Dec. 8, 1936. F. M. CARROLL 2,063,486

TABULATING MACHINE

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FIG.1.

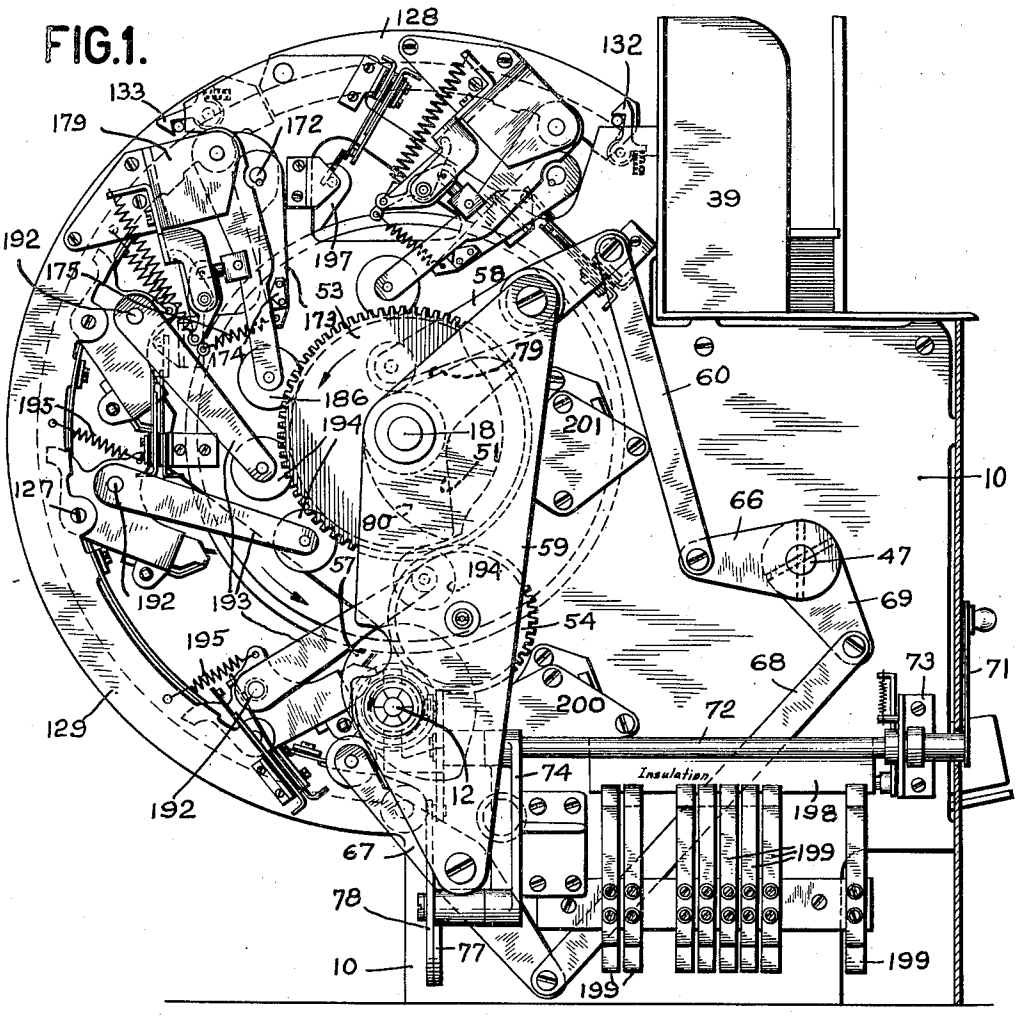
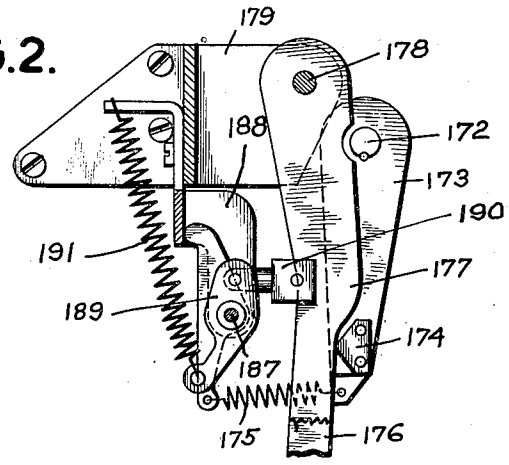


FIG.2.



INVENTOR
Fred M. Carroll
BY
O. M. Wilson
ATTORNEY

Dec. 8, 1936. F. M. CARROLL 2,063,486

TABULATING MACHINE

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FIG. 3.

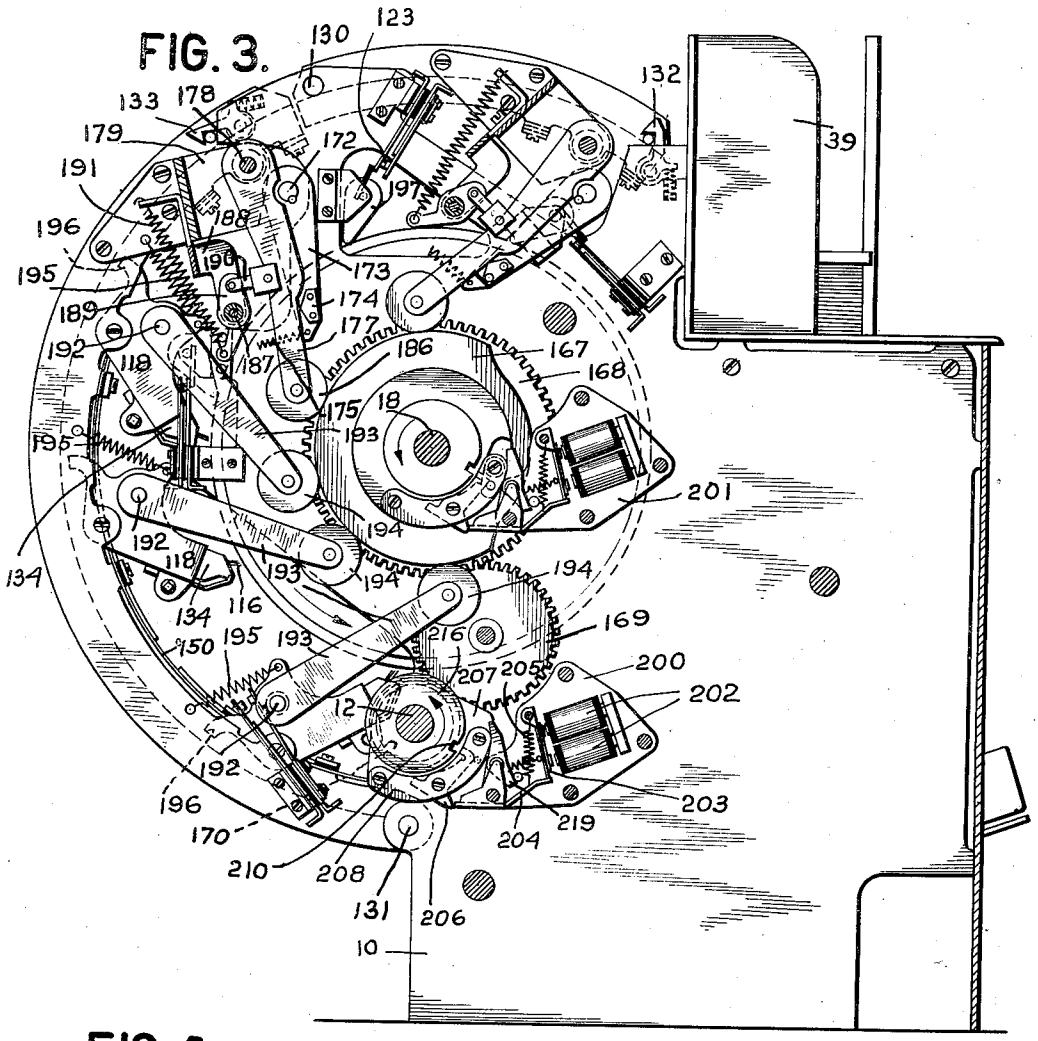
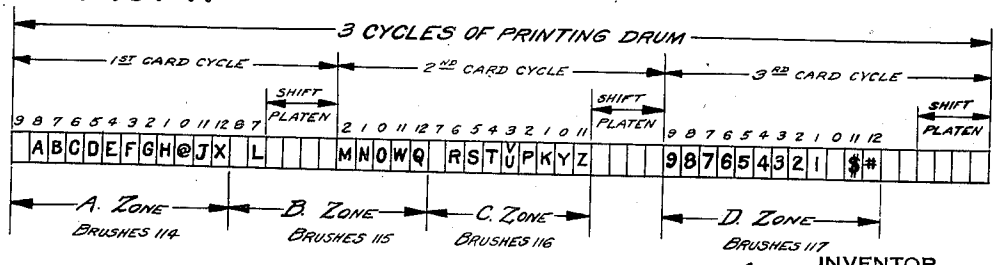


FIG. 4.



INVENTOR

Fred M. Carroll

BY

W. M. Wilson

ATTORNEY

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TABULATING MACHINE

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FIG.5.

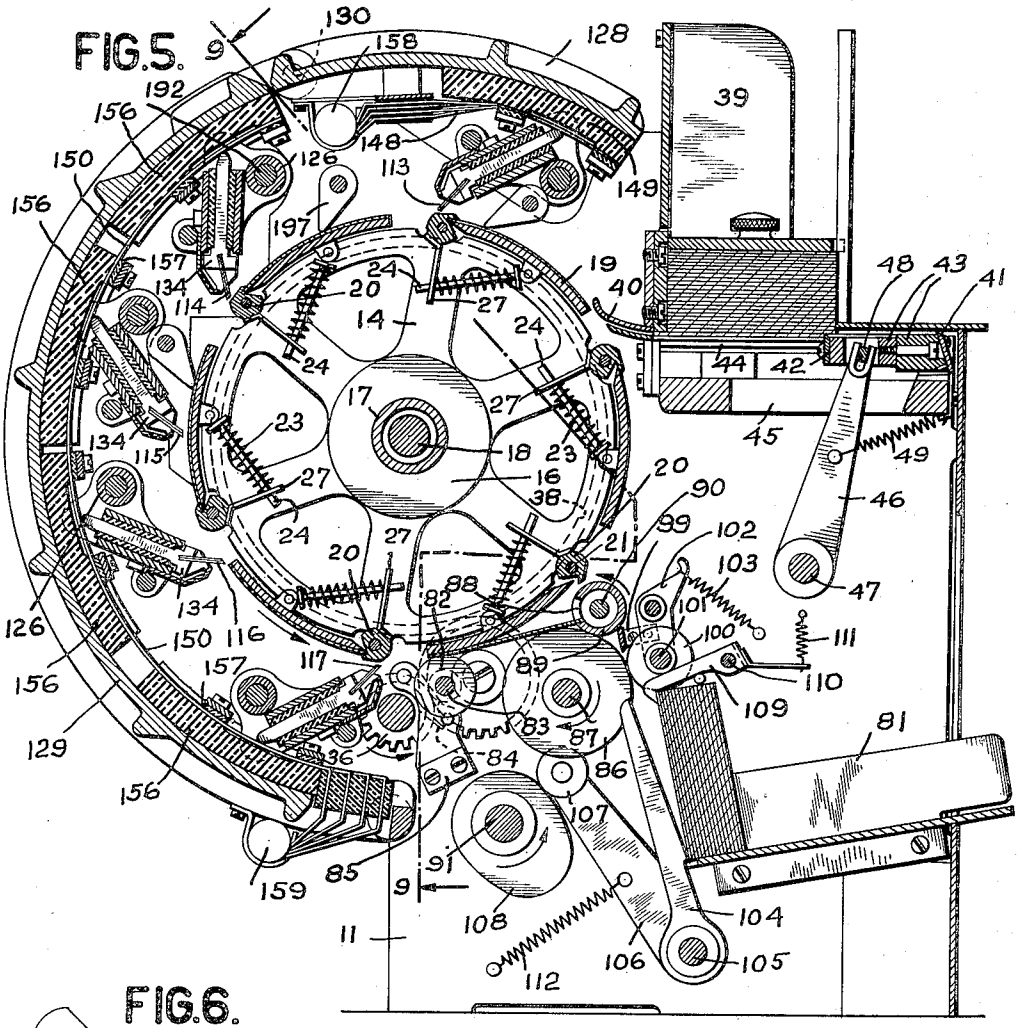
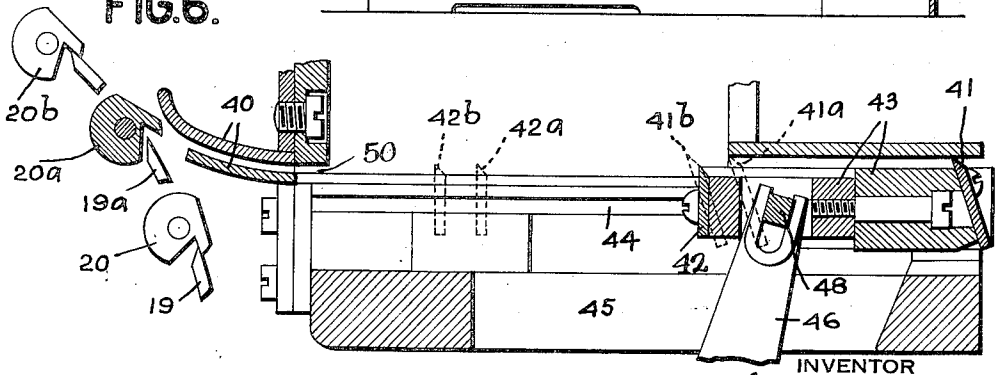


