Sept. 1, 1936. J. W. BRYCE 2,053,063

RECORD CONTROLLED PRINTING DEVICE

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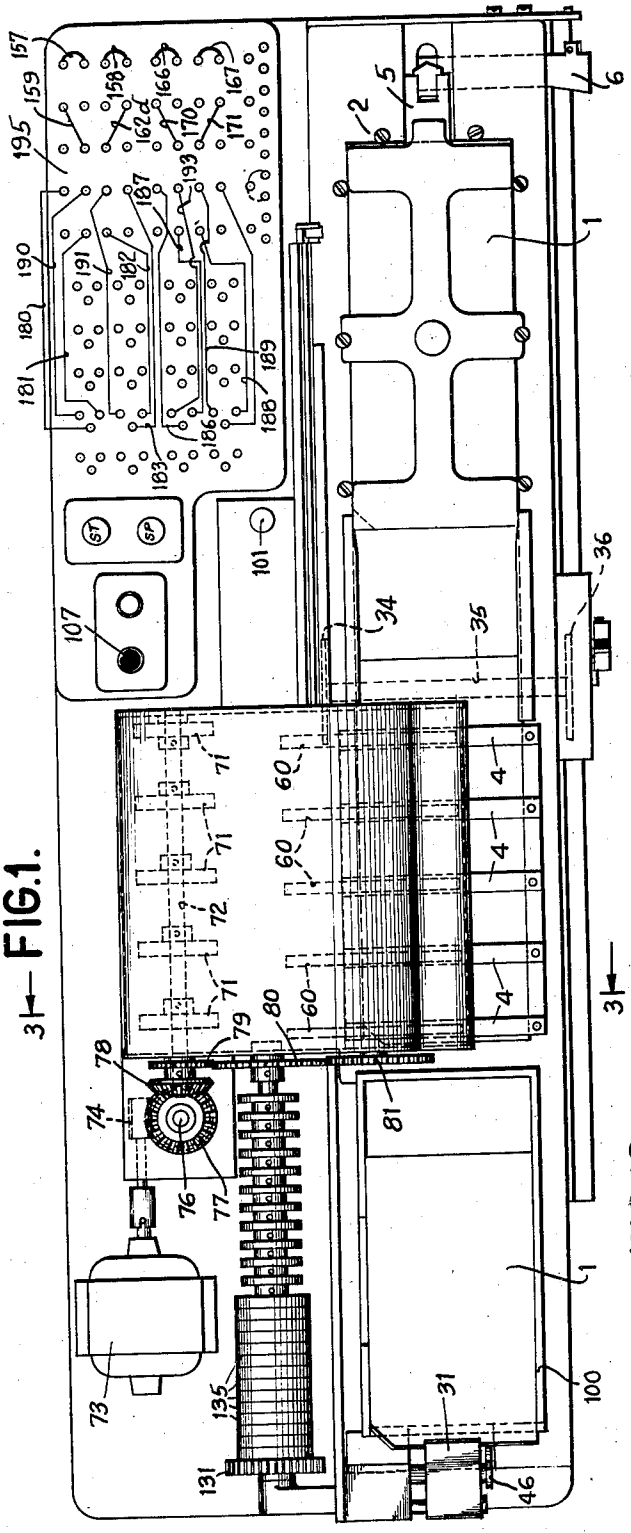


FIG.1.

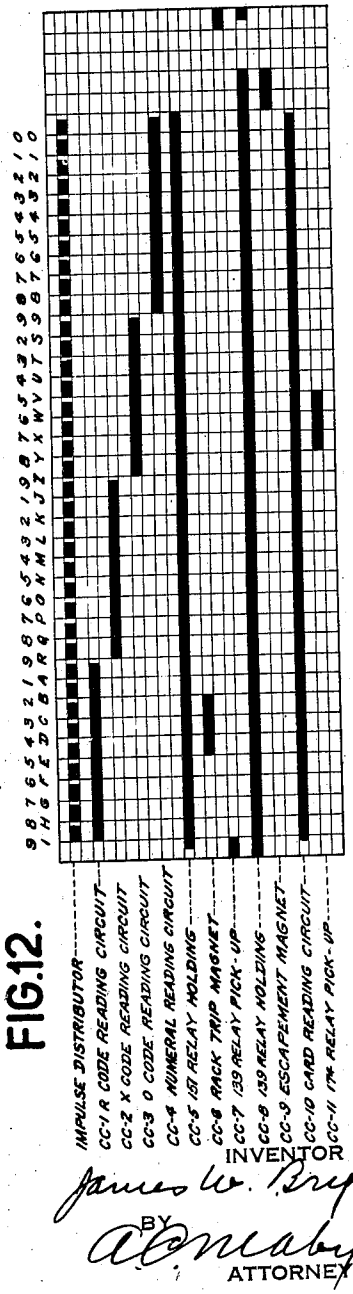


FIG.12.

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RECORD CONTROLLED PRINTING DEVICE

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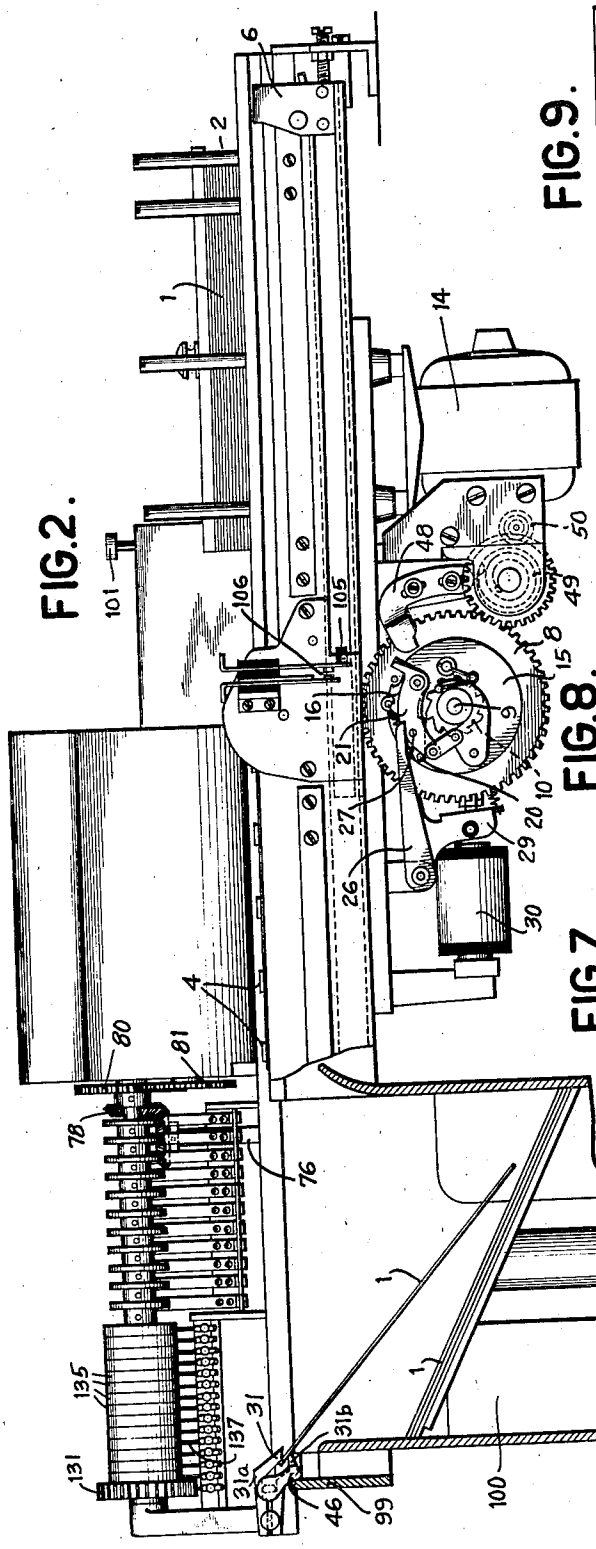


FIG.2.

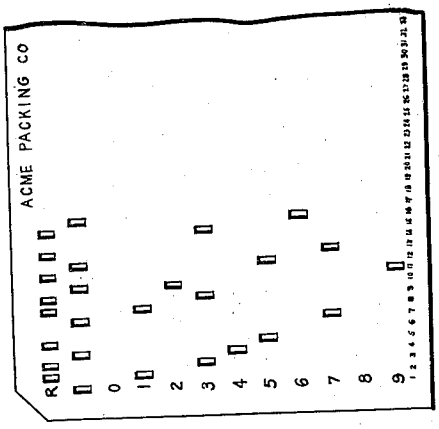


FIG.9.

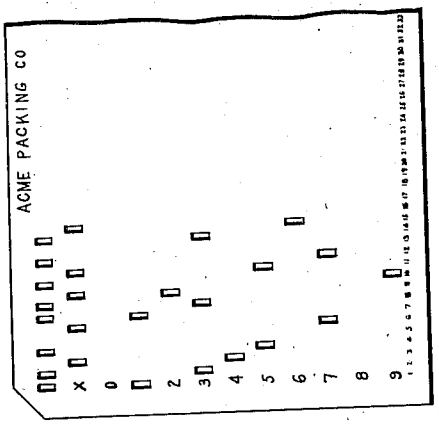


FIG.8.

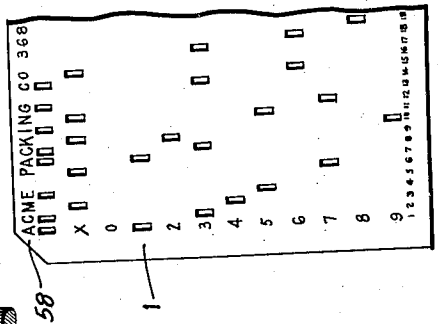


FIG.7.

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FIG.3.

