May 5, 1942. W. LANG 2,282,067

PRINTING CONTROL MECHANISM

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FIG. 1.

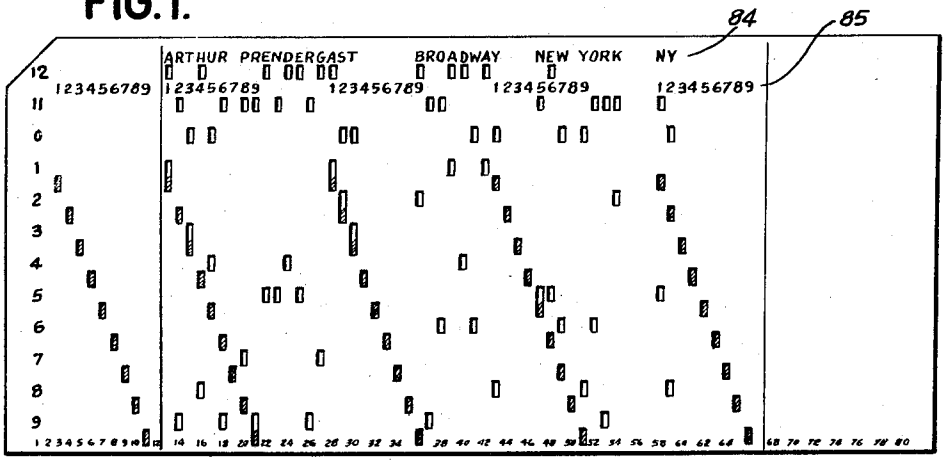

FIG. 3.

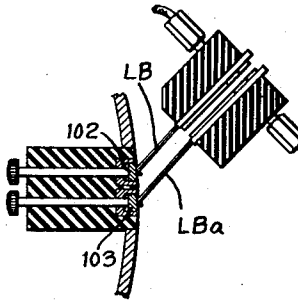

FIG. 2.

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FIG. 4.

