

March 21, 1933.

F. L. LEE ET AL

1,902,085

CIRCUIT CLOSING DEVICE

Original Filed June 3, 1925 5 Sheets-Sheet 1

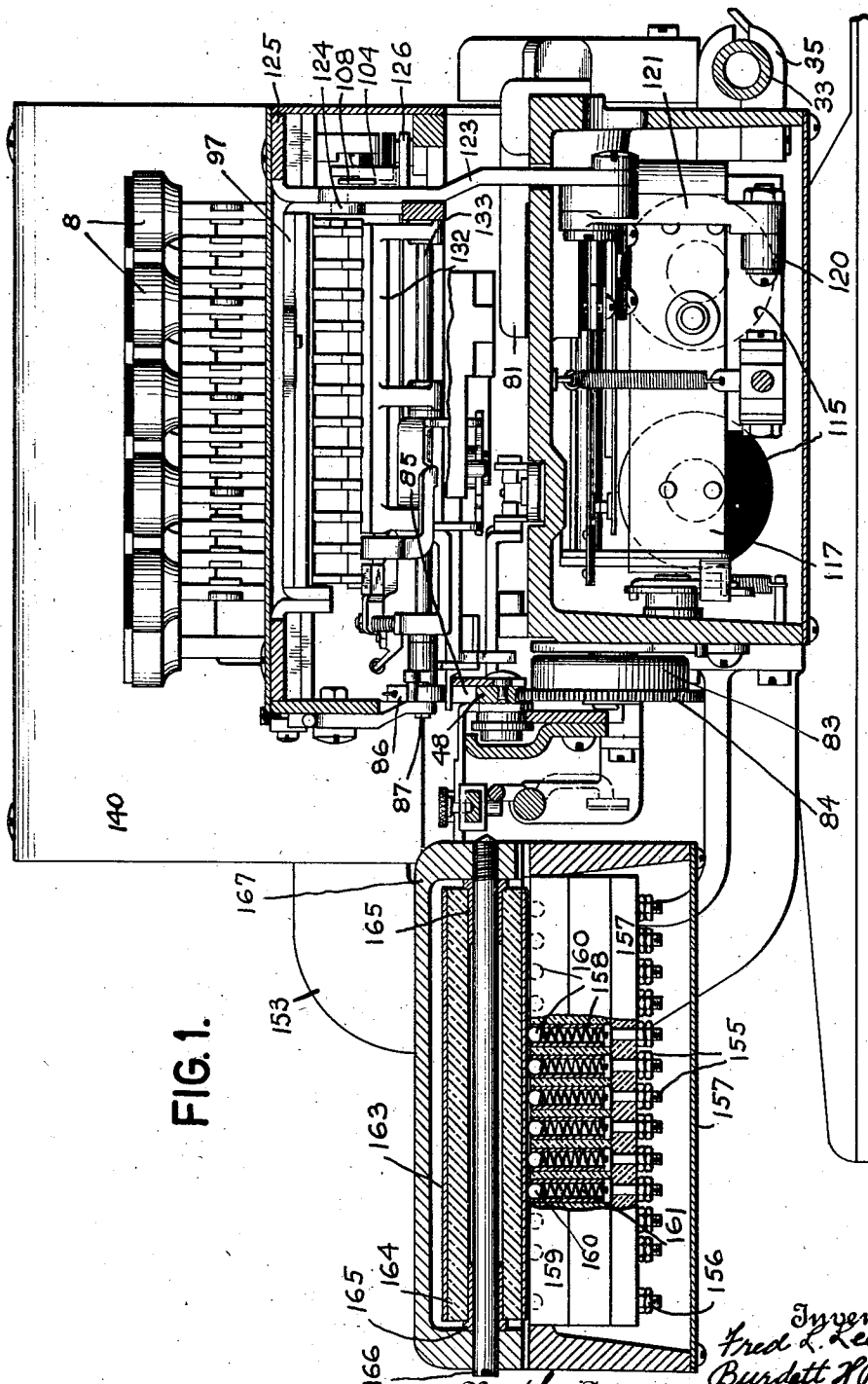


FIG. 1.