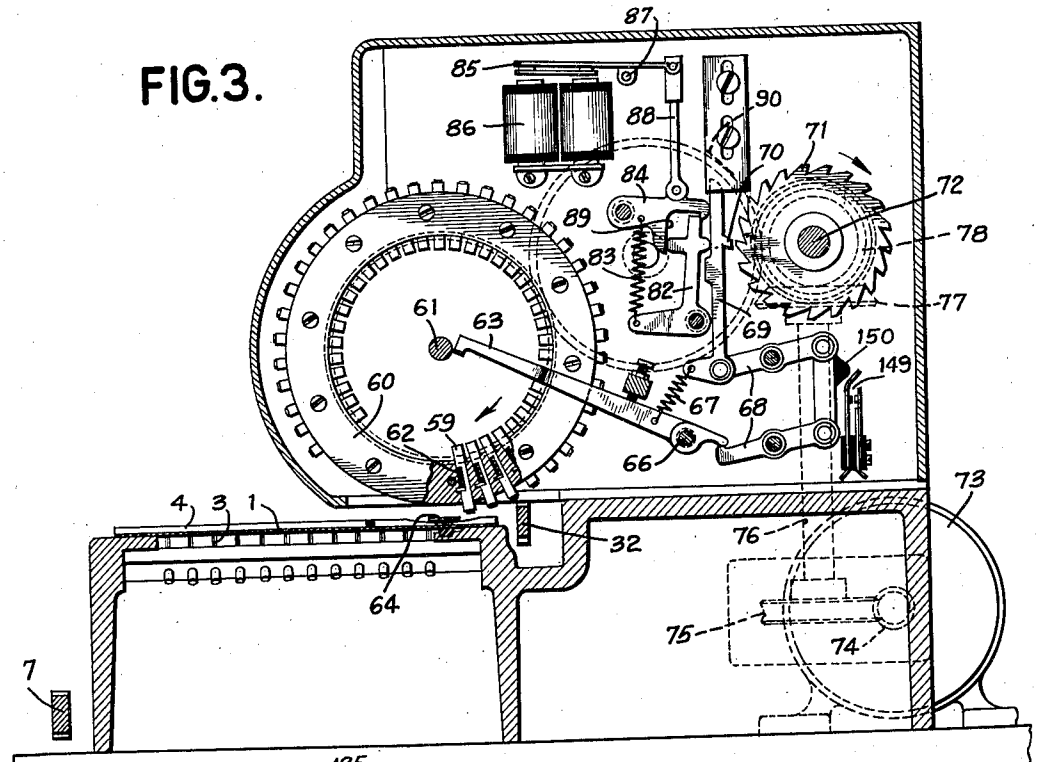
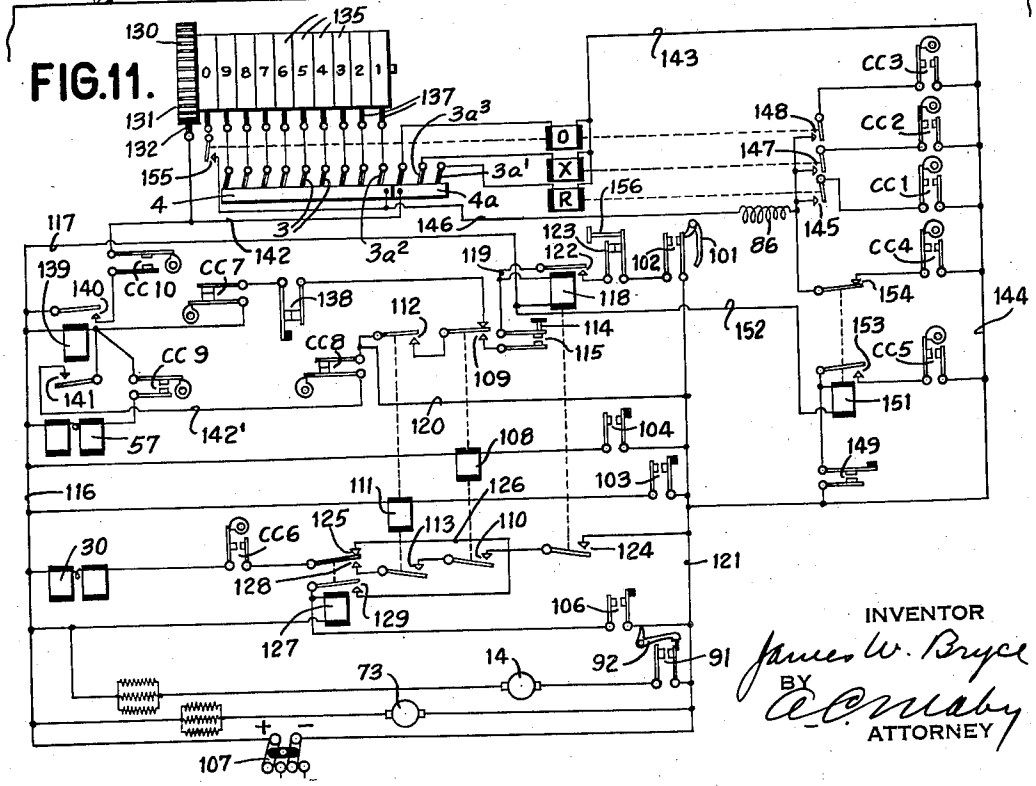


FIG.11.



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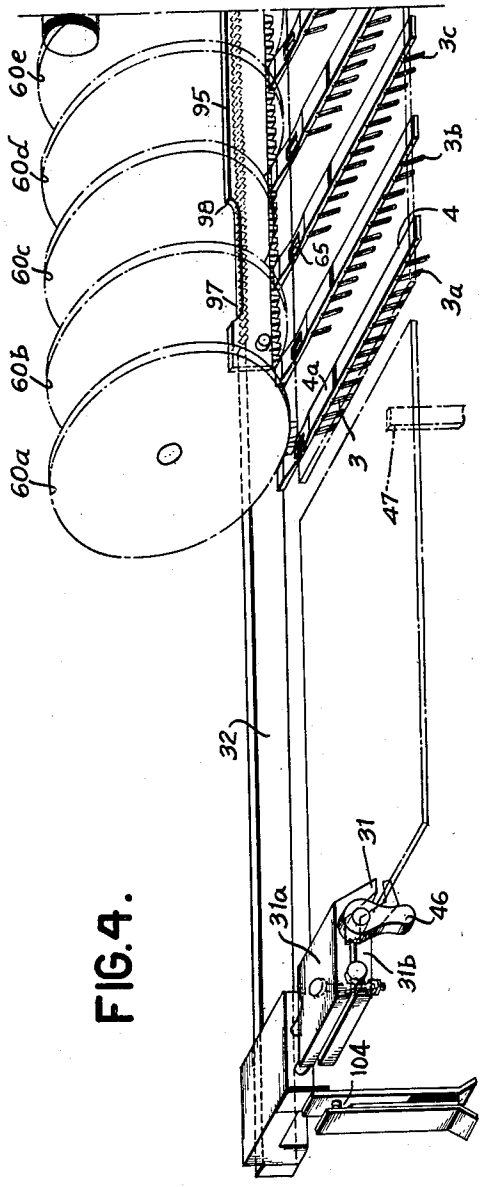


FIG.4.

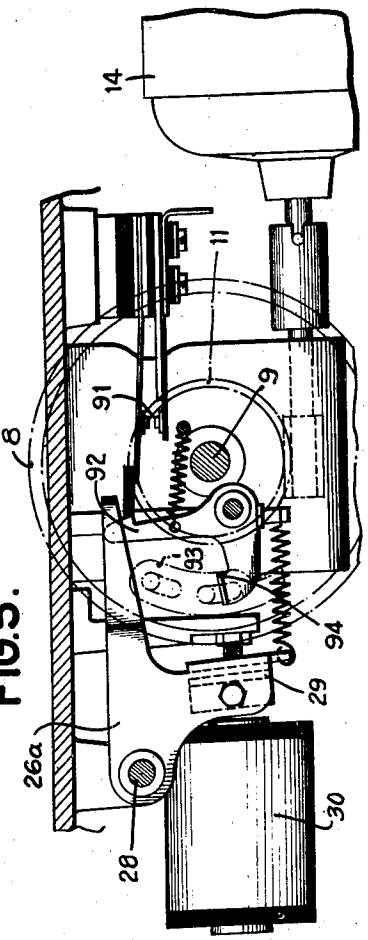


FIG.5.

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FIG.6.

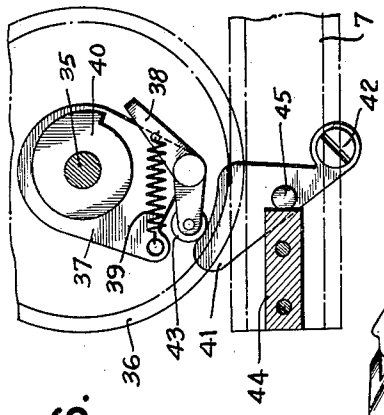


FIG.13.

