April 2, 1940. W. LANG 2,195,865

PRINTING CONTROL MECHANISM

Filed Dec. 19, 1936 5 Sheets-Sheet 1

FIG.1.

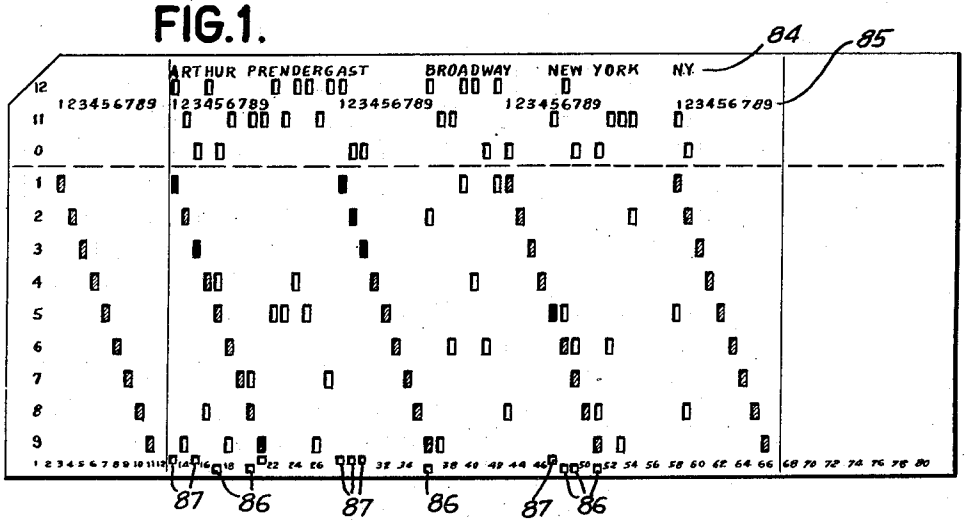
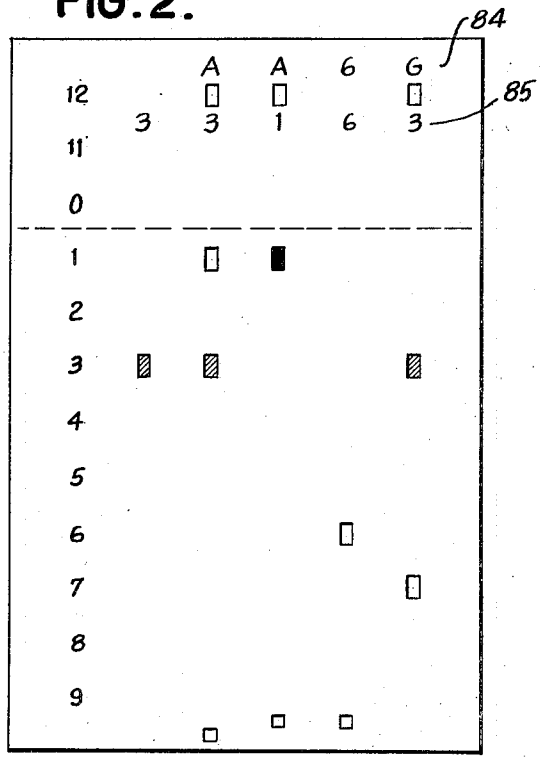


FIG.2.



