

July 4, 1939.

J. P. BUCKLEY

2,164,698

MULTIPLE CARD PUNCHING MACHINE AND CHECKING SYSTEM

Filed April 13, 1938

3 Sheets-Sheet 1

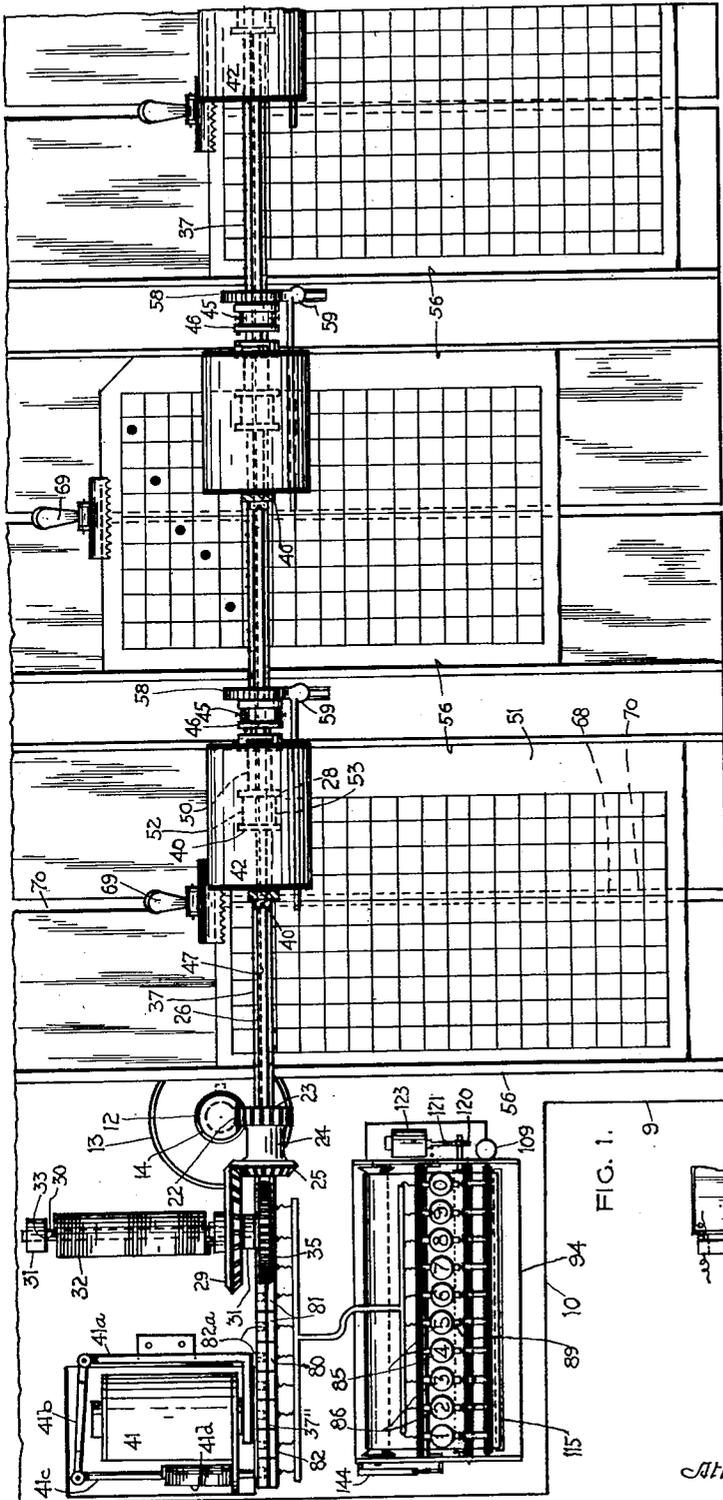


FIG. 1.

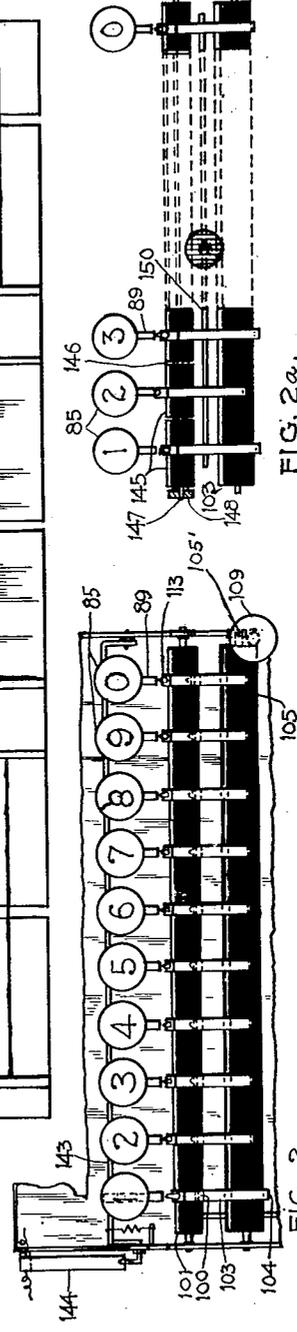


FIG. 2a.