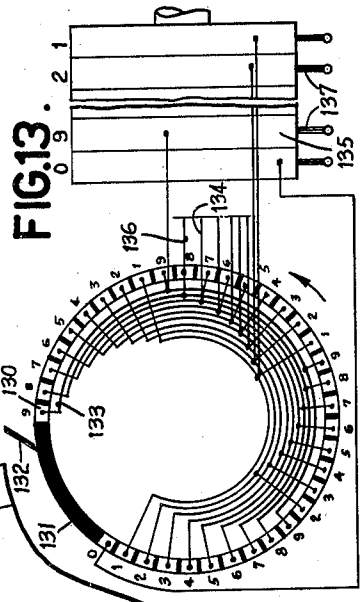
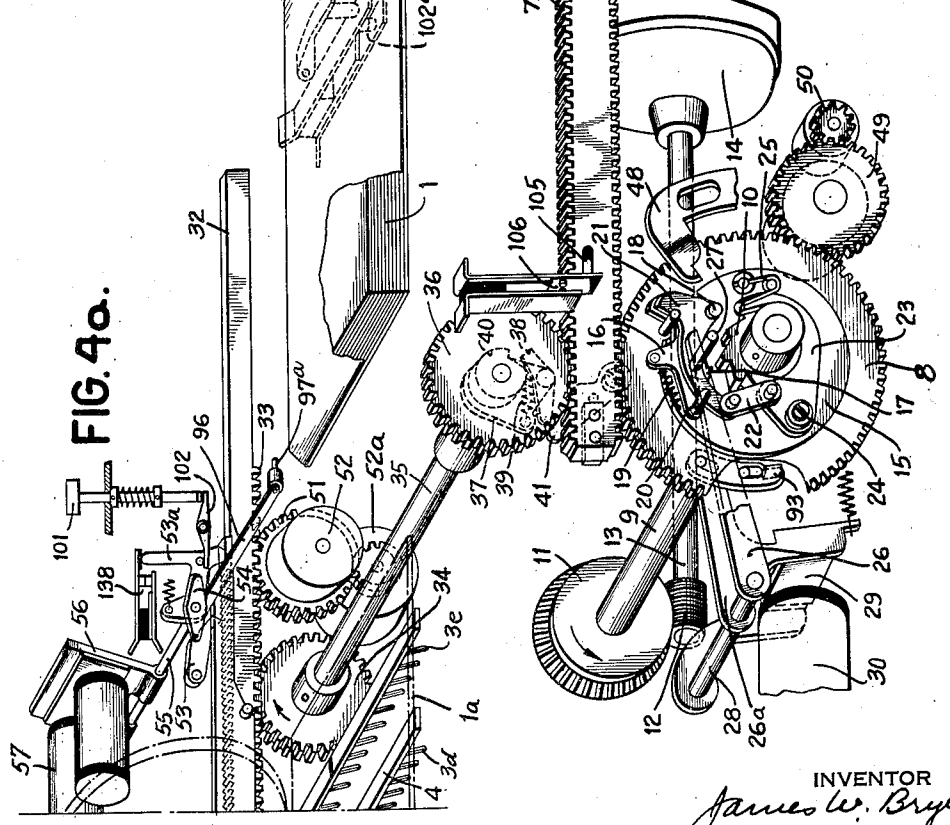


FIG.4a.



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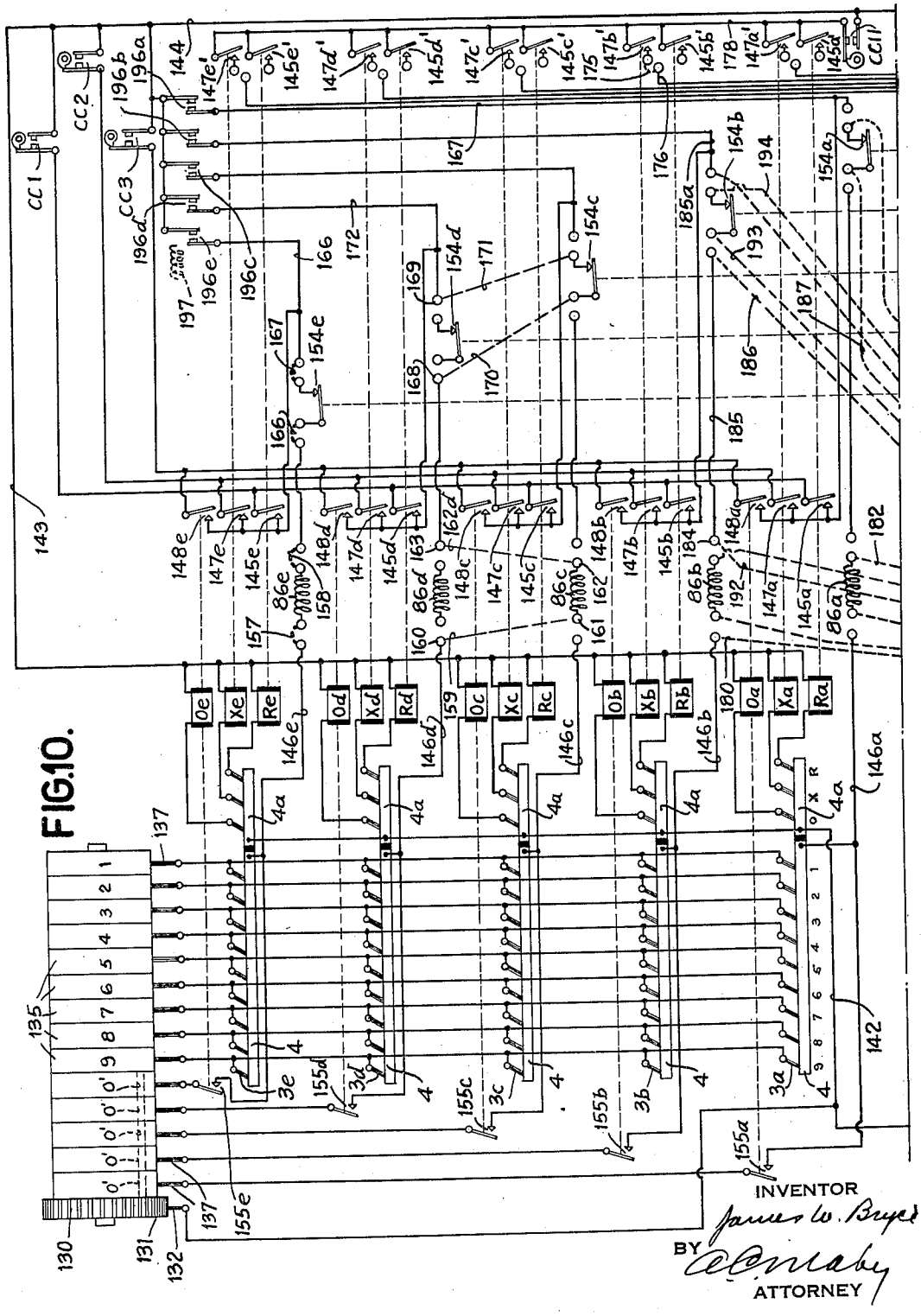


FIG.10.

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RECORD CONTROLLED PRINTING DEVICE

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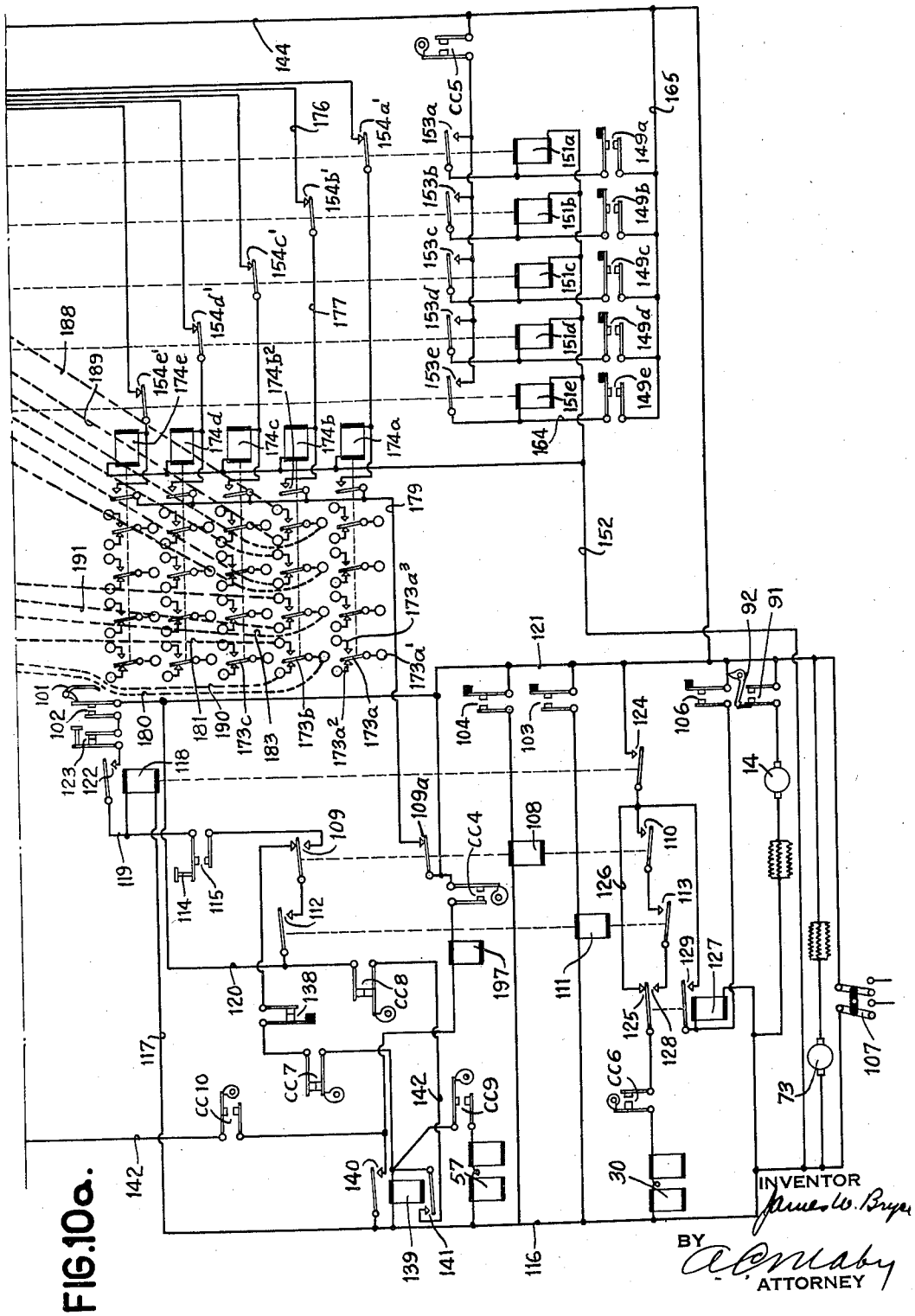


FIG.10a.

