July 10, 1934. C. D. LAKE 1,965,980

PRINTING MECHANISM

Filed Sept. 29, 1932 7 Sheets-Sheet 1

FIG.1.

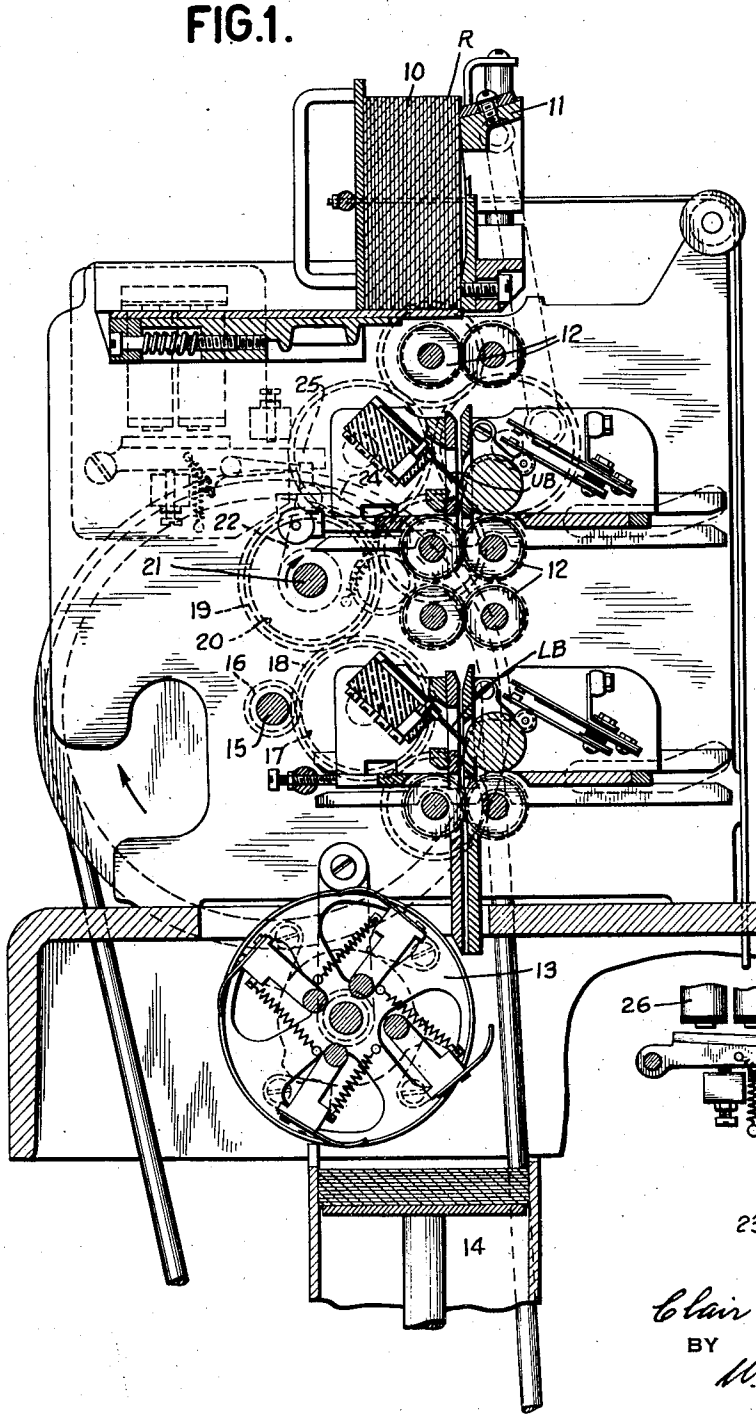
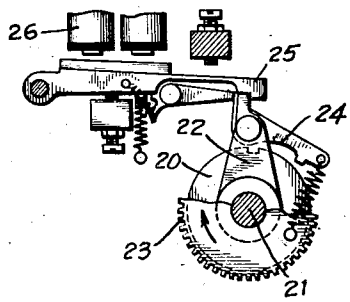


FIG.2.



