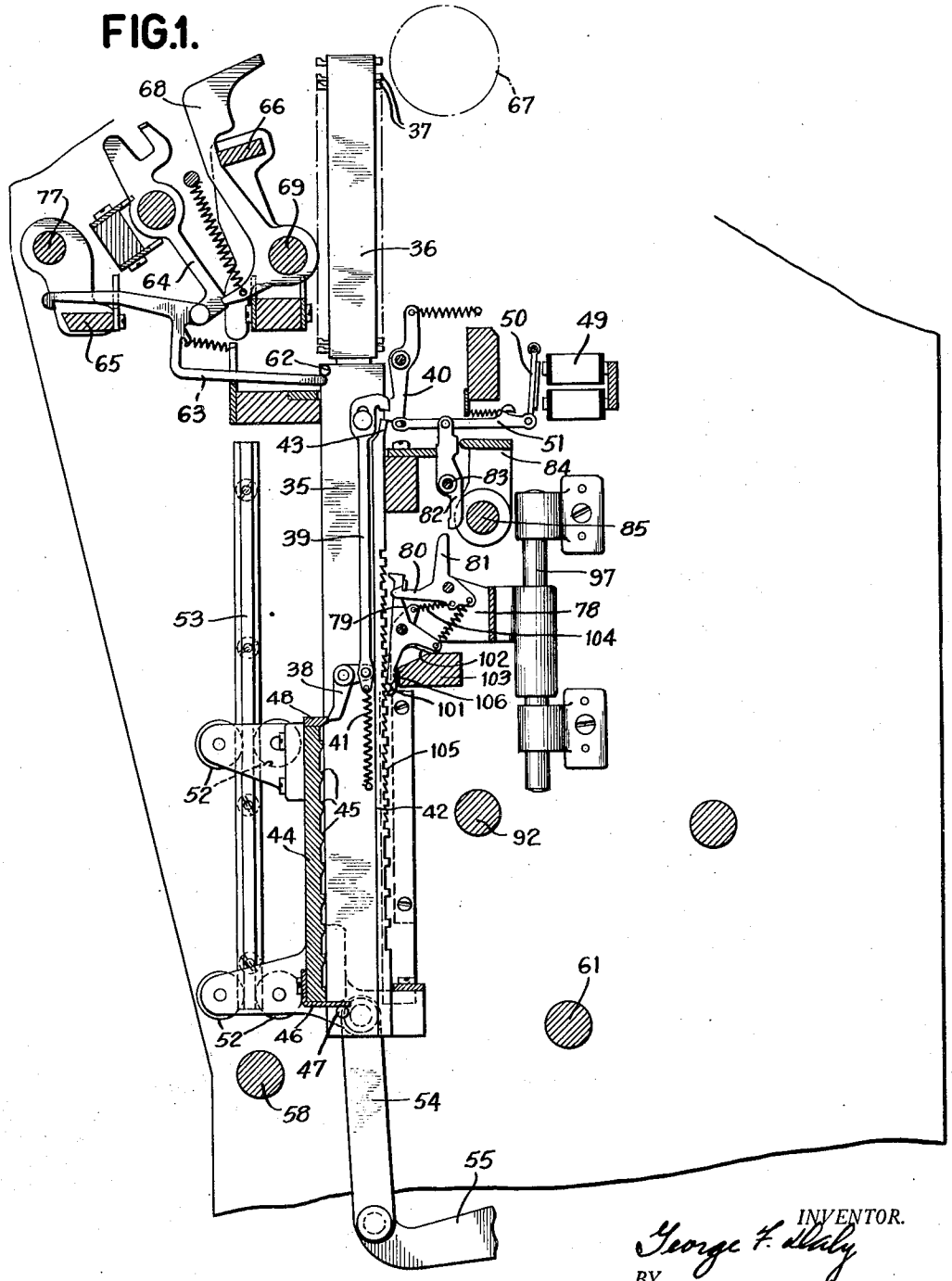
Oct. 6, 1936. G. F. DALY 2,056,391

PRINTING MECHANISM

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FIG.1.