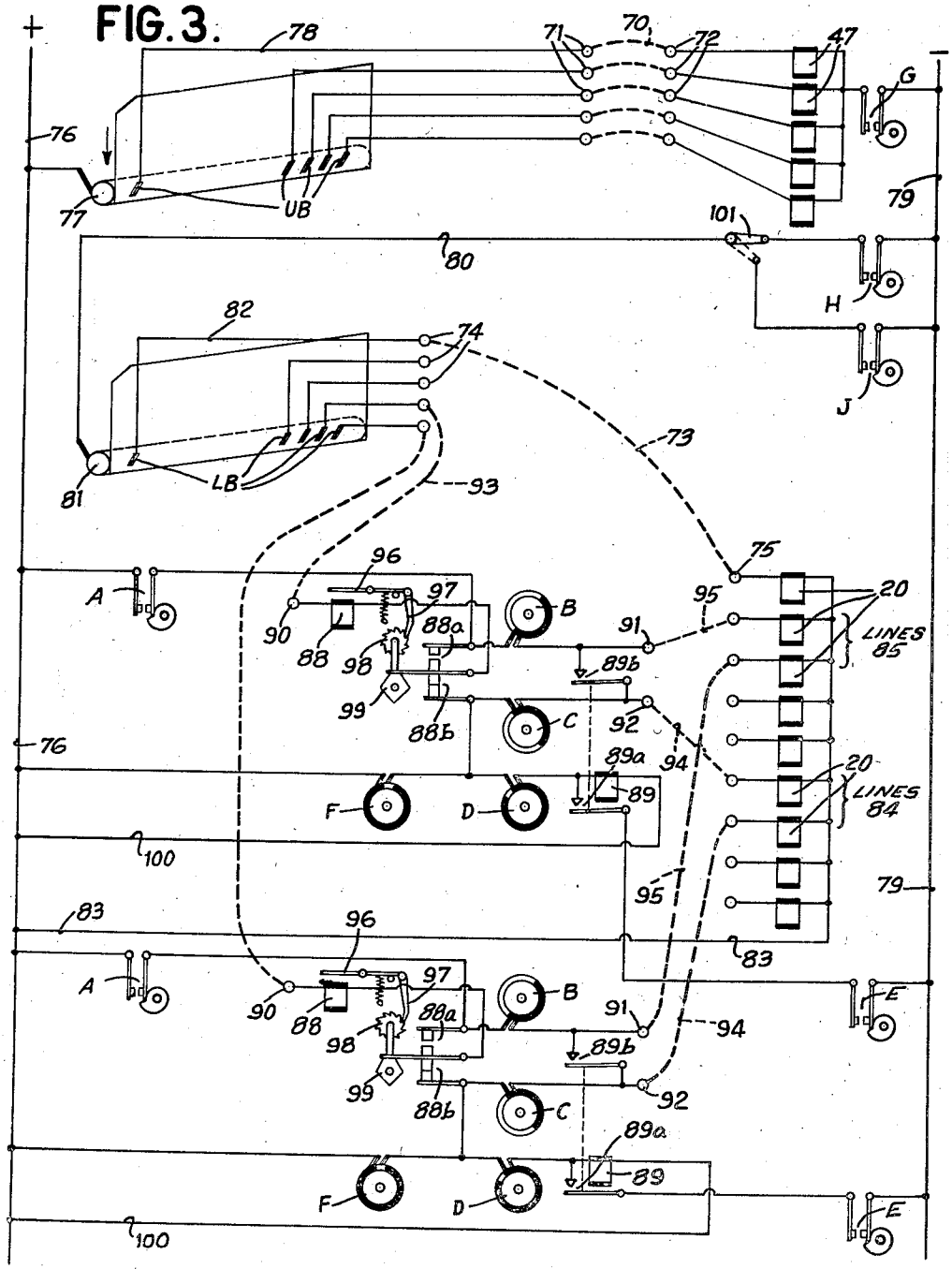
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April 2, 1940. W. LANG 2,195,865

PRINTING CONTROL MECHANISM

Filed Dec. 19, 1936 5 Sheets-Sheet 2

FIG. 3.