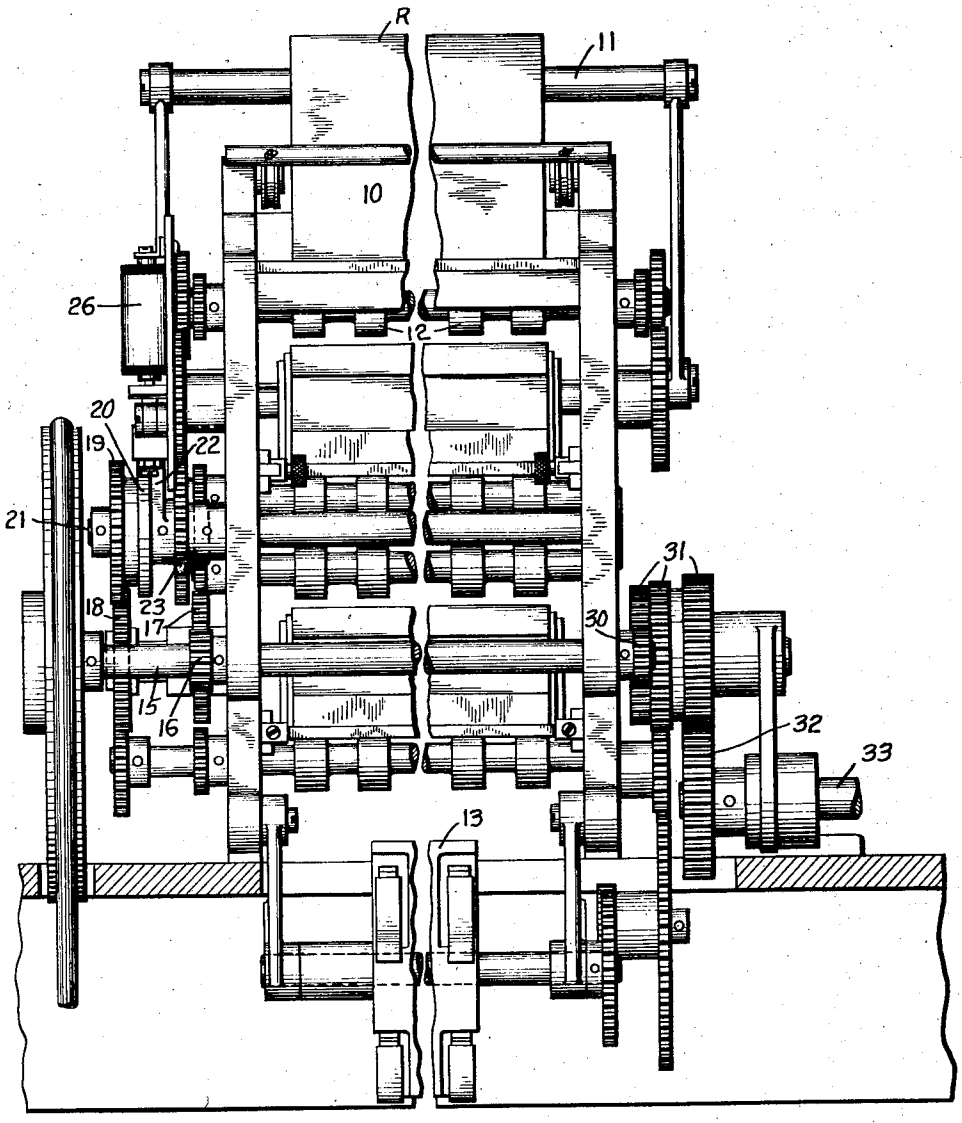
INVENTOR
Clair D. Lake
BY
W. M. Wilson
ATTORNEY

July 10, 1934. C. D. LAKE 1,965,980

PRINTING MECHANISM

Filed Sept. 29, 1932 7 Sheets-Sheet 2

FIG. 3.



INVENTOR
Clair D. Lake
BY
W. M. Wilson
ATTORNEY

July 10, 1934. C. D. LAKE 1,965,980

PRINTING MECHANISM

Filed Sept. 29, 1932 7 Sheets-Sheet 3

FIG.5.

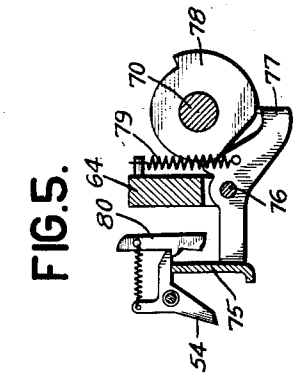


FIG.4.

INVENTOR
Clair D. Lake
BY
W. W. Wilson
ATTORNEY

July 10, 1934. C. D. LAKE 1,965,980

PRINTING MECHANISM

Filed Sept. 29, 1932 7 Sheets-Sheet 4

FIG.4a.