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UNITED STATES PATENT OFFICE

2,053,063

RECORD CONTROLLED PRINTING DEVICE

James W. Bryce, Bloomfield, N. J., assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application May 18, 1934, Serial No. 726,213

9 Claims. (Cl. 101—93)

This invention relates to perforated card controlled machines, and more particularly to machines of this nature for sensing holes in separate columns on record cards and for controlling the operation of the machine to print the data represented by the holes.

One of the objects of the invention is to provide a machine which is adapted to analyze perforations arranged in columns on a record card and to print the data represented by such perforations in the corresponding columns.

Another object is to devise means whereby the data represented by perforations in columns may be printed on other portions or, in other words, in different columns on the card.

Another object is to provide means for analyzing perforations in the card and to print the data printed thereby selectively in any one of several positions upon the card.

Another object is to devise a machine of this character in which the columns of perforations are analyzed in succession.

Another object is to devise means for simultaneously analyzing several groups of columns at a time and the successive columns in the groups, step by step.

Another object is to provide an interpreting machine having a continuously rotating type wheel for printing upon a perforated record, the data represented by the perforations.

Another object is to provide means for analyzing both single hole and combinational hole systems of perforations and controlling printing from a continuously rotating printing wheel to print the data represented by the perforations.

Referring to the drawings:

Fig. 1 represents a plan view of the machine;

Fig. 2 is a front elevation of the machine;

Fig. 3 is a section taken substantially on line 3—3 of Fig. 1;

Figs. 4 and 4*a* taken together represent a perspective view of certain of the operating portions of the machine including the feeding mechanisms;

Fig. 5 is a detail of a portion of the feeding mechanism including a controlling clutch;

Fig. 6 is a detail of another clutch employed in the feeding mechanism;

Figs. 7, 8 and 9 represent portions of perforated record cards on which data has been printed in the machine under control of perforations which were already in the cards;

Figs. 10 and 10*a* taken together constitute a wiring diagram of the machine arranged to analyze several columns simultaneously and to print the corresponding data in several columns simultaneously;

Fig. 11 is a wiring diagram of the device arranged to analyze one column at a time and to print the data represented by the perforations at the top of the same column;

Fig. 12 is a timing diagram of the operation of the different parts of the machine;

Fig. 13 is a wiring diagram of a commutator or distributor.

Referring to Figs. 1, 2 and 4*a*, the cards 1 are stacked in a magazine 2 and are fed one at a time from the bottom of the stack toward the left, into position between the perforation sensing brushes 3 and cooperating contact plates or strips 4, 4*a*.

As shown in Figs. 3 and 4, the card is above the sensing brushes 3 and below the contact strip 4. In this position, if there is a perforation through the card in a position corresponding to one of the brushes, that brush will reach through the perforation and engage the strip 4 on the opposite side and thus close an electric circuit for controlling the operation of the machine.

As shown in Fig. 3, there are twelve brushes in a row so that when a particular column on the card is in registration with the column of brushes, each brush will engage one of the index positions on the card. A single such column of brushes may be employed in the machine and the cards fed column by column to the brushes to be analyzed, or as shown in Figs. 4 and 4*a*, several columns of brushes may be employed. In the present instance, five columns are shown. Here, the columns of brushes may be arranged a distance apart, corresponding to say fifteen or sixteen columns on the record card. In other words, when the card is in the machine, if the first column of perforations are registering with the first column of brushes 3*a*, the 16th or 17th column on the card will register with the second row of brushes designated 3*b*, etc.

With this arrangement, the card may be divided into five sections. One column in each of the sections may be analyzed simultaneously and in sixteen step by step analyzing operations the entire card will be analyzed. With this arrangement, the printing of the data represented will be simultaneously effected in five different positions.

Feeding mechanism

The feeding of the cards from the magazine 2 is effected by a card picker or pusher 5 on an arm 6 fixed to a rack 7 (see Figs. 4 and 4*a*). This rack meshes with the gear 8 loosely carried on a

shaft 9. Fixed on this shaft is a ratchet wheel 10. Also fixed on shaft 9 is a worm wheel 11 meshing with a worm 12 fixed on shaft 13 of a motor 14. Fixed to the gear 8 is a disk 15 carrying a pawl 16 having a tooth 17 adapted to cooperate with the ratchet 10. The pawl 16 is pivoted at 18 on the disk 15 and is adapted to be actuated by a spring 19 into cooperation with the ratchet. A pin 20 fixed to the pawl 16, rests on the upper edge of one arm 21 of a toggle member which holds the pawl normally out of mesh with ratchet 10. Arm 21 is connected by a link 22 to the second arm 23 of the toggle. Arm 21 is pivoted at 18 with the pawl 16, while arm 23 is pivoted at 24 to the disk 15. A spring 25 cooperates with the free end of the arm 23 and is adapted to hold it in its upper position as shown in Fig. 4*a* when moved to this position, and also to hold it in its lower position when moved downwardly. An arm 26 reaches over a pin 27 fixed in arm 21. The arm 26 is fixed to rod 28 which is adapted to be rocked clockwise in Figs. 4*a* and 5 by the armature 29 of an electromagnet 30. When the magnet is energized, it will cause the arm 26 to be depressed and this will move the toggle arms 21 and 23 downwardly where they will then be held by the spring 25. This, in turn, will permit the pawl 16 to move into engagement with the ratchet 10. The turning of the ratchet 10 will now cause the gear 8 to turn counterclockwise to move the rack 7 toward the left. This will carry the card 1 from the stack in Fig. 4*a* to the dotted line position 1*a*, with the first column of perforations in register with the first column, 3*a*, of sensing brushes.

The other columns of sensing brushes 3*b*, 3*c*, etc. will register with the 17th, 33rd, etc. columns of the card. From this dotted line position 1*a*, the card will be fed one column at a time toward the left as the analyzing and printing takes place. That is, if the card is in the position 1*a*, the brushes 3*a* will sense the perforations in the first column and effect printing under control thereof, the brushes 3*b* will analyze the perforations in column 17 and also control printing, etc. As soon as these operation have been completed, the card will move one column to the left so that the row of brushes 3*a* will register with column 2 to sense the perforation or perforations in that column and to control printing, while the row of brushes 3*b* will register with column 18 on the card to sense the perforations and control printing; the rows of brushes 3*c*, 3*d* and 3*e* operating in their columns in like manner.

The feeding of the card step by step is effected by a card gripper 31 comprising upper and lower jaws 31*a*, 31*b*. The card gripper is carried by a rack bar 32 provided with rack teeth 33 meshing with a gear 34 fixed on shaft 35, on which is loosely mounted a gear 36 meshing with the upper teeth 7*b* of rack 7. Fixed to shaft 35 is a member 37 (Fig. 6) carrying a clutch pawl 38 actuated by spring 39 for cooperation with a clutch tooth 40 fixed to the gear 36. A cam arm 41 pivotally attached at 42 to a fixed part of the machine, cooperates with a roller 43 on the clutch pawl 38 and holds the latter out of cooperative position with respect to the clutch tooth 40 when rack 7 is in extreme right hand position as in Fig. 4*a*. As the rack 7 begins to move to the left with a card, it will cause the gear 36 to rotate clockwise and will also move the abutment stop 44 out of cooperation with a stud 45 carried by the member 41. This will permit the member 41 to rock downwardly which, in turn, permits the clutch pawl 38 to move upwardly.

The timing of the operations of the parts is such that the pawl 38 will engage the clutch tooth 40 before the latter has gone by, and this will cause the clockwise rotation of shaft 35. This will cause gear 34 to rotate clockwise to move the rack bar 32 to the right, carrying the card gripper 31 from its left hand position in Fig. 4 toward the right where it will grip the left end of the card in the position 1*a*.

As the gripper reaches the position with its jaws open over the card, an arm 46 will engage a projection 47 to cause the jaws to close upon the card. At this time, the pawl 16 and toggle arm 21, turning counterclockwise about shaft 9, will engage a stop member 48 and will be turned about their axis 18 (see Figs. 2 and 4*a*). This will lift the pawl tooth 17 out of ratchet 27 and at the same time positively stop the turning of gear 8. Gear 8 which is now free, will be returned in a clockwise direction by a spring drum 49 in which energy was stored during the counterclockwise rotation of the gear. This spring drum will then cause gear 8 to turn in a clockwise direction back to the position of Fig. 4*a*. The operation is under the control of the governor 50. The rack 7 is, of course, also returned to its normal position of Fig. 4*a*. The turning of gear 36 at this time, in a counterclockwise direction, takes place without the operation of the shaft 35 and when the rack 7 reaches its home position, lug 44 (Fig. 6) will engage the pin 45 on arm 41 and will cause the pawl 38 to be moved out of the path of the clutch member 40 so that the shaft 35 may now turn in a counterclockwise direction. Meshing with the rack bar 32 is a gear 51 (Fig. 4*a*) associated with a spring drum 52 and a governor 52*a*; the latter serving to control the speed of the rack when released to jump long distances.

When the grippers 31 grip the card in the position 1*a*, the parts will be held in this position against the tendency of spring drum 52 to return them toward the left, by an escapement device 53. The operation of the rocking member 54 mounted on the rod 55 fixed to armature 56 of the electromagnet 57, will operate the escapement device to permit the rack 32 with the card grippers 31, to move one step or one card column to the left. This will move the card one column with respect to the analyzing brushes 3*a*, 3*b*, etc., after the completion of the analyzing of the column, and the printing under control of the perforations in the column or columns.

The starting of the motor 14 to operate the card feeding devices may be brought about by the closing of electric contacts 91 (Fig. 5) which will be held in closed position by the latch 92. Just as the gear 8 is reaching the end of its counterclockwise rotation, an adjustable stop member 93 carried by the gear, will engage a projection 94 on the latch 92 and will release the contacts 91 so that they may open to break the circuit through the operating motor 14.