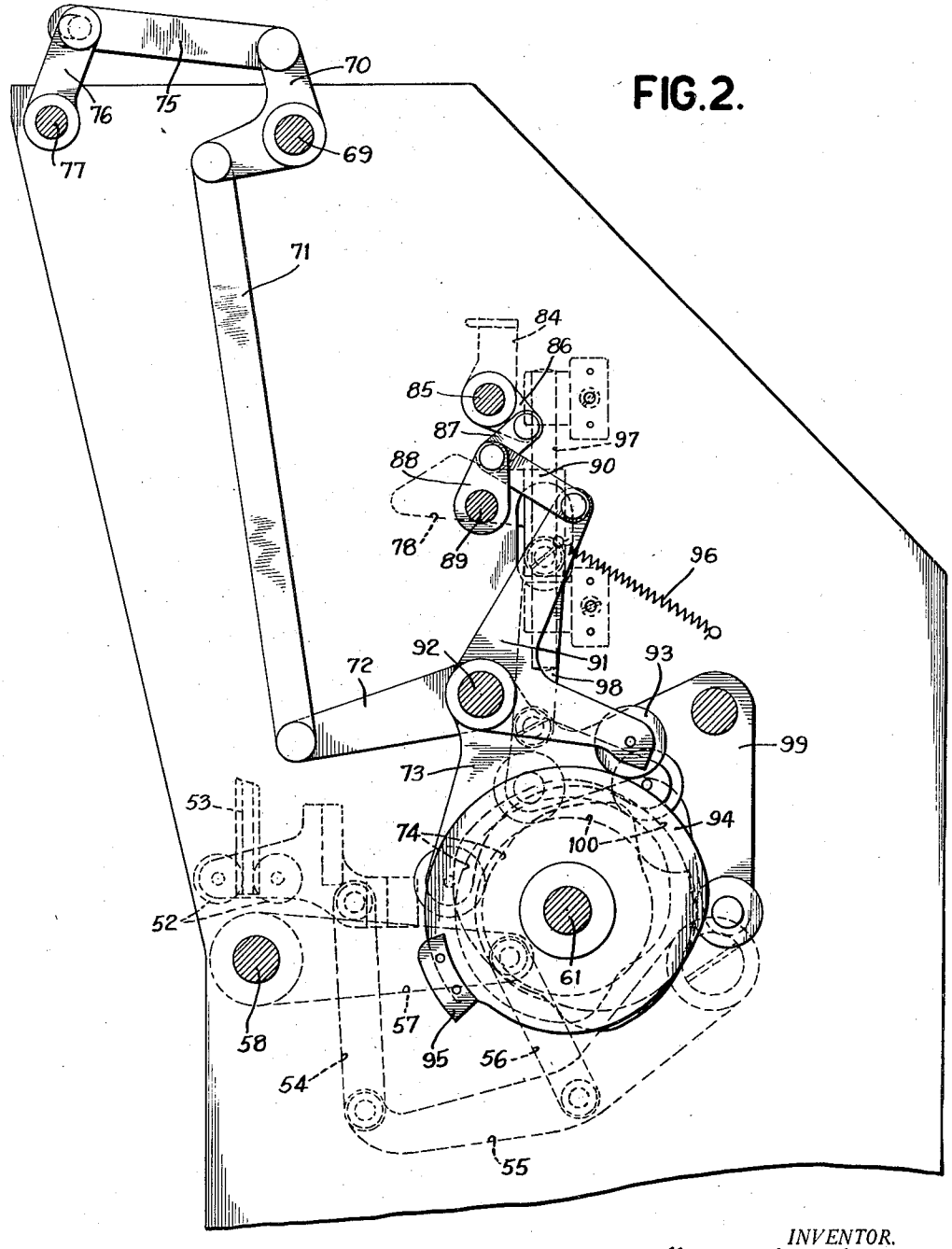
INVENTOR.
George F. Daly
BY
C. M. Addison
ATTORNEYS.

Oct. 6, 1936. G. F. DALY 2,056,391

PRINTING MECHANISM

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FIG.2.



INVENTOR.

George F. Daly

BY

William

ATTORNEYS.

Oct. 6, 1936. G. F. DALY 2,056,391

PRINTING MECHANISM

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FIG. 3.

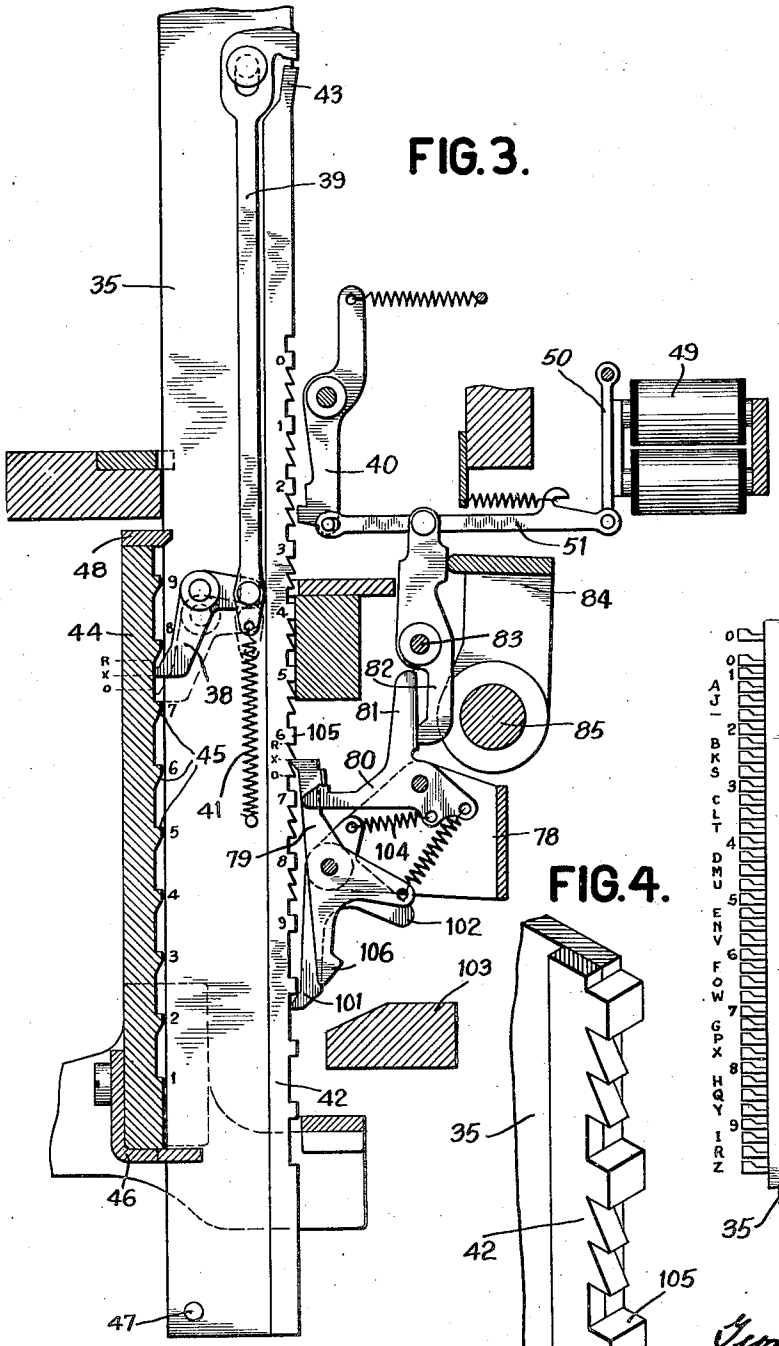
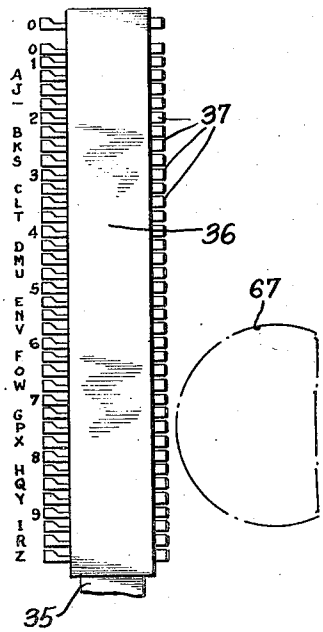