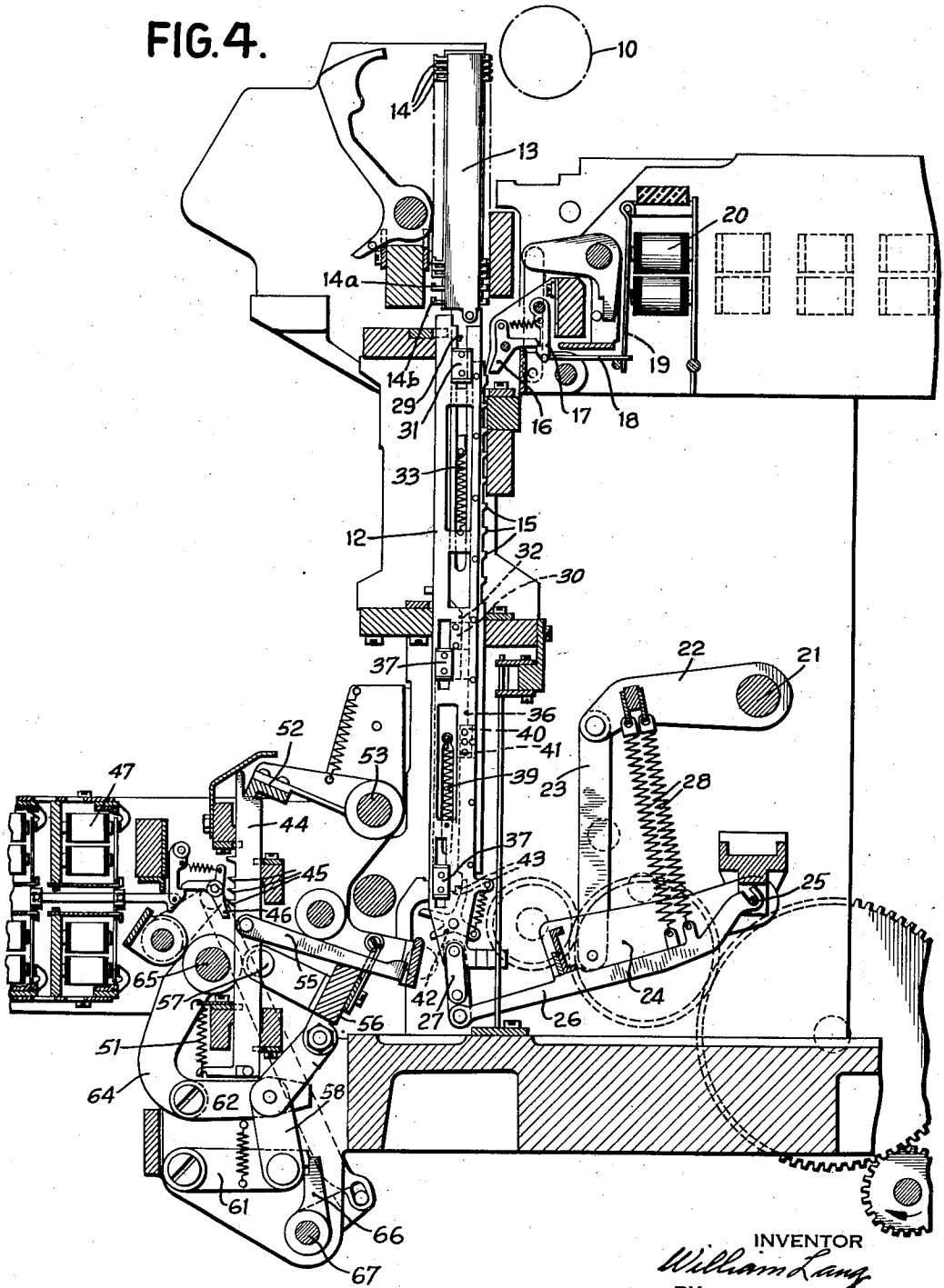
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PRINTING CONTROL MECHANISM

Filed Dec. 19, 1936 5 Sheets-Sheet 3

FIG. 4.



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April 2, 1940. W. LANG 2,195,865

PRINTING CONTROL MECHANISM

Filed Dec. 19, 1936 5 Sheets-Sheet 4

FIG.5.

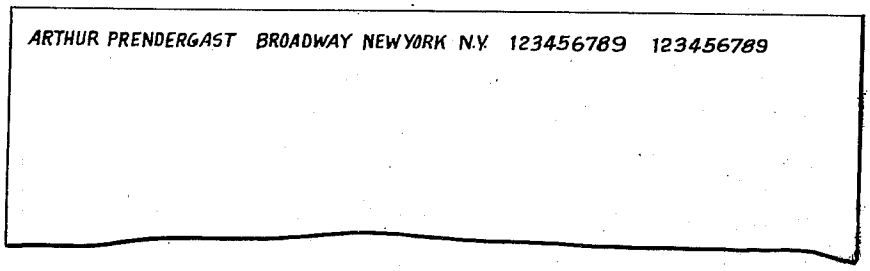


FIG.6.

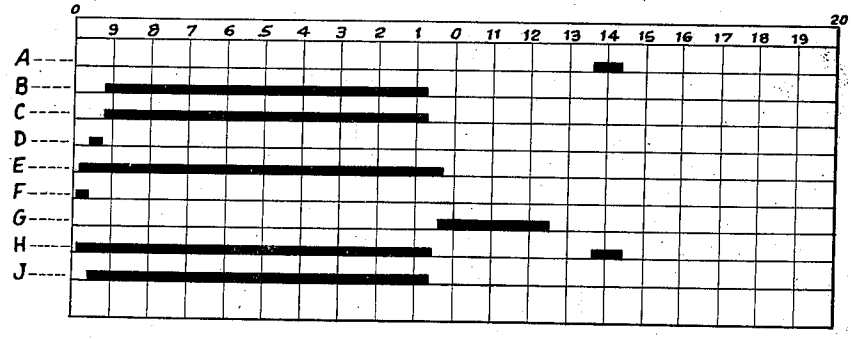


FIG.7.