FIG.6.



INVENTOR

Fred M. Carroll

BY

W. M. Wilson

ATTORNEY

Dec. 8, 1936. F. M. CARROLL 2,063,486

TABULATING MACHINE

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FIG. 7.

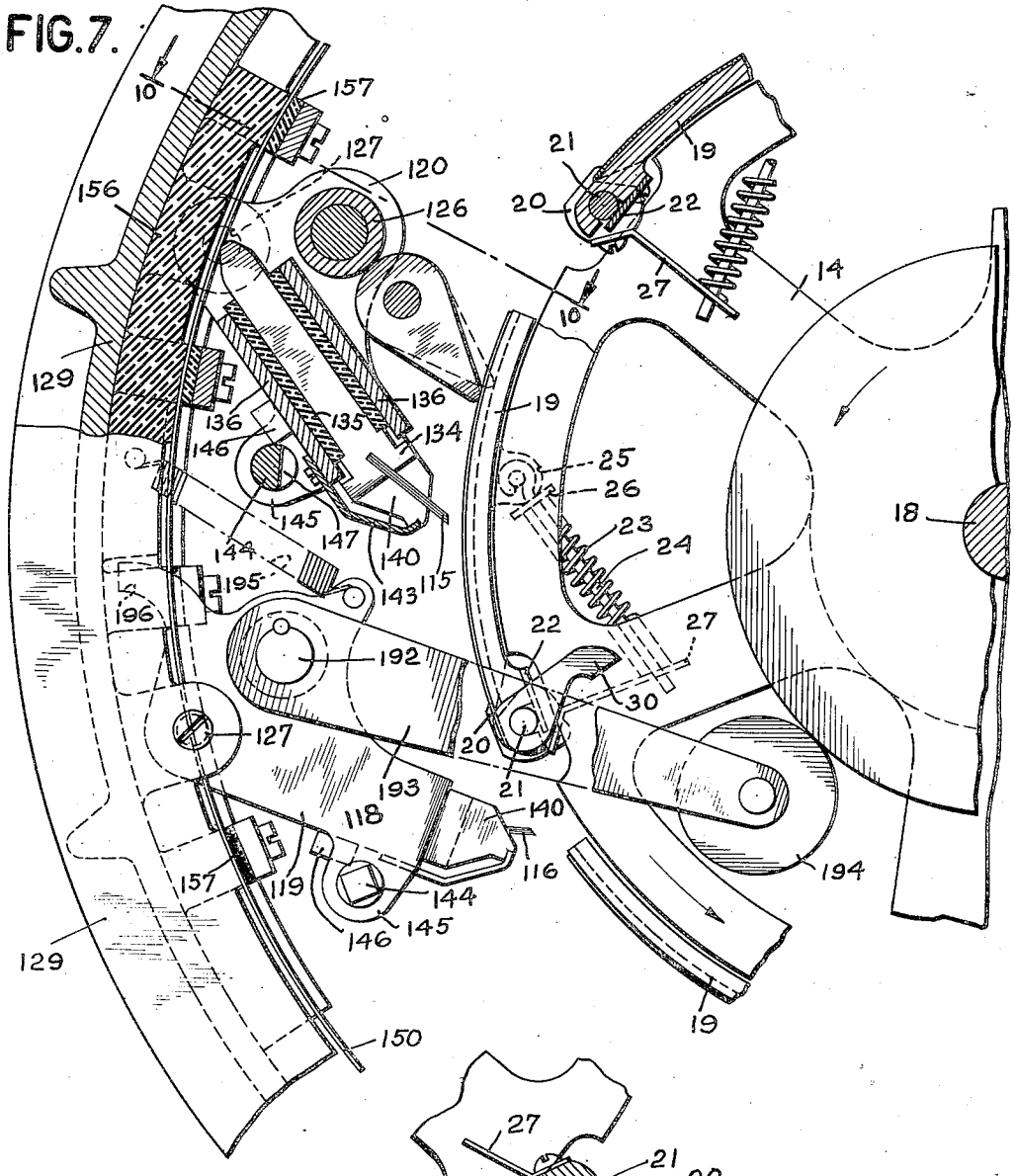
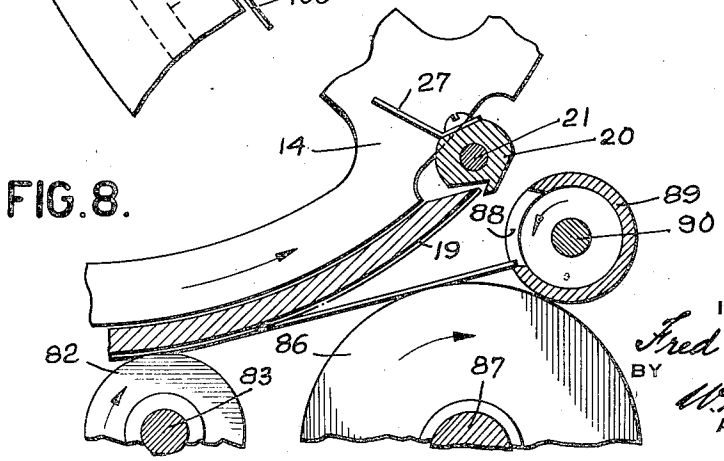


FIG. 8.



INVENTOR
Fred M. Carroll
BY
W. M. Wilson
ATTORNEY

Dec. 8, 1936. F. M. CARROLL 2,063,486

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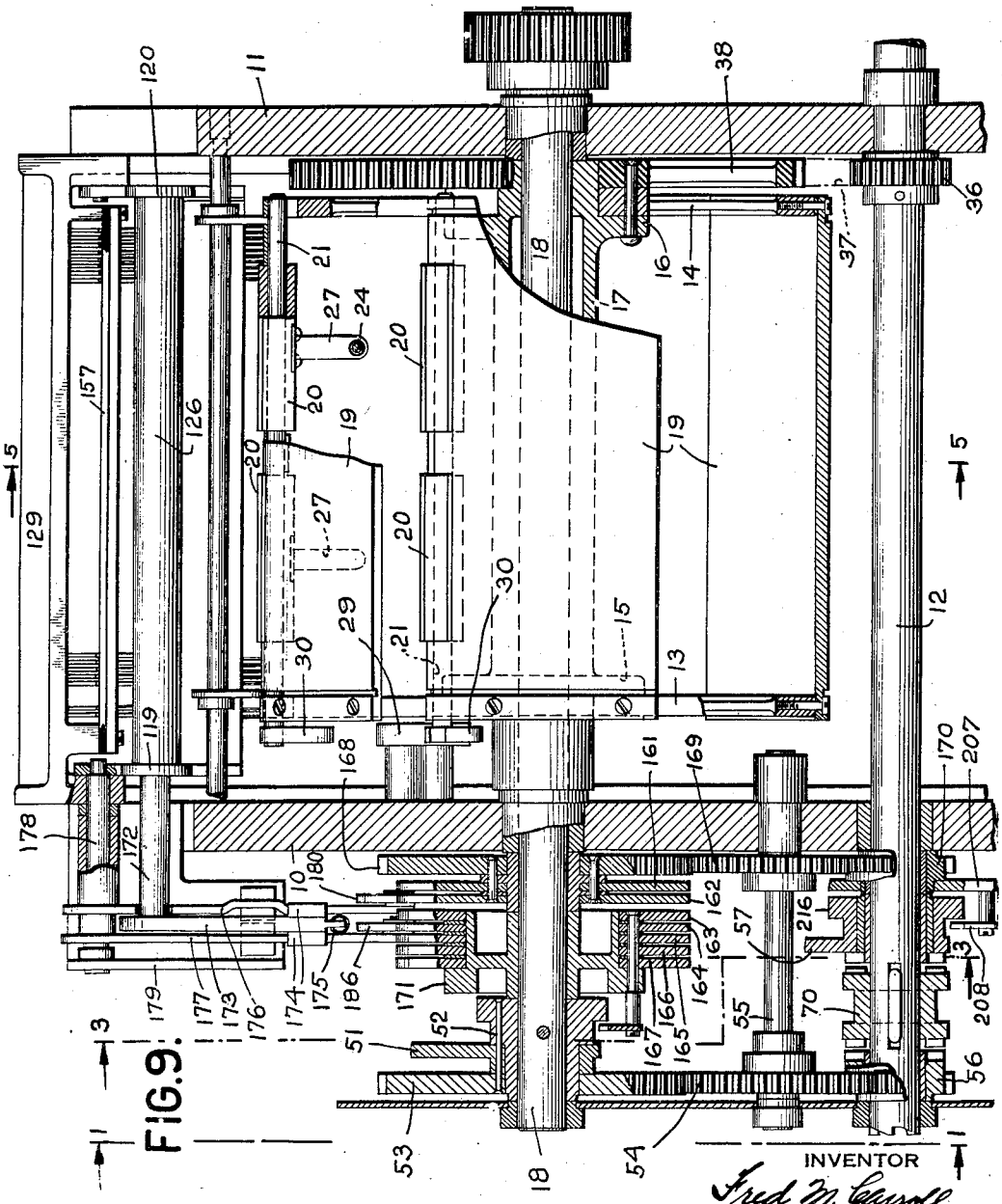


FIG. 9.

INVENTOR
Fred M. Carroll
BY
W. McAdison
ATTORNEY

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FIG.10.