FIG. 2.

Inventor
JOHN P. BUCKLEY

Attorney *J. R. Matson*

July 4, 1939.

J. P. BUCKLEY

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3 Sheets-Sheet 2

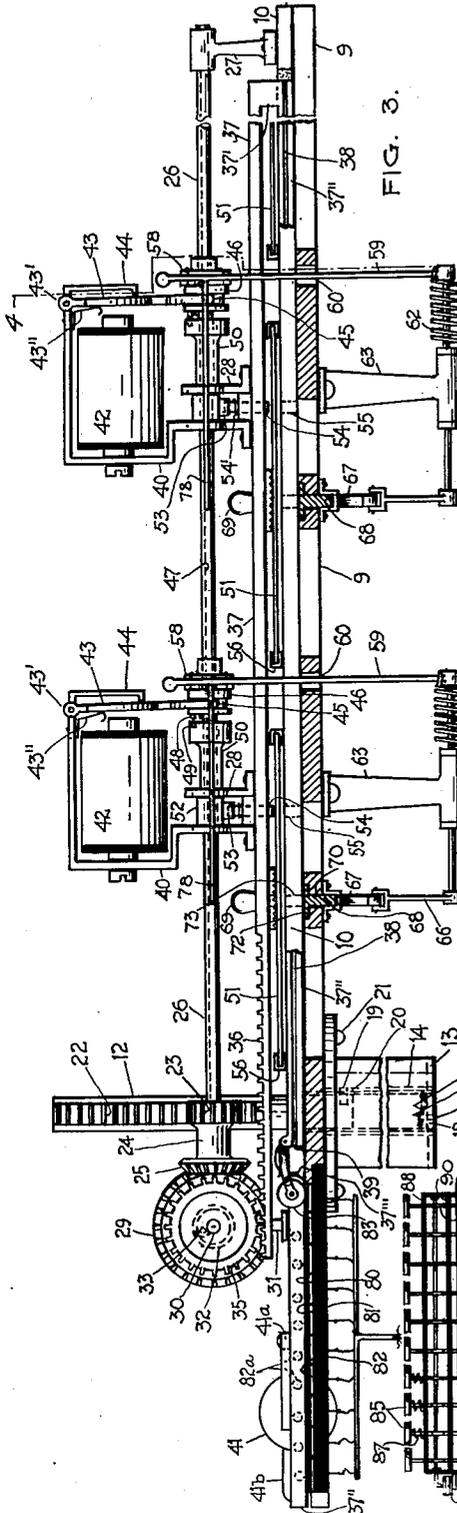


FIG. 3.

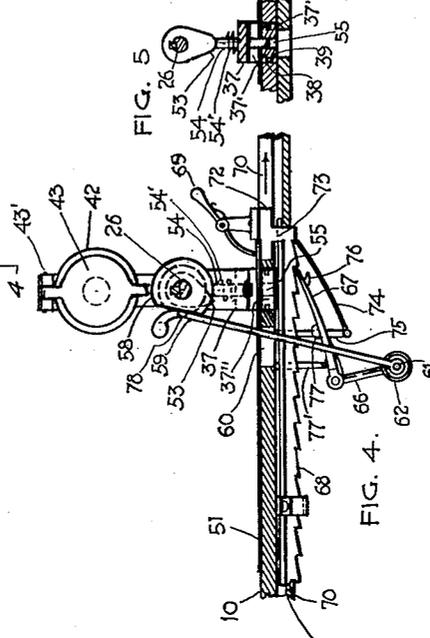


FIG. 4.

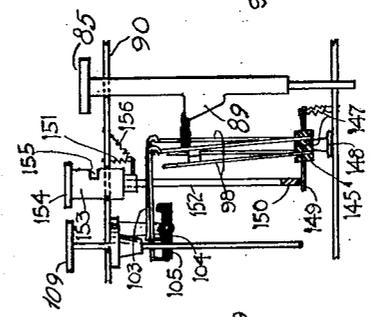


FIG. 6a.

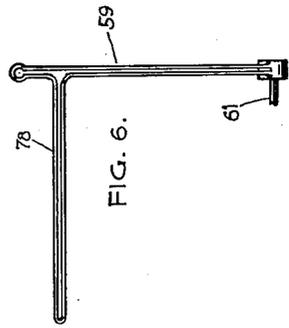


FIG. 6.