FIG. 4.

FIG. 5.



INVENTOR.
George F. Daly
BY
W. M. Wilson
ATTORNEYS.

Oct. 6, 1936. G. F. DALY 2,056,391

PRINTING MECHANISM

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FIG.6.

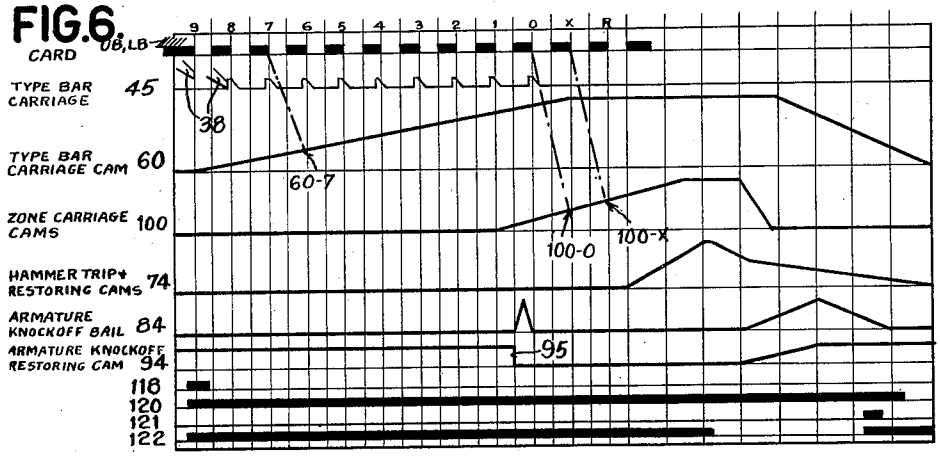


FIG.7.

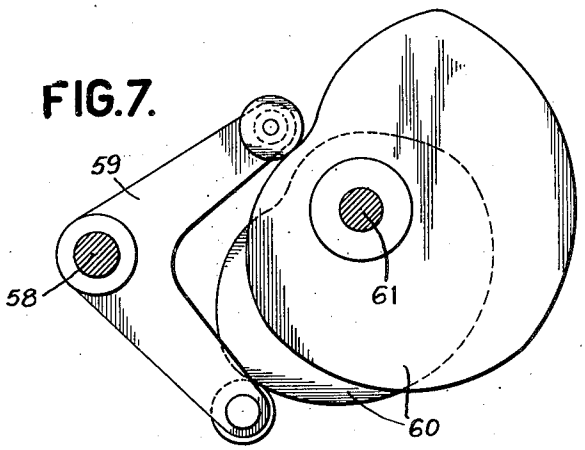
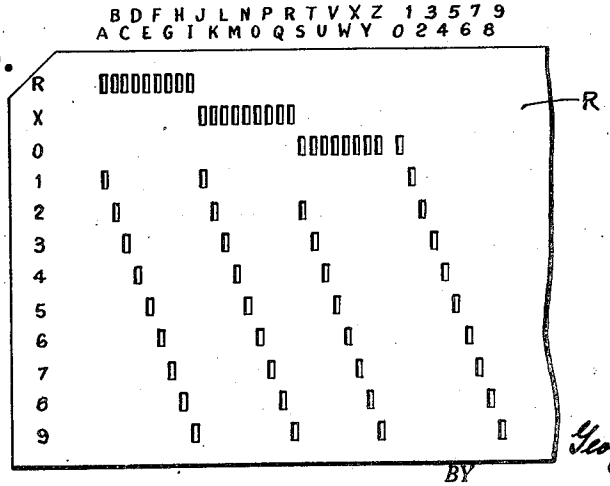


FIG.8.



INVENTOR.
George F. Daly
BY
ATTORNEYS.

Oct. 6, 1936. G. F. DALY 2,056,391

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FIG.9.