Inventor
Fred L. Lee
By the Attorney
Burdett H. Phillips
W. M. Wilson

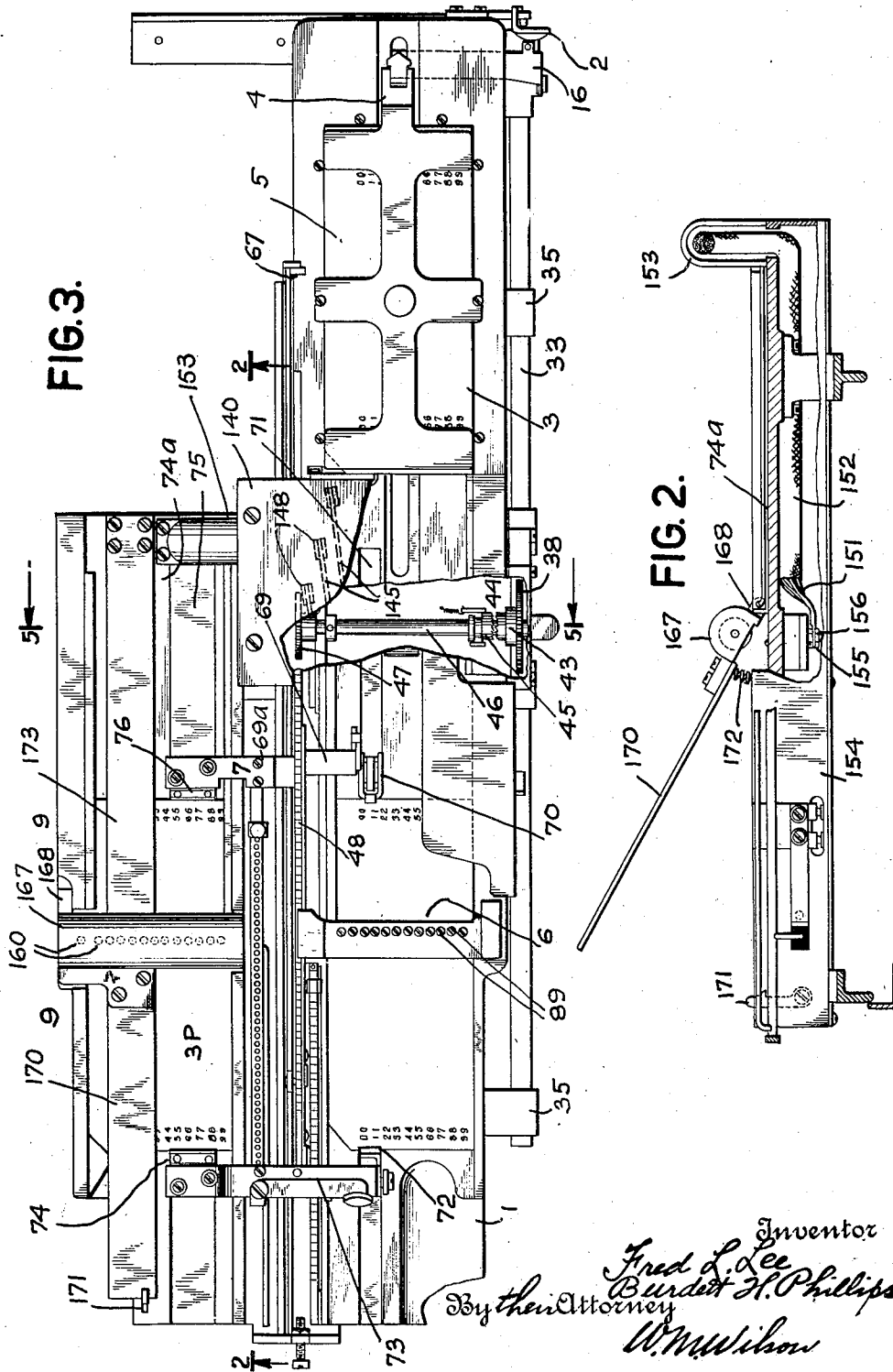
March 21, 1933.

F. L. LEE ET AL

1,902,085

CIRCUIT CLOSING DEVICE

Original Filed June 3, 1925 5 Sheets-Sheet 2



Inventor
Fred L. Lee
By their Attorney
Burdett H. Phillips
W. M. Wilson

March 21, 1933.