Inventor
JOHN P. BUCKLEY.

F. E. Watson
Attorney

July 4, 1939.

J. P. BUCKLEY

2,164,698

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3 Sheets-Sheet 3

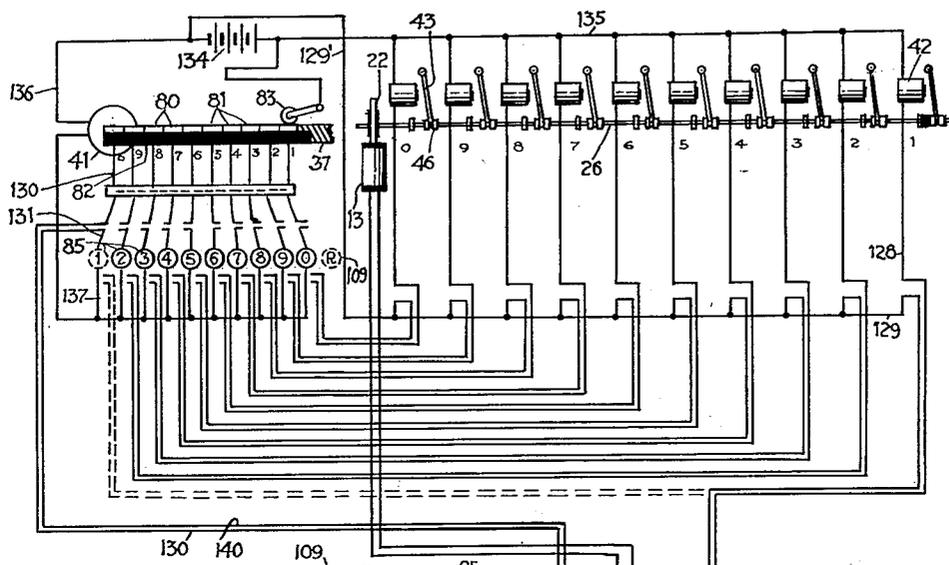


FIG. 9.

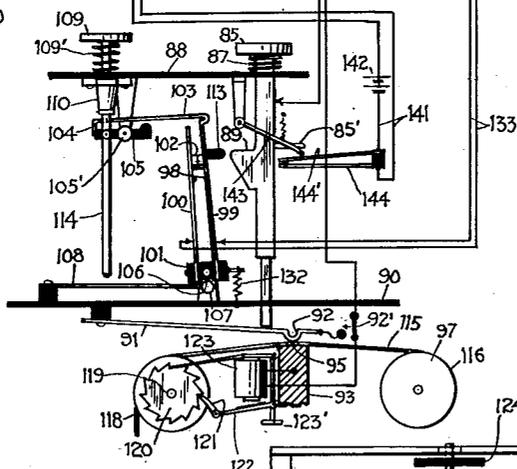


FIG. 8.

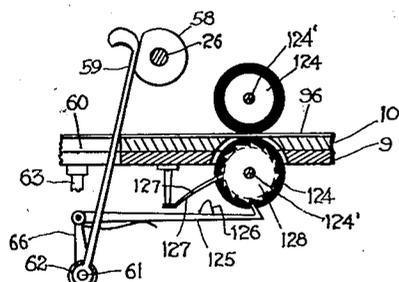


FIG. 7.

Inventor
JOHN P. BUCKLEY.

F. C. Manton
Attorney.

UNITED STATES PATENT OFFICE

2,164,698

MULTIPLE CARD PUNCHING MACHINE AND CHECKING SYSTEM

John P. Buckley, Washington, D. C.

Application April 13, 1938, Serial No. 201,820

17 Claims. (Cl. 164—113)

This invention relates to a multiple card punching machine, whereby one of a number of cards or strips of cards may be selected and thereafter punched to correspond to a desired indicia.

5 One object of the invention is to construct a group of card holding devices wherein a single punching element is provided for each, together with mechanism for selecting the punch to be operated and for subsequently positioning and operating the same.

10 A further object is to construct a device of the type described in which the selecting keys for setting up the desired punching device are also used for positioning the punch and controlling its operation, whereby only one set of keys and one operator are necessary to perform the punching operation over a much greater number of spaces to be punched than has been possible heretofore.

20 Another object of the invention is to construct a multiple card punching machine wherein the actuation of the punch and its positioning mechanism are motivated by a single driving element thus attaining simplicity, ease of maintenance and economy of operation.

25 It is a further object to provide in a multiple punching device means whereby a plurality of the punching units may be set up for simultaneous operation so that duplicate recordings may be made with only one operation.

