Dec. 18, 1934. W. W. LASKER 1,985,101

PUNCHING MACHINE

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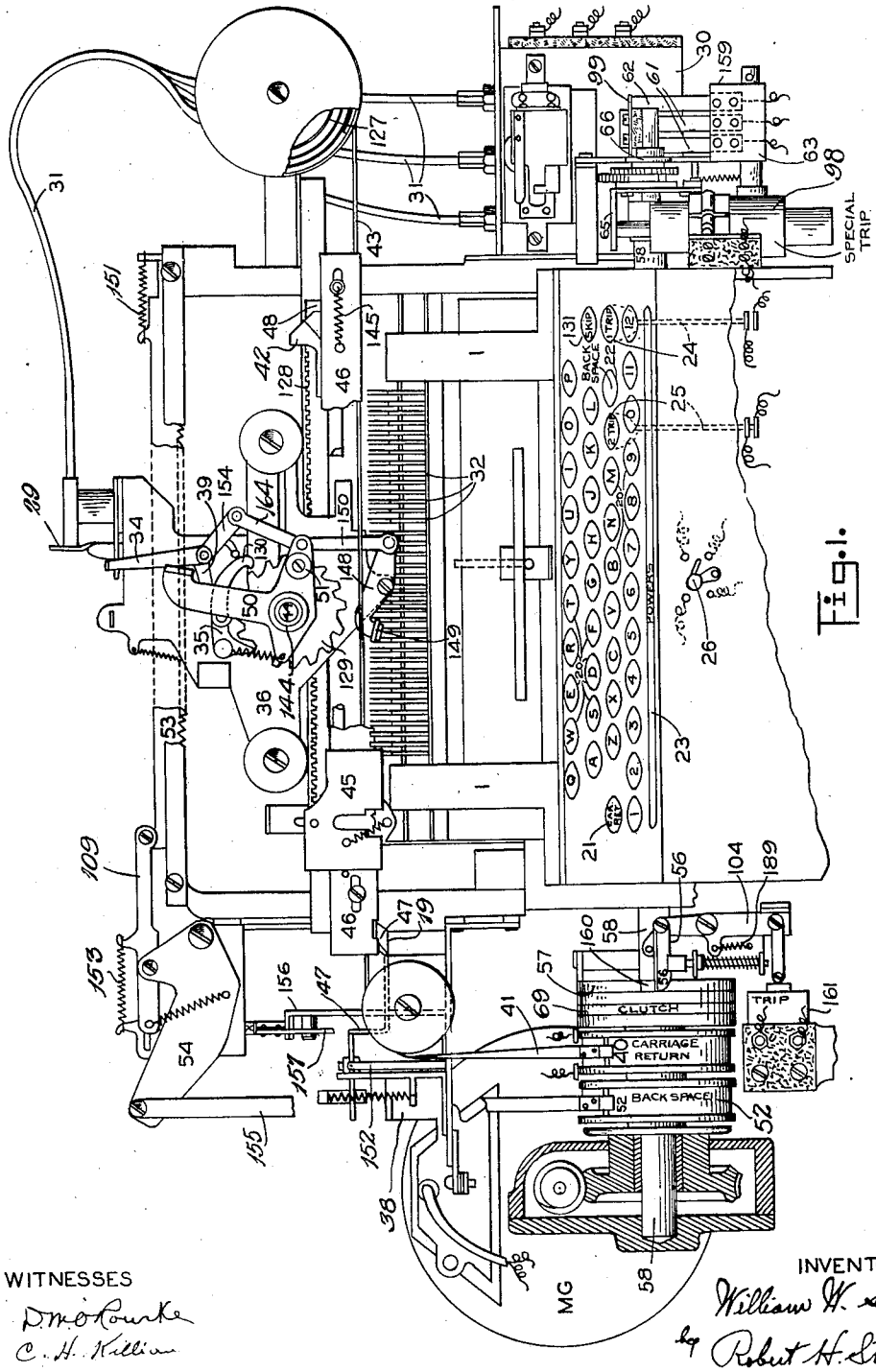


Fig. 1.

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PUNCHING MACHINE

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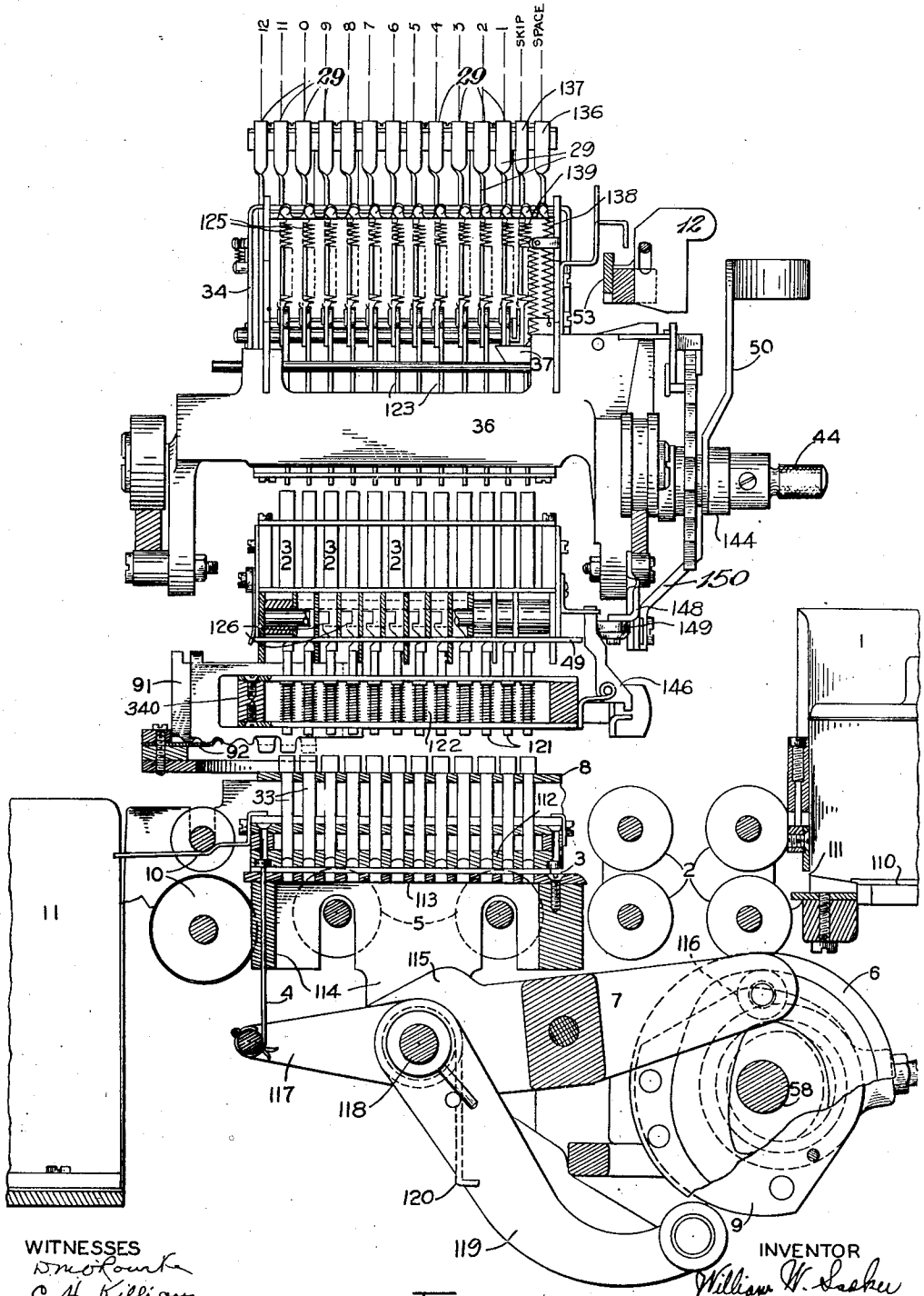


Fig. 2.