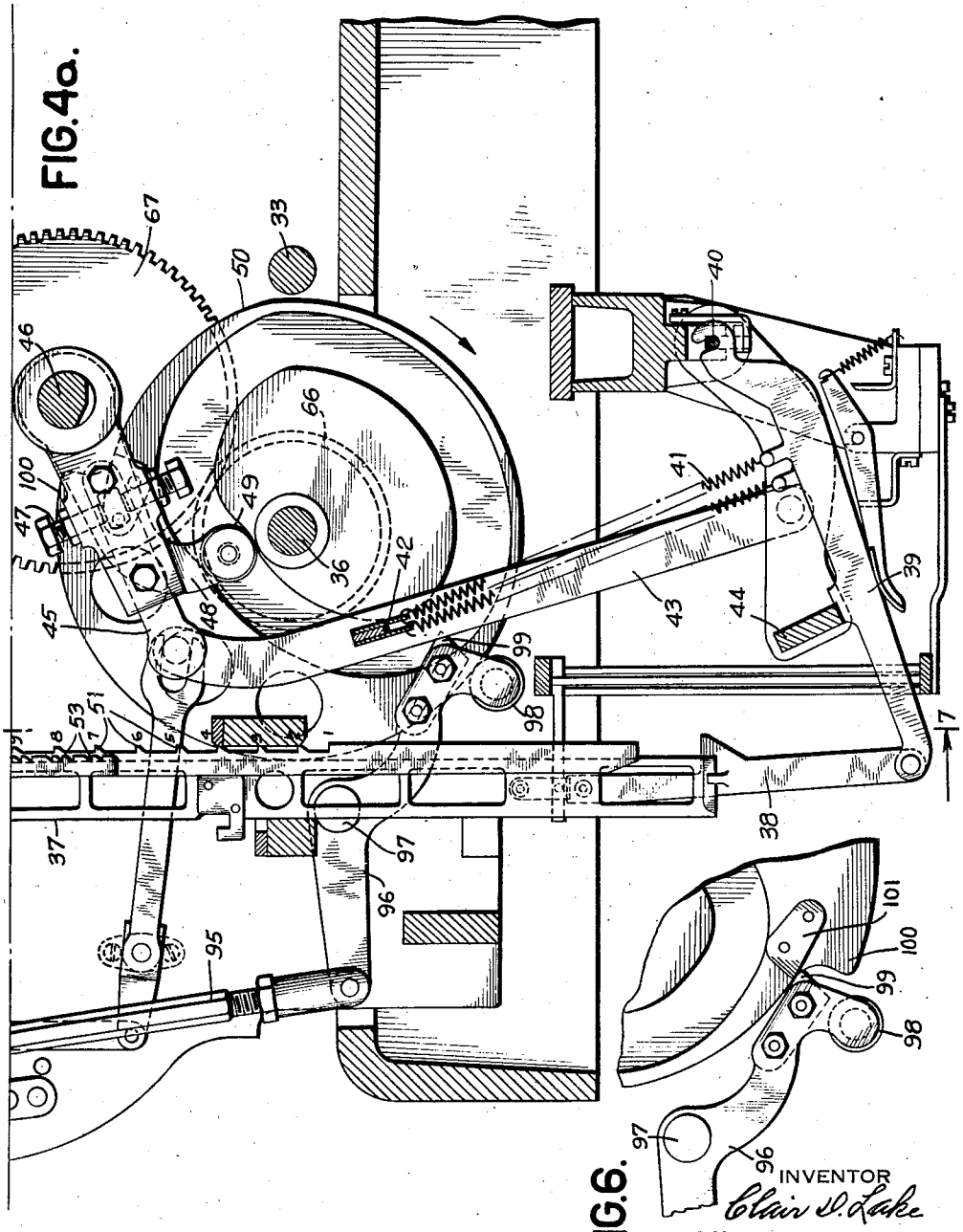


FIG.6.

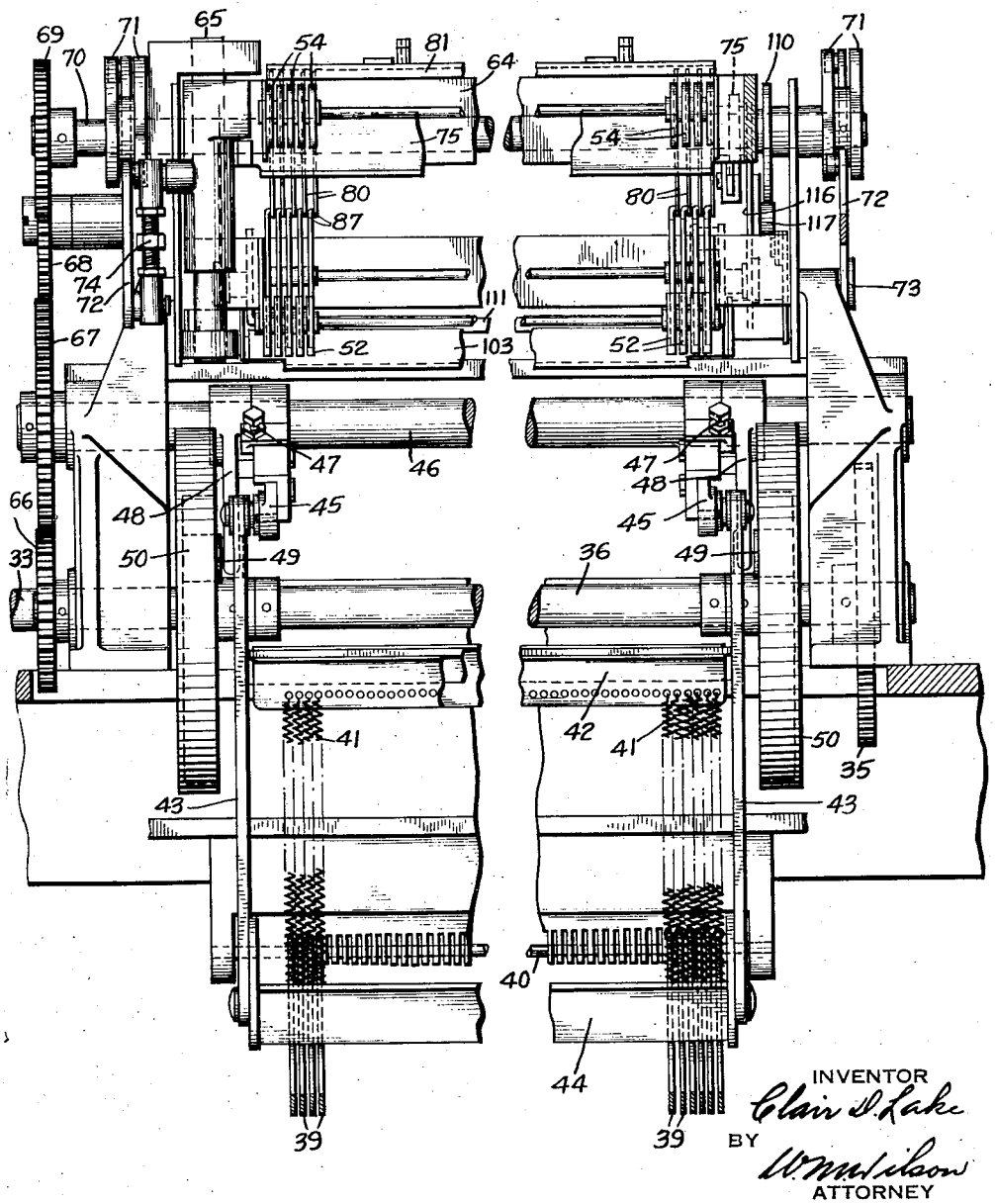
INVENTOR
Clair D. Lake
BY
W. M. Wilson
ATTORNEY

July 10, 1934. C. D. LAKE 1,965,980

PRINTING MECHANISM

Filed Sept. 29, 1932 7 Sheets-Sheet 5

FIG.7.