30 A still further object is to provide a novel rubber wheeled card feeding device which assures positive movement of the punched card strip after each punching operation and which is simple in construction but at the same time accurate.

35 These and other objects will be readily perceived from the following description and drawings in which like reference characters refer to like parts throughout the various figures.

40 Fig. 1 is a plan view of the essential parts of the complete apparatus, parts omitted being exactly the same as those shown.

Fig. 2 is a plan view of the key board and switches operated thereby.

45 Fig. 2a is a plan view of a modified form of the key board.

Fig. 3 is an elevational view of the structure shown in Fig. 1 with parts broken away and the key board detached to show important details more clearly.

50 Fig. 4 is a combined elevational and sectional view, showing the punching mechanism and card advancing device in elevation, and the stationary bed plates in section, as indicated by the line 4—4 of Fig. 3.

Fig. 5 is a detail section of the punch itself.

Fig. 6 is a detail of the operating bar for the card advancing mechanism.

Fig. 6a is an elevation view of Fig. 2a, showing the key switches and controlling means for same.

Fig. 7 is a view in plan showing a form of continuous card strip advancing device.

Fig. 8 is a side elevation view of Fig. 7 in which the stationary bed plates are shown in section.

Fig. 9 includes the circuit diagram and a detail elevational view of one of the numerical keys, the release key and the switches associated therewith, together with their relation in the circuit diagram, and a checking or monitoring device.

The apparatus consists essentially of a combined punch setting and punch operating means, a card positioning means, a commutator and punch setting control means and a key board provided with suitable switching means to operate the various parts of the apparatus through suitably arranged circuits. The elements just mentioned are described in the order named and severally mounted on upper and lower bed plates 10 and 9.

The numerals 10 and 9 designate the top and bottom bed plates through which the armature 12 of the solenoid 13 passes freely in a vertical movement, when the solenoid is energized or de-energized. The lower part of the armature 12 is slidably arranged in the case of tube 14 of the solenoid, which is provided with the valve 15 having a vent 16 through which the air passes out through the port 17 in the bottom plate 18 for the purpose of regulating the downward movement of the armature in a manner similar to a dash pot. I do not confine the invention to this method solely as any other means may be employed to retard or control the movement of the armature in its downward stroke. The pin 19 projecting from the armature serves to limit the upward travel by contacting with the upper end of the slot 20 in the tube. The screw 21 secures the solenoid to the bottom of the bed plate 9.

The upper portion of the armature is provided with the rack 22, which meshes with the pinion 23 on one end of the elongated hub 24; on the other end is secured the bevel gear 25, the whole being fixed on the shaft 26. The shaft is journaled in the bearings 27 mounted on the bed plate 10, while the standards 28 are placed along the upper surfaces of the bar 37. The larger bevel gear 29 is loosely mounted on the shaft

30 which is suitably journaled in the bearings 31 and arranged to mesh with bevel gear 25. The spiral spring 32 surrounds the shaft 30, one end of the spring being anchored to the shaft as at point 33 while the other end is secured to the loosely mounted bevel gear 29. The spur gear 35 is secured to the outer end of the shaft 30 and is arranged to mesh with the rack 36, cut in the upper face of the bar 37, which extends to the bridge 37' and then beneath and back toward and beyond the rack extends the lower bar 37'' which has inset 37'''. The grooves 38 in the lower bar 37'' are made to slidably fit the tongues 39 of the bed plate 10, as may be seen best in Figs. 3 and 5. This arrangement guides the bars in reciprocal motion, in true alignment transversely across the cards to be punched as will be described later.

On the bar 37 are mounted a number (corresponding to the number of keys) of card punching mechanisms. All being the same, it is necessary to describe but one. Attached to the upper bar 37 is the rear standard 40, which is suitably formed to clear the shaft 26, and which extends upwardly to support the electromagnet 42 and the armature 43. The armature 43 is pivotally mounted at 43' and urged away from the magnet by spring 43'' to the stop 44. The lower portion 45 of the armature engages the clutch 46, the key of which is made slidable in the keyway 47 of the long shaft 26. The small pin 48, projecting from the inner face of the clutch is adapted to engage the recess 49, in the elongated sleeve 50, which thus may be made to turn with the shaft 26 when the electromagnet 42 is energized, as will be described hereinafter.

The elongated sleeve 50, through which the shaft 26 passes, is journaled in the short standard 28. Between the short standard 28 and standard 40 the sleeve 50 has an enlarged cylindrical portion 52 provided with a cam 53. By this arrangement the cam is maintained in alignment with the punch pin 54 which is vertically and slidably mounted in the bars 37 and 37'' and held in raised position by spring 54'. In this manner when any one of the keys is struck, the punching unit, together with the counterpart or die 55 of the punch in the lower bar, is moved forward immediately above the stationary strip of forms, 51, to be punched.