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PUNCHING MACHINE

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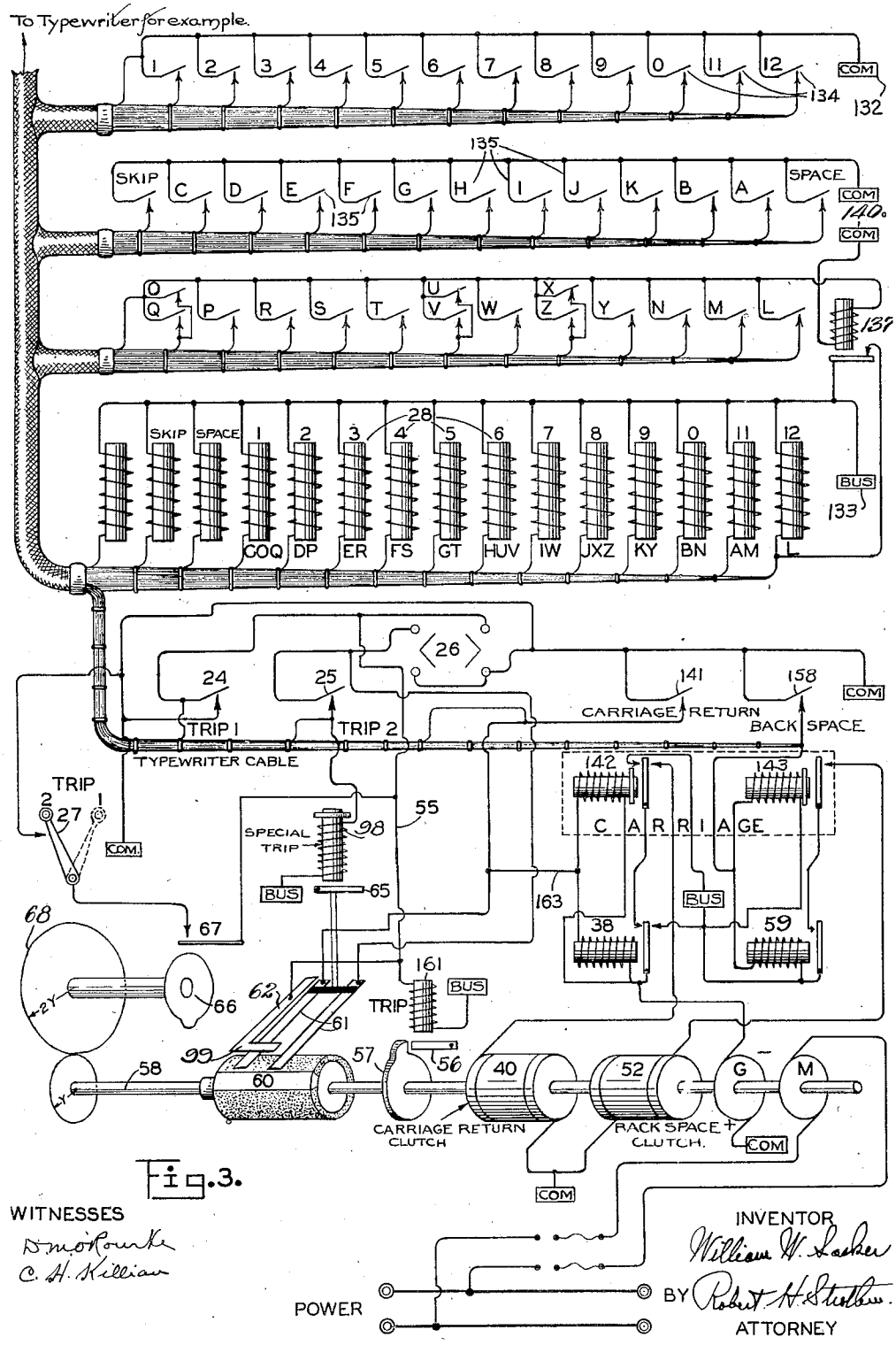


Fig. 3.

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PUNCHING MACHINE

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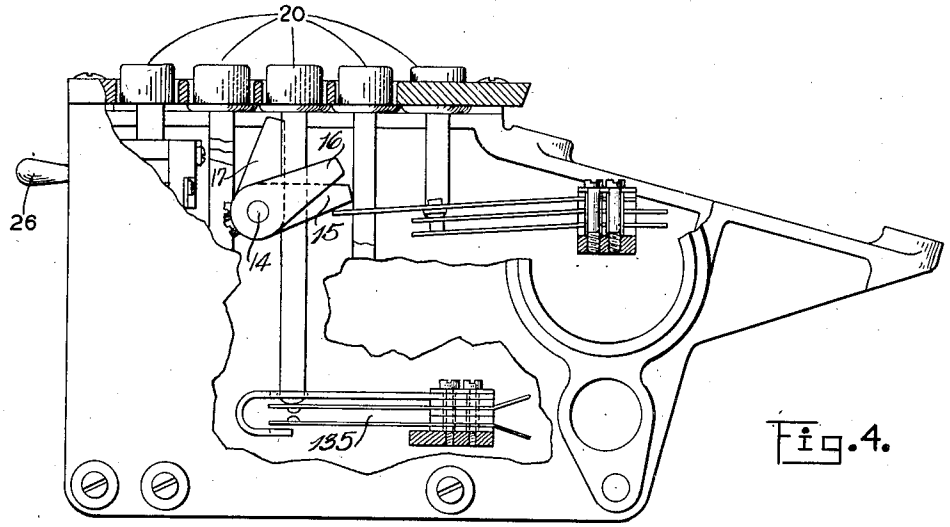


Fig.4.

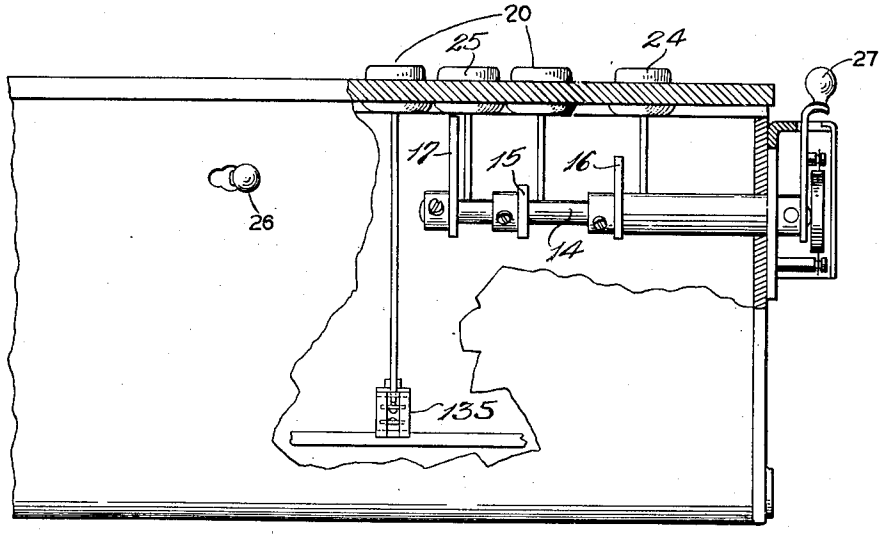


Fig.5.

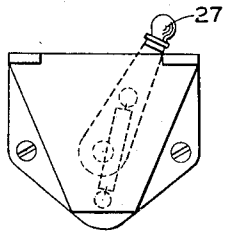


Fig.6.