INVENTOR
Clair D. Lake
BY
W. M. Wilson
ATTORNEY

July 10, 1934. C. D. LAKE 1,965,980

PRINTING MECHANISM

Filed Sept. 29, 1932 7 Sheets-Sheet 6

FIG.8.

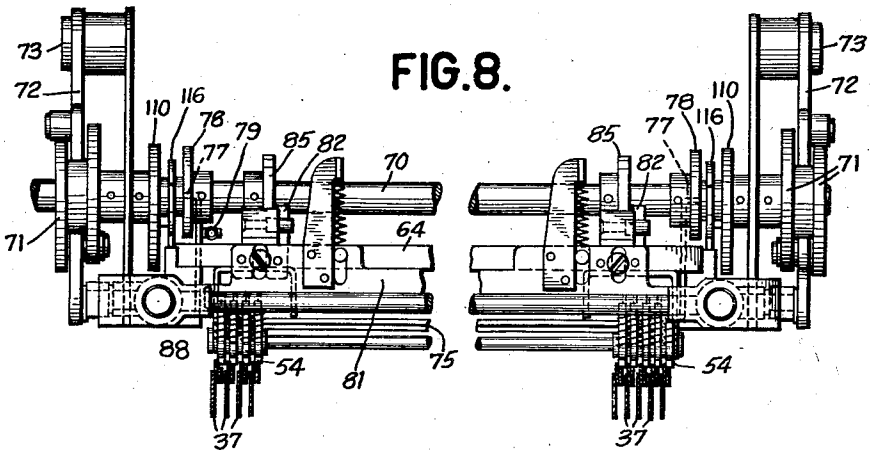
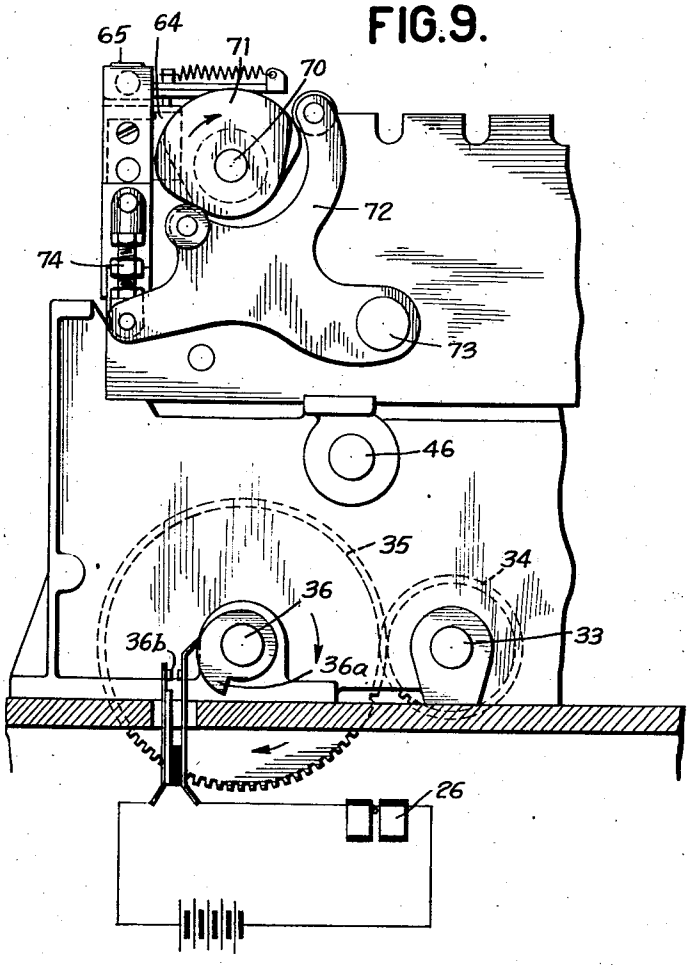


FIG.9.



INVENTOR
Clair D. Lake
BY
W. M. Wilson
ATTORNEY

July 10, 1934. C. D. LAKE 1,965,980

PRINTING MECHANISM

Filed Sept. 29, 1932 7 Sheets-Sheet 7

FIG.11.