Beside the narrow portion or inset 37''' of the bar 37'' is carried a spring pressed contact roller 83 which is arranged to cooperate with the commutator 80. The commutator consists of an insulation bar 82 on which are mounted, electrically independent of each other, plates 81. Mounted fixedly on the bed-plate is the magnet 41 together with its armature 41b pivoted to the arm 41a. The locking pin 41c is guided in the magnet frame and held away from engagement with the narrow portion of the bar 37'', which extends beyond the rack portion, by spring 41d. At the same time this pin is arranged to engage recesses 82a therein when the magnet 41 is energized. Each commutator plate is connected with one of the operating keys by circuits to be subsequently described, arranged so that by pressing down a designated key the corresponding commutator plate is energized, the solenoid 13 is also energized thus drawing the rack bar 12 down, rotating pinions 23, 25 and gear 29 which drives gear 35 through the spring 32. The gear 35 imparts motion to the bars 37 and 37'' until the contact roller reaches the energized commutator plate. When such contact is made the magnet

41 is energized and the movement of bars 37 and 37'' is arrested, by the locking pin 41c, in the position corresponding to the number of the key struck, and thus every punch is positioned with respect to its card. Although the motion of bars 37 and 37'' is arrested in the manner just described, the rack bar 12 may complete its stroke in every instance and as it does so it will coil up the spring 32 and continue to rotate shaft 26 to its extreme position. When the key is released the spring 32 will then have sufficient power to return the parts to normal. The gear relations are such that there will be sufficient time, after the punch has been moved to the farthest space on the card, for the operation of the punching device before the end of the rotation cycle of the shaft 26. The punching operation takes place when the cam 53 forces the punch pin 54 downward through the card (see Fig. 5).

The operations just described will be referred to hereinafter as the "punch positioning operation" and the "punching operation." Next will be described the card advancing mechanism.

The strips of forms are guided in a true path at right angles with respect to the movement of the punch pin 54 by guides 56 fixed in the bed plates, and, may be stepped up or advanced to be successively punched by the arrangement shown in Fig. 4. The cam 58 is fixed on the face of the clutch and operates against the rockable arm 59 protruding upwardly through the slot 60 of the bed plate. The other end of the arm 59 is made fast to the shaft 61 (see Fig. 3) and around the latter is coiled a spring 62, one end of which is fastened to the arm 59 and the other end is attached to the fixed bearing 63 in which the shaft 61 is journaled. The spring 62 is initially tensioned to normally urge the arm 59 against the cam 58. Set collars 64 are provided on the shaft 61 to hold it against lateral shifting. At the end of the shaft opposite to that to which the arm 59 is attached is fastened another arm 66 which carries the spring pressed pawl 67 in engagement with the ratchet bar 68 designed at one end to carry the spring clamp 69 of the usual type. The groove 70 in the bed plate serves as a track for the rack bar 68 and the flange 72 of the rack forms a slidable guide on the upper face of the plate 9. The neck 73 extends upward from the ratchet bar to support the clamp. The detent 74, held fast by the depending arm 75, protects the rack bar from any backlash in the recovery of the pawl. The arm 59 is provided with an extension 78, Figs. 4 and 6, so that cam 58 cooperates therewith to operate the step-up mechanism from any position of the punching unit. The cam 58 is provided with a flattened surface angularly related to the punch operating cam 53 so that when the shaft 26 is energized the fixed cam 58 turns around, and, in being forced off of the cut portion of the cam to the circular portion of same, the arm 59 is forced rearwardly to the extent of retracting the pawl 67 by one tooth of the rack bar 68, thus conditioning the step-up mechanism for moving the card. After the card has been punched and the key released, the cam 58, through the deenergization of the solenoid returns to zero, at which time the pawl, through the tension of the spring 62, advances the card by one step motion.

Suspended from the under part of the pawl is the tongue 76, Fig. 4, and rearwardly on the upper part of the pawl is the cam 77. This cam is placed at a proper distance on the pawl so that

when the rockable arm 59 is manually drawn backward, as when, at the end of the run, tripping means is desired to restore the ratchet bar 68 to zero, the cam will be pushed downward by contacting with the depending arm 77' and, through the tongue on the pawl, the detent 74 will be displaced from the teeth of the ratchet bar thereby allowing the operator, by holding the arm 59 outwardly to push the whole rearwardly to zero for reception of the next card strip.