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PUNCHING MACHINE

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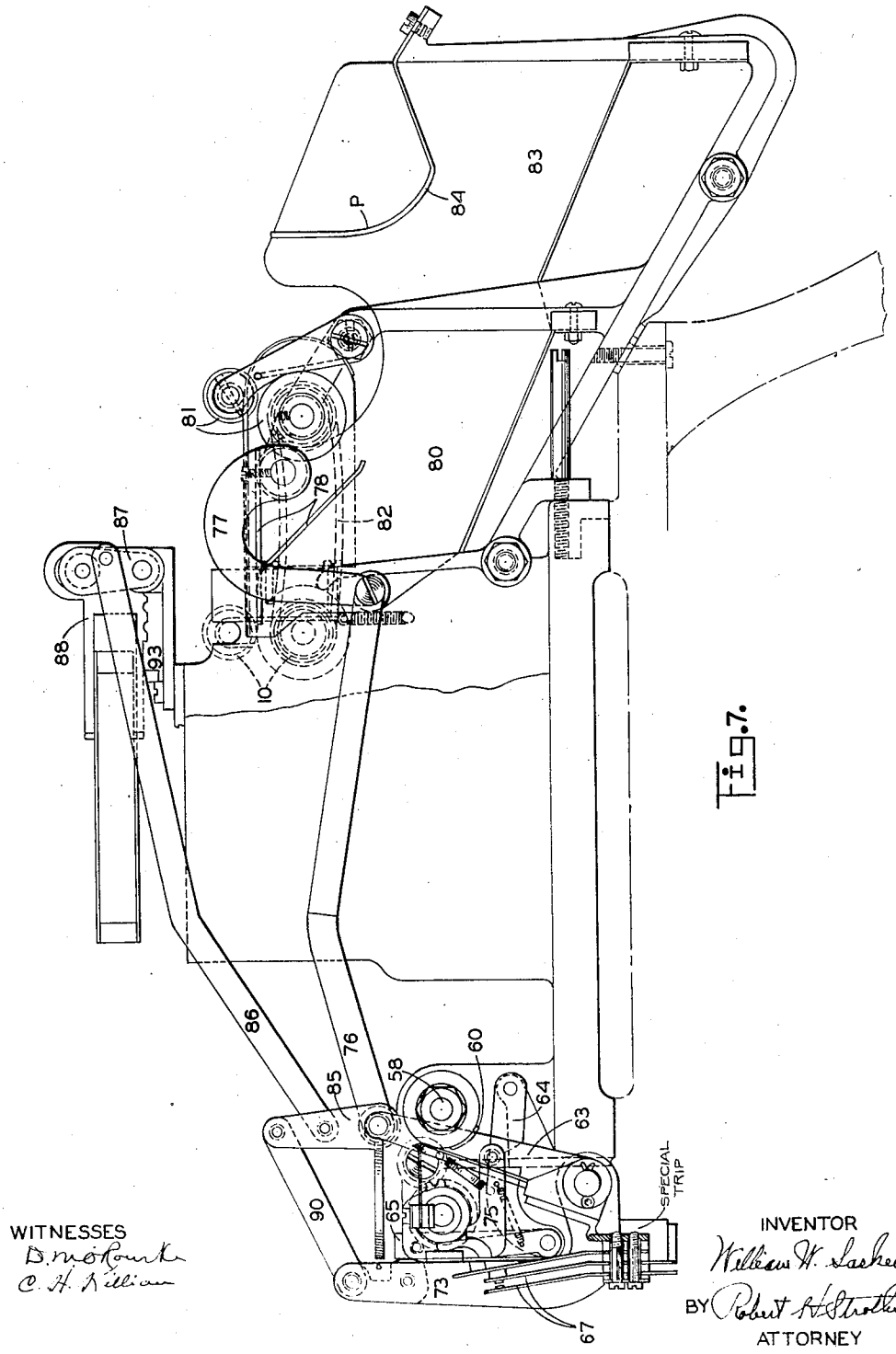


Fig. 7.

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Dec. 18, 1934. W. W. LASKER 1,985,101

PUNCHING MACHINE

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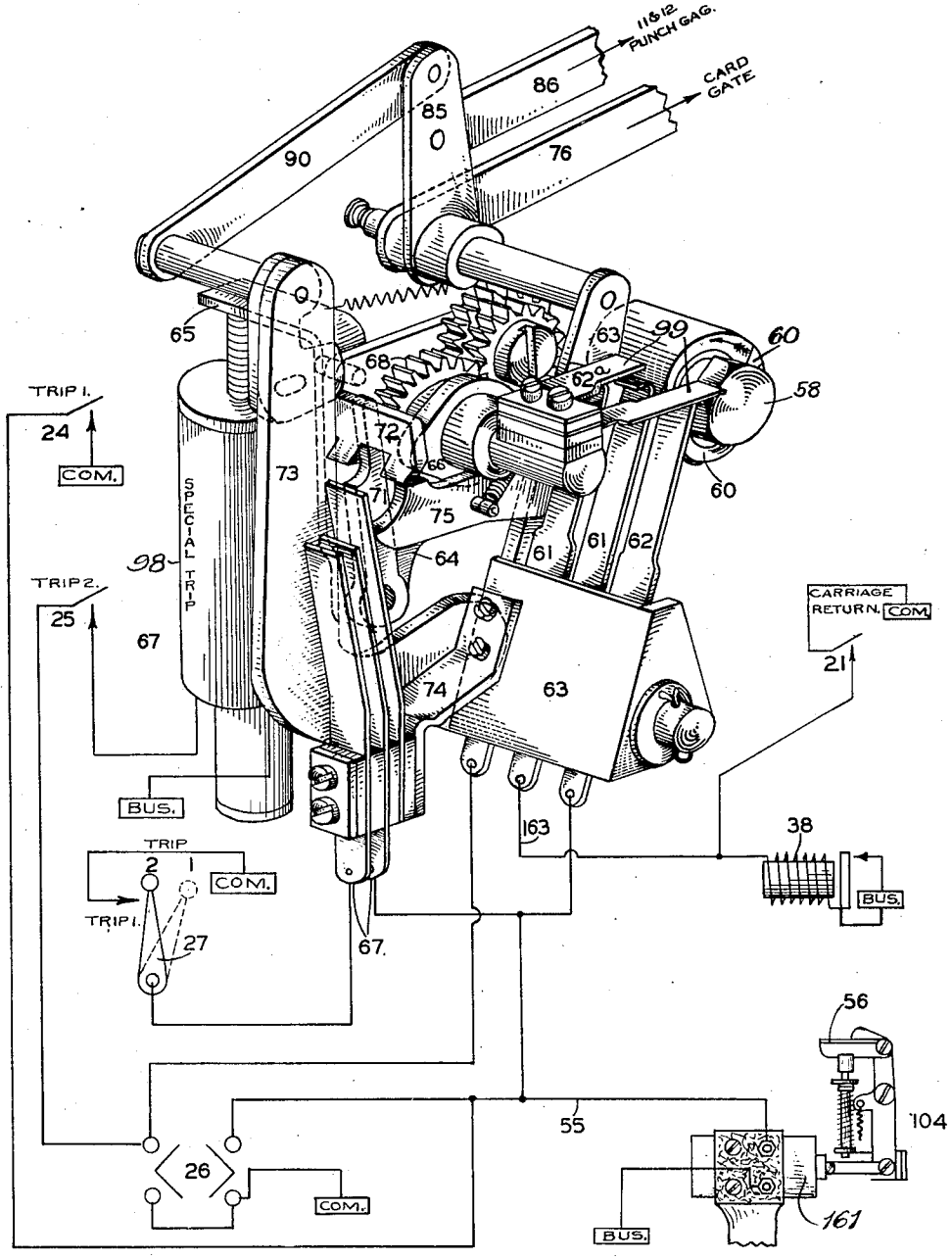


Fig. 8.