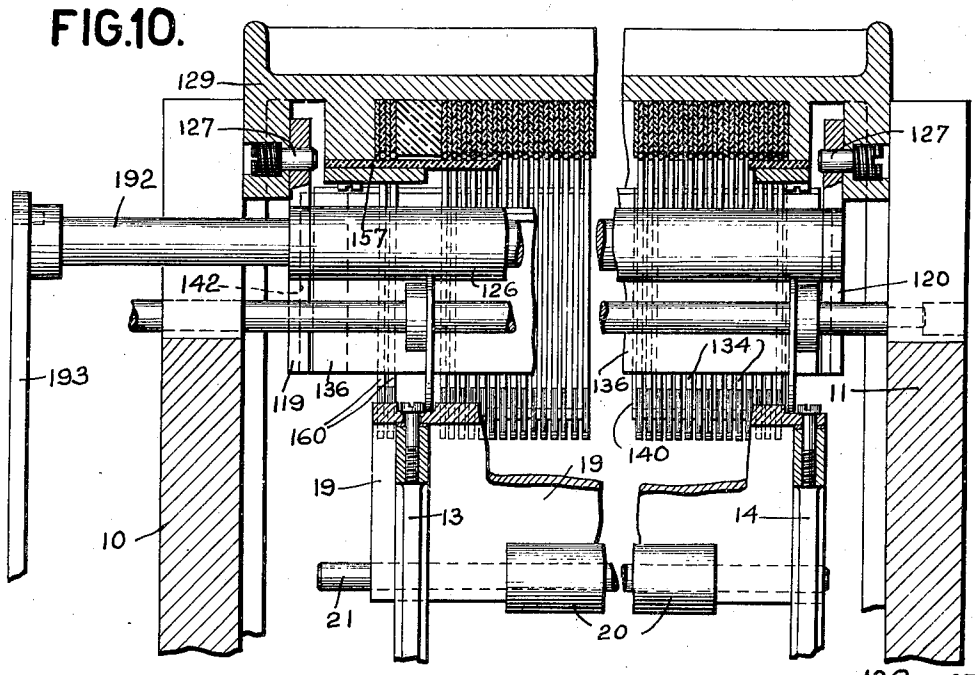


FIG.10a.

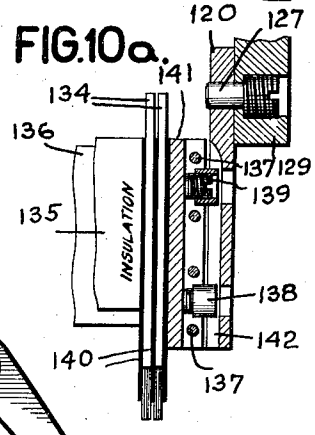
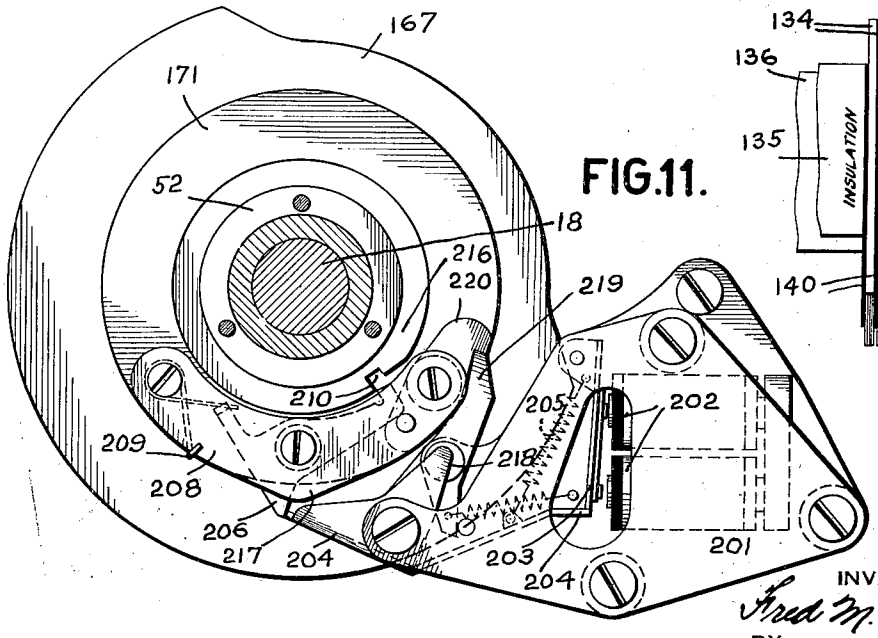


FIG.11.



INVENTOR
Fred M. Carroll
BY
W. M. Wilson
ATTORNEY

Dec. 8, 1936. F. M. CARROLL 2,063,486

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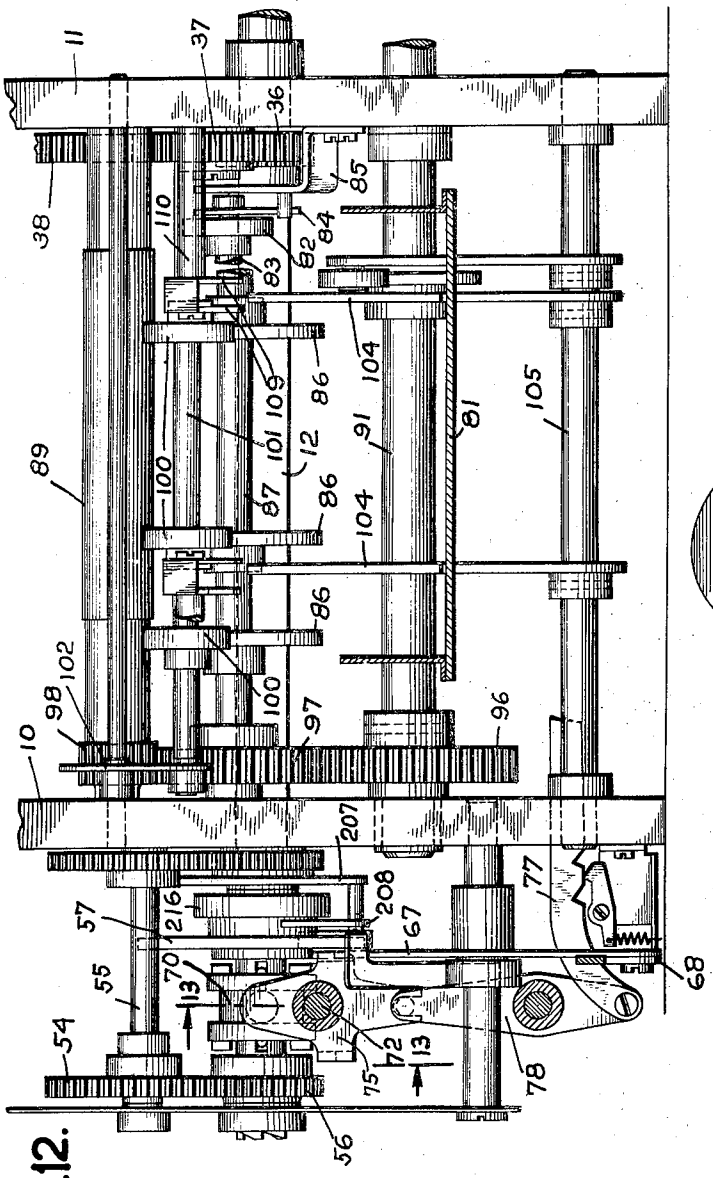


FIG.12.

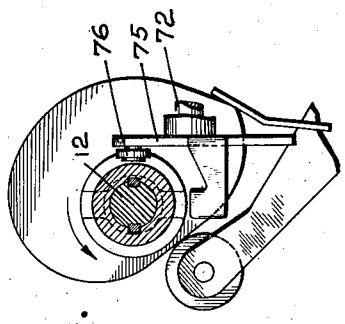


FIG.13.

INVENTOR
Fred M. Carroll
BY
W. Wallace Lane
ATTORNEY

Dec. 8, 1936. F. M. CARROLL 2,063,486

TABULATING MACHINE

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FIG.14.

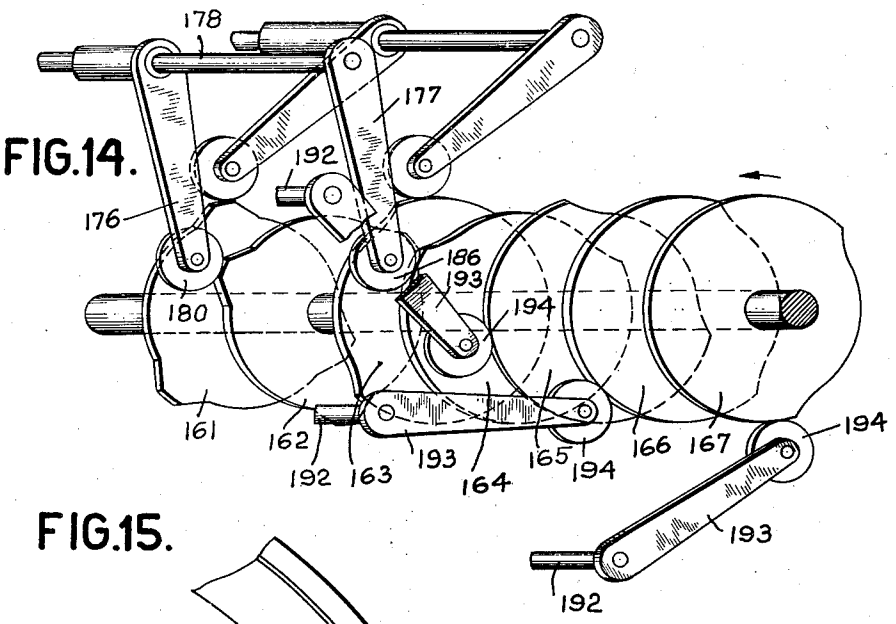
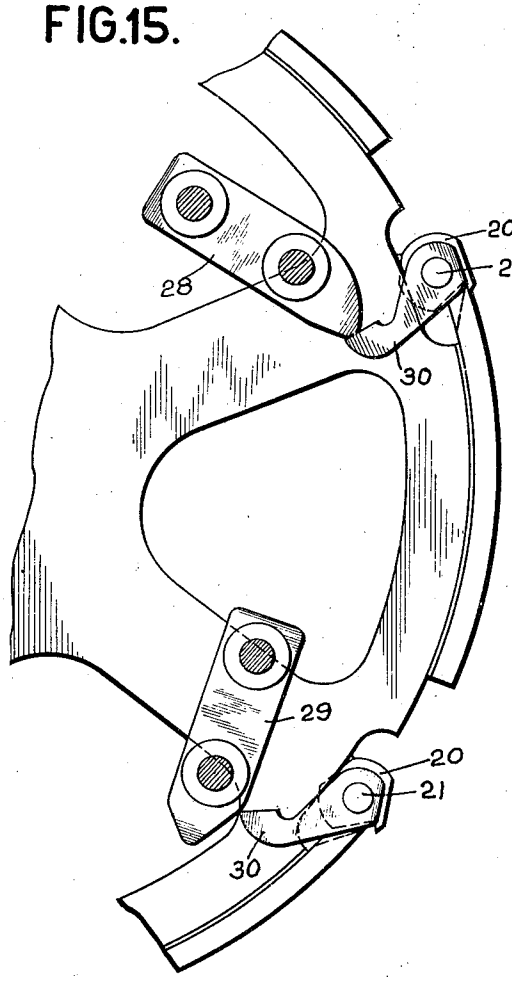


FIG.15.