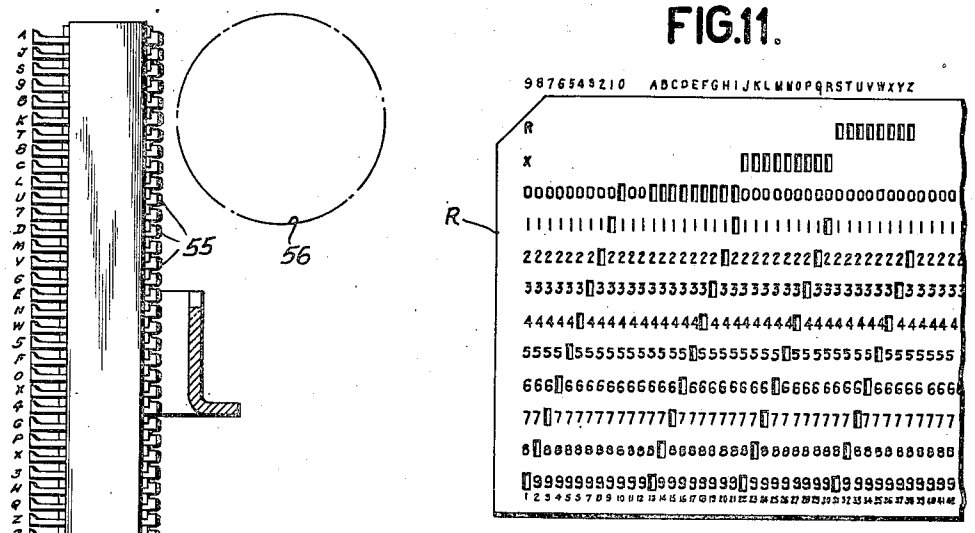
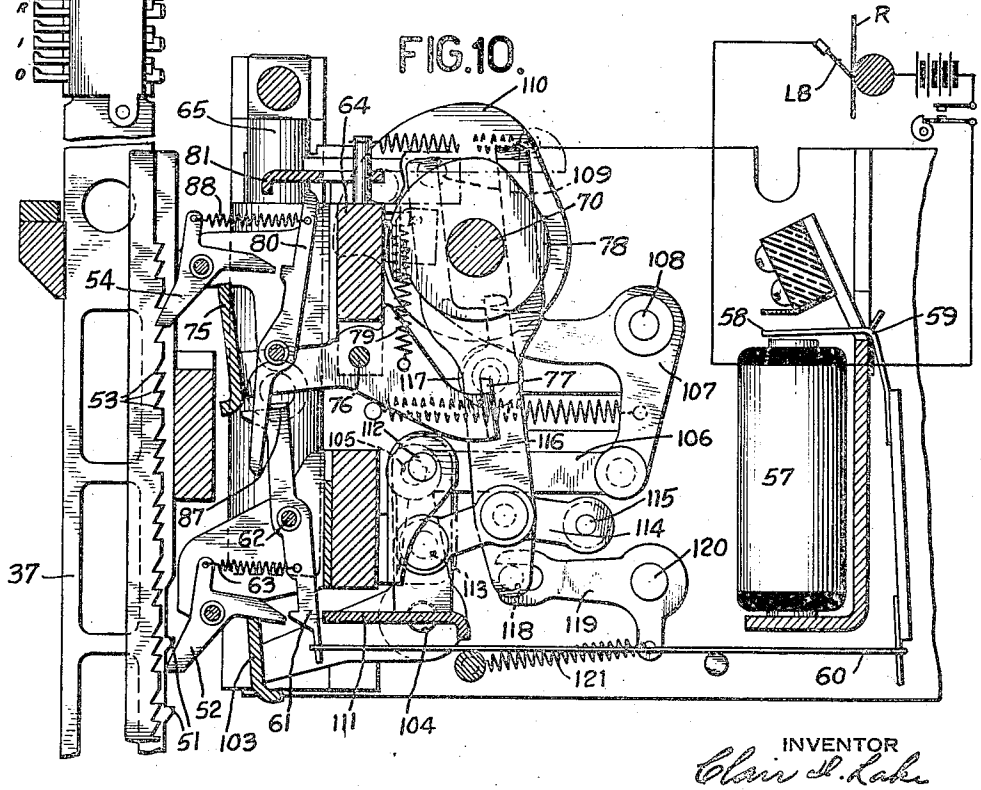


FIG.10.



INVENTOR
Clair D. Lake
BY
W. M. Wilson
ATTORNEY

Patented July 10, 1934 1,965,980

UNITED STATES PATENT OFFICE

1,965,980

PRINTING MECHANISM

Clair D. Lake, Binghamton, N. Y., assignor, by mesne assignments, to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application September 29, 1932, Serial No. 635,325

13 Claims. (Cl. 101—93)

This invention relates to tabulating machines and more particularly to improvements in the printing mechanisms therefor.

Tabulating machines as presently developed are provided with printing mechanisms, whereby numerals represented by index point perforations may be indicated by printing upon a record strip and, in addition thereto, such printing mechanisms are also employed to represent the results of some computation, such as a total of a series of items. It frequently happens that it is desirable to identify the printed items or computations by printed words, abbreviations or the like, and in some instances this can readily be accomplished by substituting letter type for the numeral bearing type so that the index points will represent alphabetical or other characters. Due to the limitations in the number of index points in a card column which is usually ten, a limited number of characters may be printed, detracting from the usefulness of such an expedient.

It is then the main object of the present invention to extend the usefulness of such printing mechanisms whereby they may be called upon, when occasion requires, to print either numerals or substantially all of the alphabetical characters and under control of a single card column.

It is a further object to provide an improved mechanism designed to be controlled by a single card column which may print either alphabetical or numerical characters arranged in groups, which characters are far in excess of the number of index points in a card column.

It is a further object of the present invention to provide improved means whereby group selection and type selection occur during the same card feeding cycle and by the same analyzing means. In order to carry out the above object, each type bar is provided or has associated therewith two stopping pawls, both of which may be actuated by a single magnet controlled from a single brush. Mechanical control is exercised over these two stopping pawls so they operate alternately, the one set operating to select the zone from which printing is to take place, and the second pawl operating to select a particular character in the selected zone.

In carrying out the present invention, the preferred means comprises a type carrying member provided with a plurality of groups of type, one group, for example, being numeral type; a second, substantially a third of the letters of the alphabet; a third, the second third of the letters of the alphabet and the last, if so desired, the remaining letters of the alphabet. The several groups of type are overlapped so that a numeral type is followed by a type of each of the other three groups, and the numeral type are arranged to be normally presented to the printing line as the card perforations register with the usual lower analyzing brushes. Each group of type is represented on the record card with what is known as a zoning perforation. These zoning perforations apply only to the alphabetical characters, the numerical characters being indicated by single perforations in the usual manner, and the alphabetical characters being indicated by a numerical perforation accompanied by a zoning perforation, thus forming a two-hole combinational reading. As the record cards pass the analyzing brushes, the numerical perforations are first sensed, and cause the type bars to be interrupted with the corresponding numerical type in printing position. Following this operation, the zoning holes are analyzed by the same set of analyzing brushes and control the second stopping pawl which causes retrograde movement of the type bars to select one of the type adjacent to the numeral type in accordance with the location of the zoning perforation on the record card.