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PUNCHING MACHINE

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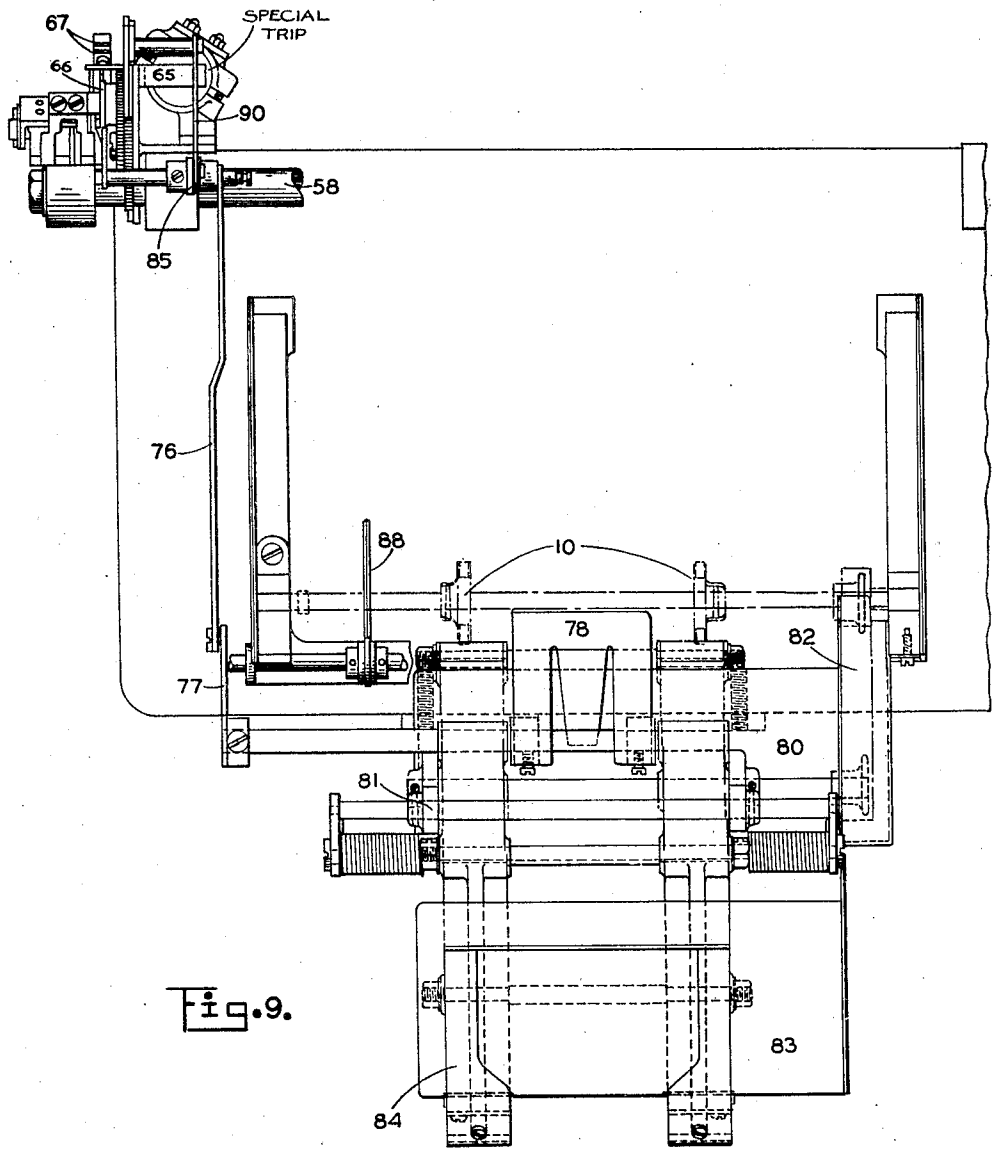


Fig. 9.

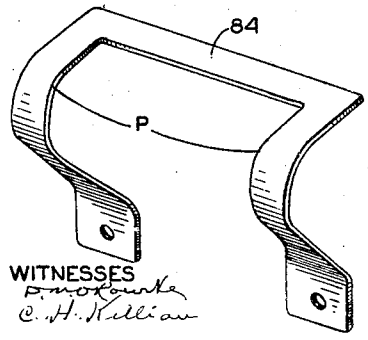


Fig. 16.

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PUNCHING MACHINE

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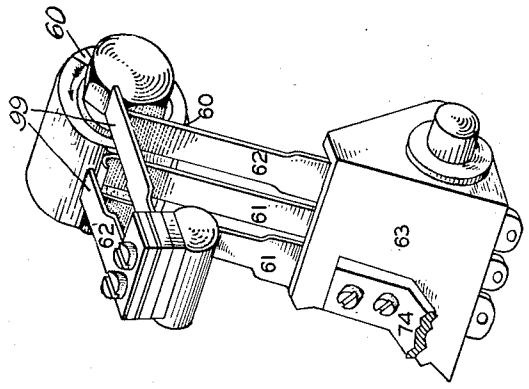


Fig. 12.

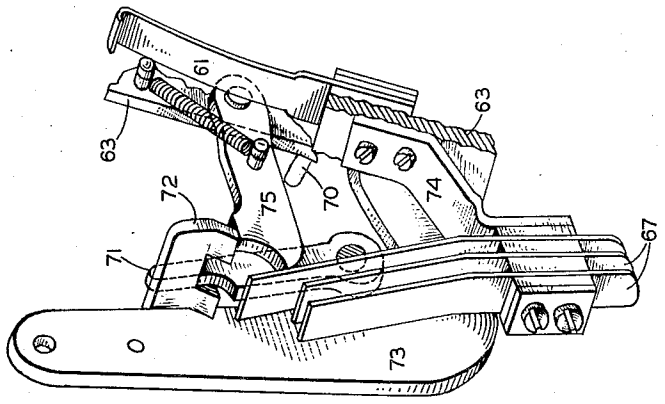


Fig. 11.

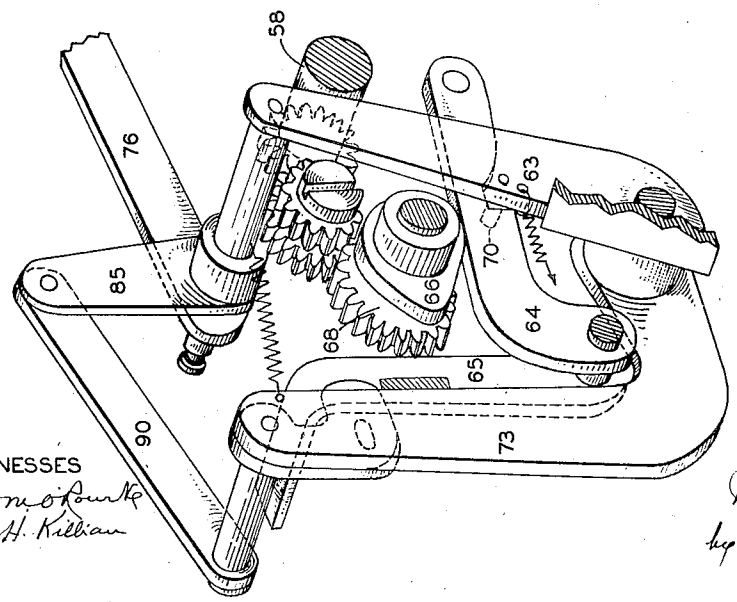


Fig. 10.

WITNESSES

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PUNCHING MACHINE

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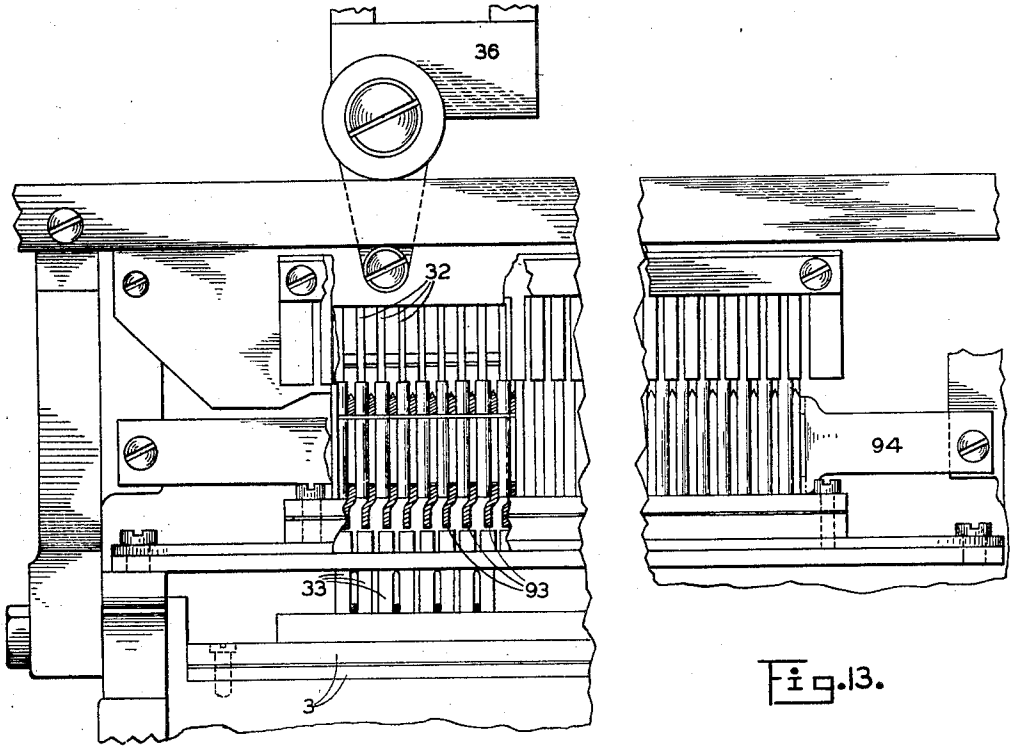


Fig.13.