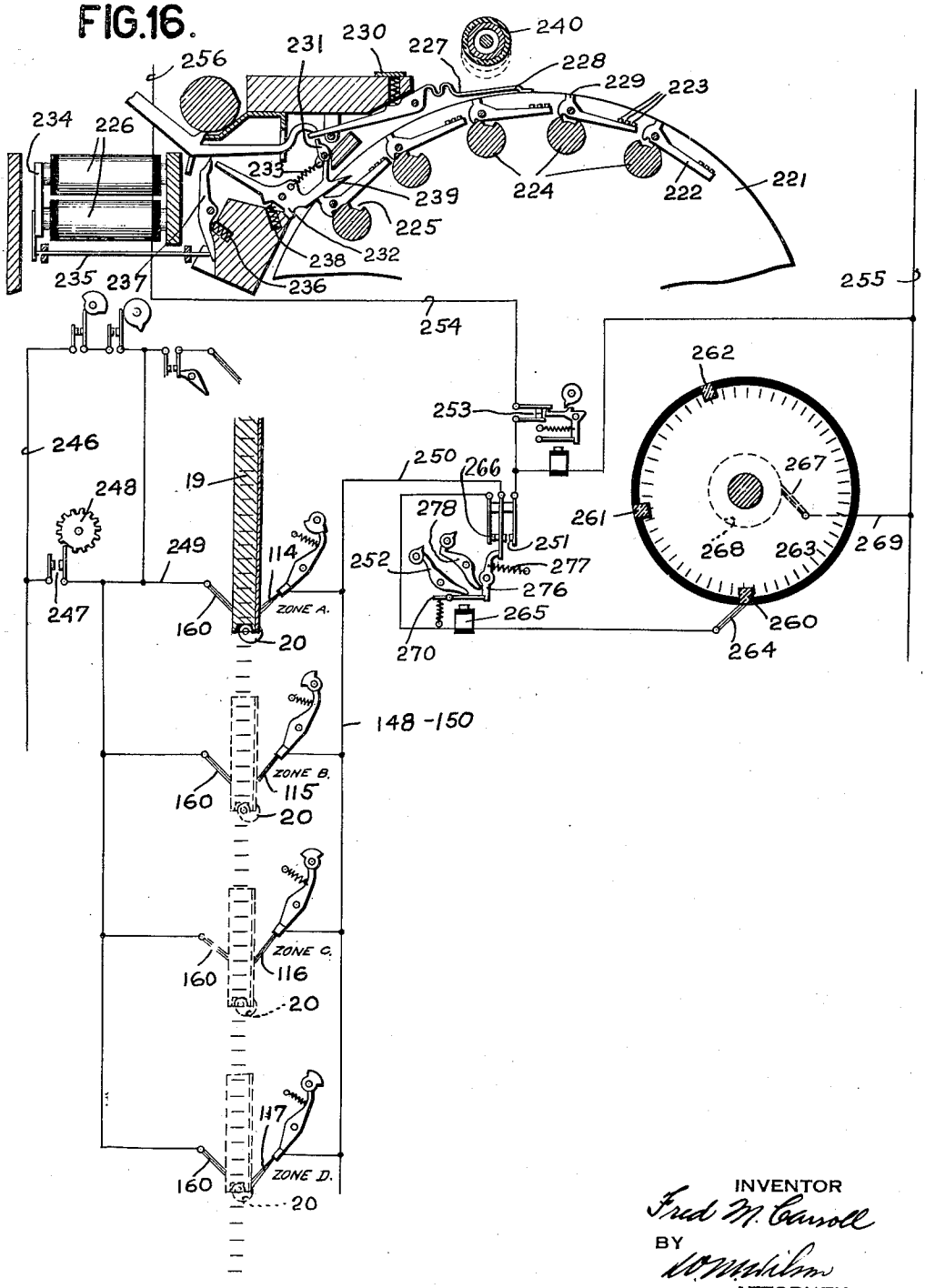
INVENTOR
Fred M. Carroll
BY
ATTORNEY

Dec. 8, 1936. F. M. CARROLL 2,063,486

TABULATING MACHINE

Filed March 30, 1933 9 Sheets-Sheet 9

FIG.16.



INVENTOR
Fred M. Carroll
BY
W. Mahlon
ATTORNEY

Patented Dec. 8, 1936

2,063,486

UNITED STATES PATENT OFFICE

2,063,486

TABULATING MACHINE

Fred M. Carroll, Yonkers, N. Y., assignor, by mesne assignments, to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application March 30, 1933, Serial No. 663,472

20 Claims. (Cl. 101—93)

This invention relates to accounting machines and more particularly relates to perforated record controlled machines adapted to print numerals, alphabetical characters, special identifying characters, etc.

My invention is particularly adaptable for use in connection with continuously rotating printing drums such, for instance, as are disclosed in my prior U. S. Patents No. 1,516,079 issued November 18, 1924 and No. 1,623,163 issued April 5, 1927. Such printers utilize a continuously rotating printing drum which carries printing characters adapted to be called into operation as they successively pass a printing platen. By using this construction much higher printing speeds were obtained than previously were possible. However, when such a structure was employed for printing alphabetical characters, numerals, etc., it was found that the drum was so large as to entail an almost prohibitive cost of manufacture. Also, due to its unwieldy size, operating difficulties were encountered.

In order to reduce the size of the printing drum it was proposed in my prior U. S. Patent No. 1,726,539 issued Sept. 3, 1929, to provide the necessary printing capacity by mounting a plurality of types, one below the other, on each pivoted type carrier, and to cause a relative movement of the platen to select one of the printing characters on the type carriers. This resulted in a smaller printing drum having many advantages over the prior construction but required three rotations of the drum for a single card feed cycle.

It is proposed in the instant invention to develop a still greater speed, particularly on operations wherein numerals only are to be analyzed and printed.

To this end one of the objects of this invention is to provide in a machine of the type indicated a dual control for a card sensing mechanism whereby the number of printing cycles is materially reduced when analyzing control cards bearing only numeral designating perforations.

Another object is to provide a manual control to change the machine from an alphabet and numeral analyzer to a straight numeral analyzer.

A further object is to provide a novel card picker having a plurality of picker knives adapted to operate on the card at different times.

Still another object is to provide a dual card feed operating mechanism.

Another object is to provide novel mechanism whereby automatic control of the machine is effected between certain sets of brushes at one operation and between certain other sets of brushes on another operation.

A further object is to provide novel mechanism to render sensing brushes effective from a plurality of sources.

Another object of the present invention is to provide a novel card stripping and stacking device.

Still a further object is to provide a novel brush support whereby the brushes may be removed readily from the machine.

The invention may be clearly understood from the following detailed description which should be read in connection with the drawings which accompany and form a part of the specification.

In said drawings:

Fig. 1 is a view in left elevation of the card feeding and sensing mechanism. This view is indicated by lines 1—1, Fig. 9.

Fig. 2 is a fragmentary view of the zone 1 brush operating mechanism.

Fig. 3 is a sectional view taken on line 3—3, Fig. 9 looking in the direction indicated by the arrows.

Fig. 4 is a diagrammatic view showing a comparison of the zoning arrangement with the cycles of the printing drum.

Fig. 5 is a sectional view taken laterally through the card drum and sensing mechanisms substantially on line 5—5, Fig. 9.

Fig. 6 is a detail view of the card picker showing the picker by dot and dash lines in its actuated position, and by full lines in its normal position.

Fig. 7 is an enlarged detail view showing the details of construction of the brush holders and of card drum.

Fig. 8 is a fragmentary view of the device for stripping the cards from the card drum.

Fig. 9 is a longitudinal sectional view taken substantially on line 9—9 of Fig. 5.

Fig. 10 is a sectional view taken on line 10—10, Fig. 7, showing the brushes for sensing zone 1.

Fig. 10*a* is a detail view showing the method of mounting the brushes in the brush holder.

Fig. 11 is an enlarged detail view of the clutch mechanism for controlling alphabetical brush operating cam assembly.

Fig. 12 is a detail view in front elevation showing the drum shaft and clutch mechanism.

Fig. 13 is a detail sectional view of the clutch for driving either the alphabet cams or the numerical cams. The section is indicated in Figure 12 by line 13—13.

Fig. 14 is a disjoined view of the brush operating cams and their followers.

Fig. 15 is an enlarged detail view of the cam plates for operating the card grippers.

Fig. 16 is a conventional illustration of a fragment of the printing mechanism and a partial circuit diagram.

General description

Described in general terms, the invention includes a rotatable card drum having a plurality of card positions about its periphery. A card picker is provided to pick cards one by one from the bottom of a stack and move said cards into cooperative relation with gripping devices located adjacent the several card positions on the drum, as said card positions are rotated successively past the card chute leading from the picker.

Shortly before the cards arrive opposite the card chute the grippers release the cards which are then fed into a stacker by novel mechanism provided for that purpose.

During the course of travel of the cards from the chute leading from the picker to the point where they are finally released by their grippers, they are carried successively past a plurality of sensing stations. These sensing stations and brushes are, reading in a counterclockwise direction (Fig. 1), (1st) the automatic control brushes, (2nd) the zone A brushes (3rd) zone B brushes (4th) zone C brushes and (5th) the zone D brushes. The card first passes the automatic control brushes the purpose of which brushes is to compare the card with the preceding card in order to effect a total printing operation upon the occurrence of a change in group numbers. The next or zone A brushes are adapted, on alphabetical operation, to read the perforations in zone A (Fig. 4) to control the printing mechanism on its first cycle to print the alphabetical characters in zone A. Similarly zones B, C and D on alphabetical operations control the printer to print the characters represented severally therein. However, on straight numerical operations the zone brushes B, C and D are not used and the numerals, which in alphabetical operations are read by the zone D brushes, are now, on numerical operations, read by the zone A brushes. The mechanism for operating and for controlling the operation of the brushes for the several zones will be described in detail later.

The analyzing mechanism, the card picker and card feed mechanisms are all mounted between a pair of frames 10 and 11 (Figs. 9, 10 and 12) suitably supported in the machine proper (not shown herein). The machine is adapted to be driven from a main drive shaft 12 which in turn may be driven by any suitable device preferably by an electric motor of suitable design.

The feed drum

The card feed drum for carrying the cards successively past the several sensing stations includes a pair of end members 13 and 14 (Figs. 9 and 10) in the form of wheels which members are secured to flanges 15 and 16 on a hub or axle 17 rotatably supported on a shaft 18 which in turn is rotatably mounted in the frames 10 and 11. A series of arcuate card plates 19 are spaced around the peripheries of, and secured to the wheels 13 and 14 there being six plates 19 provided in the instant case. Associated with the leading edge of each of the plates 19 is a pair of card grippers 20 (see Figs. 5, 7, 8, 9, and 15) mounted on shafts 21 pivotally supported in the plates 19 and held in place by retaining clips 22 secured to the inner surface of the plates 19 (Fig. 7). The grippers 20 are normally urged in a clockwise direction, to grip the cards, by springs 23 surrounding spring pilots 24 pivotally supported by projections 25 on the inner sides of their respective plates 19. The springs 23 are compressed between retainers 26 and arms 27 secured to the grippers 20, through holes in which arms 27 the free ends of the spring pilots 24 project.