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 novel features of construction and combination of parts hereinafter set forth and claimed.

In the drawings:

Fig. 1 is a central section through the card feeding mechanism on the tabulating machine;

Fig. 2 is a detail of the card feed clutch mechanism;

Fig. 3 is an end elevation of the card feeding mechanism;

Figs. 4 and 4a taken together with Fig. 4 placed above Fig. 4a represent a central section to the alphabetical printing mechanism of the machine;

Fig. 5 is a detail of a pawl restoring cam and operating connections;

Fig. 6 is a detail of the type hammer tripping cam and follower;

Fig. 7 is a sectional view of the type bar stopping mechanism, the view being taken substantially along the line 7—7 of Figs. 4 and 4a;

Fig. 8 is a detailed sectional view taken along the line 8—8 of Fig. 4;

Fig. 9 is a detail of the type bar stopping pawl operating mechanism;

Fig. 10 is an enlarged detail position view of the type bar and its operating pawls; and

Fig. 11 is a fragment of the card showing the combinational arrangement of the perforations thereon.

Referring to Fig. 11, the record card R has the usual perforations for indicating numerical values as shown at the left end of the card. The alphabetical characters from A to I are combinations of one of the numerical characters from 9 to 1, plus a perforation in the zero index point position. The characters J to R comprise a perforation in one of the numerical positions 9 to 1, plus a perforation in the X index point position. The remaining letters of the alphabet, namely S to Z, comprise a combination including one of the perforations 9 to 2, plus a perforation in the R index point position.

The record cards R are placed in the usual feed magazine 10, Fig. 1, from which they are fed one by one by the picker 11 into engagement with the usual feed rollers 12 which convey the cards downwardly past the usual upper analyzing brushes UB and exactly one machine cycle later past the lower analyzing brushes LB, after which the cards continue downwardly into engagement with the usual stacker mechanism 13 which passes the cards, as they are sent through, on to the usual stack 14. The card feed mechanism shown in Fig. 1 is of the usual structure found in this type of machine. In the present instance, however, provision is made for feeding the cards every alternate cycle. The manner in which this alternate feeding of cards is effected will now be described.

Pulley shaft 15 (Fig. 1) driven from the usual motor located in the base of the machine, has secured thereto a gear 16 meshing with a gear 17 (see also Fig. 3). On the same center with gear 17 and connected thereto is a gear 18 which has driving connection with a gear 19 to which is secured a driving member 20, freely mounted on a shaft 21 (see also Fig. 2). Secured to shaft 21 is a clutch member 22 to which is secured a gear 23 and a spring pressed clutching dog 24, normally held in the position shown in Fig. 2 by the armature latch 25, which is controlled in its operation by magnet 26. Energization of magnet 26 will raise the armature latch 25 and permit coupling of arm 22 and driving member 20, so that gear 23 will rotate with the driving member and with the pulley shaft 15. Magnet 26 will become deenergized before the completion of a revolution of shaft 21 and the clutch will therefore disconnect at the completion of this revolution. The gear 23 has the usual gear connection to the three uppermost pairs of feed rollers 12 which are also geared to drive the picker 11 in the usual manner. By energizing magnet 26 each alternate cycle of operation of the machine, the cards will feed during one cycle and the mechanism will remain idle for the next, then feed cards, remain idle and so on.

Printing mechanism

The right end of pulley shaft 15 (Fig. 3) has secured thereto a gear 30 which meshes with one of a group of gears 31, one of which meshes with a gear 32 secured upon a shaft 33 (see also Figs. 7 and 9). In Fig. 9 shaft 33 is shown as having secured thereto a gear 34 meshing with a gear 35 secured upon the listing cam shaft 36. The ratio between gears 35 and 34 is two to one, the gear 34 being arranged to make one complete revolution for each card feed cycle, so that two card feed cycles are required for a full revolution of shaft 36 and since it has been pointed out above, a card is fed each alternate cycle, it follows that shaft 36 will make one complete revolution for each card, a card being fed during the first half revolution of the shaft and the feed mechanism remaining idle for the second half revolution. Shaft 36 carries a cam 36*a* adapted to close a contact 36*b* once each revolution thus completing the circuit through magnet 26 which is shown in Fig. 9 as being connected in series between contact 36*b* and a suitable source of current, such as a battery as indicated.

Referring to Figs. 4 and 4*a*, the type bars 37 are mounted for vertical reciprocation in the frame of the machine. The lower end of each type bar is connected by a link 38 to the end of an arm 39 which is pivoted at 40. Arm 39 is urged in a clockwise direction by a spring 41 anchored at its upper end to a cross bar 42 carried between a pair of links 43 (see also Fig. 7). The lower ends of the links 43 are pivoted to a bail structure 44, which is also pivoted at 40 and the upper ends of the links are connected to arm 45 which are loosely pivoted on a shaft 46. The arm 45 has adjustable screw and nut connections 47 with cam follower arm 48 which is provided with follower roller 49 extending within a cam slot in box cam 50. Box cam 50 is secured to the printing shaft 36 and controls the elevation of the type bars 37 as the record card is passing the analyzing brushes and causes the lowering or restoration of the type bars during the cycle in which the card feed mechanism is idle. As the cam 50 rotates in a clockwise direction, the follower arm 48 will follow the groove of the cam and cause the clockwise rocking of arm 45 which will draw upwardly on links 43, carrying therewith the cross bar 42 which tends to extend the springs 41.