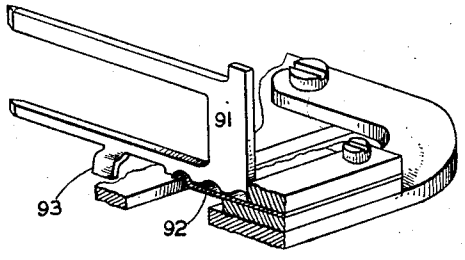


Fig.14.

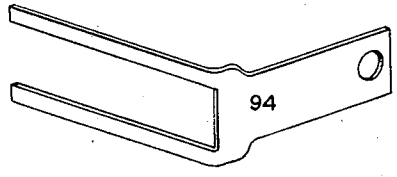


Fig.15.

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PUNCHING MACHINE

Filed Jan. 26, 1932 10 Sheets-Sheet 10

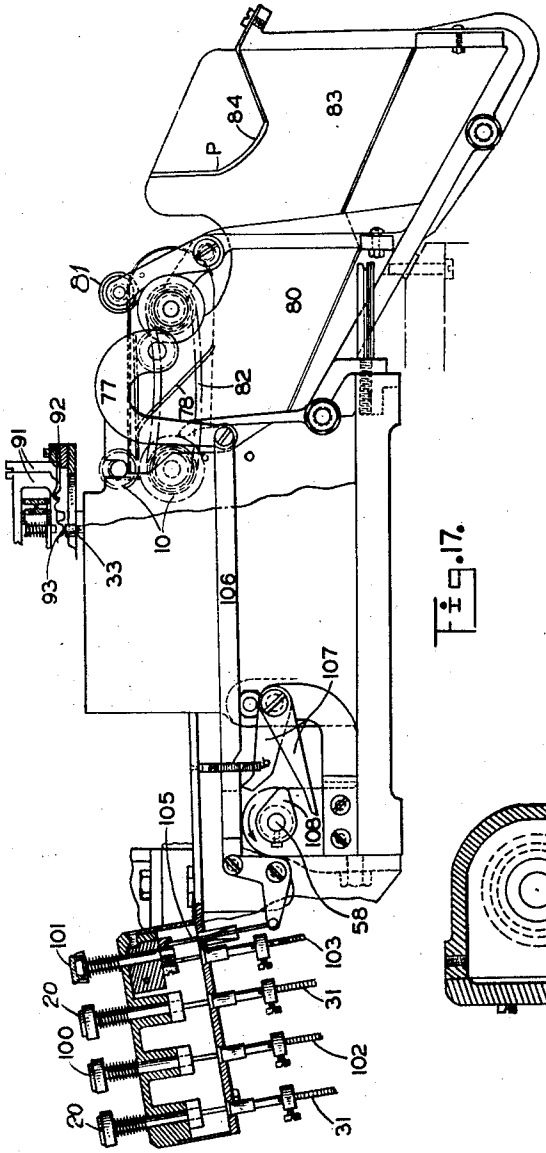


Fig. 17.

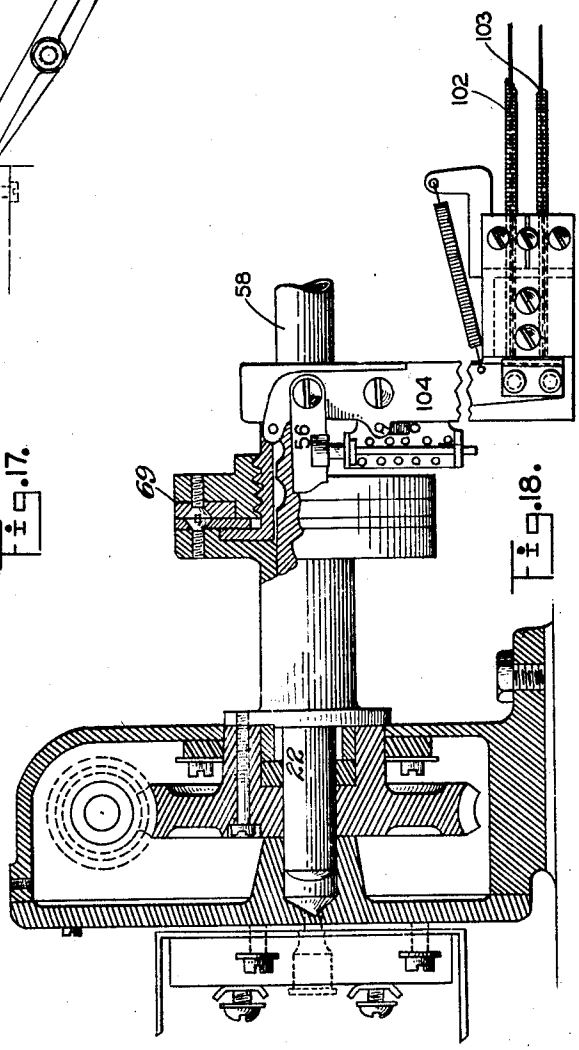


Fig. 18.

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Patented Dec. 18, 1934 1,985,101

UNITED STATES PATENT OFFICE

1,985,101

PUNCHING MACHINE

William W. Lasker, Brooklyn, N. Y., assignor to Remington Rand Inc., Buffalo, N. Y., a corporation of Delaware

Application January 26, 1932, Serial No. 588,863

27 Claims. (Cl. 164—113)

The present invention relates to punching or perforating machines and more particularly to improvements in keyboard controlled punching or perforating mechanism for perforating statistical or record cards to represent digits and letters of the alphabet.

Some of the objects of the present invention are to provide a mechanism for perforating special perforations in that portion of the card or record outside the regular numerical field; to provide means for automatically selecting a plurality of punches for successive operation during a plurality of operations of the punching mechanism; to provide means for automatically alternating an effective operation of two special punches during dual cycle operations; to provide means for automatically storing perforated cards in accordance with the presence of corresponding special perforations; to provide a plurality of trip keys each of which corresponds to storage receptacles; to provide plural trip keys for differing cycles of operation; to provide a special key to normalize the machine for any of a plurality of differing cycles; to provide an improved card stacking device to avoid shuffling of the perforated records; to provide means for preventing uneven or irregular stacking of perforated cards. The machine of the invention consists broadly of a card punching machine, which may utilize either electrical contacts and circuits for connections between the keys and the punch members or may utilize a series of direct mechanical connections with a mechanism to cause, at the operator's will, the punching of two identical cards, which are stacked in accurate sequence in a pair of card pockets, or alternatively to punch a single card from each setting of the punch mechanism, all of which cards are stacked in accurate sequence in a single card receiving pocket.

The electrical embodiment utilizes a series of switches, contacts, etc., for the control of the punch operation, among which is included a special switch, which, according to its position, will cause a single card to be punched from a given setting of the machine, or will cause two cards to be punched from a single setting, and the cards distributed in separate pockets. In addition, the machine includes mechanism for permitting a large number of identical cards to be punched from a single setting, and also the usual control of members. For this purpose, the machine utilizes a new commutator and contact system, including a half speed shaft for resetting after the punching of a pair of similar cards. The embodiment also includes an adjustable mechanism, whereby an auxiliary perforation is included in one of a pair of cards (or in differing locations on each of the pair of cards) to distinguish the first card from a second card (or to distinguish the cards of each pair), which are, in other respects, identical. It also includes a manually adjustable member for blocking any desired gag in the eleventh or twelfth row in a column for a constant perforation in all cards punched at a given time.

Other objects and details will appear from the accompanying drawings, when read in connection with the following description, in which:

Fig. 1 is a front view of the improved punch with certain parts broken away and others omitted for the sake of clearness of illustration;

Fig. 2 is a section through the machine illustrating the cooperation of the elements for controlling the blank card and the punches to be selected;

Fig. 3 is a wiring diagram illustrating certain electromechanical elements with conventional symbols;

Fig. 4 is a fragmentary section of the keyboard showing a key switch and the normalizing switch;

Fig. 5 is a front elevation of Fig. 4;

Fig. 6 is a detail pertaining to Figs. 4 and 5;

Fig. 7 is an end elevation showing the automatic control for sorting punched cards according to the presence of special perforations;

Fig. 8 is an isometric view of the principal elements of Fig. 7 with diagrammatic circuit connections to the elements controlled;

Fig. 9 is a plan view of Fig. 7;

Fig. 10 is an isometric view of a portion of Fig. 8;

Fig. 11 is an isometric view of the mid portion of Fig. 8;

Fig. 12 is an isometric view of certain contacts from Fig. 8;

Fig. 13 is a rear elevation of a modified form of special perforation controlling elements.