Each of the grippers 20 is opened twice at each complete rotation of the card feed drum, first to receive the card and second to release the card after having carried said card successively past the several sensing stations. The opening of the grippers is effected against the tension of the spring 23 by cam plates 28 and 29 secured to the inner side of the frame 10 (Figs. 9 and 15). As the card drum rotates an arm 30 secured to the shaft 21 wipes by the cam plate 28 rocking the arm 30, shaft 21 and gripper 20 secured on that particular shaft 21, counterclockwise thus opening the gripper to receive the card advanced thereinto by the picker (to be described later). Continued rotation of the drum carries the arm 30 away from the cam plate 28 whereupon the spring 23 acts to rock the grippers clockwise to securely grip the card. After the card is carried past all of the sensing brushes or stations the gripper arm 30 engages the cam plate 29 thus again opening the grippers as above set forth, this time, however, for the purpose of releasing the card, which is then fed into a receptacle by means to be later described.

The card drum is operated from the main drive shaft 12 by a gear 36 (Figs. 5, 9 and 12) secured to said shaft. The gear 36 meshes with an intermediate gear 37 which in turn meshes with a large gear 38 secured to the flange 16 of the drum. The rotation of the drive shaft 12 and the arrangement of the gears 36, 37 and 38 are such that the card drum makes one complete rotation while the printing drum (to be described later) makes six cycles or rotations. Stated otherwise the card drum carries a card past a given set of brushes in synchronism with and while the printing drum is making one rotation.

The rotation of the card drum does not vary, and when the machine is set for straight numerical operations a card is fed by the card picker to every card position on the drum, however, when the machine is set to analyze alphabetical cards the timing of the picker is changed (as is fully brought out later) to feed a card to every third card position on the card drum. The reason for the above will be pointed out later.

The card picker

The cards to be analyzed are placed in a hopper indicated generally at 39 (Figs. 1, 3 and 5) from where they are fed, from the bottom of the stack, through a card chute 40 to the passing card gripper 20 which is opened just before it arrives opposite the guide 40 and closed shortly after it passes said guide to grip the leading edge of the card. The mechanism for feeding the cards out of the hopper 39 includes a picker knife 41 and a feed knife 42 (Figs. 5 and 6) secured on the right hand end and left hand end (as viewed in Fig. 6) respectively of a slide 43. The slide is mounted in grooves 44 in a frame 45 suitably supported in the side frames 10 and 11. The slide is adapted to be reciprocated first toward the left (Fig. 6) and then back by a pair of arms 46 (only one of which is shown herein) secured on a shaft 47

supported between the frames 10 and 11. The free ends of the arms 46 are bifurcated and embrace studs 48 pivotally mounted in the slide 43. Springs 49 (Fig. 5) resiliently hold the slide 43 and the arms 46 in their retracted positions in which they appear in Figure 5.

The shaft 47 may be operated from two sources, both of which are driven from the main drive shaft 12. On those operations wherein alphabetical data are being analyzed the picker shaft 47 is operated by a cam 51 (Figs. 1 and 9) secured to a hub 52 which in turn is secured on the shaft 18. A gear 53 secured to the cam 51 and to the hub 52 meshes with an intermediate gear 54 on a shaft 55, and the gear 54 meshes with a gear 56 freely mounted on the drive shaft 12.

On operations which analyze numerical data the picker mechanism is operated by a cam 57 on the shaft 12. The cam 51 cooperates with a roller carried by one arm of a lever 58 pivoted on a stud mounted between the frame 10 and a plate 59. A link 60 connects the other arm of the lever 58 to an arm 66 secured to the shaft 47. Likewise the cam 57 cooperates with a roller carried on one arm of a lever 67 pivoted on a stud projecting from the plate 59. A link 68 connects the other arm of the lever 67 to an arm 69 secured on the shaft 47. Obviously, rotation of the cam 51 will rock the lever 58 first clockwise and due to the link 60 rock the arm 66, shaft 47 and arms 46 (Fig. 5) counterclockwise to advance the picker slide 43 against the tension of the springs 49, which, after the cam 51 has passed the roller of lever 58 restores the picker slide 43 and its operating mechanism to normal positions. Likewise the cam 57 rocks the lever 67 counterclockwise and due to the coupling 68 rocks the arm 69, shaft 47 and arms 46 counterclockwise to actuate the picker slide.

The cam 57 and the gear 56 are freely mounted on the shaft 12 but either one may be operatively coupled to said shaft by manually sliding a clutch member 70 (Figs. 9, 12 and 13) either toward the right or left into engagement with the desired member. The clutch member 70 may be operated by a hand lever 71 (Fig. 1) secured to the end of a shaft 72 mounted in brackets 73 and 74 secured to the frame 10. An arm 75 (Fig. 12) secured to the opposite end of the shaft 72 carries a roller 76 projecting into an annular groove in the periphery of the clutch member 70. Rotation of the shaft 72 in a clockwise direction (Fig. 12) will engage the clutch with the cam 57 and counterclockwise rotation of the shaft will engage said clutch with the gear 56. In actual practice the clutch has no neutral position being actually engaged with either the cam 57 or the gear 56.

The clutch 70 may be operated automatically from the machine by means of a link 77 (Figs. 1 and 12). This link is connected to a lever 78 pivoted on a stud projecting from the bracket 74 (Fig. 1) which lever 78 at its upper end is operatively connected to the arm 75. The means for operating the link 77 to control the clutch 70 has no bearing on the instant invention for which reason description thereof is omitted from this specification.

It was stated above that when the machine is operated to analyze numerical data only, the card drum 14 (Fig. 5) makes one rotation to six printing drum cycles, that is, a printing cycle occurs as each of the card plates 19 passes a given set of brushes. For this reason the slide 43 is operated to feed a card out of the hopper 39 as each gripper 20 passes the guides 40. A description will now be given of the operation of the card picker on such operations.

The main drive shaft 12, and consequently the cam 57 (Fig. 1) when clutched thereto makes one complete counterclockwise rotation for each printing cycle, which rotation of the cam 57 corresponds to the passage of each card position of the card drum past the card guides 40. At each rotation the cam 57 operates the card picker knife and card feed knife in the following described manner: When a stack of cards is placed in the hopper 39, it may be noted by an examination of Figures 5 and 6 that the feed knife 42 in its extreme right hand position rests a short distance to the left of the right hand edge of the bottom card, consequently the first stroke of the feed knife 42 is idle. However, as the picker knife 41 nears the end of its leftward travel, it picks up the bottom card and advances it a short distance to the position indicated at 41*b* (Fig. 6) which is slightly in advance of the fully retracted position of the feed knife 42. At this point the leading edge of the card has entered the card throat 50 which is just wide enough to accommodate a single card.

The slide 43 is then restored toward the right to its fully retracted position and, as the knife 42 nears this position, it passes the right hand edge of the bottom card which immediately drops into position in front of the feed knife, and when the slide 43 again is shifted toward the left, the knife 42, now having a firm grip on the card, thrusts said card through the throat 50 and guides 40 where it is seized by the passing gripper 20 and drawn out of the guides 40 by the rotating card drum.

When the cam 57 has advanced the knives 41 and 42 to the positions indicated at 41*a* and 42*a*, respectively, a dwell on the cam 57 causes the slide 43 to stop momentarily. At this point the knife 41 is about to start the next card and since the preceding card still is in the throat 50 damage would result if insertion of another card into the throat were attempted at this point. When the knife 42 is momentarily at the position indicated at 42*a* the leading edge of the card is firmly grasped by the gripper 20 as at 20*b* (Fig. 6) and during the brief dwell of the knives 41 and 42 the continuously rotating card drum draws the card out of the throat 50 and guides 40. The cam 57 (Fig. 1) now advances the slide 43 and the knives 41 and 42 to the positions indicated at 41*b* and 42*b*, the movement of the knife 42 from 42*a* to 42*b* being idle whereas the knife 41 picks up the next card from the bottom of the stack and advances this card to position 41*b*. The cam 57 now restores the slide at one continuous movement to its fully retracted position.

When the machine is operated to analyze alphabetical data or a combination of alphabetical and numerical data the picker arms 46 and the slide 43 are operated by the cam 51 (Fig. 1). Prior to such operations, the clutch 70 (Fig. 9) is shifted out of engagement with the cam 57 and into engagement with the gear 56 which, as set forth above, drives the cam 51 through gears 54 and 53. The ratio of the gears 56 and 53 is such that the gear 56 makes three rotations while the gear 53 and consequently the cam 51 makes one rotation. The shaft 12 makes six rotations while the card drum makes one rotation. It is obvious, therefore, that the gear 53 and the cam 51 make two rotations while the card drum makes one rotation. It follows that the card

picker and card feed mechanism, when operated by the cam 51 will feed two cards at each rotation of the card drum. This card feed differs from the numerical feed first described in that the feed for alphabetical cards is divided into two strokes of the slide 43. The first stroke starts the card, after which the slide 43 is fully retracted. The second stroke of the slide feeds the card out of the hopper where it is seized by the passing gripper 20 whereupon the slide 43 again is fully restored.

This is necessary due to the timing of other elements of the machine and the necessity of bringing the picker and feed slide to rest at the end of a cycle in its fully retracted position, also it is desirable, when the picker mechanism is stopped at the end of a cycle, that there be no card in the started position which would be possible if a card were started by a slight additional movement of the picker slide 43 following a feeding movement as is the case when operating the picker slide by the cam 57.

These two separate movements are effected by the cam 51 (Fig. 1) which is provided with two lobes 79 and 80. The lobe 79 which extends radially a greater distance from the center than does the lobe 80, first operates the lever 58 and through the linkage 60 rocks the shaft 47 counterclockwise to shift the slide 43 at one stroke to its extreme leftward position. This carries the picker knife 41 to its position 41*b* starting the bottom card of the stack. As soon as the lobe 79 has passed the roller carried by the lever 58, the springs 49 (Fig. 5) rock the arms 46 clockwise to fully retract the slide 43.

At the proper time the lobe 80 (Fig. 1) acting on the lever 58 rocks the arms 46 (Fig. 5) again counterclockwise to advance the slide 43 to the position indicated at 41*a*—42*a* (Fig. 6) at which point the card is fully gripped by the gripper 20 and drawn out of the guides 40 by the rotating card drum. The springs 49 again restore the slide 43 as soon as the lobe 80 has passed beneath the roller on the lever 58. The cam 51 making two rotations to one rotation of the card drum again operates the picker mechanism to feed another card to the gripper 20 diametrically opposite the one to previously receive a card.

The card stacker

After a card has been carried past the several sensing stations it is released by the gripper 20 and stacked in a receptacle 81 (Fig. 5). As hereinbefore stated, the gripper 20 releases the card at the proper time under the influence of the arm 30 (Fig. 15) striking the cam 29. Shortly after the leading edge of the card passes the last sensing station it encounters spring pressed rollers 82. These rollers are mounted on a shaft 83 rotatably carried by arms 84 (only one being shown) which arms are pivotally supported on brackets 85 (see also Fig. 12).

The brackets 85 are secured to the inner sides of the frames 10 and 11 respectively. Springs (not shown) urge the arms 84 counterclockwise (Fig. 5) to press the rollers 82 resiliently against the plates 19 to retain, and feed the card after it has been released by the gripper 20.

When the card has reached approximately the position in which it is illustrated by dot and dash lines in Fig. 8 the gripper 20 is operated to release it whereupon the resilience of the card causes it to assume its normal flat shape. Since the card is still held between the plate 19 and roller 82 the leading edge of the card springs downwardly where it rests on a plurality of rollers 86 secured on a shaft 87. The card is shown in this position in full lines in Fig. 8. As the card springs downwardly the leading edge thereof enters a longitudinal opening 88 in a roller 89 mounted on a shaft 90 suitably supported in the frames 10 and 11. Continued rotation of the drum 14 thrusts the card further into the opening 88. The rollers 86 and 89 constantly rotate, the roller 86 clockwise and the roller 89 counterclockwise, the latter being so timed as to present the opening 88 to each card as said card is released by its gripper.

