above the highest significant digit such 0 holes are ineffective and zero printing will be suppressed for corresponding orders.

For zero printing of intermediate zeros and zeros to the right of the first significant digit, bail 142 is effective to prepare an electrical circuit for causing the energization of the printing control magnet 61 and the engagement of the printing clutch. The bail 142, as shown in Figs. 1 and 2, is carried by a sleeve 155 loosely mounted on shaft 145 and integral with the bail 142 is a yoke or cross-over bail 156 to which is secured an arm 157, loosely mounted on the shaft 145. Referring to Fig. 4 it will be seen that a follower arm 158 pivoted on stud 148 has a link connection 161 to the arm 157. The follower arm 158 cooperates with a profile cam 160 driven by the shaft 13.

It will be observed that in the counterclockwise rotation of cam 160 the follower arm 158 will be rocked to rock the shaft 145 counterclockwise through the operating train. This will result in the counterclockwise rotation of the bail 142 and since, at this time, the contact carrying members 134 for those orders in which zero printing is to be effected are at the normal position in Fig. 1, movement of the bail 142 to the left will cause at about 184° (see timing diagram, Fig. 6) contact between the contact members 138 and the contact plates 145 and 162. The cam 160 maintains such contact as shown in the timing diagram (Fig. 6) at the time that the N electrical impulse is transmitted. This impulse is transmitted by the contact plates 141 and 162 now shunted by the associated contact member 138 and is transmitted to the printing control magnets 61 associated with the card columns in which zero printing is to be effected. At this time the extensions 66L of the T-shaped interposers 65 are in operative engagement with only the clutch release arms 87 and the rocking of such clutch release arms 87 will engage the printing clutch, causing the cam disks 85 to rock the type wheel carrying arms, thus causing the printing wheel 60 to roll over the printing gears and strike the platen 91, the zero type on such wheels being selected thereby for zero digit printing.

Circuit description

The operation of the machine as it involves the listing or printing of items will now be described in connection with the circuit diagram shown in Fig. 7. Listing or printing of items is effected when the card passes by the LB analyzing brushes 292. Of course, there is an analyzing brush for each card column and the particular analyzing brushes which are to control the listing of items have plug connections 360 and are from the corresponding plug sockets to plug sockets 362 to the denominational orders utilized for listing. It will be noted that each of the plug sockets 362 has a wire connection to the upper contact blade 363, and the lower contact blade 364 has a wire connection 365 to the related printing control magnet 61. For each order the position of contacts 363, 364 is controlled by a related cam 367 driven by a shaft which is rotated synchronously with card feed and the CF and CR cam contacts. The profile of each cam 367 is so arranged that during the time the 9-1 index point positions are analyzed the blade 364 will make electrical contact with the uppermost contact blade 363. During the time the 9-1 index positions are being analyzed, a circuit is closed from the line 310 through circuit breaker contacts CR1, through the CF7 circuit breaker contacts driven by a shaft rotating during card feeding operations and to the contact roll associated with the LB analyzing brushes. The impulses then are directed by analyzing brushes 292 when they encounter perforations, thence through the plug connections 360, to the plug sockets 362, thence through contact blades 363, 364 and wire 365 to the print control magnet 61. This impulse will initiate the rotation of the printing wheel and at the time the type selecting clutch is engaged the printing wheel 60 will be rotated to bring a selected digit type to the printing point.

It will be recalled that for item listing operations a supplemental impulse is directed to the printing control magnets 61 at the N time in the machine cycle to cause the engagement of the printing clutches to effect printing from the selected digit type. This circuit extends from line 310, cam contacts CR25 to plug socket 394. A plug connection 395 is made between plug socket 394 and one of the plug sockets 396. For the particular denominational columns utilized for printing, plug connections 397 are made to interconnect the plug sockets 396 to thereby transmit the common impulse from the CR25 contacts to all of the contact bars 140. For each denominational order that a digit 1-9 inclusive is to be printed the contact bar 138 will be in such moved position that it will shunt contacts 140 and 141, thereby transmitting the impulse from cam contacts CR25 through 140, 138, 141 to the related print control magnet 61.