The printing device

In Fig. 7, a card is shown with several columns of perforations. As this card is fed column by column through the machine as described, the brushes 3*a*, etc., upon sensing the perforations, will cause the printing of the characters represented by the perforations, at the head of each column as shown at 58. The mechanism for printing these characters is shown in Fig. 3 and

comprises type elements 59 mounted in a rotating type carrier 60 fixedly mounted on a shaft 61. The type elements are held by springs 62 in normal retracted position and are adapted to be actuated by a hammer 63 to impel them against an inking ribbon 64 to print through an opening 65 on the contact strip 4a. This will cause printing in the particular column on the card directly under the contact strip 4a.

As shown in Figs. 4 and 4a, where several rows of brushes 3a, 3b, etc., are employed, there will be as many type wheels or carriers 60 as there are rows of sensing brushes.

The type wheels 60 are constantly rotated and the type elements are struck by the hammer 63 the moment that the desired type element is passing the printing position. The operation is so rapid that the printing may be effected without stopping the type elements. The type hammers are pivoted at 66 and held in their upper position by springs 67. Parallel motion arms 68 are connected to an actuating latch member 69 having a tooth 70 adapted to cooperate with the ratchet wheel 71 which is also constantly turning in a clockwise direction. The operation of the ratchets 71 which are fixed on shaft 72 is effected by a motor 73 having a worm 74 meshing with a worm wheel 75 on shaft 76. This shaft is provided with a bevel gear 77 meshing with a bevel gear 78 on shaft 72. Also fixed on shaft 72 (Fig. 1) is a gear 79 meshing with a gear 80 which in turn meshes with a gear 81 fixed on the shaft 61 which carries the type wheels 60. The latching member 69 (Fig. 3) is normally held out of cooperation with the ratchet 71 by spring 67. Adjacent to the latch 69 is a bell crank member 82 having a spring 83 tending to rock the bell crank 82 against the latch 69 to cause the latter to move into cooperation with the ratchet 71. A latch 84 normally holds the bell crank 82 from actuating latching member 69. The armature 85 of an electromagnet 86 when attracted, rocks about pivot 87 and through link 88, lifts the latch 84 to release the bell crank 82. The bell crank will then be actuated by its spring to move the latch 69 into cooperation with ratchet 71.

A projection 89 on latch 84 may also impart a slight movement to the bell crank 82 to positively move the latter into cooperation with the actuating ratchet. The ratchet 71 will then lift the latch 69, rocking the parallel arms 68 to impel the hammer 63 against the type element 59. The upper end of the latch 69 is adapted to cooperate with a camming surface 90 to be moved out of cooperation with the ratchet 71. This will move the bell crank 82 back to its normal position with respect to latch 84 which by now has been released by the magnet 86 and it will be restored to latching position by spring 83. The pressure of the bell crank 82 against the projection 89, under the influence of the cam 90, will positively insure latching of the bell crank 82, and will also insure a positive knock off of armature 85.

As we have stated, if but one row of sensing brushes 3 is employed in the machine, it will take as many step by step operations to analyze the card and effect printing, as there are columns on the card. If certain columns are now to be analyzed these columns may be skipped. This may be effected by the use of a skip bar 95 fastened to the rack bar 32. A skip arm 96 pivoted at 97a reaches across the bar 95. As long as the arm 96 cooperates with the bar 95 in a depressed portion as at 97, it will have no influence upon the escapement mechanism 53. But as the bar 95 moves to the left with the rack 32, if a raised portion 98 engages the arm 96, it will lift the latter and this, in turn, will lift the escapement pawls out of cooperation with the rack 32 and permit the latter to move to the left until the arm 96 drops into another notch or depressed portion of the bar 95.

In the disclosure of Figs. 4 and 4a, where several rows of sensing brushes 3a, 3b, etc. are employed, it will be recognized that after the carriage has moved say 16 steps to the left, the entire card will have been analyzed, and printing effected. In other words, the carriage will have moved only 16 steps to the left to effect the complete analyzing operation. The carriage may then be released at this point and permitted to escape the rest of the distance to the left. For this purpose, the bar 95 may have a notch 97 corresponding to the travel of the carriage over the 16 columns on the card, at which time the arm 96 will be raised at 98 by the bar 95 to release the carriage. When the card carriage reaches the end of its travel to the left, the arm 46 will strike a stop 99 (Fig. 2) and be slightly rotated to effect the opening of the card grippers 31 to permit the card to drop into the receiving pocket 100. The grippers will remain open until the arm 46 strikes the stop 47 as previously described.

A skip key 101 (Fig. 4a) may be provided to release the carriage at any time to cause it to escape the full distance to the left. This key, when depressed, rocks a lever 102 and lifts the holding pawl 53a of the escapement without causing the stepping pawl to take hold, so that the carriage moves freely under the power of spring 52 and controlled by governor 52a.

Wiring diagram

Referring to Figs. 4 and 4a, it will be seen that when there are cards in the supply magazine, these cards will depress a lever 101a to close contacts 102a. Also when the rack 7 is in its normal position to the right, it will close contacts 103, and when the rack bar 32 and card grippers 31 are in their normal position to the left, they will close contacts 104. This is the position of the parts before the machine is started.

Referring to Fig. 11, closure of the switch 107 will cause the motor 73 to operate and this will cause the type wheels 60 to rotate continuously. By reason of the closed condition of contacts 104, the electromagnet 108 will be energized and will close the lower contacts 109 and also contacts 110. The closed condition of contacts 103 in like manner causes energization of electromagnet 111 to close contacts 112 and contacts 113. Now if the operator depresses the start key 114 to close contacts 115 this will complete the following circuit: from the left side of the line 116, through wire 117, electromagnet 118, wire 119, contacts 115, contacts 109, contacts 112, wire 120, back to the other side of the line 21.

The energization of magnet 118 closes contacts 122 to shunt the circuit away from contacts 115, around through contacts 122, stop key contacts 123, contacts 102a, now closed, to the line 121. Magnet 118 also closes contacts 124 to close a circuit through electromagnet 30, contacts CC6 which are closed by a cam at this time (see Fig. 12) contacts 125 now closed, wire 126, contacts 124, to line 121. We have seen that the armature 29 of this magnet 30 operates arm 26 to throw in the clutch pawl 17. The armature also

actuates a second arm 26a. The clockwise rotation of arm 26a will close contacts 91 which will be locked in this position by the latch 92. Closing of contacts 91 now causes the motor 14 to operate. This will cause the shaft 9 to turn and through the clutch members 17, 27, will cause the feeding of the card from the supply magazine into operating position with respect to the analyzing brushes 3. We are assuming that there is only one row of analyzing brushes 3, i. e., the row 3a and that the brushes 3b, 3c, 3d and 3e are omitted or not in operation. We are also assuming that there is only one printing wheel 60, i. e. the one farthest to the left in Fig. 4 and associated with the column or row of brushes 3a.

The movement of the rack 7 to the left will open contacts 103 and, when it reaches its extreme position to the left, will close contacts 106. Closure of contacts 106 will cause energization of electromagnet 127 to open contacts 125 and close contacts 128 and 129. Magnet 30 is now deenergized, releasing arm 26a so that when the projection 93 strikes the rear portion 94 of latch 92, contacts 91 will open and the motor 14 will be deenergized. The opening of clutch 17, 27 by stop 48 will now permit the spring drum 49 to restore the rack toward the right, again closing contacts 103. The rack bar 32 has moved to the right and gripped the end of the card which has just been fed in and these parts remain in this position, held by the escapement pawl 53a.

The machine will now proceed to analyze the first column, which is under the brushes 3a, and to control printing by the type elements 59 carried by the corresponding type wheel 60. The type wheel is shown as having 36 type elements 59. Corresponding to these 36 type elements are 36 contact segments 130 on a distributing commutator 131. As shown in Fig. 13, the segments 130 are divided into several groups corresponding to the index positions in a column on the record card.

It may be stated here, that if a perforation appears in one of the index positions ranging from 0 to 9 and no other perforation appears in that column, the perforation will represent the particular numeral. If, in addition to a perforation in one of the numeral positions, there is an additional perforation in the X or R or O position, the combination of these perforations will represent one of the characters of the alphabet.

The type elements on the wheel 60 are divided into four groups. The commutator 131 turns synchronously with the operation of the type wheel 60 so that as each type element 59 is passing through the printing position over the ribbon 64, a corresponding one of the segments 130 will be passing over the brush 132. When the particular type element 59 corresponding to the character or value represented by the perforation or combination of perforations in the column is passing through printing position, a circuit will be closed through the printing magnet 86 under control of the distributing commutator 131 to actuate the printing hammer 63 to effect printing of the character. As shown in Fig. 13, all of the four segments corresponding to the index position 9 on the card (one in each group) are connected to each other by bus wires 133 and are, in turn, connected by a wire 134 to a contact ring 135. In like manner, all of the segments 130 corresponding to the index position 8 on the card are interconnected and are connected by wire 136 to another of the contact rings 135. In this manner, all of the segments 130 representing a particular index position on the column of the card are interconnected and connected to one of the several contact rings 135. A separate brush 137 cooperates with each of the contact rings 135. Each of the brushes 137 is connected to a separate one of the analyzing brushes 3 associated with the index positions 1, 2, etc. to 9 on the card.

Referring to the card in Fig. 7, the first column is shown as having perforations in the 1 position and in the R position.