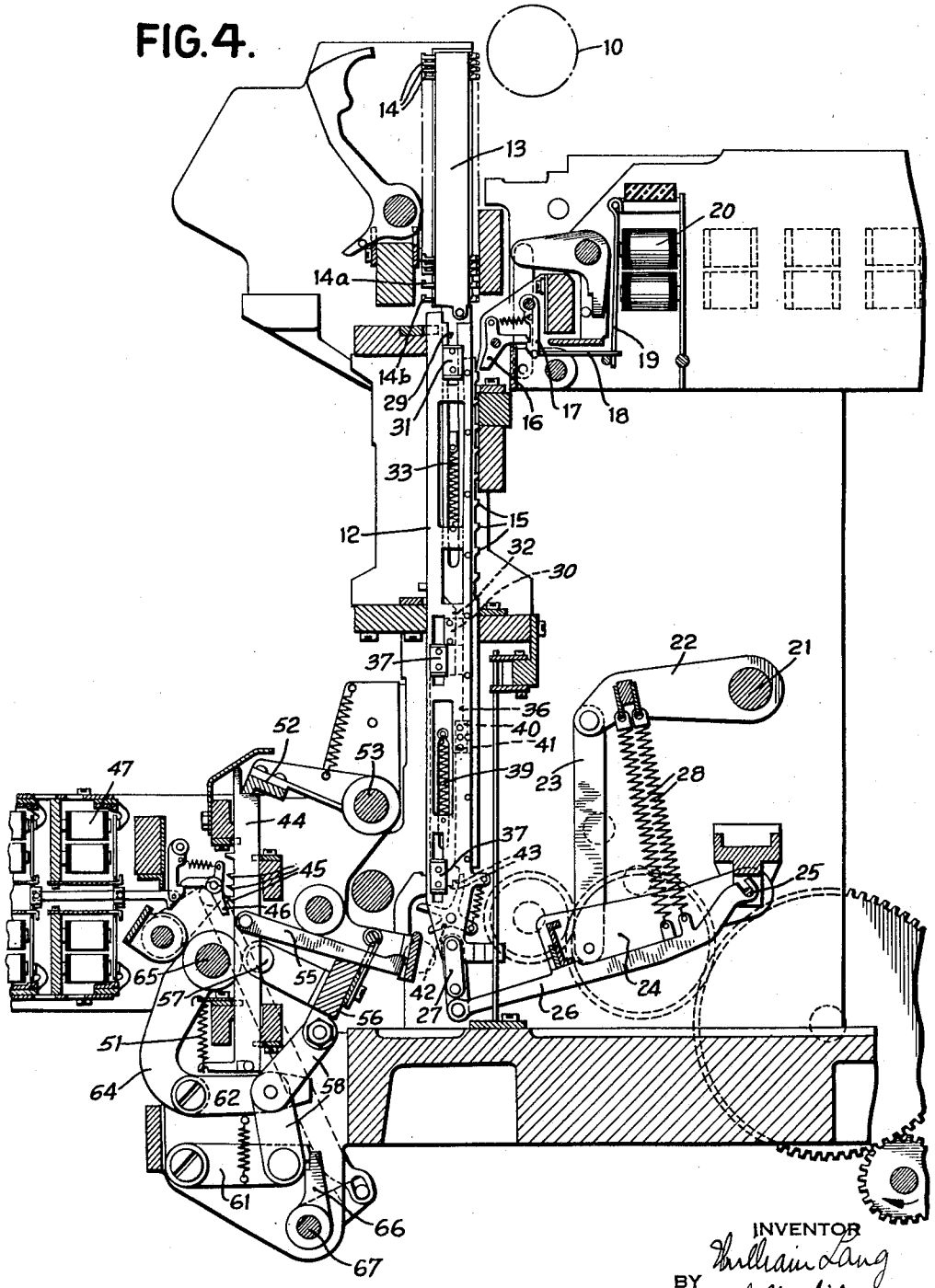

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FIG.5.

ARTHUR PRENDERGAST BROADWAY NEW YORK NY 123456789 123456789

FIG.6.

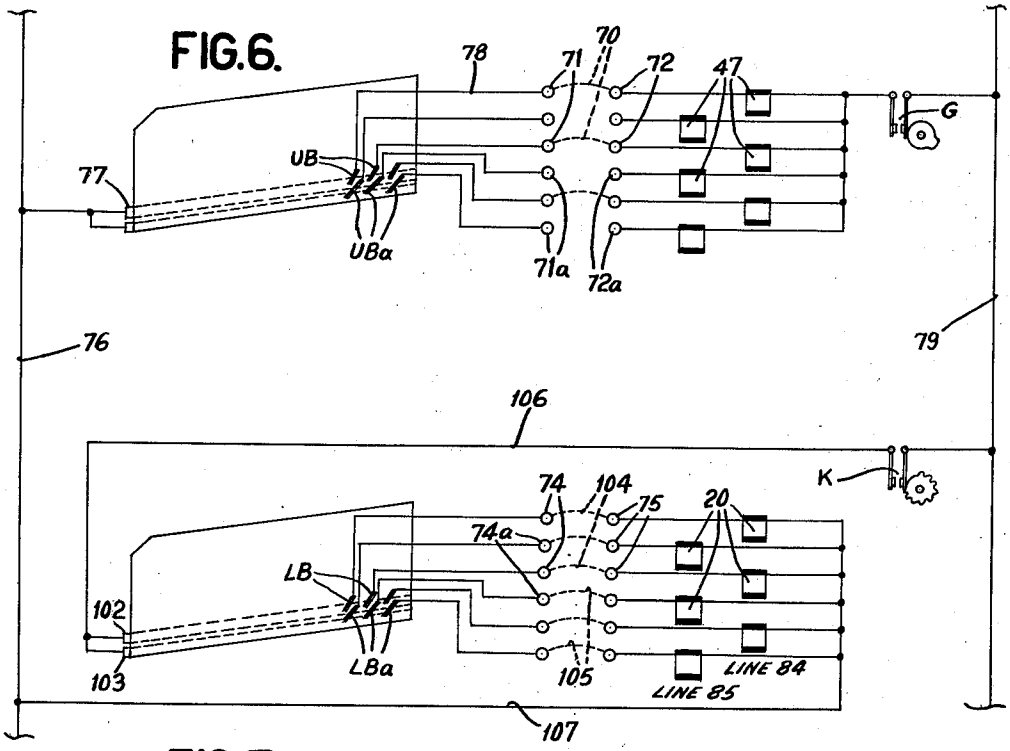
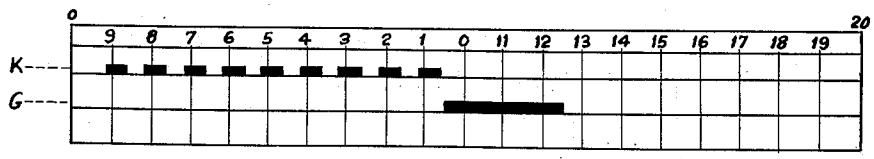


FIG.7.