Zero elimination and zero insertion mechanism

If zeros are to be inserted for intermediate orders, or successive zeros to the right of the first significant digit, this will be effected by the following circuit: Referring to Fig. 1, it will be recalled that for zero representing orders to the right of the first significant digit the contact bars 138 are in the position shown in Fig. 1, and in the circuit diagram of Fig. 7 when the zero print bail 144 moves to the left contact points 141 and 162 will be electrically shunted by the contact bar 138. Assuming that the amount 4,000 is to be printed, the contact bar 138 related to the thousands order will be in position to shunt electrical

contacts 140 and 141 and accordingly the impulse directed by cam contacts CR25 will be transmitted through such contacts 140, 141 now shunted by contact bar 138 and then by wire 400 to the print control magnet 61 for the thousands order. By means of plug connections 399, this same impulse is directed to the print control magnet for the hundreds order through contacts 162 and 141 of the hundreds order now shunted by the contact bar 138, wire 400, to the hundreds order print control magnet 61. In the same manner, by other plug connections 399 for the next lower orders it will be seen that the same impulse is transmitted by a similar circuit to the print control magnets 61 for tens and units orders. This N impulse transmitted to the print control magnets for one or more lower orders to the right of the first significant digit will cause zero printing in such orders.

For the one or more higher orders which are to the left of the first significant digit, it will be observed that zero printing is automatically eliminated or suppressed, due to the breaking of the zero circuit for such higher orders by the shifting of the contact bar 138 in the order representing the first significant digit. Since the contacts 141 and 162 in this first significant digit order are not bridged by the contact bar 138 the impulse from the CR25 contacts cannot be directed to the print control magnets for one or more such higher orders. Hence, since their printing control clutches will not be engaged the related printing wheel 60 will not be impressed against the platen 91 and zero printing is suppressed.

By the provision of the present arrangement, it will be observed that the printing control magnets 61 have a triple function. They initially function during the analysis of the card to select the desired digit type for printing; the second impulse directed to the magnet 61 effects printing from the selected digit type; and third, other printing control magnets receive the N impulse for the first time at the N time in the machine cycle to impress the printing wheels in orders below that of the first significant digit to print the intermediate zeros. The absence of the transmission of such impulse to the print control magnets of orders to the left of the first significant digit enables the related printing wheel 60 to remain at normal position to enable zero suppression or elimination.

While there have 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:

1. In a record controlled machine, record analyzing means, a plurality of denominationally ordered type carrying members, each with a plurality of digit type 1-9 and a 0 type, an individual electromagnetic device for each order to select the digit type 1-9, and for effecting printing impressions from the digit type 1-9 and 0, a circuit for each electromagnetic device controlled by the analyzing means to energize the related electromagnetic device the first time to effect the selection of the digits 1-9, a printing

impulse circuit common to the electromagnetic devices of all orders to concurrently energize the latter a second time to effect concurrent printing from selected digit type 1-9, an auxiliary circuit for each electromagnetic device of each lower order to cause the imprint from the 0 type of next lower order, and means controlled by the type carrying member of a lower order when at the 0 digit position and by the type carrying member of the next higher order when at any of the 1-9 digit positions to connect said printing impulse circuit to the auxiliary circuit of the electromagnetic device of said lower order to energize the latter at said second time to concurrently effect 0 digit printing in such lower order with printing from digit type 1-9 in other orders.

2. In a record controlled machine in which a type carrying member carrying digit type 1-9 and 0 is differentially moved to select the 1-9 type and is at a position to normally print 0, the combination of printing means for each order to bodily move said printing member at its differential position to printing position to print from selected type, an electromagnetic control means for each order to cause the operation of the related printing means, a printing impulse circuit common to the electromagnetic devices of all orders to concurrently energize the latter to concurrently effect the operation of the printing means of all orders to print selected digits 1-9, an auxiliary circuit for each lower order to energize the electromagnetic device of such lower order to cause the imprint from the 0 type of next lower order, and means controlled conjointly by a type carrying member at the digit positions 1-9 and the type carrying member of next lower order when unmoved and at the 0 digit position for connecting the printing impulse circuit to the auxiliary circuit of the electromagnetic device of said lower order to energize the latter to cause the operation of the printing means for said lower order to print the 0 digit concurrently with the 1-9 digits of higher orders.

3. In a record controlled machine for printing from selected digit type 1-9 and 0, a plurality of denominationally ordered differentially movable type carrying members carrying digit type 1-9, and 0, a contact making member controlled by the related type carrying member and having one non-contact making position when the related member is at digit positions 1-9, and having another non-contact making position when at the 0 digit position, a timed printing impulse circuit to effect printing from 0 type and from the selected digit type 1-9, an auxiliary 0 printing control circuit completed conjointly through a contact member of higher order when moved from the first named non-contact making position to contact making position and a contact member of next lower order when moved from said other non-contact making position to contact making position, and means for moving said contact members to contact making positions to connect said printing impulse circuit through a contact member of higher order and a contact member of next lower order to cause 0 printing from the type member of next lower order.