Fig. 14 is an isometric view of a single element from Figs. 2 and 13;

Fig. 15 is an isometric view of a guide for an extreme end perforation controlling element;

Fig. 16 is an isometric view of a stacking guard;

Fig. 17 is a modified form applied to a mechanical punch;

Fig. 18 is a detail of the clutch mechanism and its mechanical release.

The machine to which my improvements have been shown as applied is of the type exemplified by the well known Powers perforating mechanism of commerce, the basic organization of which is disclosed in Patents Nos. 1,305,557, issued June 3,

1919; 1,684,001, issued Sept. 11, 1928; 1,798,610, issued March 31, 1931; 1,684,546, issued Sept. 18, 1928; and, 1,810,317, issued June 16, 1931.

General organization and operation of the tabulating mechanism

The cards or blank records to be punched are fed one by one from a stack in a magazine 1 by a reciprocating card picker 110, which feeds the cards through a pre-adjusted throat 111 to pairs of constantly rotating feed rolls 2. From the feed rolls 2 the cards pass between a pair of matched perforated plates 112 and 113 mounted upon a vertically movable frame 114 and spaced apart to form therebetween a punching chamber 3. The punching operation is effected by vertical reciprocation of said plates relative to selected punches 33 of a set suspended vertically in denominational rows from a stationary perforated plate 8 and positioned to pass through the perforated plates 112 and 113 upon upward movement of the latter to thereby perforate the card, the plates 112 and 113 acting as punch guiding and die members, respectively, as will be clear. The punches 33 are vertically movable in the plate 8 and normally spaced slightly above the card whereby they are normally moved upwardly and idly by the latter. Reciprocation of the plates 112 and 113 is effected by means of a cam 6 fast upon a main drive shaft 58, and a rocking lever 7 operatively connected to the frame 114, as indicated at 115, and having a roller 116 engaging said cam 6. The card to be punched is temporarily held stationary in the chamber 3, and against the action of continuously driven feed rolls 5, by a pair of card stops, one of which is shown at 4, mounted on stop operating levers, as at 117, fast upon a shaft 118 rocking in opposite directions to move said stops to card obstructing and releasing positions, respectively. The shaft 118 is rocked in one direction by a lever 119 fast thereon and operated by a cam 9 fast on the main shaft 58 and in the opposite direction by a suitably arranged spring 120. After the card is punched and released by the stops 4, it is fed by rolls 5 to ejecting rolls 10, thence into a storage receptacle 11, or over an automatically controlled card gate.

The punches 33 are selectively set, through the medium of punch setting mechanism obstructing upward movement of said punches whereby the latter are forced through the cards when the plates 112 and 113 are moved upwardly. The punch setting mechanism includes a set of vertically movable settable stops 32 arranged in denominational rows and each related to one of said punches, a set of vertically movable interponents or gags 121 between related stops and punches tensioned by springs 122 to yieldingly sustain said stops in normal unset position, and a series of stop setting pins 123 mounted upon a denominationally movable carriage 36 for selection of the rows of stops and individually operative, against the tension of pin returning springs 125, by levers 29 to set the stops. Spring pressed perforated slides 49 engage shoulders 126 on said stops to releasably latch the latter in set position.

The carriage 36 is moved denominationally by the usual carriage advancing spring motor (not shown) and under control of escapement mechanism cooperating with a carriage feed rack 128 and including an escapement wheel 129, holding and spacing dogs 35 and 130, respectively, and a universal bail 34 operatively connected to said dogs and actuated through the medium of the levers 29, all as disclosed in the previously noted Patent No. 1,305,557.

Other mechanisms, with which the previously identified type of machine is equipped, such, for instance, as carriage returning, back spacing, single revolution clutching and set-up, releasing, or erasing mechanisms, respectively, will be hereinafter described in connection with keys and other instrumentalities controlling the same.

The keyboard is generally the same as shown in the Patent No. 1,684,001, granted to Weiland et al. Sept. 11, 1928. Briefly, it comprises numeral and alphabet keys 20 (Figs. 1, 3, 4 and 5), a series of special keys such as a space key or bar 23, a skip or tabulating key 131, a carriage return key 21, a back space key 22, a "1 trip" key 24, and a "2 trip" key 25. Special levers, such as the repeat switch 26 and the normalizing lever 27, are also provided. The mechanism and operations controlled by these keys and levers will now be described.

Numeral keys

Each numeral key 20 is operatively related to a switch 134 in Fig. 3 for closing an individual shunt circuit between a common return indicated at 132, and a bus bar 133, and including a solenoid 28. The solenoids 28 are disposed in a housing 30 (Fig. 1) and each is operatively connected to a related one of the before mentioned stop setting levers 29 by a Bowden wire 31.

Depression of a numeral key 20 and the closing of its shunt circuit effects operation of the related stop setting lever 29 to set a stop 32 and a punch 33 as will be clear. As an incident to the stop setting operation the universal bail 34 is operated by said stop setting lever 29 to release the escapement holding dog 35 and permit the carriage 36 to be advanced one step or column space to the right by the carriage advancing motor.

If desired the contacts controlled by the keys 20 may be paralleled for operation by a duplicate set of keys (not shown) and by bundling the proper wires into a cable which may be attached to an auxiliary machine such as a typewriter, an adding machine, a cash register, or the like as indicated by the legend in Fig. 3.

In the simplified mechanical punch illustrated in Fig. 17 the numeral keys 20 are directly connected to the Bowden wires 31 and thus directly actuate the requisite stop 32 as is more fully described in the cited patent Lasker 1,305,557.

Alphabetical keys

The alphabet keys are divided into two classes, the one class corresponds to approximately the first half of the alphabet, and the second class corresponds to the remainder of the alphabet. The first class of alphabet keys actuate switches 135 in parallel with the numeral keys as is indicated by the legends on the solenoids 28 in Fig. 3, so that the numeral key description suffices for this class. In the Powers perforating mechanism the same punch combination is used for plural sets of letters as is indicated by the pairs O, Q; U, V and X, Z in Fig. 3. The second class of alphabet keys is in parallel with the first class except that their "common return" 140 or "top" includes a special low resistance "12 relay" 137, which in turn closes an additional shunt circuit through the "12" solenoid 28 when a key of this class is depressed. Hence the depression of a key of this class causes the actuation of two solenoids 28, the setting and locking of two stops 32 and consequently the punching

of two holes in the same punch-hole column by the punches 33.

Space and skip keys

The space and skip keys 23 and 131 control electric circuits identical with those of the numeral keys, or what is the same thing, the first class of alphabet keys. This identity is indicated by their location in Fig. 3. Sometimes the space key contact is in parallel with the "zero" key, or what is the same thing, there are two zero keys, one of which is designated on the keyboard as "space" and the other as "0". Neither the space nor skip keys set stops 32, except as above noted, but each operates to release the escapement, the one through a lever 136 and the other through a lever 137, both mounted on the carriage 36 and operated against the tension of springs 138 and 139 by solenoids and Bowden wires in the same manner as levers 29. Operation of the space key 23 momentarily releases the escapement dogs 35 and 130, as disclosed, for instance, in Patent No. 1,305,557. The skip key 131, through its lever 137 operates a lever 37 (Fig. 2) to release the escapement, which is then automatically latched in released condition to free the carriage 36 for advance to a position predetermined by a settable skip stop 12, Fig. 2, in which position the escapement is unlatched for normal operation.

It will be understood that in the mechanical punch shown diagrammatically in Fig. 17 that these space and skip keys are directly connected to their Bowden wires so that a key depression results in the above described operations without the intermediary of the electric switches and solenoids.

Carriage return key

The carriage-return key 21 controls carriage-returning mechanism substantially identical with that disclosed in Patent No. 1,684,546, dated September 18, 1928, and previously noted.