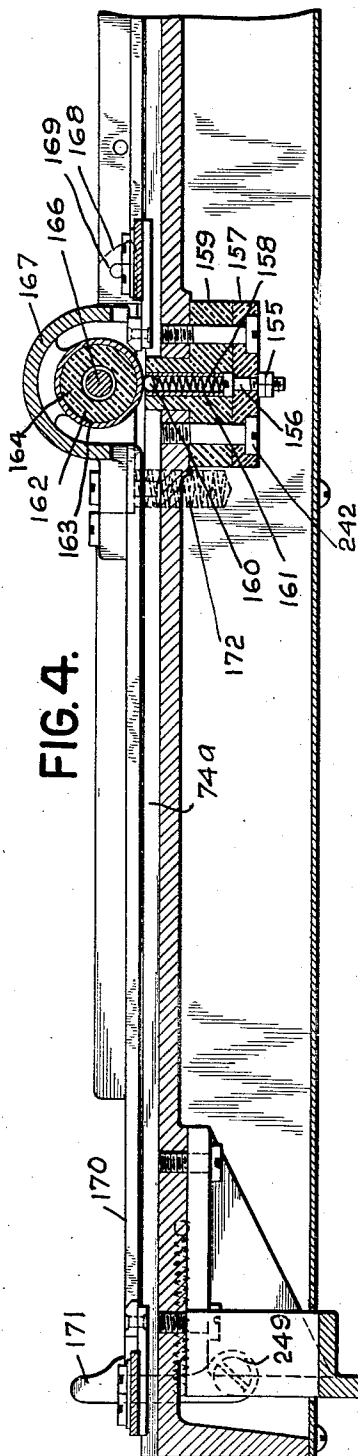
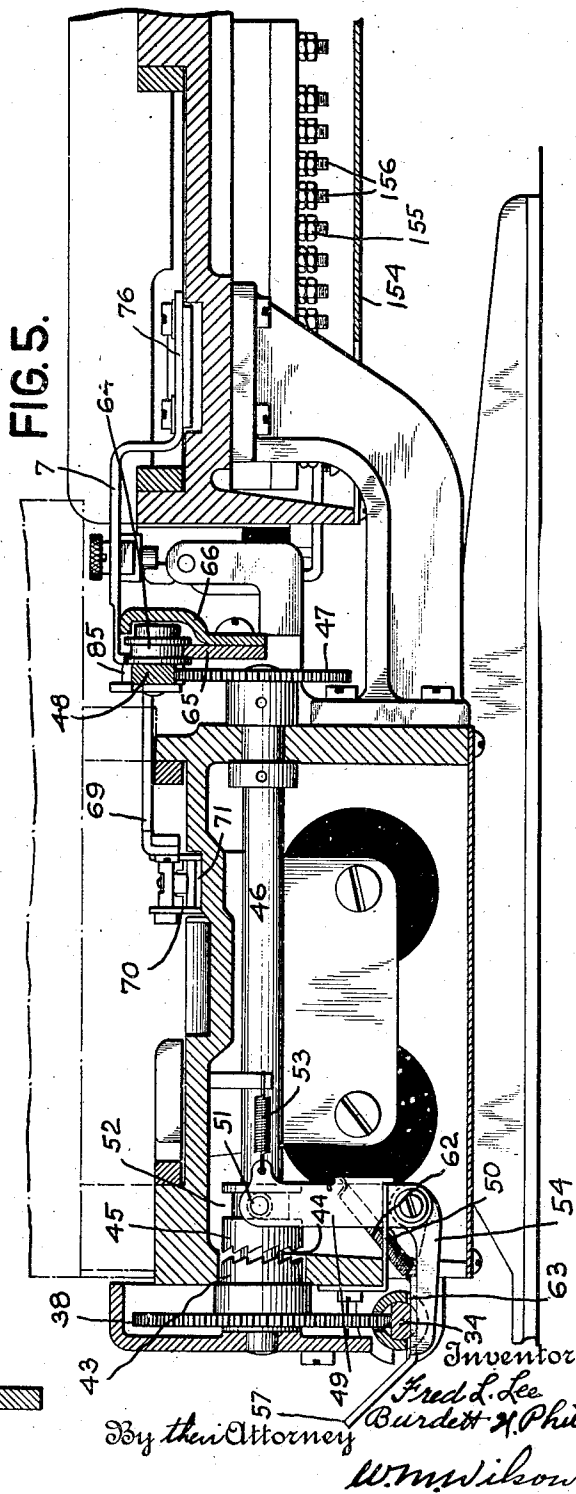
F. L. LEE ET AL