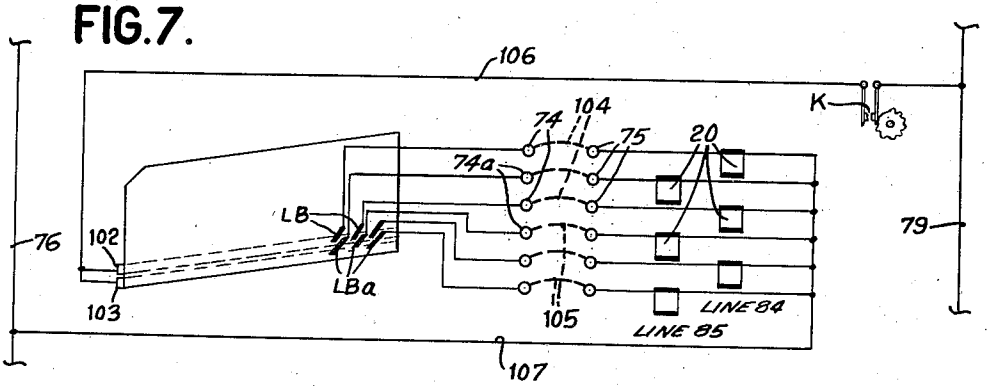
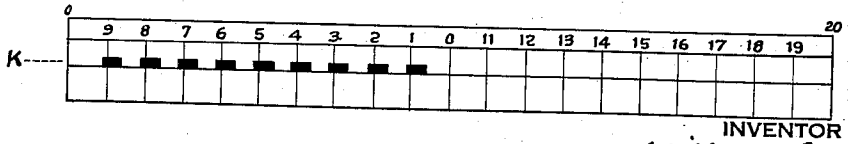


FIG.8.



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April 2, 1940. W. LANG 2,195,865

PRINTING CONTROL MECHANISM

Filed Dec. 19, 1936 5 Sheets-Sheet 5

FIG.9.

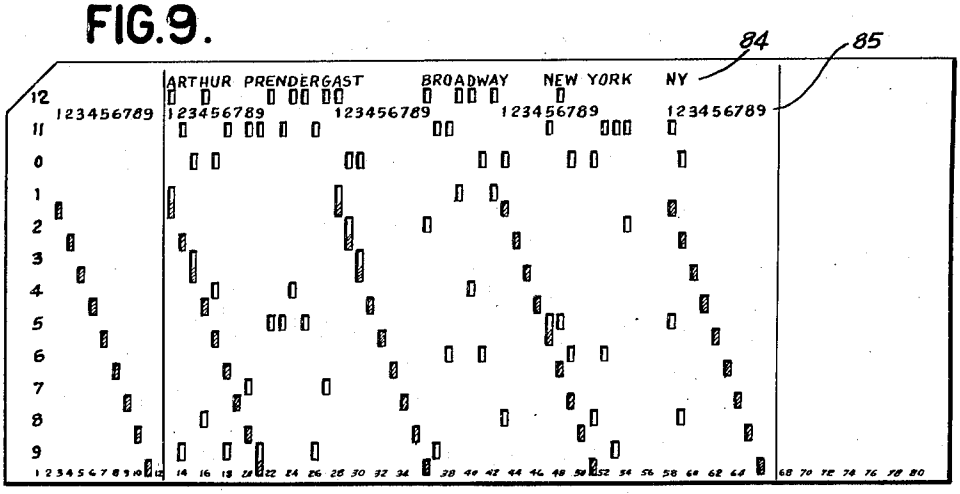


FIG.11.

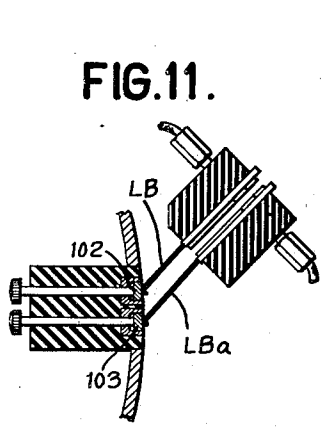


FIG.10.

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Patented Apr. 2, 1940 2,195,865

UNITED STATES PATENT OFFICE

2,195,865

PRINTING CONTROL MECHANISM

William Lang, New York, N. Y., assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application December 19, 1936, Serial No. 116,703

15 Claims. (Cl. 101—93)

This 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 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 the form of an attachment which can readily be utilized in connection with commercial tabulating, printing, sorting, and like accounting machines.