Generally described, and with reference particularly to Figs. 1 and 3, said mechanism comprises a power-driven, magnetic carriage return clutch 40 operatively connected by a tape 41 to a sliding hook 42 held in a normal position by a reactive-motor 127 and tape 43 and movable to pick up and return the carriage 36. Slidingly mounted on the machine is a bar 46 endwise movable parallel with the carriage 36 and tensioned by a spring 145. The bar 46 is operatively connected to a bell crank contact member 47 pivoted at 19 and movable to open and close a clutch energizing circuit presently described. The contact member is normally urged toward circuit-closing position by the spring 145 but held in circuit opening position, against the urge of said spring, by latch mechanism represented at 152. A relay 38 operates the latch mechanism to release said contact member 47 which is then moved to circuit-closing position by said bar 46 and spring 145. Retraction of the carriage 36 engages a collar 144 (Fig. 2) thereon with a settable stop 45 on the bar 46 whereby the latter is picked up by said carriage and said contact member 47 is moved to circuit-opening position in timed relation to the return of said carriage to home position as will be clear.

For convenience in the illustration of circuits controlling the contact 47, in Fig. 3, a conventionalized showing has been given in which the contact has been eliminated and operation thereof in timed relation to the return of the carriage represented by a slow-acting relay 142, it being understood that attraction of the armature of relay 38 is intended to represent unlatching of said contact-member 47 and its movements to circuit-closing position and attraction of the armature of relay 142 to represent movement of contact-member 47 by said carriage to the before-described circuit-opening position.

Depression of the carriage-return key 21 closes a switch 141 to complete a circuit including the "common" and "bus" terminals of a generator G, the relay 38, and the slow-acting relay 142. The attracted armature of relay 38 completes a circuit from generator G through the armature of the slow-acting relay 142, to the winding of the carriage-return clutch 40, thereby rendering the latter effective to return the carriage. As soon as the armature of relay 38 is attracted, the connection to "bus" is broken, thereby disabling other solenoids or magnets deriving current from "bus" and presently referred to in detail. The relay 38 is connected to the negative side of the generator G through the switch 141 and to the positive side through "common" so that it will hold its armature as long as key 21 is held depressed. When the slow-acting relay 142 retracts its armature, the circuit, including the winding of the carriage return clutch 40 is broken and said clutch rendered ineffective.

The machine is equipped with set-up erasing mechanism disclosed in the before-mentioned Patent No. 1,305,557 and Patent 1,807,267. Such mechanism comprises a series of levers, one of which is shown at 146, Fig. 2, operative to disengage the slides 49 from set stops 32, an erasing-arm 148 carrying an eraser-roller 149 and movable on the carriage 36 to position said roller for operative engagement with said levers 147, a tensioned arm-operating bell crank 50 on said carriage, a link 150 connecting the bell crank 50 to said arm 148, a roller 51 on the bell crank and a cam 48 on the carriage-return hook 42 located in the path of travel of the roller 51. When the carriage 36 nears the limit of its advancing movement, roller 51 is engaged with the cam 48 and the bell crank 50 thereby rotated in the proper direction to position the erasing roller 149 for operative engagement with the levers 146. During return of the carriage the erasing roller operates the levers 146 to disengage the slides 49 and release the set-up of stops 32, which are then returned to normal unset position by the interponents 121. The carriage return mechanism is electrically connected to mechanism which will be more fully described hereinafter.

The mechanical punch diagrammatically illustrated in Fig. 17 does not have a carriage return key. When it is desired to return the carriage the operator grasps the lever 50 (Fig. 2) and shifts the carriage to any desired position, thus accomplishing manually the above described automatic operations.

Back space key

The back space key 22 controls back-space mechanism featured in the previously noted Patent No. 1,798 610.

With reference now to so much of the back-spacing mechanism as has been illustrated in the drawings, the primary element thereof is a ratchet bar 53 endwise movable, diagonally, toward the left as viewed in Fig. 1, against the tension of a spring 151, for back-spacing operations. Such movement of the bar 53 is imparted thereto by a magnetic back-space clutch 52, a

rocker 54 tensioned by a spring 153, a link connection 109 between said rocker and bar, and a link 155 operatively connecting said clutch and rocker. Mounted on the carriage 36 is a pawl mechanism, indicated at 39, establishing a pick-up connection between said carriage and bar during back-spacing operation of the latter. As an incident to its back-spacing operation, said bar 53 swings the bell crank 50, through connections 154 and 164, to operatively position the erasing roller 149 relative to levers 147 so that an erasing operation may be effected during back-spacing movements of the carriage 36.

The back-space clutch 52 is rendered effective and ineffective by means of the following:

Adjacent the rocker 54 is a circuit making and breaking member 156 tending to close a clutch energizing circuit, presently described. The member 156 is normally held in circuit opening position by latching devices 157. A relay 59 (energized by the closure of contact 158 of the back-space key 22) releases said member 156, whereupon said clutch 52 is energized and the back-spacing operation effected. The member 156 is moved back to circuit-opening position by the rocker 54 which is engaged with said member, by movement of the bar 53, in timed relation to one step of back-space movement of the carriage 36.

As in the case of the carriage return mechanism, in illustrating the back-spacing circuits a conventional showing has been resorted to. In said showing (Fig. 3) release of the member 156 and its movement to circuit-closing position is represented by attraction of the armature of relay 59, and movement of said member in timed relation to back-space movement of the carriage 36 by attraction of the armature of a slow-acting relay 143.

Referring now to Fig. 3, depression of the back-space key 22 closes a switch 158 to complete a circuit from the "common" through the relays 59 and 143 to "bus". The attracted armature of relay 59 completes a circuit from "bus", through said armature, and through the armature of slow-acting relay 143 and thence through the magnetic clutch 52 to "common", thereby energizing said clutch and effecting back-spacing. When the slow-acting relay 143 attracts its armature, the circuit, including the magnetic clutch 52, is broken and the latter disengaged.

In the mechanical punch diagrammatically illustrated in Fig. 17 there is no automatic back space mechanism. Back spacing is merely an abbreviated manual carriage return which was described above.

Electro-mechanical switch

A special electro-mechanical switch is provided which contains circuit elements common to certain of the special keys. This switch mechanism has been highly conventionalized in Fig. 3 by certain reference characters which are repeated in Figs. 8, 10, 11 and 12. The details and operation of this device will now be described.

Lever 63 is normally latched by latching member 64 hooking over a pin 70 rigid with said lever (Fig. 10). Latching member 64 is pivoted at its forward end to a reciprocable slide 65 which is elevated by the plunger armature of the special trip solenoid 98 thus releasing lever 63 so that its U-shaped contact members 99 close a circuit through the contact strip 61 and 62 under the action of the spring connecting the top of arm 73 to the long stud at the top of lever 63. Also pivoted at the lower end of 65 is the interponent member 71 the rearward edge of which is in the plane of cam 66. When 64 is latched over the pin 70 on 63 the upper end or point of 71 is below the bent over lug 72 on arm 73 so that cam 66 is ineffective to operate arm 73 through interponent 71. When 64 is elevated by the plunger of the special trip solenoid 98 then 71 is in the path of the lug 72 so that cam 66 will rock the arm 73. The lower end of 63 is provided with a bracket 74 which carries a pair of contacts 67 which swing in synchronism with 63. Pivoted on 63 is a spring urged latch 75 (Fig. 11). When the cam 66 through 71 shifts 73 forwardly, the extreme forward end of 75 under the influence of the spring attached between 75 and 63 swings the extreme forward end of said latch 75 into the path of the lug 72 of arm 73 to hold the latter in its shifted position.

If 63 is latched by 64 and cam 66 is in its abnormal diametrically opposite position, (as it would be after an odd number of "1 trip" cycles) the contacts 67 are closed by 75 through an insulating button on one of the said contacts to restore the machine to normal two cycle condition when the normalizing lever 27 is shifted. The two-to-one gear train for driving cam 66 is best shown in Fig. 10, as consisting of a frame supported ratio change idler interposed between a gear on the main shaft 58 and the gear 68 rigid with the cam 66. At the end of a two cycle operation when the "2 trip" key is used cam 66 forces lever 63 toward shaft 58 and latch 64 drops into its normal latched position, as the special trip magnet is deenergized as soon as key 25 is released.