Fig. 7 is a partial top view of a modified form of the step-up mechanism, wherein two pairs of rubber-tired wheels 124, oppositely disposed above and below plate 10 and fixed on the shafts 124', grip the strip of cards 96. When the wheels are rotated by the operation of the ratchet wheel 128, which is actuated by the cam 58 and arm 59 through the pawl 125, the strip of cards is advanced a predetermined distance. Fig. 8 is a vertical section view of the construction of Fig. 7 showing certain other parts of the modified step-up mechanism. The pawl 125 is provided with the cam 126, which, as the arm 59 is manually drawn backward, contacts with the detent 127, and, in this manner frees the ratchet to be turned backward. The extent of the backward movement of the pawl 125 to bring the cam 126 into engagement with the detent 127 is sufficient to render the ratchet free of the pawl 125.

Referring now to Figs. 2 and 9, the keyboard may be composed of a plurality of keys of any design or arrangement, each key to represent, individually, one of the metallic plates of the commutator 80. For purposes of illustration key #1 has been shown as removed from the keyboard. The remaining keys are similarly constructed and arranged. The key 85 is normally held upward by the spring 87 surrounding the upper part thereof, while below the insulation top 88 of the frame, the key carries the cam 89. The lower insulation 90 of the frame forming the bottom piece serves as a bearing for the narrow lower end of the key. Cooperating with the lower end of the key is the contact spring 91 so that when the key is struck, the loop 92 of the spring makes contact with the metallic bar 93 which is supported on the bottom plate 94.

Cooperating with the cam 89, of the key, is the switch 98 carrying insulation stud 113 and composed of two springs, 99 and 100, oppositely disposed and suitably held fast at their lower ends to the insulation bar 101. Contact points 102 are provided on the springs. The spring 99 has an angular extension 103 which is provided at its free end with a hook 104. The insulation bar 105 is pivoted in the frame by its mounting 105' and so arranged that the hook 104 will cooperate therewith to lock the switch in closed position. The star wheel effect, of the V cut 106 in the lower face of the bar 101 and its mounting on the roller 107 which is supported on the spring 108, causes the bar to continue to turn slightly beyond the distance that might be caused by the cam 89 alone in forcing the spring contacts over, and thus serves to lock the insulation bar in proper angle to escape all the other keys in the group. This arrangement serves to provide a full open keyboard for whatever selection of the punching units is made. Such selection is made in striking the first key when all switches are open, as when the release key has been struck.

Also associated with the keyboard is a switch bar 143 pivoted in the frame and arranged to operate spring contacts 144 and 144' which are directly connected to the solenoid 13 and electrical

source 142 through wires 141. The projection 85' provided on each key is designed to cooperate with the bar 143 to close the contacts 144 and 144' when the key is depressed, but not until after the contacts 102 have been closed. Thus the punch selected is set up, that is, its corresponding clutch is conditioned for engagement, before the solenoid 13 becomes energized and is held in this condition, by circuits later to be described, until the release key 109 is struck.

The release key 109 is slidably mounted in the bearing 110, fixed to the top 88, and pivotally engages the insulation bar 105 so as to swing one side of the bar downward, thus causing the bar to pivot about 105'. This movement will effect the release of the hook 104 and the switch 98 will then return to normal open position. Coincidentally the bottom of the rod 114 pushes the insulated spring down thus releasing the insulation bar 101.

A monitoring device may be provided for checking the first operator and preventing mistakes. The device used for this purpose is similar to that described and claimed in my prior Patent No. 2,060,974 on an Educational device. In the present case the monitoring device consists of spools 116 and 118, the former carries the previously made record which is wound on to the latter as the latter is rotated by the pawl and ratchet arrangement 120 and 121. The pawl is operated by the electromagnet 123 through movement of the armature 122. The circuit which controls the magnet will be described later.

The schematic circuit diagram of Fig. 9 shows how the multiple electromagnetic clutches, in combination with the specially designed switching means, may selectively operate the punching devices associated with the strips of cards desired to be punched. The selection of the punching unit to be operated is made when the first key is struck, which, it must be noted, therefore determines which strip of cards will be punched by the successive manipulation of the keys.

The action of the key, carrying the tongue 85' and the cam 89, during its downward stroke displaces the switch outwardly to a closed position, as previously described, at contacts 102 and locked thus, as also previously described, the remaining switches will be held in non-operative position with respect to their respective keys. With reference to key #1, the closing of contacts 102 shunts conductors 128 and 129 so that the clutch magnet 42 of the corresponding #1 punching device is immediately energized through conductor 135 to one side of the electrical source 134 and through conductors 128, 133, 129 and 129' to the other side of the source. This circuit is maintained until the release key 109 is struck. In completing the downward stroke of the key 85 the circuits for the solenoid 13 and commutator bar #1 are subsequently and simultaneously completed. The circuit for the solenoid 13 is completed by the trip 85' on the key cooperating with the switch bar 143 to close switch contacts 144 and 144' so that solenoid 13 is directly connected across the electrical source 142. The circuit for the commutator bar #1 is completed by shunting conductors 130 and 140 through the key and the monitoring device where the loop on spring 91 will complete the circuit by contacting the metallic bar 93 through openings 95 in the paper strip if the proper key is struck or through switch 92' when monitor is eliminated. This circuit includes magnet 123 so that each time the circuit is completed the paper strip 115 is advanced to the next