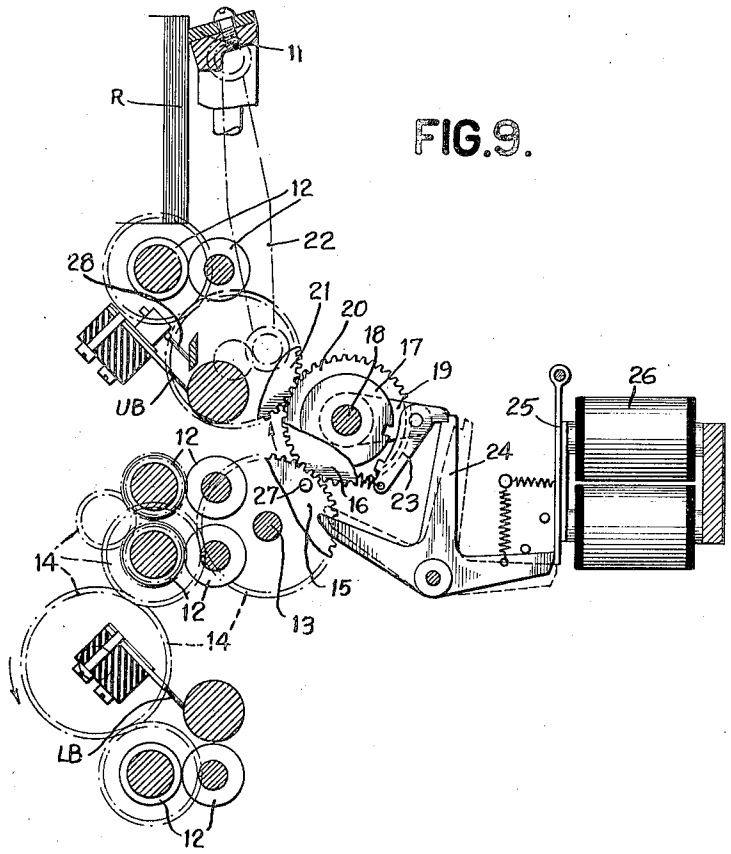
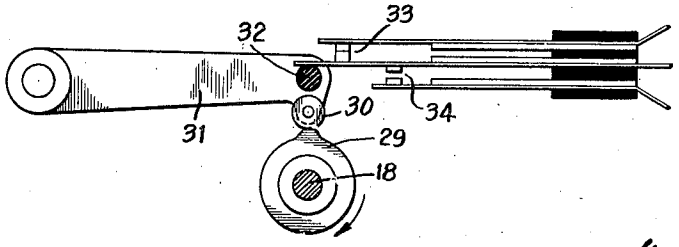


FIG.10.



INVENTOR.
George F. Daly
BY
W. Wilson
ATTORNEYS.

PRINTING MECHANISM

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FIG.11.

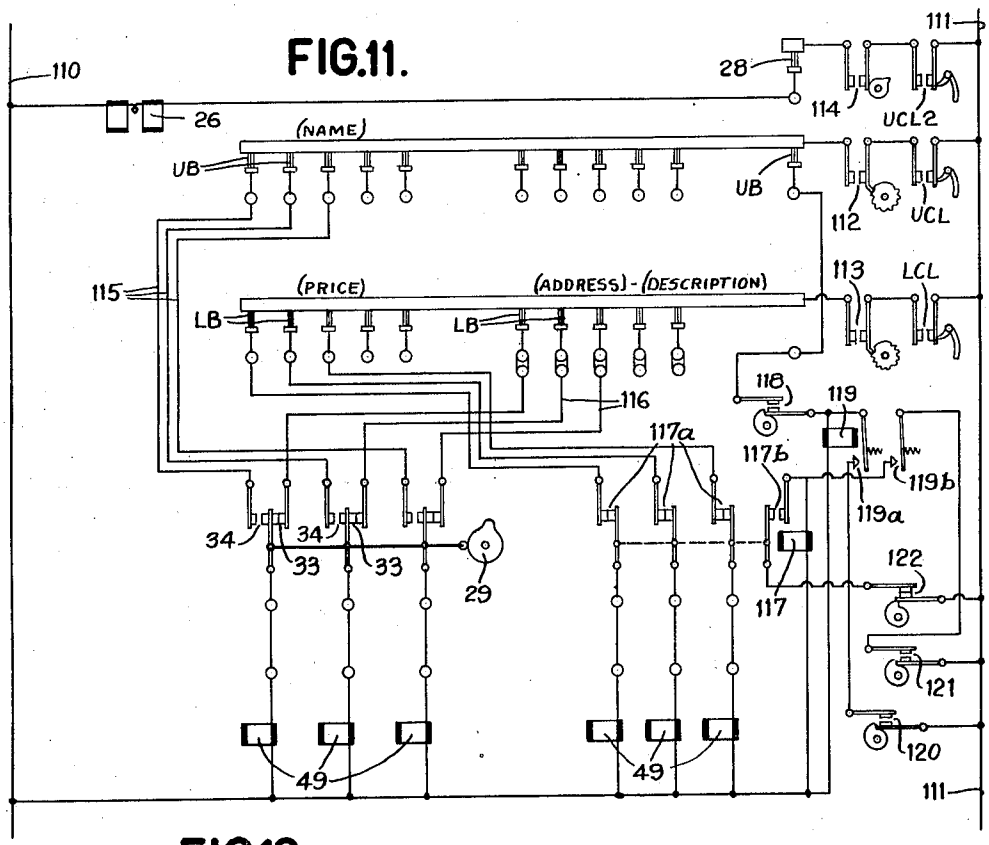


FIG.12.

JOHN SMITH

COLUMBIA OHIO

1 GAL. VARNISH	5.22
1 GAL. 533 PAINT	7.40
5 GAL. TURPENTINE	11.00

INVENTOR.
George F. Daly
BY
W. McGibson
ATTORNEYS.