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2,282,067

UNITED STATES PATENT OFFICE

2,282,067

PRINTING CONTROL MECHANISM

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Application September 20, 1939, Serial No. 295,717

1 Claim. (Cl. 101—93)

This is a continuation in part of my application Serial No. 116,703, filed December 19, 1936, (now Patent 2,195,865, issued April 2, 1940), and the invention relates to record controlled machines and more particularly to machines controlled by perforated record cards of the Hollerith type.

The principal object of the invention resides in the provision of an improved form of sensing means for a record card having increased data receiving capacity.

A more specific object of the invention is to provide improved means for interpreting data representing perforations in my improved record card, said means being in readily applicable form for use in connection with commercial tabulating, printing, sorting, and like accounting machines.

A still further object is to provide means for sensing both entries in a column of a card during a single transit of the column by a sensing station and controlling two separate printing devices, each in accordance with a different one of the two entries.

In carrying out the objects of the invention, one or all of the columns of a Hollerith record card may be doubly punched, once to represent a letter of the alphabet or a digit, and a second time to represent another digit.

The well known Hollerith card usually has alphabetic characters represented thereon by a two-hole code punching, one being made in the "0", "11", or "12" index point positions known as the "zone" positions and the second in one of the digit index point positions "1" to "9". Thus, the letter "A" is represented by holes in the "12" and "1" positions. If it is desired to enter a digit, say, "3", in the column, a hole is punched in the "3" index point position.

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

The invention will be described to show how it may be applied to a printing machine, but it will be apparent that it may with equal facility be attached to other forms of accounting and statistical machines.

In the drawings:

Fig. 1 is a view showing the double-punched record card.

Fig. 2 is a section through the card feeding mechanism of an accounting machine showing the special brushes for sensing the card of Fig. 1.

Fig. 3 is an enlarged detail of one of the brush sensing stations of Fig. 2.

Fig. 4 is a central section of the printing mechanism.

Fig. 5 is a portion of a record printed under control of the double-punched card.

Fig. 6 is a circuit diagram of the invention.

Fig. 7 is a diagram showing the timing of the contacts shown in Fig. 6.

The printing mechanism will first be described to explain the manner in which it is controlled and operated when only a single character is entered in a card column after which it will be set forth how, with the use of the devices constituting the invention, two characters punched in a single column may be concurrently sensed to concurrently control two separate type bars.

The printing mechanism may be of any suitable form, but for convenience may be assumed to be substantially identical with the one described in Patent No. 2,016,682, granted to A. W. Mills, October 8, 1935. It includes the usual platen 10 (Fig. 4) and a number of vertically movable type bar assemblies including carriers 12, slidably mounted on each of which are type heads 13. The purpose of this type of construction will be explained more fully hereinafter. Each type head has type elements 14 adapted to print the numerals 1 to 9 and the letters A to Z. The type elements 14 are arranged in nine groups in the following order from top to bottom in Fig. 4: 9, I, R, Z; 8, H, Q, Y; 7, G, P, X; 6, F, O, W; 5, E, N, V; 4, D, M, U; 3, C, L, T; 2, B, K, S; 1, A, J. Below the type elements 14 are two zero type elements 14*a*, 14*b* referred to hereinafter as the numeral zero and the alphabetic zero, respectively, which are separated from each other by a distance equal to that between centers of three successive type elements 14. The numerical type elements 14 correspond to the usual numerical type elements of a conventional Hollerith type bar, but are spaced far enough apart to make room for three alphabetic type elements between successive numeral type elements.

The numeral type elements are selected for a printing operation in identically the same manner as in conventional Hollerith tabulating machines, for instance, as in Patent No. 1,822,594 under control of a perforation in one of the index point positions 1 to 9 of a record card column. The alphabetic type elements are selected under control of combinations of perforations, each of which may comprise a perforation in one of the

index point positions 0, 11, and 12, with another in the remaining nine index point positions; thus, the letter I of the type group is selected by the combination of a 9 perforation and a 12 perforation in one of the columns of the record card; the letter R by a 9 perforation and an 11 perforation. The entire code is similarly arranged and the particular combinations are as set forth in Patent No. 2,053,243, granted to A. W. Mills on September 1, 1936.