The rollers 86 and 89 are driven from a shaft 91 which in turn is driven from the main body of the machine (not shown). A gear 96 fast on the shaft 91 meshes with a gear 97 fast on the shaft 87, and the gear 97 meshes with a gear 98 fast to the roller 89.

As the roller 89 advances, the wall of the opening 88 comes into contact with the card and thrusts the leading edge thereof between the rollers 86 and 89. These rollers now feed the card past a guide bar 99 and between the feed roller 86 and spring urged tension rollers 100 mounted on a rod 101 carried between a pair of pivoted arms 102. The arms 102 are pivotally supported on studs projecting inwardly from the frames 10 and 11. Springs 103 serve to press the rollers 100 constantly against the rollers 86. The feed rollers 86 now feed the card downwardly to the right (Fig. 5) of a pair of stacker arms 104 secured on a shaft 105 supported in the frames 10 and 11. Also secured to the shaft 105 is an arm 106 carrying at its free end a roller 107 cooperating with a cam 108 secured on the shaft 91. The shaft 91 and consequently the cam 108 make six rotations while the card drum makes one rotation and the cam 108 is timed to rock the arm 106, shaft 105 and stacker arms 104 clockwise (Fig. 5) to press each card onto the stack as it is fed downwardly by the rollers 86. As the card is pressed against the left hand end of the stack (Fig. 5) it wipes by spring-pressed retaining hooks 109 mounted on studs 110 projecting inwardly from the frames 10 and 11. As the card passes the hooks 109, springs 111 restore said hooks to their effective positions wherein said hooks prevent retrograde movement of the card when the stacker arms 104 are retracted by the springs 112.

The sensing brushes

Described in general terms the sensing brushes include a plurality of groups of brushes (five groups in the instant case) each group extending the length, and comprising a sufficient number of individual brushes to sense each column of the well known Hollerith card. The brush groups are arranged concentrically about the card drum and each individual card is carried by each group of brushes successively as the drum rotates.

The groups of brushes according to their purposes are hereinafter referred to as follows, considered counterclockwise (Fig. 5) beginning at the group nearest the card hopper 39. The automatic control brushes 113, zone "A" brushes 114, zone "B" brushes 115, zone "C" brushes 116 and the zone "D" 117 or numerical brushes. The purposes of these brushes are as follows: The automatic control brushes 113 function in connection with the zone A brushes 114 on numerical operations to compare the group number of succeeding cards and to control the machine upon the occurrence of a group change. In addition to the above function the zone A brushes

serve to read off data from zone A of an alphabetical card. Similarly the zone B and C brushes 115 and 116 respectively read off the alphabetical data from their corresponding zones. The zone D brushes 117 function in connection with the automatic control brushes 113 on alphabetical operations to compare the group numbers on succeeding cards to determine when a group change occurs.

A detail description of the construction and method of mounting and operating the brushes will now be given. Since the brushes of each group are mounted in the same manner only one group will be described in detail.

Each of the groups of brushes are mounted in a rockable frame 118 (Figs. 1, 3, 5, 7 and 10) including end plates 119 and 120 joined by a tube 126, the plates 119 and 120 being pivotally mounted on studs 127 in the sides of arcuate frames 128 and 129 which are, in turn, pivotally supported between the frames 10 and 11. The frames 128 and 129 are normally concentric with the card drum but may be swung outwardly on their pivots 130 and 131 respectively (Fig. 3) for the purpose of gaining access to the several groups of brushes 113 to 117, inclusive. Latches 132 and 133 (Fig. 1) are provided to latch the frames 128 and 129, respectively, in their operating positions.

Each individual brush of a group is mounted in a segment 134 and all of the segments for each group are securely clamped between two bars 135 of insulation, which bars 135 are in turn held by bars 136 of metal or other suitable material secured together by screws 137 (Fig. 10a). Clamped between the ends of the bars 135 are threaded sleeves 138 adapted to receive screws 139. These screws, when tightened, clamp the brush segments 134 longitudinally in the holders, the segments 134 being separated by thin strips 140 of insulation. A plate 141 is provided at each end of the group of brush segments to act as a bearing for the screws 139.

A comb 143 (Fig. 7) secured to the bar 136 opposite the sleeve 126 spaces the ends of the dielectric strips 140 which project beyond the segments 134 to properly space the brushes as near their ends as is practical.

When the frame 128 or 129 is swung to its opened position the brush unit may readily be inserted into or removed from the brush frame, the plates 119 and 120 being provided with grooves 142 (see Fig. 10a) to receive the projecting ends of the sleeves 138 to guide and to properly locate the brush assembly in the frame.

The brush assembly is held in the brush frame by a shaft 144 (Fig. 7) rotatably mounted in projections 145 on the plates 119 and 120. The bar 136 adjacent this shaft carries a plurality of lugs 146 opposite each of which lugs the shaft 144 is flattened as indicated at 147 (Fig. 7). When it is desired to remove or to insert a brush assembly the shaft 144 is rotated until the flattened portions are parallel with the bar 136 whereupon the lugs 146 may readily move past the shaft. After a brush holder has been inserted in its frame the shaft 144 is given a partial turn, the end of said shaft being square to accommodate a wrench, thus securely clamping the holder in position.

The brush segments 134 for the automatic control brushes make contact with conductors 148 supported by an arcuate bar 149 of insulation secured on the inner periphery of the frame 128, there being a conductor 148 for each brush segment 134 in this group. The segments 134 carrying brushes 114, 115, 116 and 117 of like denominational order for the group or zones A, B, C and D contact common conductors 150 supported on dielectric blocks 156 secured on the inner periphery of the frame 129. The conductors 148 and 150 are secured to the blocks 149 and 156, respectively, by bars 157 of insulating material secured to their respective frames 128 and 129 by screws or other suitable means, the bars 157 extending across all of the conductors 148 and 156 (see Fig. 10).

The conductors 148 are connected to suitable wires which are formed into a cable 158 secured to the frame 128, and the conductors 150 likewise are connected to wires formed into a cable 159 secured to the frame 129. The cables 158 and 159 form a convenient means for connecting the conductors to the main tabulating machine. It is to be understood that the wire for each denominational order conductor 148 on the frame 128 is connected to the wire for the corresponding denominational order conductor 150 on the frame 129 (see Fig. 16). Near the left hand end (Fig. 10) each brush holder carries a pair of brushes 160 which make contact with the plate 19 to one side of the card thus supplying current to the plate 19, the circuit being completed when a brush 113 to 117, inclusive, makes contact with the plate 19 through a hole in the card.

The brushes are normally out of contact with the plates 19 and are lowered into contact therewith at the proper time under control of two sets of cams, one of said sets functioning on numerical operations and the other of said sets of cams functioning on operations when alphabetical data, or a combination of alphabetical and numerical data are to be read off from the cards. The cams for controlling the automatic control brushes and the zone A brushes for reading numerical data only will first be described.

It was stated above that the brushes for zones B, C and D are not used when tabulating cards bearing numerical data only, and that all of the brushes are brought into use when alphabetical cards are to be tabulated. A separate cam is provided for each group of brushes but when numerical cards are being run through the machine the cams for operating the zone B, C, D brushes are not operated, consequently, these brushes are inactive and are held out of contact with the pressing plates 19. In Fig. 9 these cams are shown partly in section and reading from right to left these cams are identified as follows: 161 represents the cam which operates the automatic control brushes on numerical operations, 162 is the zone A brush operating cams for numerical operations, cam 163 operates the automatic control brushes on alphabetical operations, and cams 164, 165, 166 and 167 operate the zone A, B, C and D brushes respectively on alphabetical operations. It may be noted that the cams 161 and 162 are secured together and to a gear 168 having its hub journalled on the shaft 18. An intermediate gear 169 freely mounted on the shaft 55 meshes with the gear 168 and with a gear 170 loosely mounted on the drum shaft 12. The gear 170 is adapted to be driven through a clutch (to be described later) when the clutch member 70 is in engagement with the card picker cam 57 when the machine is set to read numerals only.

The cams 163 to 167 inclusive are secured together and to a hub 171 also freely mounted on the shaft 18 and which is adapted, at the proper time, to be clutched to the hub 52 previously de-

scribed. These cams are driven only when the machine is set to work on alphabetical cards.

Since the automatic control brushes and the zone A brushes are used on both numerical and alphabetical operations, dual operating means is provided therefor.

The operating mechanisms for the automatic control brushes and for the zone A brushes are identical therefore only the mechanism associated with the zone A brushes will be described. This mechanism includes a rod 172 (Figs. 1, 3 and 9) secured against rotation in the sleeve 126 for the zone A brush holder frame. An arm 173, secured on the left hand end of the rod 172, has blocks 174 fast one on each side thereof. A spring 175 having one of its ends secured to the end of the arm 173 holds the blocks 174 against cam arms 176 and 177 pivoted on a rod 178 supported between the frame 129 and a bracket 179 secured to the side of said frame. The arm 176 carries a roller 180 cooperating with the cam 162 and the arm 177 carries a roller 186 cooperating with the cam 164.

A short shaft 187 mounted in an extension 188 of the bracket 179 carries a pair of arms 189 connected to the cam arms 176 and 177 by links 190. A spring 191 stretched between an arm also fast on the shaft 187, and the bracket 188 urges the shaft 187 and arms 189 clockwise to press the rollers 180 and 186 against the peripheries of their respective cams 162 and 164.

If the machine is set to read numerical cards only and the clutch member is shifted toward the right (Fig. 9), and if a clutch (to be described later) between the cam 57 and the gear 170 is effective, the cams 161 and 162 will be rotated whereas the cams 163 to 167, inclusive, will be inactive. On such operations the zone A brushes as set forth above are used to read off numerical values from each card. The cam 162, therefore, lowers the brushes for this position into contact with each plate 19 and raises said brushes after the 12th or last index position of the card passes beneath the brushes. The gear 166 and the cams 161 and 162 receive two rotations for each rotation of the card drum, consequently, the configuration of the cam 162 is such that it lowers and then raises the brushes three times at each rotation (see Fig. 14).

However, when the machine is set to analyze alphabetical cards the clutch member 70 is shifted into engagement with the gear 56 and the brushes are operated through the gear 53 and cams 163 to 167, inclusive, by means of a clutch between the hubs 52 and 171. In this case the cams 161 and 162 are idle. Since on such operations a card is fed only to every third gripper 20 it is necessary to lower the brushes as the card passes thereunder and to raise said brushes and hold them out of contact while the next succeeding two plates 19 pass. The cam 164 (see Fig. 14) is designed to accomplish this result.

On numerical operations the automatic control brushes 113 (Fig. 5) are operated in synchronism with the zone A brushes 114 to compare the group numbers on succeeding cards and to control the machine in a well known manner when said numbers do not correspond. For this reason the above description of the zone A brush operating mechanism may also be applied to the automatic control brush operating mechanism. On numerical operations these brushes are operated by the cam 161 whereas the cam 163 which operates said brushes on alphabetical operations is inactive.

The zone B, C and D brushes operate on alphabetical operations only, consequently, the cams 165, 166 and 167, provided to operate these groups of brushes, are inactive on numerical operations. The operating mechanisms for the zone B, C and D brushes are identical excepting as to the timing of the cams 165, 166 and 167 for which reason only one of these structures will be described.