Patented Oct. 6, 1936 2,056,391

UNITED STATES PATENT OFFICE

2,056,391

PRINTING MECHANISM

George F. Daly, West Orange, N. J., assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application August 14, 1934, Serial No. 739,760

5 Claims. (Cl. 101—93)

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

The main object of the invention is to provide an improved printing mechanism for printing alphabetical characters as well as digits in which the type characters are moved into printing position in a positive manner. 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 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 perforations in Hollerith record cards register with the usual record analyzing brushes. Each group of alphabetic type is represented on the record card with what is known as a zoning perforation. These perforations apply only to the alphabetic characters, the numerical characters being indicated by single perforations in the usual manner and the alphabetic 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 bar to be positively advanced from a position of rest to present the numerical type corresponding to the location of the perforation to printing position.

Following this, the zoning holes are analyzed by the same set of analyzing brushes and cause the further positive advance of the type bar to select one of the type adjacent to the numeral type in accordance with the location of the zoning perforation on the record card.

A further object of the invention is to provide printing mechanism responsive to perforations in a record card whereby repeated printing operations may be effected from the same record card. In the well known form of Hollerith tabulating machine, two card analyzing stations are usually provided and known as the upper and lower brush stations. With the present arrangement of printing mechanism, analysis of alphabetical designations may be made as the record card passes the upper brushes and printing effected accordingly. As the card proceeds past the lower brushes, analysis may be made of alphabetic designations in another portion of the card and caused to control the same section of the printing mechanism. This arrangement has particular utility in printing names and addresses where the name is on one portion of the card and the address on another. Heretofore in machines of this type it has been necessary to provide two record cards, one bearing the name and the other the address and throughout tabulating operations it has been necessary to keep these two related cards together. With the present arrangement, the obvious inconveniences of using two cards are entirely eliminated. In the operation of the machine, so-called "address" cards which contain a name and address are provided with a distinguishing perforation in a selected index point position and the presence of this perforation is detected before the card arrives at the analyzing stations and its presence causes the machine to pass the address card by the upper and lower brushes completely before the next following record card is advanced.

Other record cards which are not classified as address cards move past the brushes in the normal manner; that is, as one card is passing the lower brushes, the next following card is passing the upper brushes.

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 of the printing mechanism.

Fig. 2 is an outside view of the printing mechanism, showing some of the driving cams.

Fig. 3 is a position view at an enlarged scale of the essential parts of the printing mechanism.

Fig. 4 is a detail isometric view showing the arrangement of the stopping teeth on the type bar.

Fig. 5 is a detail of the type head with a selected character in printing position.

Fig. 6 is a time chart of certain of the operations of the machine showing the relationship therebetween.

Fig. 7 is a detail view of the type bar carriage operating cams.

Fig. 8 is a fragment of a card showing the combinational arrangement of the perforations.

Fig. 9 is a diagrammatic view of the card feeding and analyzing mechanism.

Fig. 10 is a detail of certain cam controlled contacts associated with the card feeding mechanism.

Fig. 11 is a circuit diagram of the electric wiring of the printing circuits of the machine.

Fig. 12 is a sample of a record showing the manner in which successive lines of alphabetic data are printed from the single record card.

Referring to Fig. 8, the record card R has the usual perforations for indicating numerical values as shown at the right 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 R index point position. 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 zero index point position. The record cards R are placed in the usual feed magazine (Fig. 9) 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 the usual stacker mechanism (not shown). The card feeding mechanism shown in Fig. 9 is of the usual structure found in this type of machine. In the present instance, however, provision is made for suppressing operation of the picker 11 and the uppermost pair of feed rollers for a cycle of operations so that the preceding card may first be completely passed through the machine. The manner in which this is effected will now be described.

Shaft 13 may be driven continuously from a suitable source of power during the operation of the machine and is adapted to make one revolution for each cycle of operations. Through gearing, generally designated 14, the three lower pairs of feed rollers 12 are rotated to advance the card after it has passed the upper brushes UB. A gear 15 on shaft 13 drives a gear 16 to which is secured a clutch driving element 17 rotatable on the shaft 18. Secured to the shaft 18 is an arm 19 which has secured thereto a gear 20 which meshes with a gear 21. The gear 21 through eccentrically attached link 22 operates the picker 11 once each revolution of gear 21 and also serves to drive the uppermost feed rollers 12. Carried by arm 19 is a spring-pressed dog 23 which is normally in engagement with driving element 17 so that the parts rotate in unison. A member 24 is normally adapted to be latched in the dotted line position by armature 25 and magnet 26. Energization of magnet 26 will release the member 24 so that it will assume its full line position and cause dog 23 to rock out of engagement with element 17 thereby interrupting the operation of picker 11 and uppermost feed rollers 12. Toward the end of the cycle the pin 27 carried by gear 15 will engage a laterally extending arm of member 24 and rock the same to its dotted line or latched position so that operation of picker 11 will resume after an interruption of a single cycle. Magnet 26 is energized under control of a record analyzing brush 28 located slightly in advance of the brushes UB and is adapted to sense a special designation indicating the presence of a so-called "address" card.

Sensing of such perforation will cause energization of magnet 26 in a manner to be pointed out in connection with the description of the circuit diagram whereby the interruption of the operation of the upper pair of feed rolls 12 will permit the address card to completely traverse both the upper and lower brushes before the next card is fed. Shaft 18 (Fig. 10) carries a cam 29 which cooperates with follower roller 30 on arm 31. Arm 31 carries a bail 32 of insulating material which serves to hold contacts 33, 34 in the position shown in Fig. 10 whenever shaft 18 is disconnected from driving engagement with the shaft 13. When the parts are connected, the bail 32 is lowered throughout the major portion of the cycle so that contacts 34 are closed and contacts 33 open. The manner in which the contacts function and the circuits which they control will be further explained in connection with the circuit diagram.