The selection of the alphabetic type elements 14 is effected by arresting each carrier 12 in the appropriate position corresponding to the value of a perforation in index point positions 1 to 9 of the record card and by further movement of the type head 13 relative to its carrier one, two, or three steps according to whether the other perforation of the combination necessary for a selection is in the 12, 11 or 0 positions, respectively.

As a matter of convenience, the four positions of the type elements in each group are termed zones 1, 2, 3, and 4, the numeral type being in zone 1, the letters A to I being in zone 2, the letters J to R in zone 3, and the letters S to Z in zone 4. The 0, 11, and 12 perforations which control the selection of the alphabetic type elements are termed "zone perforations." The mechanism which effects relative movement between each carrier 12 and its type head 13 may be termed the "zoning" mechanism.

Each carrier 12 is provided with a series of stops 15 which represent the corresponding index point positions 0 to 9 on the record card. As the carrier 12 is moved upwardly, the stops 15 move in succession to pass a stopping pawl 16. The latter is held in the position of Fig. 4 by a latch 17 which has connection 18 with armature 19 of the usual printing magnet 20.

When a type carrier is used to print numerals only, it will, of course, be controlled by a single perforation in one of the index point positions 0 to 9, inclusive. In such case, each type head 13 and its carrier 12 is maintained in the relationship shown in Fig. 4, and as the card is passing the lower analyzing brushes, a circuit completed through the perforation in the card will energize the magnet 20 in a well known manner and will effect the release of pawl 16, causing it to engage the stop 15 corresponding in value to the location of the single perforation in the record card column. This operation results in bringing the corresponding numeral type element in the type head 13 to the printing line.

The carriers 12 are moved upwardly by a cam operated shaft 21 which carries arms 22 having depending link connection 23 with a bail 24 pivoted at 25. Also pivoted at 25 are actuating arms 26 which are connected at their free ends to the lower extremity of carriers 12 through link connections 27. Arms 26 are urged in a clockwise direction by springs 28 which are connected at their upper ends to a cross bar secured to arms 22. Thus, as the arms 22 and bail 24 are rocked in a clockwise direction by shaft 21, the springs 28 will rock the arms 26 in the same direction and will cause elevation of the carriers 12.

The manner in which the type bar assemblies comprising carriers 12 and heads 13 are constructed to permit relative movement will now be explained, after which the zoning mechanism whereby such relative movement is effected will be set forth briefly.

The carrier 12 is shown in Fig. 4 as being provided with a slot 29 and a guide 30 which are adapted to receive a slotted block 31 and the lower end 32 respectively of the type head 13, the block sliding within the slot 29 and the lower end 32 sliding in the guide 30. A spring 33 whose lower end is anchored to the carrier 12 is provided at its upper end with a hooked member which engages the lower edge of an opening in the shank of the type head 13, the spring 33 tending to resiliently hold the head 13 in cooperation with the carrier 12.

Mounted upon the lower portion of each carrier 12 is a slide 36 provided with grooved blocks 37 which cooperate with suitable slots in the carrier 12. A spring 39 anchored at its lower end to the carrier 12 and at its upper end to the slide 36 tends to move the slide downwardly to bring a shoulder 40 in the slide into engagement with a bock 41 riveted to the carrier 12. With the parts assembled as in Fig. 4, the spring 39 draws the slide 36 downwardly and spring 33 urges the type head 13 in the same direction so that the lower end 32 thereof engages the slide 36.

It is plain that, if the slide 36 is moved upwardly relative to carrier 12, the head 13 will move likewise.

A spring-pressed latch 42 pivoted at the lower end of the carrier 12 is adapted to cooperate with three shoulder stops 43 formed in the slide 36. When the slide is moved upwardly one or more steps with respect to the carrier, the latch 42 will cooperate with one of the steps 43 to hold the parts in their displaced relationship. The manner in which such displacement is auotmatically effected under control of the zone perforations in the card will now be explained.