A rod 192 is fixed in the sleeves 126 forming the frame plates 119 and 120 (Fig. 1) for each of the zone B, C and D brush frames. Arms 193 secured on the outer ends of these rods carry rollers 194 (see also Figs. 1, 3 and 14) cooperating with the cams 165, 166 and 167 associated with the zone B, C and D brush frames, respectively.

Springs 195 constantly urge the brush frames and the arms 193 counterclockwise (Figs. 3 and 7) thus maintaining the rollers 194 always in contact with their cams. When the cams 165 to 167 permit counterclockwise movement of their respective brush frames, the springs 195 effect such movements to bring the brushes into contact with the plates 19 of the card drum, the counterclockwise movement of the brush frames being limited by projection 196 (Figs. 3 and 9) on the plates 119 striking the inner periphery of the frame 129.

It will be borne in mind that on alphabetical operations any numerals perforated on the cards are read off by the zone D brushes 117 instead of the zone A brushes 114 as on numerical operations, also that on alphabetical operations the automatic control brushes 113 operate in conjunction with the zone D brushes to compare the group numbers on succeeding cards.

The brush cams 161 to 165, inclusive, do not rotate, however, until a card is actually approaching the zone A brushes on either a numerical or an alphabetical operation. These cams are controlled by two brush cam clutches substantially the same in structure, one of these clutches being located interjacent the drive means and the cams 161 and 162, and the other brush cam clutch being located interjacent the drive means and the brush cams 163 to 167 inclusive. These brush cam clutches are rendered effective to couple their respective groups of cams to the drive means by an electrical impulse set up under the control of a card lever 197 (Fig. 5). Only one of the clutches is effective at a given operation, the particular clutch to be rendered effective depending upon the setting of the control lever 71 (Fig. 1). The shaft 72 carries a dielectric bar 198 adapted to operate a plurality of switch contacts 199 to either open or close said contacts as the lever 71 is swung to the numerical or to the alphabetical position for the purpose of controlling certain elements of the machine. Certain of these switch contacts are adapted to complete the circuit set up by the card lever 197 either to the numerical brush cam clutch indicated generally at 200 (Fig. 3) or to the alphabetical brush cam clutch indicated generally at 201 depending upon the position to which the lever 71 has been set.

As an example, it is assumed that the lever 71 has been set to the "numerical" position, the movement of the lever 71, shaft 72 and the arm 75 (Fig. 12) shifting the clutch member 70 toward the right (see also Fig. 9). This movement of the lever 71 also operates the contacts 199 (Fig. 1) to direct the electrical impulse effected under the control of the card lever 197 to the

clutch magnets 202 for the numerical brush cam clutch 200. When the magnets 202 are energized they attract their armature 203 freeing a tripping pawl 204 to the action of its spring 205, which spring rocks the pawl 204 counterclockwise to free a clutch dog 206, pivotally carried by a segmental plate 207 secured to the hub of the gear 170 and a plate 208 secured to plate 207 to the action of its spring 209 (Fig. 11). This spring immediately tends to rock the dog 206 to engage the nose thereof with a notch 210 in a disc 216 integral with the cam 57, but, since this cam has started to rotate, the notch has moved away from the nose of the dog, which nose, therefore, comes to rest on the periphery of the disc 216. When the cam 57 and disc 216 have completed one rotation the notch is again brought opposite the nose of the dog 206 whose spring 209 now enters said nose into the notch thus coupling the drive means to the gear 170, which, through the gear 169 drives the gear 168 and the cams 161 and 162. These cams, it will be remembered, operate the automatic control brushes and the zone A brushes on numerical operations.

The impulse to the magnets 202 is further under the control of cam contacts (not shown herein) and is of a very short duration. Shortly after the driving member 216 starts to rotate the segmental plate 207 and the plate 208 a projection 217 on the plate 208 strikes a finger 218 integral with the tripper 204 clockwise about its pivot, whereupon the spring 205 restores the armature 203 to its normal position to hold the tripper 204 in the path of the clutch dog 206. If the magnets 202 are not energized again before the clutch completes one rotation the tail of the dog 206 strikes the tripper thus disengaging the dog from the driving disc 216. The momentum of the plate 207 carries it slightly past normal position whereupon a spring pressed retaining pawl 219 drops into a notch in said plate 207 to prevent retrograde movement thereof. The tail of the dog 206 and the pawl 219 serve to aline the clutch member in normal position.

When a series of cards are being passed through the machine the magnets 202 are energized as each card passes the card lever 197 (Fig. 5) effecting the removal of the tripper 204 from the path of the dog 206 before the dog strikes said tripper thus effecting a continuous rotation of the cams 161 and 162 as long as cards are being fed from the hopper 39 and until the last card has passed the card lever 197.

The clutch 201 for the cams 163 to 167, inclusive, differs only slightly from the clutch 200 just described. In this case the drive forms a part of the hub 52 for the gear 53 and cam 51 and the plate 208 carrying the clutch dog is carried on the hub 171 of the cams 163 to 167. Also the pawl 219 cooperates with a notched member 220 carried between the hub 171 and the plate 208.

It will be remembered that on numerical operations a card is fed to each card position on the card drum, and that the shaft 12 and gear 170 make one rotation each time a card passes a given set of brushes, consequently, after the last card passes the card lever 197 the magnets 202 are not again energized and the clutch at once becomes ineffective. However, the gear 53 whose hub 52 drives the clutch 201 makes two rotations to one rotation of the card drum. It will also be remembered that on alphabetical operations a card is fed to every third position on the card drum. While the two intervening card positions are passing the card lever 197 the magnets 202 from the clutch 201 remain unenergized but the next card passes under the card lever 197 before the dog 206 arrives at normal position thus energizing the magnets and removing the tripper from the path of the dog 206 and effecting a continuous rotation of the brush operating cams 163 to 167 so long as cards are passing under the card lever 197 on alphabetical operations.

A number of card levers in addition to the lever 197 are provided to variously control the machine, but, since these levers have no bearing on the instant invention, they are not described herein.

Printing mechanism

The printing mechanism with which the present invention is adapted to be used is preferably of the type disclosed in my prior Patents No. 1,726,539 issued Sept. 3, 1929, and No. 1,835,466 issued Dec. 8, 1931. The printing mechanism is illustrated in Fig. 16 and includes a constantly rotating drum 221 carrying a plurality of pivoted type carriers 222 upon each of which carriers is mounted a plurality of type 223 arranged one below the other.

A locking cam 224 is associated with each type carrier 222, the cams being operated by a train of gears (not shown) in synchronism with the drum 221 so that each cam makes one rotation for each rotation of the drum. Each of the locking cams 224 is provided with a notch 225 which is timed to free the associated type carrier for operation at the printing position, but to lock the carrier against operation in all other positions of the drum.

The types are selected for printing by a call magnet 226 and, when called, are actuated by a finger 227 having a hook 228 at its end adapted to be lowered into the path of projections 229 on the type carriers 222. The hook 228 is normally held out of the path of the projections 229 by a compressed spring 230. A dog 231 pivotally carried by one arm of a lever 232 normally abuts against the end of the finger 227. The dog 231 is free to rotate about its pivot on the lever 232 but is normally urged in a clockwise direction against a suitable stop (not shown) by a spring 233.

Energization of the magnet 226 attracts its armature 234 which thrusts a rod 235 toward the right (Fig. 16) rocking counterclockwise against the action of a spring 236, a lever 237 normally hooked over the end of the other arm of the lever 232 thus freeing said lever 232 to the action of its spring 238 which immediately rocks the lever 232 clockwise, the dog 231 snapping beneath the end of the finger 227.

Shortly after this action occurs a projection 229 on one of the type carriers comes into contact with a cam face 239 on the lever 232 and rocks this lever counterclockwise. The dog 231, being at this time beneath the end of the finger 227, rocks this finger clockwise to interpose the hook 228 in the path of the projection 229 on the next succeeding type carrier 222 which is thus operated for printing. As the projection 229 continues to wipe by the cam face 239 the lever 232 is rocked further counterclockwise carrying the dog 231 past the end of the finger 227 which is then rocked counterclockwise to its normally ineffective position. The latter part of the counterclockwise movement of the lever 232 carries the other arm thereof into position to be again latched by the lever 237 in which position the parts remain until the magnets 226 are again energized.

Near the end of each cycle of the printing drum 221 on alphabetical operations the platen 240 (Fig. 16) is shifted successively from the position in which it appears in full lines to the dotted line positions in order that, as the type carriers are rotated about their pivots the proper type will strike the platen.

However, on numerical operations, it is not desired to shift the platen since the numerals may all be printed at a single rotation of the printing drum 221. It will be recalled that the printing drum 221 makes six rotations or cycles while the card drum 14 makes one rotation but that on numerical operations a card is fed to each position on the card drum whereas on alphabetical operations a card is fed to every third position as the card drum, or, two per each rotation of said drum. The platen shifting means is operated through a clutch (not shown) which is under the control of one of the switches 199 (Fig. 1) so that when the lever 71 is set for numerical operations the clutch is rendered ineffective to operate the platen shifting means.

When the lever 71 is shifted to control the machine to make alphabetical operations the platen control clutch is rendered effective to drive the platen shifting means.

The platen shifting means is preferably of the type disclosed in my prior U. S. Patent No. 1,726,539, issued Sept. 3, 1929 to which reference may be had for a complete understanding thereof.

Operation

A brief description of the operation of the machine on both numerical and alphabetical operations will now be given.

The operation of the machine when analyzing numerical data will be described first. To condition the machine for such an operation the lever 71 is first set to the "numeral" position, thereby operating the control switches 199. One of these switches renders the platen shifting clutch ineffective while another of said switches directs the impulses from the card lever 197 to the numerical brush cam clutch magnets 202. Other of the switches 199 otherwise prepare the machine for numerical operations. Setting the lever 71 to the numeral position also throws the clutch member 70 into operative relation with the numerical card picker cam 57, which, upon energization of the clutch magnets 202 also drives the numerical brush cams 161 and 162.

The cards which are to be run through the machine are now placed in the hopper 39 and the machine is started by operating the usual start key (not shown). When the machine starts its operation the picker cam 57 operates the picker knife 41 and the feed knife 42 to feed a card to each of the grippers 20 as they successively pass the guides 40, the cards being carried successively past the automatic control brushes and the zone A brushes. The cards are also carried past the zones B, C and D brush stations but these brushes are not operated on numerical operations.

The automatic control brushes do not function when the first card passes this station since the brush cam clutch magnets 202 are not energized to render this clutch effective to drive the numerical brush cams 161 and 162 until the leading card comes into contact with and operates the card lever 197. When this occurs the cams 161 and 162 operate the automatic control brushes 113 and the zone A brushes 114 simultaneously to bring these brushes into contact with the second and leading cards respectively. The card passes the zone A brushes in synchronism with the passage of the type carriers past the printing position, consequently, when a perforated index point in the card passes beneath the brush 114 (see Fig. 16) a circuit is established from line 246 through contacts 247, now closed by the synchronous impulse emitter 248, wire 249, brush 160 (see also Fig. 10), plate 19, brush 114, wire 250, contacts 251 now closed automatically by a cam operated lever 252. From the contacts 251 the circuit leads through contacts 253 and wire 254 to the call magnets 226 to selectively operate the type carriers in the manner set forth above. The circuit is completed to the other side of the line 255 by a wire, a fragment of which is shown at 256.