Printing mechanism

The printing type bar is designated 35 in Fig. 1 and carries at its upper end the type head 36 provided with type elements 37 horizontally slidable in the head 36. The bars 35 are suitably guided for vertical reciprocation in the frame of the machine. Each type bar carries a pawl 38 pivoted thereto which is connected to a hook 39 which is normally held in the position shown in Fig. 1 by a latch 40 which, when the type bar is in its lowered or restored position, tends to hold hook 39 upwardly against the tension of its spring 41 and bell crank 38 is accordingly held in the position shown.

Integral with bar 35 is a notched member 42 whose upper end terminates in a finger 43 which also cooperates with latch 40 and restrains the type bar 35 against upward movement. Extending across type bars 35 is a so-called carriage 44 which is given an invariable vertical reciprocation each cycle of the machine from the position shown in Fig. 1 to that of Fig. 3 and back again. Carriage 44 is provided with a succession of ledges 45 numbered 9 to 1 and these ledges successively pass the toe of pawl 38 as the carriage moves upwardly. At differential times during the upward movement of the carriage pawl 38 may be permitted to rock in a clockwise direction into engagement with one of the ledges 45. When this occurs the pawl 38 and associated bar 35 will be effectively coupled to the carriage and will move upwardly therewith to present the digit corresponding to the engaging ledge in printing position. On the return movement of carriage 44 the member 46 will engage a pin 47 in the lower end of bar 35 to cause the positive restoration of the bar and a cam bar 48 extending across the top of the carriage will engage the toe of pawl 38 rocking it counterclockwise so that hook 39 will be reengaged with latch 40. The initial tripping of pawl 38 is effected under control of printing magnet 49 which upon energization will attract its armature 50 and draw spring-pressed link 51 toward the right. The left end of the link is connected to the free end of latch 40 and will accordingly disengage the same from hook 39 so that spring 41 may draw the latter downwardly and rock pawl 38 into engagement with a ledge of carriage 44. The manner in which carriage 44 is reciprocated will now be described.

The carriage is provided with pairs of rollers 52 (Fig. 1) which ride upon a vertical track 53. The lower end of the carriage is connected by a

link 54 (see also Fig. 2) to an arm 55 which in turn is connected by a link 56 to an arm 57 secured upon shaft 58. In Fig. 7, shaft 58 is shown as having secured thereto a double armed cam follower member 59 which cooperates with complementary cams 60 secured upon shaft 61. Shaft 61 is adapted to make a single revolution for each cycle of the machine and may be suitably geared to shaft 13 of Fig. 9 for rotation in synchronism therewith so that each shaft will make one revolution per cycle of the machine.

Referring again to Fig. 1, each type bar is provided with a pin 62 which, when the type bar moves upwardly, will permit counterclockwise rocking of a member 63 pivoted to the lower end of a latch 64 so that the left end of member 63 will engage a bail 65. After the carriage 44 has reached its uppermost position, bail 65 is rocked clockwise and in those positions in which the type bar has advanced member 63 will be drawn toward the left causing clockwise rocking of the attached latches 64. The latches 64 normally hold spring-pressed printing hammers 66 in the position shown and since hammer restoring bail 66 is out of engagement with the hammers at this time, unlatching by 64 will permit printing to take place and the type elements on the printing line will be urged against platen 67. The operating mechanism for bails 65 and 66 is shown in Fig. 2 where shaft 69 supporting bail 66 has secured thereto the bell crank 70 connected by a link 71 to an arm 72 integral with a double armed cam follower member 73 whose rollers cooperate with a pair of complementary cams 74 mounted on shaft 61.

Bell crank 70 is connected by a link 75 and arm 76 to shaft 77 upon which the bail 65 is carried and the timing is such that bail 66 is retracted before bail 65 operates to trip the hammers. The hammer tripping mechanism per se forms no part of the present invention and only so much thereof has been described as is necessary for an understanding of the operation.

It will be understood, of course, that the upward movement of carriage 44 is in synchronism with the movement of the record cards past the analyzing brushes in such manner that the ledges 9, 8, 7, etc., successively pass the toe of pawl 38 as the corresponding index point positions of the record cards pass the analyzing brushes. Near the end of the upward stroke of carriage 44 a secondary carriage 78 is moved upwardly. Carriage 78 has pivoted thereon spring-pressed pawls 79 normally held in the position shown in Fig. 1 by latches 80 spring-biased in a clockwise direction. The latches 80 are provided with upwardly extending fingers 81 which, as carriage 78 moves upwardly, come within the range of members 82 pivoted at 83. The upper extremity of members 82 are connected to links 51 so that energization of any magnet 49 will rock its member 82 clockwise causing counterclockwise rocking of the member 80 so that pawl 79 will be urged into engagement with notched member 42 and, depending upon the time of energization of member 49, bar 35 will be advanced by carriage 78 an additional 1, 2, or 3 steps to select the first, second or third alphabetic character adjacent to the previously selected numerical character.

The position of the parts for the selecting of the character "P" is shown in Fig. 3 wherein carriage 44 is shown in its extreme upward position and pawl 38 in its dotted line position indicates the extent to which it is advanced by carriage 44 after having been tripped into engagement with a ledge 45 under control of the perforation in the "7" index point position of the card, this position being one of the combination associated with the character "P". As the carriage 78 subsequently moves upward the reenergization of magnet 49 trips pawl 79 into engagement with the member 42 as shown and bar 35, together with pawl 38, advances upwardly two additional steps, bringing pawl 38 to the full line position and moving the type head 36 two additional steps beyond the "7" position. This, it will be observed in connection with Fig. 5, is the position in which the character "P" occurs.