With the card in position for reading and the carriage rack 7 in its restored position, contacts 103 are again closed and magnet 111 reenergized to close contacts 112 and 113. Also with the rack bar 32 standing in position at the right and being held by the escapement pawl 53a, which pawl when in such position permits contacts 138 to close, (see also Fig. 4a). The following circuit will now be closed: from the left side of the line 116, through electromagnet 139, contacts CC7 which according to the timing diagram (Fig. 12) are closed at the beginning of an analyzing cycle, contacts 138 which are closed when the rack 32 is standing still, upper contacts 109, which are closed as long as the rack 32 is out of its home position at the left, contacts 112, now closed, wire 120, back to the line 121. Energization of magnet 139 closes contacts 140, 141, and the circuit through the magnet is now held as follows: from line 116, through the magnet 139, contacts 141, wire 142', contacts CC8 which as shown in the timing diagram (Fig. 12) close a moment after closure of contacts CC7, through wire 120, back to the line 121. Contacts CC10 close according to the timing diagram, at the beginning of the analyzing cycle and a circuit is now completed from the line 116, through contacts 140, contacts CC10, wire 142, plate 4a, the sensing brush 3a' which is in register with the R index position on the card which as we have seen in Fig. 7, is perforated in column 1. Current then passes through magnet R, wire 143, wire 144 and back to the line 121. The energization of magnet R closes contacts 145 to permit closure of the circuit through the printing magnet 86 and through the second perforation in the particular column on the card at a time depending upon the condition of the contacts CC1, and also the closing of the circuit through the particular segment 130. For instance, according to the timing diagram, contacts CC1 are closed during that portion of the sensing and printing cycle, when the first nine type elements are passing through printing position.

During this portion of the cycle, as each type element passes the printing position, a corresponding one of the segments 130 will be passing over brush 132. According to the timing diagram, the segment 130 connected to the 9 position on the card, first passes over the brush 132, then the segment representing the 8 position passes the brush and so on. In the present instance, when the segment 130 corresponding to 1 position on the card passes over the brush 132, a circuit will be completed from the line 116, through contacts 140, contacts CC10, wire 142, brush 132, the particular segment 130, and, through the interconnection shown in Fig. 13, across to the contact ring 135 corresponding to the 1 position on the card, then through the corresponding brush 137, sensing brush $3a^2$ which is in register with the perforation in the card, then through contact plate 4, wire 146, printing magnet 86, contacts 145, contacts CC1, wire 144, back to the line 121. The energization of the

printing magnet 86 at this moment, will as we have seen, referring to Fig. 3, cause the printing hammer 63 to actuate the particular type element 59 to print the character represented by the particular combination of perforations which, in the present instance, is the alphabetic character A.

After the completion of the printing and at the end of the first zone portion of the printing cycle, contacts CC1 open as shown in Fig. 12. Now during the second zone portion of the cycle another one of the segments 130 associated with the 1 index position will cooperate with brush 132 but will not close a circuit through the printing magnet, as the magnet X has not been energized and has not caused closure of contacts 147, although contacts CC2 are now closed. Similarly, during the third zoning portion of the cycle, the magnet O has not been energized and contacts 148 are open, so that although contacts CC3 are now closed, the current cannot pass through the printing magnet.

However, during the fourth zone, when the contacts CC4 are closed, the current would pass through the printing magnet 86 to print the numeral 1 in the absence of provision to prevent this. In the present instance, the operation of the printing magnet under control of any one of the zoning magnets R, X or O will, by operation of the parallel arms 68 in operating the printing hammer 63, close the normally open contacts 149. This is done by the projection 150 carried by the arms 68 (see Fig. 3). The closing of contacts 149 in Fig. 11 closes a circuit through electromagnet 151 as follows: from line 116, wire 117, wire 152, magnet 151, contacts 149, back to the line 121. Contacts 149 are closed momentarily during the printing operation and the circuit through magnet 151 will be held after contacts 149 open, by a shunt circuit which passes through contacts 153 and contacts CC5 which latter are closed throughout the printing cycle. The energization of magnet 151 open contacts 154 so that now when contacts CC4 are closed for the fourth zone portion of the printing cycle and the sensing brush $3a^2$ would otherwise tend to close a circuit through the segment 130 to energize magnet 86, the open condition of contacts 154 prevents this and thus prevents printing of the numeral 1.

After the completion of the printing under control of the perforations in the first column on the card, the escapement 53 will operate to release the rack 32 to permit the card to be fed one column to the left to bring the second column into cooperation with the analyzing brushes $3a$. The escapement is effected by energization of magnet 57 as we have seen. This magnet is energized by the closing of contacts CC9 which in Fig. 12 takes place at the end of the cycle, and after the completion of printing. This permits energization of magnet 57 through the following circuit: from the line 116, through magnet 57, contacts CC9, contacts 141 which are still closed, wire 142', contacts CC8 which are still closed, wire 120 back to the line 121.

While the escapement is taking place under control of magnet 57, contacts 138 are open and are not closed again until the carriage has moved and brought the next column into register with the analyzing brushes. In Fig. 11, it will be seen that contacts 138 are in series with contacts CC7. Contacts CC7 according to the diagram (Fig. 12) close for a short period just before the next printing cycle commences. If the escapement has not been completed before contacts CC7 close, then the printing control circuit through magnet 139 will not be reestablished for that cycle. If, on the other hand, the escapement has been completed and contacts 138 have reclosed, then closure of contacts CC7 will reestablish the circuit through magnet 139.

The reason for the control by contacts 138 is that if the escapement of the carriage is delayed and since the type wheel is constantly rotating, one or more of the type elements may have passed the printing position before it is possible to commence analyzing of the perforations in the next column on the card. Under these conditions, it would not be possible to print the first or second, etc. character on the printing wheel, should the perforations represent one of such characters. Therefore, by providing contacts 138 and contacts CC7, if the escapement has not been completed, then the analyzing and printing cannot commence during the following printing cycle but must skip that cycle and commence in the next cycle later. Having escaped to the second column now, we find a perforation in the R position and in the 3 position. The R perforation will again energize magnet R (Fig. 11) and the perforation in the 3 position will close the circuit as before through the printing magnet 86 at a time with respect to the operation of the type wheel 60, to print the alphabetic character C. After the next escapement, to place the third column in analyzing position, we find that the zoning perforation is in the X position.

This will close a circuit through the magnet X as follows: from the line 116, through contacts 140, contacts CC10, wire 142, sensing brush $3a^3$, zoning magnet X, lines 143, 144, back to the line 121. Magnet X closes contacts 147. Now, during the first zone portion of the printing cycle, no printing circuit will be closed but during the second zoning portion, contacts CC2 will close so that the printing circuit will be closed through contacts 140, CC10, brush 132, the particular segment 130 corresponding to the 4 index position, then through contact ring 135 also corresponding to the 4 index position, the brush 137, corresponding sensing brush $3a$, contact strip 4, wire 146, printing magnet 86, contacts 147, contacts CC2, wire 144, back to the line. This energization of magnet 86 takes place in time to effect the operation of the type element 59 representing the alphabetic character M to print this character.

If there is a perforation in one of the numeral index positions on the card but none in either the X or R or O positions, then none of the contacts 145, 147, 148 will be closed and the circuit through the printing magnet 86 will not be closed until sometime during the fourth zone portion of the printing cycle. During this portion of the cycle, contacts CC4 are in closed position and when the particular segment 130 corresponding to the position of the perforation reaches brush 132, a circuit will be closed through the corresponding one of contact rings 135, contact strip 4, magnet 86, contacts 154, contacts CC4 to the other side of the line. This will print the numeral.

If a perforation appears in the 0 index positions on the card, the resultant energization of electromagnet O will close zone contacts 148, and also contacts 155. Referring to Fig. 13 it will be seen that there is only one O segment 130 which is the last segment on the commutator. Now when this segment reaches brush 132, the circuit through the segment to the O contact ring 135 will pass through contact 155, wire 146, magnet 86, contacts 154, contacts CC4, to the other side

of the line to print 0. This is assuming that there is only a zero perforation in the column. If there is another perforation in one of the numeral index positions, then a circuit will be closed through that particular perforation and through the corresponding segment 130 in one of the earlier zone portions of the printing cycle to effect printing of the corresponding alphabetic character, and as we have seen, such a printing operation will cause the contacts 154 to be opened so that when the fourth zone portion of the cycle is reached, no printing can take place.

If there is no perforation at all in a column, for instance, between the end of a word and the beginning of another word, escapement of the card carriage will take place as usual when the contacts CC9 close.

This will go on column by column until all of the columns on the card have been analyzed and printing effected at the heads of such columns. If several columns are to be skipped, a skip bar 95 (Fig. 4) will bring this about as has been described.

After the card has been completely analyzed and the last escapement takes place, the rack bar 32 will cause closure of contacts 104. At the same time, card grippers 31 will be opened as described to allow the card to drop into the receiving hopper 100. The closure of contacts 104 reenergizes magnet 108, opening the upper contacts 109 so as to interrupt the circuit through contacts 138 and CC7 and magnet 139. This will prevent analyzing and printing operations during the next cycle of the machine while the new card is being fed in. Contacts 110 are also closed by magnet 108 so that as soon as contacts CC6 close, a circuit through magnet 30 will be reestablished through contacts 128 which are being held closed by magnet 127, then through contacts 113 which are closed by reason of the energization of magnet 111 through contacts 103 now in closed position under control of the rack 7, then through contacts 110 which have just closed as we have seen, then through contacts 124, which are held closed by magnet 118, then back to the line 121. The energization of magnet 30 at this time will again close contacts 91 to energize motor 14 and also to cause operation of the clutches 17, 27 to cause the next card to be fed to the machine, and the movement of the rack bar 32 to the right where the grippers 31 will grip the new card as before. After the rack 7 has delivered its card and returned to its normal position to the right, analyzing of the first column on the card will commence as previously described and the machine will again proceed column by column to analyze the perforations and effect printing.

If it is desired to stop the machine at any time, this may be done by depressing the stop key 156 to open contacts 123. This will break the circuit through electromagnet 118 and permit the contacts 124 to open. This, in turn, breaks the holding circuit through magnet 127 so that when contacts CC6 again close, no circuit will be closed through magnet 30. Motor 14 will therefore not be energized to operate the feeding rack 7 or the rack 32. If the supply magazine 2 becomes empty, releasing card lever 101, contacts 102 will open with the same results. However, the repeated energization of magnet 139 is not interrupted, and a card that is in analyzing position continues to be analyzed column by column until work upon that card has been completed, at which time the rack bar 32 has reached the end of its movement toward the left where it will close contacts 104 and the card which has been carried out will be deposited in the receiving hopper 100. Motor 73, of course, continues to operate until the switch 107 is manually opened.