A still further object of the invention is to provide means for sensing and interpreting a column of a record card in which code perforations representing two characters are punched and in which the perforations may occupy any index point position or positions in the column.

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 now it is desired to enter a digit, say, "3" in the same column, a hole is punched in the "3" index point position.

For the purpose of reading this doubly punched column it is necessary to distinguish which digit hole is the companion of the "0," "11" or "12" zone hole. This is effected by providing a key hole made in the margin of the card in line with the perforated column when the digit hole alone is greater than the digit hole belonging to the letter. When the condition is reversed, no key hole is required. A third condition, namely, that in which both digit holes are the same, as where an "A" and a "1" are punched in the same column or two "3's" etc., requires a differently located key hole to identify such condition and control the machine accordingly.

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 attached 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 diagrammatic showing of various punching conditions.

Fig. 3 is a wiring diagram of the essential circuit connections for carrying out the objects of the invention.

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 timing diagram of the circuit closing devices of the circuit diagram.

Fig. 7 is a circuit diagram of a modified form of the invention.

Fig. 8 is a diagram showing the timing of the contacts shown in Fig. 7.

Fig. 9 is a view of a record card punched in accordance with the modified form of the invention.

Fig. 10 is a section through the card feeding mechanism of an accounting machine showing the special brushes for sensing the card of Fig. 9.

Fig. 11 is an enlarged detail of one of the brush sensing stations of Fig. 10.

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 attachment 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 14a, 14b 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 the Patent No. 2,053,243, granted Sept. 1, 1936, to A. W. Mills, Serial No. 701,444, filed December 8, 1933.

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 block 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 automatically 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. 3, 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 73 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 roller 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 H, wire 80, common contact roller 81, hole in the "1" to "9" positions, wire 82, socket 74, connection 73, socket 75, magnet 20, wire 83 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 contained 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 three different manners. The holes having no sectioning or shading relate only to the characters printed on the upper line designated 84. The holes having section lines therein relate only to the digits printed on the lower line designated 85, while the holes that are blackened relate to both upper and lower lines 84 and 85.

In preparing the card, the holes relating to the upper line may first be perforated in the usual manner in any or all of the eighty columns provided. If now additional numerical information is to be entered on the card any or all of the eighty columns are punched again with the desired digit holes just as though the columns had not already received punchings. This gives rise to three distinct conditions of which the mechanism of the invention must take cognizance. The second punching may be greater than, equal to, or less in value than the digit hole already made. If the second hole is greater in value, a key hole 86 is made in line with that column above the leading edge of the card. If the second hole is equal in value, a key hole 87 is made in line with the column intermediate the row of lower key holes 86 and the row of "9" holes. If the second hole is less in value, no key hole is required.

It will be understood, of course, that the punching of key holes is effected only where two separate items are punched in a column and that where only a single item is recorded, whether is corresponds to printing on line 84 or 85, no key holes are necessary.

The several different conditions are shown in the enlarged diagram of Fig. 2. In this figure a "3" is punched in the first column and as this item stands alone, no key punching accompanies it. The second column contains the letter "A" coded as a "12" and a "1" hole and the numeral "3." Since the "3" hole is greater in value than the "1" of letter "A", the key hole 86 is made at

the extremity of the column. The third column contains the letter "A" and a "1." Since the "1" holes coincide, key hole 87 is made. Again, in the fourth column, the numerals in both lines 84, 85 are "6" and key hole 87 is also made. Finally, in the last column a "G" coded as a "12" and a "7" hole and the numeral "3" are entered. Here, since the "7" is of greater value than the "3" no key hole is required.

The interspersed perforations made in accordance with the above described arrangement are to be concurrently read to cause printing on a single line as represented in Fig. 5 with the data shown in line 84 printed in any position of the sheet and the data shown in line 85 printed in any other position, either adjacent to one another or with the characters interspersed according to the manner in which connections are made as will be described.

Referring now to Fig. 3, there is provided for each column from which double punching is to be read a relay and commutator unit comprising a stepping relay 88, pairs of contacts 88*a* and 88*b*, a relay 89, with its contacts 89*a* and 89*b* and commutators B, C, D, and F, timed to electrically connect their related brushes as shown in Fig. 6. Each unit is wired to plug sockets 90, 91, and 92 as shown.