1,902,085

CIRCUIT CLOSING DEVICE

Original Filed June 3, 1925

5 Sheets-Sheet 3



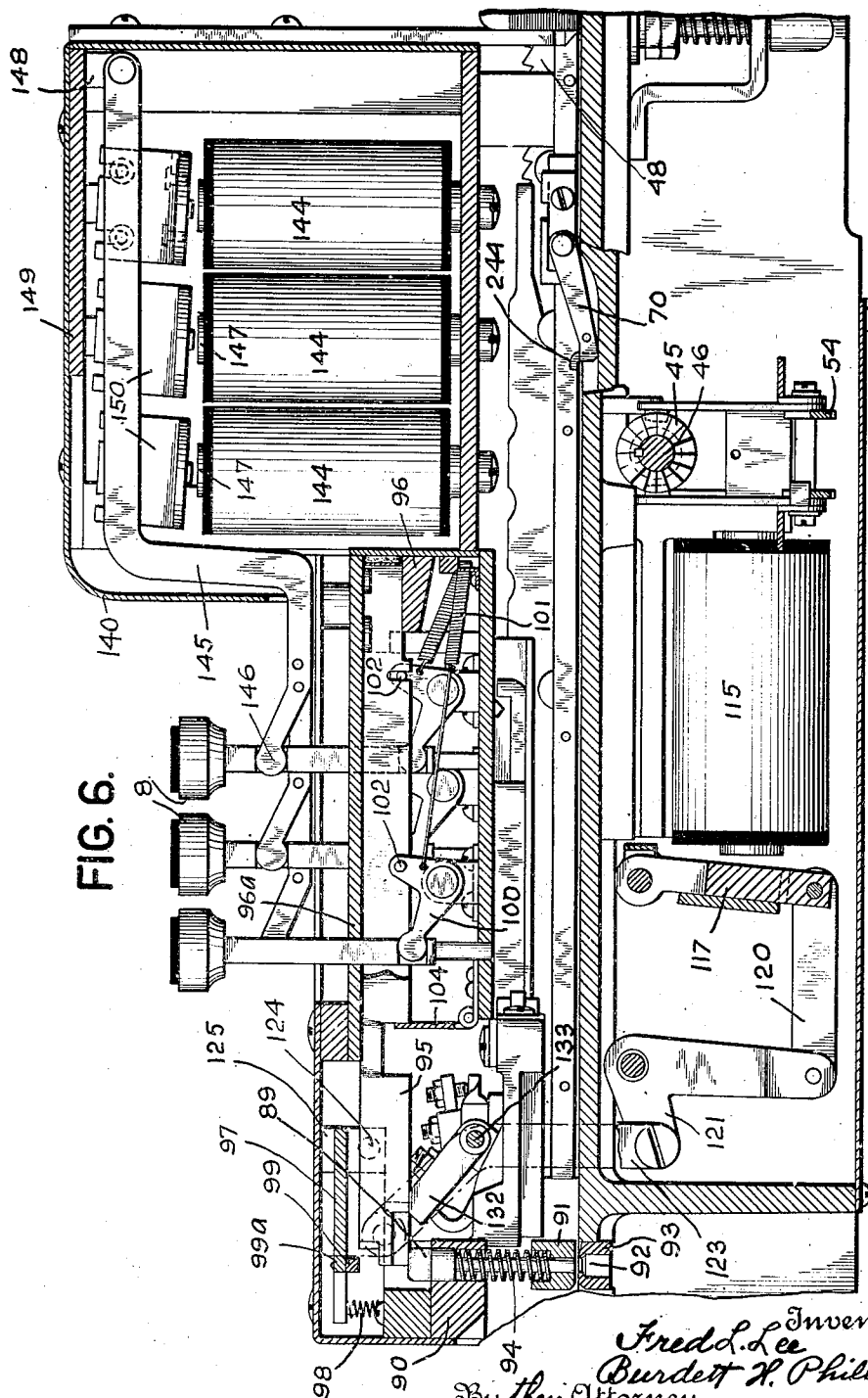
March 21, 1933.

F. L. LEE ET AL

1,902,085

CIRCUIT CLOSING DEVICE

Original Filed June 3, 1925 5 Sheets-Sheet 4



Fred. L. Lee Inventor

Burdett H. Phillips

torney
Wm. L. P.

By their Attorney

W. M. Wilson

March 21, 1933.

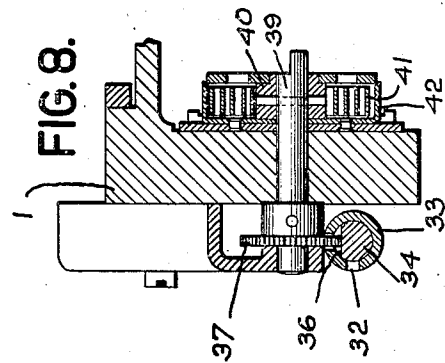
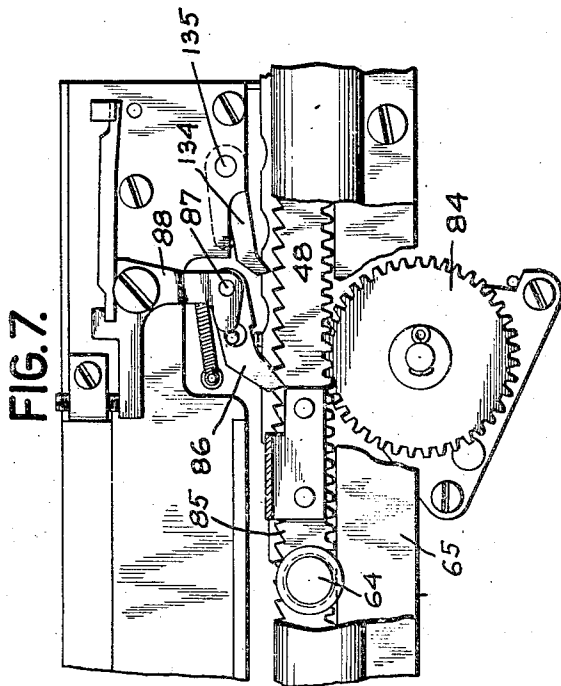
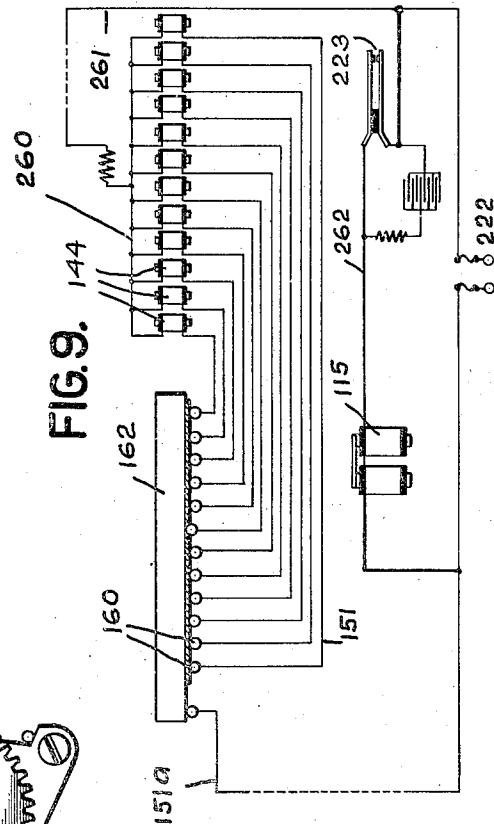
F. L. LEE ET AL