Since magnet 49 may be energized twice during the cycle in response to each of the pair of combinational perforations, it is desirable to effect restoration of the armature 50 during the interval between energizations of the magnet. This is effected by means of a bail 84 carried by shaft 85. In Fig. 2, shaft 85 carries an arm 86 whose free end supports a link 87 connected to an arm 88 on a stud 89. Link 87 and arm 88 form a toggle connection whose common center is connected by a link 90 to a bell crank 91 pivoted on shaft 92. The other arm of bell crank 91 carries a roller 93 which traverses the periphery of a cam 94 mounted on shaft 61. As the cam rotates clockwise the arm carrying roller 93 engages and rides upon a shoe 95 secured to cam 94. As the arm drops off the abrupt edge of the shoe, spring 96 will rock bell crank 91 rapidly in a clockwise direction drawing toggle 87, 88 across dead center.

During further rotation of the cam 94 the high portion will rock bell crank 91 back to its initial position. It will be observed that the action of the toggle is such as to reciprocate bail 84, moving it rapidly toward the left and then back again.

The mechanism for elevating carriage 78 will now be described. The carriage is supported on rods 97 (Figs. 1 and 2) which are supported in suitable bearings in the frame of the machine. Link 98 connects the frame to cam follower member 99 whose rollers cooperate with a pair of complementary cams 100 carried by shaft 61.

Carried by frame 78 and adjacent to each pawl 79 is an overthrow pawl 101 having an arm 102 which, when the carriage 78 is in its lower or restored position, engages a fixed cross member 103 to hold the pawl 101 away from the member 42. As the frame 78 moves upwardly, pawl 101 will be free to rock clockwise under the influence of its spring 104 and will move into the path of tabs 105 formed on member 42. It will be recalled that frame 78 moves upwardly just as the carriage 44 is at the end of its upward movement and the function of pawl 101 is to prevent any overthrow of type bar 35 due to the stopping of carriage 44 at the upper end of its stroke. As the carriage 78 moves downwardly to restored position, arm 102 engages member 103 and a depending arm 106 of pawl 79 will also engage member 103 to retract the pawl for relatching by latch 80.

The sequence of the various mechanical operations will now be reviewed with particular reference to the timing chart (Fig. 6) in which the more important operations are diagrammatically illustrated.

It will be noted that the upward rise of the operating cam 100 of carriage 78 commences before the cam 60 has completely elevated the carriage 44 so that for an interval the two carriages are moving together with the carriage 78 advancing at a slower rate. It will also be observed

that the restoration by cam 95 of the armature knock-off bail 34 occurs before the "O", "X" and "R" index point positions are sensed by the brushes UB or LB. This, it will be observed, occurs after the carriage 78 has commenced to rise but takes place before finger 81 (Fig. 1) has risen sufficiently to lie in the path of member 82. In the example selected, that is, selection of the letter "P" whose combination perforation is represented by a "7" and an "11" hole, energization of the magnet 49 will occur as soon as the perforation is encountered but coupling of the type bar to the carriage 44 is delayed for almost a cycle point due to the mechanical action of the parts so that tripping under control of the "7" hole results in commencement of the upward movement of the type bar just before the sixth position is analyzed. The upward rise of the type bar, therefore, commences at the point indicated 60—7 of the line of cam 60 and proceeds seven steps with the upward movement of the carriage 44, after which the carriage dwells for a considerable period while the secondary carriage 78 completes its movement. The second perforation in the "X" position causes coupling of the type bar to the carriage 78 at the point indicated 100—X which is at a time when the carriage 44 is at rest. The frame 78 will therefore further advance the type bar two steps until it also dwells before restoration is effected.

It will be noted that for alphabetic characters whose combinations include either an "X" or an "R" perforation, the advance of the type bar is in two distinct steps as the movement of the carriage 44 is completed and a numerical character presented to the printing line before the type bar is coupled to the secondary carriage which then advances it one or two additional steps. Where a zero perforation is part of a combinational designation, the timing chart shows that a type bar is coupled to the frame at the point 100—0. As pointed out above, the tripping of the pawl 79 occurs about a cycle point before this so that the pawl is in engagement with the notched member 42 and moving upwardly therewith but at a slower rate so that immediately upon stopping of carriage 44, pawl 79 will pick up the type bar at point 100—0 and continue its advance for three additional steps. The type bar is thus given a continuous movement from restored position to the alphabetic printing position without interruption.

Wiring diagram

Referring now to Fig. 11 the entering circuits are shown as extending between lines 110 and 111. The brushes UB receive current from line 111 through the usual card lever contacts UCL and circuit breaker 112. The lower brushes LB receive current through lower card lever contacts LCL and circuit breaker 113 while the special brush 28 receives current through upper card lever contact UCL2 and a cam contact 114 timed to make at "9". Record cards bearing name and address will contain a perforation in the "9" index point position of the column traversed by brush 28 so that the presence of such perforation will complete a circuit through clutch magnet 26 and further feeding will be interrupted until the address card has passed both upper and lower brushes in succession.