Considering now a single double punched card column, a plug connection 93 is made from the socket 74 of the brush LB that traverses this column and a second plug connection 94 is made from socket 92 to the socket 75 whose magnet 20 controls print selection in the position of the record sheet wherein the character on line 84 is to be printed. A plug connection 70 is also made between the corresponding plug sockets 71 and 72 of this column and position. A further plug connection 95 is made between socket 91 and socket 75 whose magnet 20 controls print selection in the position of the record sheet wherein the character on line 85 is to be printed.

As a preliminary it must be assumed that, as will be later explained, contacts 88*b* are normally closed and contacts 88*a* open, and the operation will be more clearly understood by tracing through specific examples, one for each different condition.

Let it therefore be first assumed that the column to be sensed contains perforations corresponding to a "G" on line 84 and a "3" on line 85 as in Fig. 2. As the "0," "11" and "12" positions pass brushes UB, the zoning magnet 47 is energized through the circuit traced above in the position in which "G" is to be printed. As the card passes the lower brushes and when the "7" hole is sensed, a circuit is completed as follows: from line 79, contacts H, wire 80, common contact roller 81, "7" hole, brush LB, socket 74, connection 93, socket 90, stepping relay 88, contacts 88*b*, brushes of commutator C (now electrically bridged, see Fig. 6), socket 92, connection 94, socket 75, magnet 20, wire 83 to line 76. Energization of magnet 20 at the "7" time in conjunction with the zone selection by the "12" hole will position the selected type bar to print the letter G.

Energization of relay 88 will rock its armature 96 and raise pawl 97 to engage the next tooth of ratchet 98 which has connected to it an alternating cam 99. As the "7" hole passes brush LB the circuit just traced is broken and pawl 97 descends under the influence of its spring and advances ratchet 98 to turn cam 99 a tenth of a revolution so that one of its high points lies under the center blade of contacts 88*a*, 89*b* causing closure of the former and opening of the latter. This, in effect, switches the circuit connections so that as the card proceeds to pass brushes LB a circuit will be completed when the "3" hole arrives at the brushes which is traceable as follows: from line 79, contacts H, wire 80, common contact roller 81, "3" hole, brush LB, socket 74, connection 93, socket 90, relay 88, contacts 88*a*, brushes of commutator B, socket 91, connection 95, socket 75, magnet 20 selected to print from line 85, wire 83 to line 76.

Relay 88 by its inclusion in the print selecting circuit thus normally causes the first hole sensed by the lower brushes to print in the position selected to receive the item relating to line 84 and upon completion of the first circuit to effect switching so that the second circuit will control printing in the position selected to print the item relating to line 85. Incidentally, the second energization of relay 88 will cause further stepping of cam 99 to again close contacts 88*b* and open contacts 88*a*.

Let us consider now a second example wherein the hole relating to line 85 is greater and key hole 86 is present. Since the zoning operation under control of brushes UB is the same for all conditions, it need not be described again and the operation as regards the sensing by the lower brushes LB only will be set forth. At the moment the hole 86 is at the lower brushes, commutator F connects its brushes and permits completion of a circuit from line 79, contacts H, wire 80, common contact roller 81, key hole 86, brush LB, socket 74, connection 93, socket 90, relay 88, contacts 88*b*, brushes of commutator F to line 76. Relay 88 thereupon causes shifting of contacts 88*a*, 88*b* so that now when the "3" hole arrives at the brush LB the first printing circuit will be completed through contacts 88*a* to energize magnet 20, related to line 85 and the contacts will thereafter be again shifted so the second printing circuit through the "1" hole will be through now closed contacts 88*b* and the magnet 20 related to line 84 will, in cooperation with its zoning magnet, select the letter "A" for printing.

For this condition, therefore, magnet 88 will have been energized three times so that contacts 88*b* are open and must be returned to normal closed position before the next card is sensed. For this purpose, contacts "A" are provided which close at the time indicated in Fig. 6 completing a circuit from line 76, contacts A, contacts 88*a* (now closed), relay 88, socket 90, connection 93, socket 74, brush LB, contact roller 81 (there being no card between the brushes and roller at this time), wire 80, contacts H to line 79. Energization of relay 88 will thereupon restore its contacts 88*b* to normal closed position. It may be observed that closure of contacts H at this time will complete circuits to all magnets 20 connected to single item card columns through connections 73. The time of such circuit completion is, however, before the magnet armatures are mechanically restored so that this energization has no effect.