1,902,085

CIRCUIT CLOSING DEVICE

Original Filed June 3, 1925

5 Sheets-Sheet 5



Fred L. Lee Inventor
Burdett H. Phillips
By their Attorney
W. M. Wilson

UNITED STATES PATENT OFFICE

FRED L. LEE, OF BINGHAMTON, NEW YORK, AND BURDETT H. PHILLIPS, OF MONTCLAIR, NEW JERSEY, ASSIGNORS TO THE TABULATING MACHINE COMPANY, OF ENDICOTT, NEW YORK, A CORPORATION OF NEW JERSEY

CIRCUIT CLOSING DEVICE

Original application filed June 3, 1925, Serial No. 34,516. Divided and this application filed November 13, 1929. Serial No. 406,826.

This case is a division of an application for "duplicating punching device," Serial No. 34,516, filed June 3, 1925.

The object of the invention in general is to provide a novel circuit breaker.

Further, the object is to provide a circuit breaker which is selectively operated by a pattern card.

Still further, the object of the invention is to provide a circuit breaker which is mounted in a manner to facilitate the movement of a pattern card back and forth relative to the breaker.

Another object is to provide a machine in which the conductors connecting the duplicator with punch selector magnets are housed in an improved manner and are given a fan arrangement as they pass to the detecting portion of the duplicator.

Still another object is to provide means for breaking the duplicator circuit when a pattern card is removed from or placed in the duplicator.

Various other objects and advantages of my invention will be obvious from the following particular description of one form of mechanism embodying the invention or from an inspection of the accompanying drawing; 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 vertical section through the duplicator and punching sections.

Fig. 2 is a section on line 2—2 of Fig. 3.

Fig. 3 is a top view of the machine with certain parts removed.

Fig. 4 is a detail through the duplicator.

Fig. 5 is a section on line 5—5 of Fig. 3.

Fig. 6 is a vertical section through the punch part of the machine.

Fig. 7 is a detail of the escapement means.

Fig. 8 is a detail of the card carriage moving means, and

Fig. 9 is a circuit diagram of the machine.

The machine is provided with a main frame 1 and arranged for convenient right hand operation by a handle 2 having a normal position at the right hand end of the machine and being mounted for leftward movement along the side of the machine. Whenever the handle 2 is moved to the left in this manner, a statistical card 3 is withdrawn by a picker 4 from the bottom of a pack in a magazine 5 and advanced to be operated upon by punching mechanism 6. Such leftward actuation of the handle 2 also serves to move a card carriage 7 to the right to a position to receive the card 3 when the picker 4 reaches the end of its leftward movement. The card is then punched column by column as required and the card carriage moved step by step to the left. When the punching of the card is completed and the carriage 7 has reached the end of its movement, the punched card may be removed and the operation repeated.

The punching mechanism 6 may be operated normally by means of numeral keys 8 or may be controlled by a duplicator 9 in accordance with the perforations of a pattern member which may be a previously punched card 3P. Such pattern member is supported by the card carriage 7 and is moved through the duplicator concomitantly with the movement of a card through the punching mechanism.

The handle 2 may be used to actuate the card carriage 7. To this end the bracket 16 on which the handle 2 is secured extends through a longitudinal slot 32 (Fig. 8) in a tube 33 and is secured to a rod 34 slidable in said tube. The slot 32 is of sufficient length to permit the necessary movement of the handle 2 and the tube 33 is supported on the main frame 1 by slotted brackets 35 as shown in Fig. 3. Adjacent the extreme leftward position of the handle 2, the tube 33 is cut away at the top to permit teeth 36 on the

upper side of the rod to mesh with the teeth of a pinion 37 and a gear 38. The pinion 37 is mounted on a shaft 39 (Fig. 8) on which is fixed a hub 40 connected by a spiral spring 41 with a cup 42 secured to the frame 1. As the handle 2 is moved to the left the spring 41 is placed under tension and upon the release of the handle 2 acts to return it to its normal position.

10 The gear 38 is suitably supported for rotation and is fixed to a member 43 of a clutch 44 whereby motion may be transmitted to the card carriage 7 when the handle 2 is moving to the left. Opposed to the member 43 is another clutch member 45 having a driving connection with a shaft 46 and slidable therealong into and out of engagement with the member 43. At its other end the shaft 46 is provided with a gear 47 fixed thereon and meshing with teeth on the lower edge of a rack 48 which may be considered as forming a part of the card carriage 7.