Associated with each alphabetic type bar assembly is a vertically slidable comb 44 which is adapted to be moved downwardly and then upwardly during each cycle of the machine. Each comb has a series of three stops or lugs 45 which on the upward movement of the comb passes a stopping pawl 46 in synchronism with the passage of the zone perforations 0, 11 and 12 by the upper analyzing brushes of the machine. Each pawl 46 is controlled by a zone magnet 47, the energization of which operates its armature to release pawl 46, allowing the latter to be moved by its spring into engagement with one of the stops 45. By this action, further upward movement of the comb 44 is prevented for the time being. The combs 44 are moved upwardly by means of a spring 51 and moved downwardly by a bail 52 secured to a shaft 53. The bail engages the upper ends of the combs and moves the latter downwardly whenever the shaft 53 is rocked at the proper time by a suitable cam (not shown).

The comb 44 has pivoted thereto an arm 55 whose free end lies in the path of movement of the associated slider 36 and whose lower edge rests upon a bail 56 which is pivoted at 57. Under control of the zone perforations the pivot point of arm 55 may take one of three positions below that of Fig. 4. In this figure the parts are shown with the comb in the position it assumes when no zone holes are present in the card; that is, when numerals only are to be printed. When the carrier 12 is in its lowermost position, the bail 56 is rocked in a counterclockwise direction to move the arm 55 in a similar direction into engagement with the lower extremity of slide 36. It will be apparent that the distance which the free end of arm 55 is moved

upwardly under control of the bail 56 depends upon the location of the pivot point of arm 55 at such time. Thus, if the pivot point is located as shown in Fig. 4, the free end of arm 55 will be moved upwardly to a position where it barely touches slide 36. A zone perforation in the 0 index point position will result in the movement of the free end of arm 55 three steps upwardly from the position of Fig. 4. A perforation in the 11 position will cause it to move two steps, while a perforation in the 12 position will cause it to move only one step above the position in Fig. 4. These steps of movement are, of course, transmitted to the slide 36 and it, in turn, will be moved upwardly one, two, or three steps in accordance with the setting of the related comb 44, the latch 42 carried by the carrier 12 serving to hold the slide at its displaced position with respect to the carrier.

Bail 56 is actuated through the medium of a toggle mechanism comprising links 58, one of which is pivoted to the bail and the other is pivoted to an arm 61. The point of connection of the links 58 carries an arm 62 which is also pivoted to an arm 64 secured upon a cross shaft 65. The shaft 65 is rocked in a counterclockwise direction once each card cycle by a suitable cam (not shown) thus tending to straighten the toggle comprising links 58.

An arm 66 carried by a rod 67 is adapted to be rocked to the solid line position of Fig. 4 prior to the straightening of the toggle links 58. When shaft 65 is rocked in a counterclockwise direction under control of its cam, the right end of arm 61 will be engaged by arm 66 so that the pivot point of the toggle will be restrained against downward movement and subsequently straightening of the toggle will cause the bail 56 to rock in a counterclockwise direction.

It will be understood from the foregoing description and the more detailed explanation found in Patent No. 2,016,682 that in the case where a perforation occurs in one of the 1 to 9 index point positions only, the mechanism controlled by the zone magnets 47 will not be effective to shift slide 36 relative to carrier 12 and the type assembly will be arrested differentially, purely by the operation of print magnet 20, as in former Hollerith tabulating machines. On the other hand, if a zone perforation also appears in the 0, 11 or 12 positions, the magnet 47 will be effective in conjunction with magnet 20 to control the zoning mechanism, as described, to cause selection of one of the three alphabet type separating numeral type.

Referring now to Fig. 6, the circuits involved when a column contains only a single character will now be described. A plug connection 70 is made between sockets 71 and 72 and a second connection 104 is made between sockets 74 and 75 corresponding to the same card column.

Thereafter, as the card is advanced to pass the rows of sensing brushes LB and UB, a zone selecting circuit will be completed as the "0, "11" and "12" index point positions pass the first set of brushes. This circuit is traceable as follows: from left side of line 76, common contact bar 77, "0", "11" or "12" hole in the card, brush UB, wire 78, socket 71, connection 70, socket 72, zone selecting magnet 47, cam contacts G (closed while position "0", "11" or "12" are sensed) to right side of line 79. Later, as the digit positions pass the brushes LB, a second circuit will be completed as follows: from right side of line 79, cam contacts K, wire 106, common contact bar 102, hole in the "1" to "9" positions, socket 74, connection 104, socket 75, magnet 20, wire 107 to left side of line 76.