There remains now the third condition wherein both items are represented by the same digit hole, for example, "A" and "1" in Fig. 2. As this column has its key hole 87 presented to brush LB, commutator D bridges its brushes and a circuit is completed from line 79, contacts H, wire 80, roller 81, key hole 87, brush LB, socket 74, connection 93, socket 90, relay 88, contacts

88b, brushes of commutator D, relay 89, wire 100, to line 76. Relay 89 closes its contacts 89a and 89b, the former setting up a holding circuit for the relay traceable from line 76, wire 100, relay 89, contacts 89a, contacts E to line 79. Also as a consequence relay 88 will cause closure of contacts 88a. Thereafter when the "1" hole arrives at brush LB the print selecting circuit will follow from brush LB to socket 74, connection 93, relay 88, contacts 88a, brushes of commutator B, socket 91, connection 95 to socket 75 and magnet 20 related to line 85. The circuit will also follow a branch from the brushes of commutator B, through contacts 89b, socket 92, connection 94 to socket 75 and magnet 20 related to line 84. In this manner, the single hole will concurrently energize both connected magnets.

A switch 101 is provided, which when moved to its dotted line position cuts out contacts H and substitutes contacts J which do not close at the resetting time of relay 88. Such shifting of the switch 101 is effected when cards without interspersed punching are run through the machine and eliminates the consequent idle operation of the magnets 20.

Modification

A modified form of record card in which two items are recorded in a single column with interspersed perforations is shown in Fig. 9 and sensing means therefor in Fig. 10.

In this case, the perforations related to the upper line of printing 84 are made in the normal manner. Those relating to the line 85 instead of being made in the same index point positions are punched in the positions intermediate the normal positions. In Fig. 9, the holes relating to line 85 are sectioned to better distinguish them and where in the main form of Fig. 1 two holes coincided, they now form a single hole of double length and no key holes are required.

The only change in present machines required to sense the card of Fig. 9 is to substitute for the single line of brushes LB a double line LB and LBa as shown in Figs. 10 and 11 each with a separate common bar 102 and 103 respectively. The brushes as 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 LBa will be on the intermediate "9" position related to line 85.

Plug connections 104 are then made as in Fig. 7 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 LBa to sockets 75 of magnets 20 that are to control printing in accordance with line 85. Contacts K are timed as in Fig. 8 to make as each pair of like item representing holes are at their respective brushes and break between sensing positions.

If a similar double brush UB and UBa is provided, 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 LBa.

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 "1" hole of the letter "A" is at brush LB, the "1" hole of the numeral will be at brush LBa and closure of contacts K at this time will complete a circuit from line 79 (Fig. 7), 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 LBa, socket 74, connection 105, socket 75 and magnet 20 of line 85 and wire 107 to line 76.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to two modifications, it will be understood that various omissions and substitutions and changes in the forms and details of the devices illustrated and in their operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is as follows:

1. In a record controlled printing machine having means for moving a record card to pass a sensing station, said record card having a column of index point positions, said column having two differently located perforations therein, representing two different items, a sensing element at said station, a pair of printing devices, means operative when said sensing element senses one of said perforations for causing operation of one of said devices, a relay, circuit connections, and means including said relay and circuit connections conditioned by said sensing element in response to and as a result of said sensing operation for causing operation of the second device when the second perforation is sensed by said sensing element.

2. In a machine controlled by a record card column having index point positions in any two of which a perforation may be made, a single element for sensing said positions in succession, a pair of print controlling magnets, a partially completed circuit path for one of said magnets, means including a relay controlled by said sensing element for completing said circuit path upon sensing the first of said perforations and partially establishing a circuit path for the second magnet and means controlled by said sensing element for completing said second path upon sensing the second perforation.

3. In a machine of the class described, a record sensing device, a plurality of print controlling magnets, means normally connecting said device to one of said magnets, said connecting means including shifting mechanism, and means controlled by said sensing means upon sensing a perforation in a record column for causing operation of one of said magnets through said normal connecting means and concurrently operating said shifting mechanism to disconnect said sensing means from the normally connected magnet and connect it to another magnet.

4. In a printing machine, single sensing device for successively sensing a plurality of perforations in a record card column, a pair of like print controlling devices, and means operated under control of said sensing device for causing said controlling devices to be alternately controlled, each in the same manner, by the sensing device for each successively sensed perforation.

5. In a printing machine, a sensing device for successively sensing a plurality of perforations in a record card column, a pair of like print controlling devices, means normally effective for connecting one of said print controlling devices to said sensing device for control thereby upon sensing the first perforation and thereafter con-

necting the second print controlling device to said sensing device for control thereby in the same manner upon sensing a second perforation and thereafter restoring the connection to initial condition so that a third perforation sensed will control the said first print controlling magnet.