4. In a record controlled machine for printing from selected digit type 1-9 and 0, a plurality of differentially movable type carrying members carrying digit type 1-9, and 0, a contact member controlled by the related type carrying member moved to one non-contact making position when the related member is at digit positions 1-9, and

having another normal non-contact making position when the type carrying member is at the normal 0 digit printing position, a timed impulse printing impulse circuit to effect printing from the 0 type and selected digit type 1-9, an auxiliary 0 printing control circuit completed conjointly through a contact member of higher order when moved from the first named non-contact making position to contact making position and a contact member of next lower order when moved from its normal non-contact making position to contact making position, and means for moving said contact members of higher and lower orders to contact making positions to connect said printing impulse circuit through a contact member of higher order and a contact member of next lower order to cause 0 printing from the type member of next lower order.

5. The circuit arrangement according to claim 4 in which the movement of the contact member of the order at the extreme left in which a significant digit 1-9 is printed to said contact making position disconnects the printing impulse circuit from the contact member of next higher order when the latter is at said normal but contact making position, thereby suppressing 0 printing for orders to the left of said significant digit.

6. In a record controlled machine for printing from selected digit type 1-9 and 0, a plurality of differentially movable type carrying members carry digit type 1-9, and 0, a contact member moved by the related type carrying member and having one non-contact making position when the related member is at digit positions 1-9, and having another normal non-contact making position when at 0 digit position, a timed printing impulse circuit to effect printing from the selected digit type 1-9, and 0, said circuit being completed through said contact members when moved to contact making position from the first named position, and said printing impulse circuit being completed conjointly under control of a contact member of higher order when moved to contact making position from the first named non-contact making position and a contact member of next lower order when moved to contact making position from the second named non-contact making position to cause 0 printing from the type member of next lower order, a plurality of sequentially operated balls, one associated with the contact members at non-contact making normal position and the other associated only with the contact members at the first named non-contact making position, means for first moving the ball associated with the contact members at normal position to cause them to assume contact making positions, and other means for thereafter moving the other ball to

contact making position and concurrently with the time the impulse of the printing circuit is transmitted.

7. In a record controlled machine, record analyzing means, a plurality of denominationally ordered type carrying members having digit type 1-9 and 0, an electromagnetic device for each order, means under control of said record analyzing means to energize said electromagnetic device of the related order a first time to select a digit type 1-9, means to effect printing from digit type 1-9 and 0, a printing impulse circuit common to the electromagnetic devices of all orders to concurrently energize the latter a second time to cause said electromagnetic device to operate said printing means to effect printing of selected digit type 1-9, an auxiliary circuit for each lower order type carrying member to cause the energization of the related electromagnetic device, and means controlled by the type carrying member of a lower order when at the 0 digit position and by the type carrying member of the next higher order when at any of the 1-9 digit positions to connect said printing impulse circuit to the auxiliary circuit of the electromagnetic device of said lower order to energize the latter at said second time to operate the related ordered printing means to print 0 concurrently with printing from digit type 1-9 in other orders.

8. In a record controlled machine, record analyzing means, a plurality of denominationally ordered type carrying members having digit type 1-9 and 0, means for positioning a type member to select a digit type 1-9, an electromagnetic device for each order, means under control of said record analyzing means to energize said electromagnetic device of the related order a first time to control said positioning means to select a digit type 1-9, means to effect printing from digit type 1-9 and 0, a printing impulse circuit common to the electromagnetic devices of all orders to concurrently energize the latter a second time to cause said electromagnetic device to operate said printing means to effect printing of selected digit type 1-9, an auxiliary circuit for each lower order type carrying member to cause the energization of the related electromagnetic device, and means controlled by the type carrying member of a lower order which at the 0 digit position and by the type carrying member of the next higher order when at any of the 1-9 digit positions to connect said printing impulse circuit to the auxiliary circuit of the electromagnetic device of said lower order to energize the latter at said second time to operate the related ordered printing means to print 0 concurrently with printing from digit type 1-9 in other orders.

HORACE S. BEATTIE.

CERTIFICATE OF CORRECTION.

Patent No. 2,381,862.

August 14, 1945.

HORACE S. BEATTIE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 7, first column, line 52, claim 6, after the word "making" strike out "normal" and insert the same after "at", line 51, same claim; and second column, line 49, for "which" read --when--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of December, A. D. 1945.

(Seal)

Leslie Frazer
First Assistant Commissioner of Patents.