The opening of contacts 124 upon deenergization of magnet 118, and the resultant deenergization of the holding magnet 127 causes contacts 128, 129 to open and contacts 123 to close.

To restart the card feeding operation now, the start key 114 will be depressed closing contacts 115 and reestablishing the circuit through the magnet 118 to close contacts 124. Now, when contacts CC6 are closed, the magnet 30 will become energized as previously described to cause operation of the motor 14 and closing of the clutch 17, 27.

Figs. 10 and 10*a* show the wiring diagram of the machine arranged to operate with the five rows of sensing brushes 3*a*, 3*b*, etc. shown in Figs. 4 and 4*a*. The general control of the machine is the same as disclosed in connection with Fig. 11. For instance, the machine is started by closing switch 107 (Fig. 10*a*). This causes the motor 73 to operate. With the rack bar 32 standing in the position of Fig. 4 with contacts 104 closed, a circuit will be completed through magnet 108 to close contacts 110 and the lower set of contacts 109. Contacts 103 (Fig. 4*a*) are also closed so that magnet 111 is energized to close contacts 112 and 113. The start key 114 will now be depressed to close contacts 115 and this will close a circuit through magnet 118 as previously described and the circuit through this magnet will be held through contacts 122. Now when contacts CC6 close, magnet 30 will be energized and will cause a card to be fed to the sensing brushes as described.

Assuming now that a card is in position to be analyzed, with the first column registering with the brushes 3*a*, the 17th column registering with brushes 3*b*, etc., a circuit will be closed from line 116, through contacts 140 which have become closed by the energization of magnet 139, through contacts CC10 which as we have seen are closed throughout the analyzing portion of the cycle, then through wire 142 to commutator brush 132, and also branching over to the contact strips 4*a* associated with the five rows of brushes. If there is a hole in the O or X or R positions in the card in the first column, the current will pass through the particular brush cooperating with that hole and through the particular magnet R*a* or X*a* or O*a*, and through wires 143, 144, back to the other side of the line 121.

If there is a perforation in one of these three index positions in column 17, then the particular brush 3*b* cooperating with that perforation will close a circuit through its magnet R*b* or X*b* or O*b*. This is so also for the brushes of rows 3*c*, 3*d* and 3*e* and their respective magnets R*c*, X*c*, O*c*, etc.

In Fig. 10, the printing magnets 86*a*, 86*b*, 86*c*, 86*d*, 86*e* are normally disconnected from wires 146*a*, etc., whereas in Fig. 11 magnet 86 is shown permanently connected to wire 146. In Fig. 10 magnet 86*e* is connected to wire 146*e* by a plug connection 157. To associate printing magnet 86*e* with its corresponding sensing brushes 3*e* as is the case in Fig. 11, a plug connection 158 may be used. The return circuit for magnet 86*e* is through contacts 154*e*, contacts 145*e* or 147*e* or 148*e*, through the cam contacts CC3, or CC2, or CC1. In Fig. 7 the first column on the card is shown as being perforated in the R and 1 posi-

tions. Assuming that the column on the card which is cooperating with the row of brushes 3e is punched in these same positions, it will be recognized that the circuit which was traced to the several contact strips 4a will pass through the sensing brush corresponding to the R position, then through magnet Re and back through wires 143 and 144 to the other side of the line. This will close contacts 145e.

We have seen that contacts CC1 are closed for the first zone portion of the sensing and printing cycle according to the timing diagram of Fig. 12, so that now as the commutator 131 and contact rings 135 turn synchronously with the operation of the several printing wheels 60, the circuit which we traced as far as brush 132 will pass through the segment 130 corresponding to the 1 index position; (there are, of course, four such segments and as the contacts CC1 are closed in the first zone portion of the printing cycle the first of the segments will carry the current from brush 132 across to the contact ring 135 of the 1 index position) from here the current passes through the corresponding brush 137, to the 1 analyzing brush 3e, contact strip 4, wire 146e, plug connection 157, printing magnet 86e, plug connection 158, plug connections 166, 167 and contacts 154e, contacts 145e, contacts CC1, to the other side of the line. This will control printing by the particular type element 59 on type carrier 60e, to print the particular character which in the present instance would be the alphabetic character A. This will go on for each successive column on the card in the manner described in connection with Fig. 11.

With the plug connections 157, 158, the printing of a character will be effected at the top of the column containing the perforations. However, the printing magnets 86e, etc. may be connected with other sets of sensing brushes 3a, 3b, etc. so that where one set of sensing brushes 3a, etc. analyze perforations in a particular column, the printing of the character represented by the perforations may be effected in some other column, that is, referring to Figs. 4 and 4a, the brushes 3a may be connected to the printing magnet associated with one of the other printing wheels 60b, 60c, etc. so as to effect printing in the particular column or columns which happen to be associated with these other printing wheels.

Such a plugging connection is illustrated in connection with the sensing brushes 3d, for the purpose of energizing the printing magnet 86c, to effect printing from the wheel 60c. This plug connection comprises a plug wire 159 connected from the plug socket 160 to plug socket 161 associated with printing magnet 86c. Plug socket 162 also associated with printing magnet 86c is plugged to socket 163. This will effect printing in the manner shown in Fig. 8. There the perforations are shown in the columns which will be analyzed by the row of brushes 3a, while the printing of the data represented is effected at the top of the columns associated with the printing wheel 60b. In Fig. 10, the plugging is such that the data represented by perforations in the columns which will be analyzed by the row of brushes 3d will be printed at the tops of the columns associated with the printing wheel 60c. Assuming now that the column of perforations in register with the sensing brushes 3d contains perforations in the R and 1 positions, the current which we have traced to the several contact strips 4a will pass through the R perforation into the corresponding sensing brush 3d, through magnet Rd and back to the other side of the line. This will close contact 145d. Now when the first segment 130 associated with the 1 index position registers with brush 132, the current will pass over into the corresponding contact ring 135, brush 137, corresponding brush 3d, contact strip 4, wire 146d, plug connection 159, printing magnet 86c, plug connection 162d, plug connection 170, contacts 154c, plug connection 171, contacts 145d, which are now closed by reason of the energization of magnet Rd, then through contacts CC1 to the other side of the line.

This then, energizes magnet 86c to actuate the printing hammer associated with printing wheel 60c at the proper time in the cycle to effect printing of the particular alphabetic character which in the present instance is the letter A. In connection with Fig. 11, we have seen that it is necessary to prevent operation of the printing magnet later in the printing cycle under control of the perforation through the numeral index position, (in the present instance the 1 position) which would normally cause printing of the numeral 1 in the fourth zone portion of the printing cycle when the contacts CC4 are closed. In Fig. 11, this is effected by the energization of magnet 151 when the first printing operation is effected to open contacts 154 so that later in the cycle, when contacts CC4 close, the printing circuit cannot be closed. In connection with the printing which we have assumed under control of the plugging 157, 158 in Fig. 10, this prevention of the repeat printing is effected by the opening of contacts 154e.

In the present instance, the operation of the printing magnet 86e and printing from a corresponding type wheel 60e will effect closure of contacts 149e (Fig. 10a) in the same manner that contacts 149 were closed in Fig. 3. This energizes magnet 151e through a circuit from the left side of the line through wire 152, magnet 151e, wire 164, contacts 149e, wire 165, wire 144 and back to the other side of the line 121. Magnet 151e then causes contacts 154e to open as soon as any printing is effected by energization of magnet 86e. Since magnet 86e is connected by plugging 157, 158 with the sensing brushes 3e, the contacts 154e will be plugged by plug connections 166, 167. But where the printing under control of brushes 3d is to be effected through the printing magnet 3c then the control contacts 154c will be plugged to sockets 168, 169 by plug wires 170, 171.

The reason for this particular plugging is that, when printing is effected from the type wheel 60c as we are assuming it is, the contacts 149c will close to energize magnet 151c which, in turn, will open contacts 154c. Thus, after printing has been effected through magnet 86c, when contacts CC4 close, the circuit cannot again be closed through the printing magnets 86c during the fourth zone portion of the printing cycle because of the open condition of contacts 154c. If there had not been any other perforation in the column than the 1 perforation then, of course, printing would not have been effected to print the letter A and as the printing wheel 60c is operating through the fourth zone portion of the cycle, the circuit through the particular segment 130 will energize the printing magnet 86c through plug connection 162d, socket 163, socket 168, plug connection 170, contacts 154c, plug connection 171, socket 169, wire 172, contacts 196d, to the other side of the line, to print the numeral 1.

The contacts 196a, 196b, etc. are all closed by magnet 197 which is energized by closure of con-

tacts CC4. The circuit through contacts CC4 is through contacts 140, magnet 197, contacts CC4 to line 121.

It will, of course, be recognized that instead of plugging to the printing magnet 86c, any other of the printing magnets could be plugged in to effect printing on other parts of the card.

It is also possible to selectively effect printing under certain conditions, controlled by the card, on one part of the card, and under other conditions, on another part of the card. For instance, the machine may be set up to normally analyze perforations in certain columns and print the data represented at the tops of the same columns. But under certain special conditions controlled by a special perforation in the card, the data sensed in certain columns may be printed at the tops of other columns.

In Fig. 9, a card is shown in which a perforation is shown in the X position in the first column. The setting of the machine by plugging is such that the printing of the data represented by the perforations in the next succeeding columns is printed at the tops of different columns as shown. If it is desired to print the data represented by the perforations, at the top of the corresponding columns, then there would not be the X perforation alone in the first column. This column then could, of course, be used for ordinary data by having either a single perforation in one of the numeral positions or a perforation in either the O or X or R position along with a perforation in one of the numeral positions.

In the diagram of Figs. 10 and 10a, the sensing brushes 3b are shown so plugged as to effect printing through the printing magnet 86b and printing wheel 60b, that is, at the tops of the corresponding columns, or through magnet 86a and printing wheel 60a, that is, at the tops of different columns.