At the same time the elevation of the links 43 will rock the bail 44 upwardly out of engagement with the arms 39, which, under the influence of their individual springs 41 will tend to follow the movement of the bail. If the movement of the type bars is interrupted at any point, the arm 39 will be restrained against further movement, and spring 41 will merely extend permitting the type bars and connected arms 39 to remain in intercepted position. On the return stroke of the bail 44, the arms 39 and their connecting type bars will be picked up from the position in which they may have been located and restored to the position shown in Figs. 4 and 4*a*. Each type bar 37 is provided with a series of stops 51 (Figs. 4*a* and 10) which are adapted to be engaged by a stopping pawl 52 (Fig. 4). Each type bar is also provided with a series of stops 53, which are adapted to cooperate with a stopping pawl 54 located directly above the stopping pawl 52, the two pawls related to any type bar being offset so that each will cooperate with its own set of stops. When the type bar 37 is used to print numerical data only, the lower set of pawls 52 alone is brought into action to cooperate with the stops 51. These stops are arranged in accordance with the location of the numerical index point positions on the record cards and interruption of any stop 51 by engagement with pawl 52 will position the corresponding type 55 on the printing line of the platen 56.

Tripping of pawl 52 is controlled by the print magnet 57 (see Fig. 10) which, upon energization, will attract its armature 58 which is pivoted at 59 and which will cause movement of call wire

60 toward the right as viewed in this figure, to rock latch 61 about its pivot 62 releasing the pawl 52 which thereupon, under the action of spring 63 will rock in a clockwise direction to intercept the stop 51 of the type bar 37. Magnet 57 is wired directly to the lower analyzing brush LB as seen in Fig. 10.

Arrival of the perforation at the lower brush will instantaneously close the circuit to the magnet 57 to stop the type bar 37 in position to present the type corresponding to the location of the perforation, at the printing line. This is in accordance with the usual method of locating the type bars for the purpose of printing numerals under control of a single perforation in a column on the record card.

The upper set of stopping pawls 54 is carried by a vertically movable crosshead 64 which is slidable upon slide posts 65. Crosshead 64 and pawls 54 are adapted to be moved downwardly after the lower analyzing brushes LB have analyzed the index point positions 9 to 0 of the record card. During the period that the index point positions 0 to R are passing the lower brushes, a perforation encountered by the brushes at this time will cause energization of the magnet 57 a second time, which through the connections about to be described will trip the pawl 54 as it is moving downwardly. The pawl 54 will thereupon engage with the stop 53 of the type bars and move the type bars down, one, two or three steps, depending upon the location of the perforation in the record card.

Fig. 10 shows the condition of the parts for selecting the letter K. Reference to Fig. 11 will show that the letter K is represented by the combination of perforations in the eight index point position and in the X index point position. As the record card passes the lower analyzing brushes the perforation in the eight index point position will energize magnet 57 and trip pawl 52 to interrupt the type bar in the 8 printing position. Subsequent energization of the magnet 57, as the index point position X is analyzed, will trip the pawl 54 as the crosshead 64 is descending and pick up the type bar 37 to move it downwardly two steps to present the second type above the 8 to printing position. This is the K type.

The mechanism for timing the various operations will now be described. Referring to Figs. 4 and 4*a*, the printing cam shaft 36 has secured thereto a gear 66 which, through gears 67 and 68 drives a gear 69 secured upon a shaft 70. Referring to Figs. 7 and 9 shaft 70 has at its outer ends two pairs of complementary cams 71 cooperating with suitable follower rollers on a member 72 pivoted at 73 to the frame of the machine. An arm of member 72 has connection with the crosshead 64 through a turnbuckle connection 74. The upper set of stopping pawls 54 is normally held in inoperative position by a bail 75 pivoted at 76 to the movable crosshead 64 (see also Fig. 5). The bail 75 is provided with a rearwardly extending arm having a cam follower portion 77 which is adapted to cooperate with a cam 78 secured upon the shaft 70. As the crosshead descends, the bail and its pivot point will move downwardly away from the cam 78 and the bail will rock slightly in a counterclockwise direction under the influence of the spring 79 to thereby free the pawls 54 for type bar intercepting operation. Latches 80 which cooperate with the stopping pawls 54 are adapted to be latched in the position shown in Fig. 4 by a sliding member 81 slidably mounted upon the crosshead 64 and held in the position shown by an arm 82 pivoted at 83 and arm 84 of member 82 cooperates with the cam 85 secured to shaft 70 to effect the release of latches 80 so they may move into engagement with the stop pawls 54 before the latter are released by the bail 75. Thus, as the crosshead 64 is descending the member 80 will be in the position shown in Fig. 5, holding the pawl 54 out of engagement with the type bars. Energization of magnet 57 at this time will attract its armature to move the call wire 60 to the right rocking the latch 61 as explained above. The upper end of the latch 61 is provided with an offset projection 87 which engages a depending finger of the latch 80 and rocks the latch in a clockwise direction to the position shown in Fig. 10, thus causing the latch to release stopping pawl 54 which will thereupon, under the influence of a spring 88, rock in a clockwise direction to enter one of the notches or stops 53, thereby picking up the type bar and moving it downwardly to the extent determined by the subsequent movement of the crosshead 64.