position. Also included in this circuit is the stop magnet 41, and when the roller 83 contacts the commutator plate which is thus energized the magnet 41 will be energized and the movement of the bars 37 and 37" carrying the punching units will be arrested in a position corresponding to the energized commutator plate which in turn corresponds to the key struck. This completes the punch positioning operation. The punching operation and card advancing operation follow as previously described and upon release of the key the mechanisms return to normal ready for the next operation.

It is thus seen that any card or strip of cards of the group may be selected for punching and when selection is made, the entire card or strip may be punched in successive operations with the punching device in any desirable lateral position for each operation. When one card or strip has been completed, or before completion if desired, the release key may be struck and punching of another card may be begun.

Certain features shown but not claimed in this application are claimed in my co-pending applications Ser. No. 52,733, filed December 3, 1935, and Ser. No. 110,924, filed November 14, 1936.

Figs. 2a and 6a show a modified form of the keyboard wherein one or more punching units may be electrically grouped for selectively punching several like numbers, at one time, in each of the cards so selected. In this instance, the insulation bar 101 shown in Fig. 2, is cut into section 145, representing the number of keys. They are separated from each other by washers 146, while the group as a whole is mounted on the rod 147 in a manner to permit independent coaxial pivoting. The standards 148 support the rod 147 and retain the section 145 in position axially thereon. The switches 98, corresponding to each key, and the various other parts operably associated therewith are the same as those shown in Fig. 9 with exception of the structure now to be described. First, there is added a projection 149 which extends from each of the sections 145 beneath the flat bar 150. This bar is resiliently suspended over the projections 149 by the spring 151 and rod 152, the latter forming the lower portion of an additional control key 154. The flat portion of the key 154, which is guided in the top plate 90, has a notch 155. When the key is pressed the notch 155 is caused to interlock with the top plate 90 of the frame through the side tension of the spring 156.

The operation of this modification may be briefly summed up as follows: The initial depression of any group of keys or any single key for selecting the cards or card to be punched will lock each associated set of contacts 98 closed so that the corresponding punches will also be conditioned for subsequent punching each associated card. Before further numeral key operation takes place the key 154 must be depressed to lock out remaining clutch conditioning circuits. This lock out is accomplished by means of the bar 150 which operates on projections 149 of the remaining switches and locks them in a position where the cams on corresponding numeral key cannot close them. From this point the punching operations continue in the manner previously described in connection with Fig. 9.

I do not intend to limit myself to the specific disclosure herein but contemplate various constructions and applications of my invention limited only by the scope of the claims appended.

What I claim is:

1. In a card punching machine, a plurality of cards to be punched, single punching means for each card, and means for selectively positioning the punching means transversely of its associated card and causing operation thereof individually or in selected groups.

2. In a card punching machine, a plurality of cards to be punched, single punching means for each card, means for selectively positioning the punching means transversely of its associated card and causing operation thereof individually or in selected groups, and means for advancing the card or cards punched.

3. In a card punching device, a plurality of cards to be punched, punching means and advancing means for each card, positioning means for the punching means, a common source of motive power for said punching, advancing and positioning means, drive means associated with said source of motive power and all of said means constructed and arranged to provide for operation of the punching and the advancing means after the positioning means has set the position of the punching means.

4. In a card punching machine, a plurality of card holders, a support extending transversely of the card holders and carrying a punching device for each card holder, a common drive means for the punching devices and independently operable means for establishing driving relation between each punching device and said drive means.

5. In combination with an electro-mechanical card punching machine, a keyboard having a plurality of keys, first switching means normally operable by the depression of any one key and thereafter being inoperative, second switching means at all times responsive to the depression of any key, and means for restoring the first switching means to normal condition.

6. In combination with an electro-mechanical multiple card punching machine, a card punching device for each card, means for selectively "setting up" one of the card punching devices and excluding the others, means for selecting the position of the punching device relative to the card to be punched, a common keyboard for operating both of said means, and means for releasing the "setting up" means.

7. In a card punching machine, a plurality of card holders, a support mounted for transverse movement relative thereto and carrying a plurality of card punching devices, means for producing a given magnitude of motion, a keyboard having a key corresponding to each card punching device and also to transverse positions of the movable support, means for independently establishing mechanical connection between the motion producing means and each punching device and means connecting the movable support to the motion producing means, switch and circuit means associated with each key for controlling the corresponding mechanical connection means and further switch and circuit means associated with each key for selecting the portion of the magnitude of the motion producing means which will be imparted to the movable support and for energizing the motion producing means.