The automatic control brushes 113, as hereinbefore stated, are for the purpose of comparing the group number of a card with that of a preceding card. So long as these numbers are the same a group control circuit is set up to maintain the operation of the machine. If a change in group numbers occurs this group control circuit is opened and controls the machine to make a total printing operation in a manner well known in the art.

After the cards are sensed by the zone A brushes they pass under the raised brushes at the zones B, C, and D stations. They are then released by their grippers 20 and fed into the receptacle 81 in the manner set forth above.

The operation differs somewhat when analyzing alphabetical cards since such cards are sensed in zones and the platen is shifted at each cycle to effect printing from the types in all three positions on the type carriers.

The lever 71 is set to the "alphabet" position as a preliminary to the operation thus through the switches 199 conditioning the machine in general to perform operations whereon alphabet zoning and printing is accomplished. Setting the lever 71 renders the platen shift clutch (not shown) effective to shift the platen at each cycle of the printing drum, and directs the impulses effected by the card lever 197 to the alphabet brush cam clutch 201 to render said clutch effective when a card passes beneath the card lever. Setting the lever 71 also shifts the clutch member 70 into operative relation with the gear 56 whereby the card picker cam 51 and, upon energization of the alphabet brush cam clutch magnets, the brush cams 163 to 167, inclusive will be operated.

When the machine operates, and cards are fed to the grippers 20 the cards reach the card lever 197 which closes the switch (not shown) to energize the alphabet clutch magnets. This clutch becomes effective at the proper time to pick up the brush cams 163 to 167, inclusive. These cams are timed to successively operate the group A brushes, the group B brushes, the group C brushes, and then simultaenously operates the group D brushes and the automatic control brushes.

The "9", "8" and "7" index positions on the alphabetical cards are known as "zone" positions. The cards pass the group A, B, C brushes in synchronism with the passing of contacts 260, 261 and 262, respectively, on a zoning commutator 263, past a brush 264 connected through a magnet 265 and normally closed contacts 266 to the wire 148—150. A brush 267 in contact with a common conductor 268 is connected by a wire 269 to the line 255.

The commutator 263 rotates in synchronism with the card drum 14 so that the brush 264 contacts the contact 260 at the instant the "9" position on the card passes under the zone A brush 114. The contact 261 comes under the brush 264 simultaneously with the arrival of the "8" hole in the card under the zone B brush 115 and the contact 262 comes under the brush 264 at the same time the "7" index point on the card comes under the zone C brush 116. The purpose of these zoning circuits is to effect the closing of contacts 251 in order to establish a circuit from the zone A, B, C and D brushes to the printer call magnets 226. Assuming that a card passing through the machine has a hole in the "9" index position and a hole in the "1" index position. The cam 164 operates to lower the zone A brushes as the "9" index point is passing thereunder, and there being a hole in this position, a circuit is established from the line 246, contacts 247, wire 249, brush 160, to the plate 19, thence through the brush 114, wire 250, contacts 266, magnet 265, brush 264, contact 260, ring 268, brush 267 and wire 269 to line 255. This energizes the magnet 265 which attracts its armature 270 releasing a lever 276 to the action of its spring 277 which spring rocks said lever 276 clockwise opening contacts 266 and closing contacts 251. The card continues its passage by the zone A brushes, and as the "1" index point passes the brush 114 a second impulse is made, this time through the contacts 251 (now closed), contacts 253, wire 254 to the printer magnets 226, which, being energized calls into action the proper one of the type carriers 222 from which to effect a printing of the letter "H".

The card now passes successively beneath the zone B and zone C brushes, but since these brushes are moved into contact with the card synchronously with the passage of the "8" and "7" index positions thereunder and since there are no perforations in these positions, there is no circuit established therethrough to again energize the magnet 265, the contacts 251 having been opened and the contacts 266 closed through the agency of a cam operated lever 278.

The card now passes under the zone D brushes which on alphabetical operations read off numerals. It is to be understood that certain columns on the card are used for numerical data and certain other columns for alphabetical data, and that under the control of the usual plugging arrangement numerical and alphabetical data are never read from the same column. Simultaneously, with the passage of a card under the brushes for zone D, the next succeeding card passes beneath the automatic control brushes 113, the latter brushes serving, as on numerical operations, to compare the group numbers.

Should a hole occur in the "8" index position as the card passes the zone A brushes the contacts 260 will have passed the brush 264 and as a result a circuit will not be established through the magnet 265 when this hole comes opposite the brush 114, and as the hole in the "1" position passes the brush 114 the brush 264 will be in contact with the insulation interjacent the contacts 260 and 261 thus again no circuit will be established.

However, as this card, bearing a hole in the "8" index position and in the "1" position, comes beneath the zone B brushes, these brushes are lowered as the "8" position arrives thereunder. This also coincides exactly with the passage of the contact 261 past the brush 264 thus establishing a circuit through the magnet 265 for the purpose above set forth.

Now when the "1" index position passes the zone B brushes a circuit is established to energize the printer magnet 226 thus calling the proper type carrier into action. The platen having been shifted one step at the end of the first cycle of the printing drum 221, the "1" position on the card now causes a printing of the letter "N" (see Fig. 4).

Again, if the card bears a perforation in the "7" position and a perforation in the "1" position, said card passes the zone A and zone B brushes without setting up a circuit through the magnet 265, but the zone C brushes 116 are lowered exactly as the "7" hole passes thereunder, and in synchronism with the passage of the contact 262 by the brush 264, thus energizing the magnet 265 to close the contacts 251. Now when the "1" hole permits brush 116 to make contact therethrough, the platen having again shifted, the magnets 226 are energized to print the letter "k" from the proper type carrier 222.

Near the end of the third cycle of the printing drum the platen shifting means operates to restore the platen to its normal position.

The means for feeding the record material to receive the impressions from the types is not disclosed herein but is preferably of the type disclosed in U. S. Patent No. 1,516,079, issued Nov. 18, 1924 to F. M. Carroll. It may be noted here that the record material is advanced one step or line at the end of each numerical operation, comprising one rotation of the printing drum, and at the end of an alphabetical operation comprising three rotations of the printing drum. In this manner all of the data read from a single card is printed on one line on the record material.

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

What is claimed is:

1. In a machine of the class described, the combination of a cyclic printing mechanism requiring a plurality of cycles when printing alphabetical characters and a single cycle when printing numerical characters, revoluble card carrying means having a plurality of card positions thereon, card feeding means, and means to operate the card feeding means according to the cyclic operation of the printing mechanism.

2. In a machine of the class described, the combination of a printing drum carrying a plurality of groups of type, said drum having cyclic rotations commensurate with the number of groups of type, a constantly rotating card carrying drum, means to feed cards to the carrying drum, and means to vary the number of cards fed to the carrying drum according to the cyclic rotations of the printing drum.

3. In a machine of the class described, the combination of a rotatable card carrying drum having a plurality of card positions thereon, means to feed cards to said drum, means to control the feed means to successively feed a card to each position on the drum, and means to control the feed means to feed cards to certain positions only on said drum.

4. In a machine of the class described adapted to analyze record cards, the combination of a drum to carry cards past the sensing stations in a continuous uninterrupted movement, means to feed cards to said drum, a plurality of means to operate the feeding means, and manually adjustable means to determine which one of said operating means is to function.

5. In a machine of the class described adapted to analyze record cards, the combination of a plurality of sets of perforation sensing brushes, means to carry the record cards past the sensing brushes in a continuous uninterrupted movement, means to feed cards to the carrying means, and means controlled by the cards to render certain of the sensing brushes effective.

6. In a machine of the class described, the combination of a plurality of sets of perforation sensing brushes, means to carry record cards past the sensing brushes in a continuous uninterrupted movement, means to feed cards to the carrying means, and means controlled by the cards to render all of the sensing brushes effective.

7. In a machine of the class described, the combination of a plurality of sets of perforation sensing brushes, means to carry record cards successively past the sensing brushes in a continuous uninterrupted movement, means to feed cards to the carrying means, means to render certain of the sensing brushes effective at certain operations, and means to render all of the sensing brushes effective at other operations.

8. In a machine of the class described, the combination of a plurality of sets of perforation sensing brushes, means to carry record cards successively past the sensing brushes in a continuous and uninterrupted movement, means to feed cards to the carrying means, means to operate certain of the sensing brushes at certain operations, means to operate all of the sensing brushes at other operations, and means to determine which of said operating means is to operate the sensing brushes.

9. In a machine of the class described, the combination of a plurality of brush holders, data sensing brushes carried thereby, and means operable during the operation of the machine successively to bring the brushes into position by swinging the holders therefor.

10. In a machine of the class described, the combination of a plurality of sets of perforation sensing brushes, a card carrying drum to carry record cards successively past the sensing brushes, and means to move the brushes into operative position successively and at different times during the passage of the card.

11. In a machine of the class described, the combination of a perforation sensing brush, a card carrying drum to carry cards past the sensing brush, a plurality of means to swing the sensing brush into contact with the cards, means to select the swinging means, and means controlled by the cards to render the selected swinging means effective.

12. In a machine of the class described, the combination of a perforation sensing brush, a continuously rotating card carrying drum to carry cards past the sensing brush, a swinging frame for the brush, a plurality of normally inactive operating means for said brush, means to select the operating means, and means to render the selected operating means active.

13. In a machine of the class described for analyzing record cards, the combination of a perforation sensing brush, a drum for carrying cards past the sensing brush, means to move certain of the brushes simultaneously into contact with the cards, and other means to move the brushes into contact with the cards successively and at different times during the travel of the cards past said brushes.

14. In a machine of the class described for analyzing record cards, the combination of a drum to carry the cards, a plurality of sensing brushes spaced concentrically about the drum, said brushes being normally out of contact with the drum, individual means to rock each brush into contact with the card in timed relation with the passage of the card past each of said brushes.

15. In a machine of the class described including a main frame, a card carrying drum, an arcuate frame pivotally mounted in the main frame, a series of brush frames pivotally supported in the arcuate frame, and means to latch the arcuate frame in position to bring the brush frames into concentric relation with the drum.

16. In a machine of the class described including a main frame, a card carrying drum, an arcuate frame having an open and a closed position, said frame being pivotally mounted in the main frame, a series of brush frames pivotally supported in the arcuate frame, perforation sensing brushes removably mounted in the brush frames, said frames being arranged to bring the brushes into concentric relation with the drum when the arcuate frame is closed and to render the brushes accessible when said arcuate frame is open.

17. In a machine of the class described including a main frame, a card carrying drum, an arcuate frame pivotally mounted in the main frame, a series of brush frames pivotally mounted in the arcuate frame, perforation sensing brushes carried by said brush frames, and means to removably lock the brushes in their frames.

18. In a machine of the class described, the combination of a cyclic printing device, a continuously rotating card carrying drum, means to feed cards to the carrying drum, and manually settable means to vary the cyclic operation of the printing means and to vary the number of cards fed to the carrying drum.

19. In a machine of the class described, the combination of a plurality of sets of sensing brushes, means to carry record cards past the sets of brushes, means to feed cards to the carrying means, means to vary the number of cards fed to the carrying means, and means to render certain only or all of the brushes effective according to the number of cards fed to the carrying means.

20. In a machine of the class described, the combination of a plurality of sets of sensing brushes, a plurality of operating means for the sets of brushes, means to carry record cards past said brushes, means to feed cards to the carrying means, a plurality of operating means for said feeding means, and manipulative means to select the operating means for the brushes and to select the operating means for the feed means.

FRED M. CARROLL.