To control the clutch member 45 provision is made of a yoke 49 pivotally supported by means including a bracket 50 fixed on the main frame, and having at its free end elements 51 projecting into the groove 52. The yoke 49 is urged in a clutch breaking direction by a spring 53 and is also controlled by means of a yoke 54 pivoted to turn about the same axis as yoke 49 and having a finger piece 57. Joining the yokes 49 and 54 is a spring 62 having a greater effect than spring 53, so that upon depression of the finger piece 57 the clutch member 45 will be shifted to operative position. In this connection it should be noted that the teeth of the clutch members 43 and 45 are so inclined that when in operative relation a leftward movement of handle 2 will transmit through means including the clutch 44 power to move the card carriage 7 to the right to receive a card 3 positioned by the picker 4 in the punching mechanism 6. If, however, the handle 2 is moved to the right the teeth of the clutch members 43 and 45 will ride over each other and force the clutch members apart.

The clutch 44 is controlled by the rod 34 and to this end the yoke 54 extends through a notch in the tube 33 and engages the lower surface of the rod 34. When the rod 34 is in its retracted position the yoke lies in a notch 63 (Fig. 5) in the bottom of the rod 34 and the spring 53 is effective to disconnect the clutch. This enables actuation of the card carriage while the picker mechanism remains at rest. The notch 63 has an inclined wall at the right so that, upon movement of the handle 2 to the left the yoke will be depressed and the clutch member 45 moved into operative relation with clutch member 43.

Due to the engagement of the rod 34 with the lower side of gear 38 and of the rack 48 with the upper side of the gear 47 move-

ment of the picker 4 to the left with a card for presentation to the punching mechanism 6 will be accompanied by a rightward movement of the card carriage 7 into a position to receive the card from the picker 4. As indicated in Fig. 5 the rack 48 is carried by means of grooved rollers 64 running on a rail 65 mounted in the main frame and an adjacent member 66 with a flange overlying the heads of the studs which carry the rollers 64. The movement of the carriage 7 to the right may be limited by means of a suitable stop 67 (Fig. 3) in the path of the end of the rack 48.

In addition to the rack 48 the card carriage comprises a forwardly projecting arm 69 (Fig. 3) having at its forward end a device 70 to engage the rear edge of a card 3 in its passage through the punching mechanism 6. Such device 70 when in effective position with respect to the rear edge of a card lies in a groove 71 which also receives a device 72 to engage the forward edge of a card in the card carrier and supported on a member or arm 73 which is secured to the rack 48 and extends to the rear thereof to support a device 74 for engaging the forward edge of a card resting on the top of the duplicator which forms a table 74a. The device 74 travels in a groove 75 in the table 74a and this groove also serves to receive a device 76 for holding the other end of the pattern card and which is mounted on the rear end of an arm 69a secured to the rack 48 at its rear face.

When it is desired to punch the lowest card in the magazine 5, the handle 2 is moved to the left to advance the picker 4 and move such card into the punching mechanism. As soon as the movement of the rod 34 to the left is begun the inclined right wall of the notch 63 will cam down the yoke 54 and shift the clutch member 45 into engagement with the clutch member 43 thus connecting the gears 38 and 47 so that the leftward movement of the rod 34 will effect a movement of the rack 48 and carriage 7 in the opposite direction to a position to receive the card from the picker 4, the card passing beneath the device 70 to a position to be engaged operatively thereby.

Such rightward movement of the rack 48 is effected against the action of a spring drum 83 connected directly with a gear 84 meshing with the teeth on the lower side of said rack 48 (see Figs. 1 and 7). The top of the rack 48 is also provided with teeth 85 inclined toward the left end of the machine and when the carriage 7 has reached the limit of its movement it is held there by engagement of one of said teeth by a stepping pawl or dog 86 loosely mounted on a pivot 87 is a bracket 88 mounted on a fixed part of the machine. At this time the first column of the card to be punched will lie beneath a row of punches

89 which have enlarged upper ends guided in a member 90 and lower ends extending through openings in a guide or stripper member 91 and immediately above openings 92 in a die plate 93.

The punches 89 are normally held in raised position by springs 94 interposed between the enlarged heads thereof and the stripper member which is provided with openings to receive the lower ends of said springs. Resting on the upper ends of said punches are interposers 95 supported at their rear ends on a cross member 96 and resting against the lower face of an overlying plate 96a so that they prevent further upward movements of said punches. The interposers 95 are so notched at their forward ends that when they are in their normal positions depression of a plate 97 against a spring 98 will merely move member 99 of the depresser 99a into such notches.

When, however, any numeral key 8 is depressed it will actuate a bell crank 100 against the tension of a spring 101, the forward arm of each bell crank having a rounded head fitting into a notch in the shank of the key and the upright end having a pin 102 in a slot in the lower edge of the corresponding interposer 95. Such interposer will then be advanced to such a position that depression of the member 99 will effect depression of the interposer and consequently of the corresponding punch.