8. In a card punching machine, a plurality of cards to be punched, a punching device for each card movable transversely with respect thereto, advancing means for each card, common means for operating each punching device and its associated card advancing means independently of the others, a motion producing means for driv-

ing said common means and for imparting transverse movement to said punching device, a plurality of keys, one corresponding to each punching device, switch means operable by each key, electro-mechanical means controlled by said switch means for connecting each punch operating means with the motion producing means, interlocking means whereby when one key has been pressed the switching means is rendered unresponsive to any further key movement, means for releasing the switch means, further switch means and electro-mechanical means for positioning the punching devices to positions corresponding to the key pressed and for energizing the motion producing means.

9. In combination with a multiple card punching machine having card punching means and card advancing means associated with each of a plurality of cards, a keyboard having a key for each punching means, a switching assembly carrying a switch for each key, each switch being arranged in an electric circuit for electro-magnetically controlling the corresponding card punching and advancing means, means associated with the switching assembly for closing the switch corresponding to the key pressed and for locking the remainder of the switching assembly in inoperative position, means associated with each key for controlling the position of the punching means and the operation of it and the card advancing means, and means for releasing the locking means.

10. In a multiple card punching machine a keyboard comprising a plurality of keys corresponding to the number of cards to be punched, a rockable member carrying a series of switches, one for each key, a locking device associated with each switch, means on each key adapted to close its corresponding switch and thereby lock all the switches in position whereby subsequent operation of any key will not affect the aforesaid switches, a second switch associated with each key and operable thereby at all times and means associated with each of said first named switches for releasing the lock thereon.

11. In a card punching machine, a plurality of card holders, a support mounted for transverse movement relative thereto and carrying a plurality of card punching devices, means for producing a given magnitude of motion, a keyboard having a key corresponding to each card punching device and also to transverse positions of the movable support, means for independently establishing mechanical connection between the motion producing means and each punching device and means connecting the movable support to the motion producing means, switch and circuit means associated with each key for controlling the corresponding mechanical connection means and further switch and circuit means including checking means associated with each key for selecting, according to a previously made record, the portion of the magnitude of the motion producing means which will be imparted to the movable support and still further switch and circuit means associated with each key for energizing the motion producing means.

12. In combination with an electro-mechanical multiple card recording machine, a recording device for each card, means for selectively "setting up" one of the card recording devices and excluding the others, means for selecting the rela-

tive position between the recording device and the card on which the record is to be made, a common key board for operating both of said means, monitoring means for confining effective operation of the keyboard to a predetermined sequence, means for releasing the "setting up" means, and manually operable means for eliminating the monitoring means.

13. In combination with an electro-mechanical card punching machine, a card punching device for each card, common drive means for the card punching devices, means for selectively operatively associating one or more of the card punching devices with said drive means and excluding the others, means for selecting the position of the punching devices relative to the cards to be punched, a common keyboard for operating both of said means, and means for releasing the second named means.

14. In combination with a multiple card punching machine having card punching means and card advancing means associated with each of a plurality of cards, a keyboard having a key for each punching means, a switching assembly carrying a switch for each key, each switch being arranged in an electric circuit for electro-magnetically controlling the corresponding card punching and advancing means, means associated with the switching assembly for closing and locking the switches corresponding to the keys pressed for "setting up" the desired card punching means, means for rendering the remaining switches of said switching assembly inoperative, means associated with each key for controlling the position of the punching means and the operation of it and the card advancing means, and means for releasing the locking means.

15. In a card punching machine a plurality of card holders, means extending transversely of said card holders including a punching device for each card holder, a common drive means and independently operable means for selectively establishing driving relation between one or more punching devices and said common drive means.

16. In combination with an electro-mechanical card punching machine a keyboard having a plurality of keys, first switching means normally operable by the depression of one or more of said keys, locking means for thereafter rendering said first switching means inoperative, second switching means at all times responsive to the depression of any of said keys and means for restoring said first switching means to normal position.

17. In combination with a multiple card punching machine having card punching means and card advancing means associated with each punching means, a switching assembly carrying a switch for each key, each switch being arranged in an electric circuit for electro-magnetically controlling the corresponding card punching and advancing means, means associated with the switching assembly for closing one or more of the switches corresponding to the keys pressed and for locking the remainder of the switching assembly in inoperative position, means associated with each key for controlling the position of the punching means and the operation of it and the card advancing means, and means for releasing the locking means.

JOHN P. BUCKLEY.