After the several type bars have been positioned in accordance with the perforation in the record cards, printing may be effected by means of the usual printing hammers 89 (Fig. 4) which are carried by a common bar 90 being pivoted thereon at 91. The bar 90 has link connection 92 to a lever 93 pivoted at 94, which lever has adjustable link connection 95 (see also Fig. 4*a* to an arm 96 pivoted at 97. In Fig. 6 the arm 96 is shown as having a roller 98 and a tripping edge 99 cooperating with a cam 100 and a tripping block 101, respectively. The cam 100 is integral with the box cam 50 and the block 101 is mounted thereon. Cam 100 cooperates with the roller 98 to retract the printing hammers, after which the roller moves out of cooperation with the cam 100 and the tripping edge 99 is in sliding engagement with the block 101. As the cam 100 continues to turn, the edge 99 will drop off the edge of the block 101 giving a sharp drop to the edge 99, thus effecting a rapid printing action, the spring 102 in Fig. 4 serving to rapidly swing the hammers against the printing type.

After printing has been effected, the stopping pawls 52 (Fig. 10) are restored under the influence of a bail 103 pivoted at 104 and having connection at 105 with a link 106 whose operative end is connected to a bell crank lever 107 pivoted at 108 to the frame of the machine. The bell crank lever 107 is engaged by a pin 109 carried by a cam 110. The pin 109 actuates the linkage to elevate the bail 103 at the same time that a bail 111, pivoted at 112 is rocked in a clockwise direction against the latches 61 to move them beneath the pawls 62 to securely effect a latching cooperation between the pawl and the latch. The bail 111 has connection at 113 with toggle links 114, one point of which is pivoted at 115 to the frame of the machine. The connecting point of the links 114 carries an arm 116 whose upper end is bifurcated to straddle the shaft 70 and which carries a roller 117 which is adapted to cooperate with the cam 110. The high portion of the cam 110 will force the roller 117 downwardly to straighten the toggle links 114, thus rocking the bail 111 in a clockwise direction.

The lower end of the member 116 carries a pin 118 engaged in the bifurcated end of a bell crank lever 119 pivoted at 120 and having a spring 121 secured to the other arm thereof. The function of the spring 121 is to restore the toggle

links 114 and the member 116 to the position shown in Fig. 10 after the bail 111 has operated to restore the latches 61. After the crosshead 64 has again been returned to its uppermost position, the bail 75 is operated by the cooperating cam 78 to restore the latches 54 and hold them in restored position until such time as the bail moves downwardly to take a reading from the next record card.

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 an accounting machine comprising in combination, a printing bar carrying a plurality of groups of type common to a card column, controlling means whereby index points in a certain card field control the selection of a particular group of type, and means for causing the same controlling means to control the selection of a particular type in a group.

2. In an accounting machine comprising a bar provided with a plurality of groups of type, a reciprocating member adapted to present said groups to a printing point, card analyzing means adapted to cause selection of one of said groups for printing action and means controlled by the same analyzing means for subsequently causing selection of a particular type in the selected group.

3. In a printing mechanism having a type bar provided with a plurality of groups of type elements, means for selecting a group of type, means for selecting a particular type in the selected group and a common actuating means for controlling the operation of both said selecting means.

4. In a printing mechanism having a type bar provided with a plurality of groups of type elements, means for selecting a group of type, means for selecting a particular type in the selected group, a common record controlled actuator and means whereby said actuator is adapted to effect successive operation of both said selecting means.

5. In a machine of the class described having a reciprocable type carrier provided with a plurality of type elements, means for advancing said carrier to printing position to present a particular type to printing position, means for effecting retrograde movement of said carrier, means for determining the extent of said retrograde movement to present the type element adjacent to said initially presented element to printing position and means for effecting printing from said adjacent element.

6. In a printing mechanism, means for successively analyzing a plurality of index point positions in a column of a record card, a reciprocable type carrier provided with a plurality of groups of type elements, a single selecting device operable by said analyzing means for each perforation analyzed and means controlled by said device for effecting a group selection and a type selection in succession upon successive operations of said device.

7. A printing mechanism having a plurality of groups of type, group selecting mechanism and individual type selecting mechanism, a single electromagnet for operating said mechanisms, controlling means therefor adapted to repeatedly energize the same at different times to select a group upon one energization and an individual type within said group upon another energization, said selections being in accordance with the time of energization of said electromagnet.

8. A printing mechanism having a type carrier with a plurality of groups of type thereon and having the type of one group intermediate the type of another group, means for moving said type carrier into different positions, a stop member for determining the printing positions of said carrier, means for operating said stop member for selecting a type and means for subsequently shifting the selected type with respect to said stop member to select a type of a different group.

9. A printing mechanism having a reciprocable type bar provided with a plurality of type elements, means for controlling the differential movement of said bar in one direction to select a type element for printing and further means for subsequently controlling the differential movement of the bar in the opposite direction to effect further type element selection.

10. A printing mechanism having a reciprocable type bar provided with a plurality of type elements, an invariably movable member adapted to move said bar in one direction, a second invariably movable member adapted to move said bar in the opposite direction and means for associating said bar with each of said members to effect positioning of the bar to present a particular type element for printing.

11. A printing mechanism comprising an invariably movable member, a type bar provided with a plurality of type elements connected to said member for movement therewith in one direction, a second invariably movable member, means for interrupting movement of said bar with said first named member and means for associating said bar with said second member for movement therewith.

12. A printing mechanism comprising an invariably movable member, a type bar provided with a plurality of type elements connected to said member for movement therewith in one direction, a second invariably movable member, means for interrupting movement of said bar with said first named member and means for associating said bar with said second member for movement therewith, both said means operating in alternating sequence.

13. A printing mechanism comprising an invariably movable member, a type bar provided with a plurality of type elements and connected to said member for movement therewith in one direction, a second invariably movable member, an electromagnet and means controlled thereby for causing interruption of the movement of said bar with said first named member and further means controlled by said electromagnet for subsequently connecting said bar to said second invariably movable member for movement therewith.

CLAIR D. LAKE.