Upon movement of any of the interposers, a common or universal member 104 (Fig. 6) will be actuated and move a link 108 (Fig. 1) in contact therewith in a direction to close contacts 223 (Fig. 9) to complete a circuit through a punch magnet 115. The latter thereupon attracts armature 117 which through link 120 rocks bell crank 121 to draw downward the link 123 and rock the plate 97 or depresser 99a about the pivots 124 in brackets 125 (see Figs. 1 and 6) thus depressing the advanced interposer to operate the corresponding punch. As the depresser moves in this manner, an arm 126 rigid with the depresser (see Fig. 1) engages link 108 and moves it out of contact with member 104, thus permitting the link to return to normal position. The contacts 223 then open and magnet 115 will restore the depresser 99a to initial position.

Upon depression of an interposer during punching, it will swing a universal frame 132 about a shaft 133 and through suitable connections swing a dog 134 (Fig. 7) about a pivot 135 into engagement with the rack 48 to prevent movement thereof by the gear 84 and the spring drum 83. The dog or pawl 86 will be raised at this time and due to the loose mounting thereof will be moved to a position to rest on the point of the teeth 85 with which it was previously engaged. When the universal frame is released the locking dog 134 will be lifted and the rack 48 and

the card carriage 7 will advance one tooth to permit punching in the next column of the card.

The escapement mechanism just referred to is of the same general nature as that disclosed in the patent to Schaaff, No. 1,426,223, granted August 15, 1922.

The operation of the punches may be controlled by means of the duplicator 9 which causes selector magnets 144 (Figs. 6 and 9) to be actuated in accordance with the perforations of a pattern card or previously punched card 3 which is arranged for punching in 45 different columns. These selector magnets are twelve in number and operate the ten numeral keys and two keys, one being marked X and the other being blank, arranged to operate the two punches at the end of the row farthest from the operator.

Such operation of the keys controlled by the selector magnets may be effected by means of levers 145 having at their ends in one direction rounded heads 146 extending into slots in the shanks of the keys to be controlled and extending in the other direction substantially horizontally into the casing 140 for the selector magnets, upwardly to a plane above the cores 147 of the magnets and then rearwardly different distances to be pivoted to brackets 148 extending downwardly from a plate 149 rigidly supported on the main frame. As indicated in Figs. 3 and 6, these brackets are arranged in three rows corresponding to the rows of the magnets and the rows of keys actuatable thereby. Adjustably attached to each of these levers is an armature 150 for cooperation with the corresponding magnet.

Extending from one end of each magnet coil is a wire 151 (Figs. 2 and 9) with an insulating cover and these wires are gathered together in a cable 152 which is led through a cable conduit 153 and down through the table 74a of the duplicator and between the table and a bottom plate 154. Here the casing of the cable ends and the wires 151 are fanned out and connected by nuts 155 to the lower ends of twelve binding posts 156 arranged in the same order as the magnets 144 and mounted in an insulating plate 157 (Fig. 4). The other ends of the magnet coils are connected through a suitable source of power to another wire 151a (see Fig. 9) which is also included in the cable 152 and connected by nuts 155 with a thirteenth binding post 156 spaced from the other binding posts 156 as seen at the left in Fig. 1. Immediately above each binding post 156 is a tube or guide 158 mounted in a second insulating plate 159. These guides 158 are slightly contracted at their tops to retain balls or analyzing contacts 160 and these contacts are urged to the upper ends of the guides by springs 161 interposed between the balls and the heads of the binding posts.

The insulating plate 159 extends completely across the duplicator and immediately above the contacts 160 is a roller 162 having a cylindrical casing 163 of conducting material such as any suitable metal mounted on a non-conducting tubular member 164 carried by bushings 165 on a shaft 166. When a pattern or master card 3P is in the duplicator it will pass between the roller 162 and all of the contacts 160 except the one to the left of Fig. 9 which is always in contact with the cylindrical casing 163 when the roller 162 is in working position. It will be evident that when there are no perforations in the portion of the pattern card between the roller 162 and the ball contacts 160 none of the selector magnets will be energized. When, however, a perforation in the pattern comes into position over one of the contacts, the circuit of one of the selector magnets will be closed and the corresponding punch operated.

The shaft 166 is mounted in opposite sides of a frame or contact box 167 which has at opposite ends ears 168 or the like pivoted to the table of the duplicator by suitable means such as screws 169 (Fig. 4). Extending to the left (Fig. 3) from the frame 167 is a resilient plate 170 which may be held down by a latch 171 during normal operation against the action of a spring 172. In addition to the plate 170 provision is made of another plate 173 to hold a pattern card in proper position. This plate 173 is attached to the table 74a at its end remote from the roller 162 and extends substantially to the roller 162.

When the card carriage 7 is in the position shown in Fig. 3, the latch 171 may be moved to ineffective position thereby allowing the frame 167 to be swung by the spring 172 from the position shown in Figs. 3 and 4 to the position shown in Fig. 2. The pattern or master card 3P may then be conveniently placed on the card carriage by first placing the right hand end thereof beneath the roller and the left hand end of the plate 173. The card carriage may then be moved to the right preparatory to starting the punching and the frame 167 and plate 170 may then be swung downwardly to the positions shown in Fig. 4 and there retained by the latch 171.