6. In a machine of the class described, means for sensing a column of a record card having index point positions in which combinational perforations are made to represent an alphabetic character and in which a perforation in any one of the same index point positions is made to represent, in addition, a numeral, alphabetic printing mechanism, numerical printing mechanism, and means controlled by said sensing means during a single sensing of said card column for controlling the operation of said printing mechanisms each in accordance with the value of its related character.

7. In a printing machine responsive to records having columns of index point positions, a sensing element for successively sensing a plurality of perforations in a column, a plurality of printing devices, means controlled by said element upon sensing each perforation for controlling one of said devices and concurrently selecting another device.

8. In a record controlled machine, controlled by a card having a column of equally spaced index point positions, there being one position for each of the digits, and in which column two different digits may be represented, each by a perforation in its related index point position, in combination with a single element for sensing said column of index point positions in succession, a pair of print controlling devices, a pair of circuit connections between said sensing element and said devices, a relay mechanism, and means including said relay mechanism controlled by said sensing element for causing operation of one of said devices through one of said connections when a single digit is represented in the column and for causing operation of both of said devices through both of said connections when two digits are represented.

9. In a record controlled machine, controlled by a card having a column of equally spaced index point positions, there being one position for each of the digits, and in which column two different digits may be represented, each by a perforation in its related index point position, in combination with a single sensing element for sensing said column of index point positions in succession, a plurality of printing devices, a pair of circuit connections between said sensing element and said printing devices, a relay mechanism, and means including said relay mechanism controlled by said sensing element during a single sensing of said column of positions for causing an operation of a different printing device, each through a different one of said pair of circuit connections for each perforation sensed by said element.

10. In a record controlled printing machine, means for sensing a column of a record card having a single set of digit representing index point positions in which a perforation is made to represent a digit and in which a second perforation is made in any other of the same index point positions to represent, in addition, another digit, a pair of printing mechanisms, a pair of circuit connections between said sensing means and said printing mechanisms, a relay mechanism including said relay mechanism controlled by said sensing means during a single sensing of said card column for controlling the operation of said pair of printing mechanisms through said circuit connections, each in accordance with the value of one of said digits.

11. In a machine responsive to records having columns of index point positions, a sensing element for successively sensing a plurality of perforations in a column, a plurality of entry receiving devices, means controlled by said element upon sensing each perforation for controlling one of said devices and concurrently selecting another device.

12. In a machine responsive to records having columns of index point positions, a sensing element for successively sensing a plurality of digit representing perforations in a column, a plurality of entry receiving devices, a switching device intermediate said sensing element and said devices, said sensing element, upon sensing each perforation, causing control of one of said devices through said switching device in accordance with the digital value of the perforation sensed and concurrently causing the selection of another device.

13. In a record controlled machine, controlled by a card having a column of equally spaced index point positions and a special key position, there being one index point position for each of the digits, in which column two different digits may be represented, each by a perforation in its related index point position and two like digits may be represented by a single perforation in the related index point position accompanied by a perforation in said key position, in combination with a single sensing element for sensing said positions in succession, a pair of entry receiving devices, and means controlled by said sensing element when two different digits are represented in a column for causing operation of each device, each in accordance with one of said digits, said means being controlled by said element when two like digits are represented in a column for causing concurrent operation of both devices in accordance with said like digits.

14. In a machine of the class described, controlled by a card having a column of index point positions in which column two different digits are represented by two differently located perforations in different index point positions and two like digits are represented by a single perforation, in combination with sensing means for successively sensing the perforation positions in said column, a pair of entry receiving devices and means controlled by said sensing means when a perforation representing two like digits is sensed for causing concurrent operation of both said devices in accordance with the value of the like digits.

15. In a machine of the class described, means for sensing a column of a record card having index point positions in which combinational perforations are made to represent an alphabetic character and in which a further single perforation is made to represent, in addition, a numeral, said numeral representing perforation lying intermediate the two alphabetic representing perforations, alphabetic printing mechanism, numerical printing mechanism, and means controlled by said sensing means during a single sensing of said card columns for controlling the operation of said printing mechanisms each in accordance with the value of its related character.

WILLIAM LANG.

CERTIFICATE OF CORRECTION.

Patent No. 2,195,865. April 2, 1940.

WILLIAM LANG.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, second column, line 61, claim 4, before the word "single" insert --a--; page 6, first column, line 74, claim 10, before "including" insert --and means--; 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 14th day of May, A. D. 1940.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)

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