The selective printing is controlled through switches 173a, 173b, 173c, etc., which are controlled by electromagnets 174a, 174b, 174c, etc. (Fig. 10a). A switch blade 173a is permanently connected to plug socket 173a' and is normally in contact with contact 173a². Energization of magnet 174a will move the blade into cooperation with contact 173a³.

If the X position alone is not punched in the first column, then the data represented by the perforations will be printed at the tops of the columns containing the perforations. If an X alone is punched in the first column, then the printing will take place in some other position on the card depending upon which of the printing magnets 86 is associated by plugging with the analyzing brushes.

Contact 147b' (Fig. 10) is connected by plug connection 175 to wire 176. If the printing is to be controlled alternatively by magnets 86b and 86a, then these two magnets will be connected by plugging to the switches 173b as shown in Figs. 10 and 10a. The corresponding contacts 154b and 154a will also be connected by plugging as shown to certain of the switches 173b. Now if the first column of the several columns which are to be analyzed by brushes 3b has an X perforation only, as in the case of the first column (Fig. 9), that perforation will be sensed by the X brush cooperating with the strip 4a to energize magnet Xb in the usual manner. This magnet will close contacts 147b' so that when, during that cycle, contacts CC11 close at the time shown in Fig. 12, a circuit will be closed through magnet 174b, from the left side of the line, through wire 152, magnet 174b, wire 177, contacts 154b', wire 176, plug connection 175, contacts 147b', wire 178, contacts CC11 to the right side of the line. Magnet 174b will shift all of the switches 173b from the position shown in Fig. 10a over to the right to open the contacts now closed and close the contacts now open, and also to close contacts 174b². These latter contacts will close the holding circuit through magnet 174b, the current now coming from the left side of the line through wire 152, magnet 174b, contacts 174b², wire 179, contacts 109a, back to the right side of the line. This circuit will be held until contacts 109a open after the completion of the printing operations upon the card. As the columns of the card are now successively analyzed, a perforation in any one of the positions R, X or O will, in the usual manner, close their respective contacts 145b, 147b, 148b to determine which zone portion of the analyzing cycle is to be effective for printing.

The other perforation in the column will be analyzed to close a circuit in the usual manner through brush 132, the particular one of segments 130, the particular contact ring 135 and corresponding brush 137, the particular sensing brush 3b which is in register with the perforation, contact strip 4, wire 146b, then by way of the plug connection 180, to one of the switches 173b, then through plug connection 181, (the switch having been shifted) to the printing magnet 86a, then by plug connection 182, back to one of the switches 173b (also shifted) and through plug wire 183, back to the contacts 145b, 147b, 148b, by way of wire 185, plug connection 186 to one of switches 173b, plug connection 187, contacts 154a, plug connection 188, switch 173b, plug connection 189, back to said contacts 145b, 147b, 148b and through whichever of these contacts have been closed, and the respective set of cam contacts CC1, CC2, CC3, to the other side of the line. The energization of printing magnet 86a will cause printing by the printing wheel 60a (see Fig. 4) although the brushes 3b, normally associated with printing wheel 60b, have sensed the card.

In order to prevent a possible repetition of the operation of the printing hammer during a subsequent zone portion of the same printing cycle, the respective control contacts 154b, 154a will be connected by plugging to switches 173b to provide the circuit which we have just traced.

If there has been printing in the first or second or third zone portion of the printing cycle, then contacts 154a will have opened prior to the beginning of the fourth zone under control of magnet 151a in the manner previously described.

But if no printing had been effected in the first or second or third zone portions of the printing cycle, then during the fourth portion of the cycle, when contacts CC4 have closed, causing closure of contacts 196a, 196b, etc. the current will pass through switch 154a, then by way of plug connection 188 to the side of its respective switch 173b which as we have seen has been closed, then through plug connection 189, back to wire 185a, and through contacts 196b to the other side of the line. Such a circuit will effect printing of a numeral during the fourth zone portion of the printing cycle.

Assuming now that the first column analyzed by the brushes 3b does not have a perforation in the X position alone, but has a perforation in any one of the positions R, X and O and also a perforation in one of the numeral positions, then, al-

though the contacts 147b' may have closed, the printing circuit through the numeral perforation will be closed before contacts CC11 permit closing of the circuit through magnet 174b. Under these conditions, the switches 173b will be in their normal position as in Fig. 10a and the R, X or O perforation having caused closure of one of the contacts 145b, 147b, 148b, the circuit through commutator segment 130 and corresponding numeral brush 3b will pass through plug wire 180 as before to the switch 173b, then through plug connection 190 to the printing magnet 86b and from the other side of this magnet through plug wire 191 to another of the switches 173b and through plug connection 192 back to plug socket 184, wire 185, plug connection 186, switch 173b, plug connection 193, contacts 154b, plug connection 194, switches 173b, plug connection 189, through the contact 145b or 147b or 148b and by way of contacts CC1, etc. to the other side of the line.

Or, if there is no perforation in one of positions R, X or O then, during the fourth portion of the printing cycle, the current upon reaching the plug socket 184 will pass through wire 185, plug connection 186, the respective switch 173b, plug connection 193 to one side of contacts 154b, through said contacts to plug connection 194 to the respective switch 173b and back by plug connection 189 to and through contacts 196b now closed under control of contacts CC4 to the other side of the line.

When one of the magnets 174a, 174b, etc. has been energized to shift all of its switches 173b, etc. we have seen that the circuit through this magnet is maintained through contacts 109a. After work has been completed upon the particular card and the rack 32 reaches the end of its travel toward the left to close contacts 104, magnet 188 will become energized as we have seen, and this will open up contacts 109a to break the circuit through the magnet 174b and the switches 173b will all return to their normal positions.

Sometimes, because of code arrangements, the X position is not available to determine whether printing shall be effected on one part of the card or another. For this reason, the system is capable of employing either the X or the R position to effect this selective printing position control. If the control is to be effected through a perforation in the R position alone, then, instead of making the plug connection 175 between contact point 147b' and wire 176, this plugging would be effected between contact 145b' and wire 176. Now, if the first column to be analyzed by the brushes 3b contains a perforation in the R position only, contacts 145b' will be closed instead of contacts 147b' as previously assumed. Now, when contacts CC11 close a circuit through the particular magnet 174a, 174b, etc. will be closed as described in connection with the X position hole.

If printing is not to be shifted under control of an X perforation only or an R perforation only, and the first column analyzed contains an X position perforation in addition to a perforation in one of the numeral positions, the printing of the corresponding alphabetic character will take place during the second portion of the printing cycle and, since this causes closure of contacts 149b, the contacts 154b' will be opened by magnet 151b so that when contacts CC11 close during the third portion of the printing cycle, as indicated in Fig. 12, the circuit through magnet 174b will be open at the point 154b' so that the switches 173b cannot be shifted.

In Fig. 10, where five sets of sensing brushes 3a, 3b, etc. are employed, it will be noted that there are five corresponding zero rings 135 which are of insulating material throughout their circumferences excepting at certain timed segmental spots O' which cooperate with the zero brushes 137 at the time in the cycle that the zero spot 130 is in cooperation with brush 132. These five spots O' are wired together and connect to the zero segment 130. Each zero printing control circuit extending to a brush 137 is provided with a separate contact 155a, 155b, etc. operated by its respective zone magnet Oa, Ob, etc.

It will be seen that by appropriate plugging, any one of the rows of brushes 3a, 3b, etc. may be connected to any one of the five of the printing magnets 86a, 86b, etc. to effect printing upon any desired portion of the card.

As shown in Fig. 1, the plug connections are made on the plugboard 195.

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:

1. In a printing device, a type wheel having radially disposed type elements, a type actuating hammer reaching past the periphery of the wheel to the interior thereof to actuate the type for effecting printing.

2. In a printing device, a plurality of coaxially mounted type wheels having radially disposed type elements, actuating hammers reaching between the wheels to the interior thereof for actuating the type to effect printing.

3. In an interpreting machine, means for sensing data designations upon a record card, a plurality of printing devices for printing upon different portions of the card, and means controlled by a record designation upon a card for selectively causing one or another of said printing devices to effect printing.

4. In an interpreting machine, a plurality of groups of sensing elements for sensing data designations in columns on a record card, a printing device, means controlled by said sensing elements for causing printing of a character by said device when one of the sensing elements of one group senses a record designation in a column, and means for causing the printing device to print a different character when said one of said elements senses such designation in a column and another of said elements senses a second designation in the same column.

5. In an interpreting machine, means for feeding record cards column by column through the machine, means for sensing designations in the columns of the cards passing through the machine, a printing device controlled by said sensing elements for effecting printing upon the card, means for causing the machine to stop, and means for causing the stoppage of the machine to take place after the completion of the sensing operations upon a card which is being sensed when the stopping means is operated.

6. In an interpreting machine, a continuously

rotating type wheel, means for sensing data designations on a record card, means for feeding cards to said sensing means, means operating synchronously with said type wheel and controlled by said sensing means for effecting printing by said type wheel, and means for preventing operation of the type wheel for printing during a cycle of its operation when the feeding of the card lags.

7. In a machine of the class described, a continuously rotating type wheel having a plurality of groups of type, means for rendering each group of type operative during a different part of the cycle of operation of the wheel, means controlled by a record card for tending to cause operation of a type in each such part of the cycle, and additional means controlled by the card for determining which part of the cycle the type shall be operated in.

8. In a printing device, a type wheel having type elements disposed on its periphery, means for turning the wheel to bring the different elements to printing position, means for sensing successive control positions on a record synchronously with the turning of said wheel and means within the wheel controlled by said sensing means for impelling the type elements to effect printing.

9. In an interpreting machine, means for sensing data designations on record cards, a plurality of differently positioned and constantly rotating type wheels for effecting printing on the cards, means for effecting selective operation by one of said type wheels, and means controlled by said sensing means for timing such operation to determine the value of the character printed.

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