Referring to Fig. 9, it is broadly stated that this circuit diagram may be said to include a punch magnet circuit 262 shown by heavy lines and a duplicator circuit shown by light lines and designated by reference characters 151a, 151, 260 and 261. It will be understood that at each punch operation, whether by means of depression of the keys or by the energization of the selector magnets 144 under the control of the duplicator, contacts 223 will be closed by the action of the interposers in the manner heretofore described to bring about the energization of the punch magnet 115. Immediately after this punch magnet 115 is energized, contacts 223

are opened by member 126, elevating link 108 free of the universal member 104. Thereafter, contacts 223 reopen under their own resiliency. The foregoing describes the operation of the punch magnet circuit.

The operation of the duplicator circuit may be thus described. The duplicator circuit is automatically closed through the pattern card 3P when holes in the card permit balls 160 to establish contact with roll 162. Assuming that a ball 160 is making contact with roll 162, current flows through duplicator circuit through source 222, through wire 151a, roll 162, contacting ball 160, wire 151, a selector magnet 144, wire 260, and back to source through wire 261. The selector magnet 144 is thus energized under the control of the pattern card and brings about the selection and operation of the associated punch in the manner previously described. As previously explained in connection with the description of the operation of the punch magnet circuit 262, contacts 223 are automatically opened after each depression of the punch.

Upon reference to Figs. 1 and 4 it will be seen that the contact structure fixed to the table 74a is such as to facilitate assembly of the parts. The guide tubes 158 may readily be placed in the insulating plate or member 159, and the binding posts 156 in the insulating plate 157. The balls or contacts 160 may then be placed in the tubes 158, the springs 161 inserted in the tubes, the plates 157 and 159 placed against each other in proper relation, and the assemblage secured to the lower side of the table 74a by means of screws 242.

The machine may be operated in various ways such as the following. A pack of cards 3 may be placed in the magazine and withdrawal therefrom one by one by means of the picker is effected by means of the handle 2 which serves to operate the rod 34. Upon movement of the rod 34 to the left with the picker 4 the clutch 44 will be closed and the card carriage moved to the right far enough for the card advanced by the picker to lift the device 70 and move under the same to such an extent that the finger 244 of the device 70 will rest on the card, the other end of the card being engaged by the device 72. The card carriage 7 will then be held, in its initial position for punching, by the stepping dog 86, the carriage being moved slightly past this position to enable the loosely mounted dog 86 to engage the proper tooth 85 of the rack 48 and also to assure proper engagement between the device 70 and the card. Upon release of the handle 2, the rod 34 and the picker will be returned to their normal positions, the card carriage remaining fixed and the clutch member 43 turning relatively to the clutch member 45 due to the inclination of the teeth on the two members.

When the duplicator 9 is to be used, the card carriage is moved to its extreme leftward position and, with the parts of the duplicator positioned as in Fig. 2, a punched card or pattern card 3P is placed in engagement with the devices 74 and 76, being inserted from the left between the roller 162 and contacts 160 and beneath the plate 173. The frame or box 167 is then swung downwardly and the end of the plate 170 brought against the beveled upper edge of the latch 171 to swing the latter about its pivot 249 against the action of a spring 250 which, when the plate 170 reaches the proper position, brings the hooked end of the latch over the end of the plate. After this stage of the operation a card should be introduced into the punching mechanism by means of the picker 4.

Each time a circuit is completed through the duplicator card 3P and punching effected, the pawl 86 is released from escapement rack 85 and the carriage 7 moves to the left (Fig. 3). When a card 3 is completely perforated, the carriage 7 and the pattern card 3P is returned to the left. During the movement of the card 3P in either direction the non-frictional engagement of the card with roller contact 162 and spherical contacts 160 facilitates the movement of the card. If inclined reading brushes or feelers, such as are ordinarily used in the tabulating art were employed, the return of the card would be interfered with and the brushes injured.

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:

1. In a circuit closing device including a support for a perforated card, a plurality of contacts carried by said support for reading perforations in the card, and a conductor bridging all the contacts and adapted to be engaged by any contact extending through a perforation in the card, a carrier for the conductor movable to separate the conductor from the contacts, and a flat plate-like guide extending from said carrier to hold the card flat when the conductor is in effective position and movable with the carrier to permit insertion or removal of a pattern card when the conductor is in ineffective position.

2. In a circuit closing device including coacting and separable contacts adapted to receive a control member therebetween, a pivoted carrier for one of said contacts, said carrier having a flat plate-like extension for engaging said control member, means directly

engaging said carrier for normally yieldably holding the carrier and its contact apart from the coacting contact, and a latch for engaging the free end of the plate-like extension of the carrier for holding it and the contact thereof in contact with the control member and in cooperative relation with the coacting contact.

In testimony whereof we hereto affix our signatures.

FRED L. LEE.
BURDETT H. PHILLIPS.