These are the usual circuits completed to select an alphabetic character as described above and in the patent referred to. If the column contains only a digit perforation, then, of course, no zone selecting circuit would be completed and the magnet 20 alone would be energized to select the appropriate digit type for printing.

Before describing the mechanism of the invention proper, a detailed explanation will be given of the improved record card to point out the essential characteristics thereof. An example of such a card is shown in Fig. 1 and for purposes of clearness the holes shown in two different manners. The holes having no sectioning relate only to the characters printed on the upper line designated 84 and the holes having section lines therein relate only to the digits printed on the lower line designated 85.

The perforations related to the upper line of printing 84 are made in the normal manner. Those relating to the line 85 are punched in the positions intermediate the normal positions. In Fig. 1, the holes relating to line 85 are sectioned to better distinguish them; where the same digit position is used for both lines 84 and 85, they form a single hole of double length as where "A" and "1" are punched in the same column.

The only change in present machines required to sense the card of Fig. 1 is to substitute for a single line of brushes LB a double line LB and LB*a* as shown in Figs. 2 and 3, each with a separate common bar 102 and 103 respectively. The brushes are spaced a distance apart equal to half the distance between two successive index point positions so that, when brushes LB are on the "9" position related to line 84, brushes LB*a* will be on the intermediate "9" position related to line 85.

Plug connections 104 are then made as in Fig. 6 from sockets 74 connected to brushes LB to sockets 75 of magnets 20 that are to control printing in accordance with line 84 and connections 105 are made from sockets 74 connected to brushes LB*a* to sockets 75 of magnets 20 that are to control printing in accordance with line 85. Contacts K are timed as in Fig. 7 to make as each pair of like item representing holes are at their respective brushes and break between sensing positions.

A similar double brush UB and UB*a* is provided so that the zoning perforations may also be doubled to permit alphabetic data to be represented on both lines 84 and 85 and the brushes connected in the same way as for the lower brushes LB and LB*a*.

In the arrangement shown, provision is made to take care of alphabetic characters in only the upper line as contacts G are timed (see Fig. 7) to be closed during the sensing of the positions 0, 11 and 12, and only one set of sockets 71 (related to brushes UB) or sockets 71*a* (related to brushes UB*a*) may be connected to sockets 72 or 72*a*. However, it is obvious that, if contacts G will be timed to close and open again for each of the zone positions in the same manner as contacts K, then alphabetic designations could be read for both lines 84 and 85. For present commercial purposes, eighty columns of alphabetic data along either the upper line 84 or the lower line 85 are sufficient.

Tracing of an example will make the simplicity

of the arrangement clear. Let us consider the column of the card containing the letter "A" and numeral "1". When the "12" hole of the letter A is at brush UB, a circuit will be completed through the selected zone magnet 47 in the usual manner. When the "1" hole of the letter "A" is at brush LB, the "1" hole of the numeral will be at brush LB*a* and closure of contacts K at this time will complete a circuit from line 79 (Fig. 6), contacts K, wire 106, common 102, brush LB, socket 74, connection 104, socket 75, to magnet 20 of line 84, and wire 107 to line 76. Concurrently a circuit runs from line 106, common 103, brush LB*a*, socket 74, connection 105, socket 75 and magnet 20 of line 85 and wire 107 to line 76. As a result both the letter A and numeral "1" will be concurrently printed when the type hammers are tripped to print each in the column of the report sheet selected to receive the same.

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 claim.

What is claimed is:

In a printing machine controlled by a record card containing a column having a group of spaced index point positions, and a second group of spaced index point positions intermediate the positions of the first set, in which column a designation may be made in each group to represent two separate items, a separate sensing element for each group of index point positions, comprising two stationary contact brushes spaced in the direction of the card column an amount equal to the distance between adjacent index point positions of the two groups, mechanism for moving the card past the pair of contact brushes, devices for controlling the effectiveness of the contact brushes to cause the same to sense the positions of their respective groups in succession, said brushes simultaneously sensing corresponding positions in the two groups, a pair of printing devices, one for each group of index point positions, and means controlled by said brushes for controlling the pair of printing devices during the sensing of the two groups to effect simultaneous operation of said printing devices when a pair of related positions both contain a designation.

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