It will be recalled that this declutching of the card feed will occur when contacts 34 are closed and contacts 33 open and the contacts will remain in this position throughout the analysis of the card by the upper brushes and the timing is such that as the card passes the lower brushes, contacts 33 will be closed and contacts 34 open. Therefore, as the address card passes the upper brushes, circuits will be completed from line 111, contacts UCL, 112, brushes UB in the field of the card in which the "name" is perforated, connections 115, contacts 34, print magnets 49, to line 110. The first energization of magnets 49 will effect the primary selection of a digit and the secondary selection will effect the final positioning of the type bar to present the proper character. As the address card passes the lower brushes, the circuit for magnets 49 is traceable from line 111, contacts LCL, 113, brushes LB in the field in which the "address" is perforated, through connections 116, contacts 33, magnets 49, to line 110. The address will thus be printed in columnar alinement with the name.

The detail cards accompanying the address card may contain information relating, for example, to "price" in the field corresponding to that in which the name is entered on the address card and information relating to, let us say, "description", in the field corresponding to that in which the address is entered on the address card. In order to read these fields of the detail cards and to prevent conflict in the circuits, a multi-contact relay 117 is provided which controls normally closed contacts 117*a* and a pair of contacts 117*b*.

The contacts 117*a* are wired to print magnets 49 in another section of the machine for printing in columns of the record other than those in which the name and address appear, for example, along the right hand edge of the record shown in Fig. 12. Thus, as a detail card passes through the machine, it will traverse the upper brushes without the completion of any circuits since contacts 34 are open at such time. As the card passes the lower brushes, the circuits through the brushes LB in the price field will complete circuits through contacts 117*a* and the right hand group of magnets 49, while brushes LB, which traverse the description field, complete circuits through contacts 33 and left hand group of magnets 49 in the same manner as explained in connection with the circuits for printing the address.

When an address card arrives at the brushes, the special perforation in the "9" index point position is sensed by the upper brush UB which traverses the column with the special perforation and completes a circuit from line 111, contacts UCL, 112, brush UB, cam contacts 118, timed to close momentarily at "9", relay magnet 119, to line 110. Relay 119 closes its points 119*a* which provide a holding circuit which extends from line 111 to cam contacts 120, contacts 119*a*, relay magnet 119, to line 110. Later in the cycle, as the address card is about to pass the lower brushes, cam contacts 121 close momentarily, completing a circuit from line 111, contacts 121, contacts 119*b*, now closed, multi-contact relay 117, to line 110. Magnet 117 opens the contacts 117*a* so that the lower brushes traversing the main field of the address card do not complete circuits to the right hand group of printing magnets 49.

Closure of contacts 117*b* provides a holding circuit for relay 117 which is traceable from line 111, cam contacts 122, contacts 117*b*, magnet 117, to line 110. This circuit is held while the address cam traverses the lower brushes. Reference to the timing chart (Fig. 6) will disclose the timing of the several cam contacts mentioned. In Fig. 12 is shown a specimen record in which the first two lines are printed under

control of the address card during the two cycles of the machine during which the address card passes the upper and lower brushes in succession. The other three lines are printed under control of detail cards, there being one line for each detail card and each line of data is printed under control of the lower brushes only. In machines of this type the mechanism for spacing the record is usually operative to effect a line space for each cycle of operation so that the record will appear as in Fig. 12 with a space between the address and the first detail line, this spacing being brought about due to the cycle of operations during which feeding of new cards is suppressed so that during the cycle following the passage of the address card by the lower brushes there will be no printing effected but record spacing will nevertheless take place.

The type bar 35 (Fig. 3) is, according to the preceding detail description, normally in restored or lowered position where it remains unless and until its associated magnet 49 is energized at which time the type bar is coupled to the invariably movable carriage 44 and thereby positively raised to printing position.

Just before it reaches this position, the overthrow pawl 101 engages the type bar to prevent the possibility of overthrowing and carriage 78 as it moves upwardly may have the type bar 35 coupled thereto, in which event further positive upward movement is imparted to the bar to bring it to a final printing position. It will thus be apparent that the type bar 35 is at all times during its operating movement under the positive and direct control of the frames of the carriages 44 or 78 and that any retardation or overthrowing is effectively prevented.

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 as follows:

1. In a machine of the class described having a reciprocable type carrier provided with a plurality of type elements, a main advancing means and an auxiliary advancing means, said main advancing means being adapted to advance said carrier to present a particular type element to printing position and said auxiliary advancing means being adapted to uninterruptedly continue the movement of the carrier, in the same direction to present the type element adjacent to said initially presented element to printing position and means for effecting printing from said adjacent element.

2. In a printing mechanism, a type bar, a carriage having an invariable extent of movement, means for connecting said bar to said carriage for movement therewith in one direction, and means effective at the end of the movement of said carriage for preventing overthrow of the bar beyond the position to which it has been moved by the carriage.

3. A positive drive mechanism for a type bar having alphabetic and numerical type elements thereon, comprising a primary type bar carriage adapted to positively advance said bar to present one of the numerical type elements to printing position and a secondary carriage adapted to positively and without interruption continue the movement of the bar to present one of the alphabetic type elements to printing position.

4. In a printing mechanism for a tabulating machine, a first and a second analyzing station each comprising a single line of brushes for successively analyzing adjacent fields of a record card for combinational representations designating alphabetic information, and means controlled by each station as the same analyzes its associated field for causing the alphabetic information therein to be printed on a separate line of a record sheet.

5. In a printing mechanism for a tabulating machine, a first and a second record analyzing station, means for successively feeding detail and address record cards past said stations whereby as a record card passes said first station, another record card is passing said second station, means for determining the presence of an address card and means controlled thereby for interrupting the normal succession of feeding until the address card has completely passed both of said stations and means controlled by each station as the same analyzes the address card for causing the data thereon to be printed on separate lines of a record sheet.

GEORGE F. DALY.