The wiring diagram in Fig. 3 contains a number of conventionalized elements for certain electro-mechanical devices in the machine as constructed. Said Fig. 3 merely diagrammatically illustrates the scheme of operation when interpreted in the light of the specification. Referring to Figs. 7, 8, 10, 11, and 12, it will be seen that the main shaft 58 carries an insulating cylinder into which is embedded the metal bridging strip 60 for the contacts 61. Member or contact 62, which is represented in Fig. 3 as the lower contact for the special trip magnet, is a brush in said figures which never contacts with the strip 60. The brushes 61 and 62 are mounted on an insulating strip carried on the bent over portion of the spring pressed lever 63 which tends to rock the brushes 61 and 62 out of contact relation with the drum carrying strip 60. A latch 64 locks the lever 63 in position against the action of its spring, and said latch is pivoted at its forward end to the armature 65 of the special trip solenoid, which operates when and only when the "2 trip" key 25 is depressed. The main shaft 58 rotates in the direction of the arrow, hence strip 60 bridges the contact springs 61 at near the completion of a rotation of said shaft to energize the carriage return mechanism.

The "1 trip" key

The "1 trip" key 24 controls the machine to effect a single cycle of operation. Proceeding to a description of the means whereby such control is accomplished, mounted on the power shaft 58 is an automatically engaging single revolution clutch 57 normally disengaged by a trip member 56 mounted on a clutch tripping lever 104 and interposed, as by spring 189, in the path of movement of a lug 160 forming part of the clutch. A trip magnet or solenoid 161 is operatively con-

nected to the clutch tripping lever 104. In describing the action of this key, it will be assumed that the repeat switch 26 is positioned so that a depression of key 24 will complete a circuit (see Figs. 3 and 8) and it will be further assumed that the normalizing switch 27 is in the "1 trip" or open position. With these assumptions the depression of the key 24 completes a circuit from "common" through contacts of key 24, thence by wire 55 through the trip magnet to "bus". As soon as the key contacts at 24 separate, the trip magnet is deenergized and the machine will stop after a single cycle of operation. Rigid with the main shaft is a drum switch 60 whose normal position is slightly beyond circuit completing position for the brushes 61. (See also Figs. 8 and 12). When the main shaft 58 has about completed a full rotation, the switch segment 60 electrically connects the brushes 61 so that a circuit is completed from "common" through the left-hand pair of contacts of switch 26, thence through brushes 61 and segment 60 (see Fig. 3) wire 163, the winding of relay 38, then to "bus". It has been described above that relay 38 is energized by the depression of the carriage return key 21 hence the last described circuit effects the return of the carriage as above described, and prepares the machine for another setting of the punches 33 by the keys 20. At times the armature of the special trip magnet is elevated mechanically by the cam 66 thus effecting a break in the described circuit for the carriage return relay 38. The electrical circuit is considerably modified by switches 26 and 27 as will be noted in the description of these switches. From Figs. 1 and 8 it will be seen that the trip magnet 161 is of the solenoidal type which, when it attracts its armature, withdraws a bolt 56 supported by a spring buffer from the path of a lug on the free element 57 of a common form of screw pressure sleeve driven friction disk clutch 69, (see also Fig. 18) so that the main shaft 58 of the punch is connected to the prime mover.

The "2 trip" key

The "2 trip" key 25 releases the machine to effect a double cycle of operation. In describing the action of this key it will be assumed that the repeat switch 26 is in the same position as specified for the "1 trip" key (otherwise the circuit of the "2 trip" key is broken) and that the normalizing switch 27 is in its "2 trip" position. When key 25 is depressed (Fig. 8) a circuit is completed from "common" through the left-hand pair of contacts of switch 26, thence through the contacts of key 25, and the winding of the special trip magnet to "bus".

When the special trip solenoid attracts its armature 65 (See Fig. 8) a circuit is completed from "bus" through the winding of the trip magnet 161 contacts 62, 99 and 61, thence to "common" through the contacts of switch 26. The trip magnet is thus energized and the machine is released for a double cycle of operation. It will be remembered that when the special trip solenoid 98 attracts its armature 65 the lever 63 (Figs. 7, 8, 10, and 11) is released until mechanically restored therefore the effect is the same as if the special trip solenoid held its armature or that the key 25 is held depressed hence the shaft 58 will continue to revolve until the circuit through the trip magnet is broken. The contacts at 67 are controlled by a cam 66 which is driven at one half the speed of the main shaft 58, and the same cam restores the lever 63 to its normal latched position. Therefore at near the end of the second cycle the armature 65 is restored to normal in time for the strip 60 to complete a circuit through contacts 61 to the carriage return relay 38 and restore the machine to the normal condition as described above.

Repeat switch

The repeat switch 26 has the effect of holding the "1 trip" key depressed continuously and of disabling the keyboard. Assuming the switch 26 to be in its repeat position then a circuit is completed from "bus" through the winding of the trip solenoid, through wire 55, right-hand contacts of repeat switch 26 then to "common". Hence the trip solenoid is held energized as long as switch 26 is in its repeat position. It is thus seen that the repeat switch is a mere parallel for the "1 trip" key and the circuit for the "2 trip" key is broken as long as the switch 26 is in its repeat position. The tops of all the keyboard keys are connected to the top of key 25 hence the keyboard is disabled along with key 25.

Normalizing lever

The normalizing lever 27 is provided to restore the machine to a condition for a series of repeated "2 trip" operations. Assume that lever 27 is in the "1 trip" position and cam 66 is in the position illustrated in Fig. 3. If now the lever 27 is shifted to its "2 trip" position nothing happens for the contacts at 67 are open, this means that the machine is already in position to begin a two card cycle. Assume that cam 66 has the contacts 67 closed, as is indicated in Figs. 7 and 11 then when lever 27 is shifted to its "2 trip" position a circuit is completed from "bus" through the winding of the trip magnet 161, wire 55, cam operated switch 67, lever 27, then to "common" thus releasing the machine for a regular completion of the second half cycle of the "2 trip" operation described hereinabove.

Referring to Figs. 4 and 5 it will be seen that the normalizing lever 27 is attached to a shaft 14 supported in the frame-work of the keyboard box and that said shaft is provided with three arms 15, 16 and 17. Two of these arms 16 and 17 are used to lock the "1 trip" and "2 trip" keys respectively according to the two positions of the said lever 27. Thus if the lever 27 is in its "1 trip" position the "2 trip" key is locked and vice versa. The third arm 15 is used to close the switch shown in Fig. 4. Said switch is the mechanical embodiment of the diagrammatic contact shown in Figs. 3 and 8.

Sorting

When the machine is operating on "2 trip" cycles it is desirable to segregate the duplicate cards into separate compartments, for it is frequently desirable to tabulate the data on the duplicate cards into different classifications. Advantage is taken of the fact that arm 63 is moved to two different positions during a "2 trip" cycle. The upper end of the arm 63 is provided with a stud from which a link 76 (see Figs. 7, 8, 9, and 10) extends to the arm 77 fixed to a shaft carrying a card gate 78. It is thus seen that when arm 63 is released by the special trip solenoid the card gate 78 is elevated so that the card first perforated will be deflected into the first receptacle 80 by the ejecting rolls and that when cam 66 restores the arm 63 to normal latched position the card gate 78 is lowered and the second card is ejected onto the top of the card gate 78. A second pair

of ejecting rolls 81 are mounted on standards of the receptacle frame in a position such that they engage the card shortly before it is completely disengaged by the ejecting rolls 10. The upper of the rolls 81 is mounted between resiliently urged arms so that it is always in contact with the lower of the rolls 81 except when a card is interposed, thus insuring a desirable amount of frictional grip upon the interposed card.

The second set of ejecting rolls 81 may be power driven in any convenient manner. As illustrated this device consists of a link belt 82 located within a guard housing passing over sprockets fixed on the drive shafts of the lower ejecting rolls. It is thus seen that the second pair of ejecting rolls discharge the second card into the separate receiver 83.

Stacking guard

The second receiver 83 is provided with a special stacking guard 84. (See also Fig. 16). This guard is constructed of formed sheet metal which is rigidly located so that the cards will be properly stacked in the magazine. The construction of the guide is such that its forward end is substantially vertical then it continues with an arc of about 45° with a diameter of approximately the width of a card, then continues with the supports for the described arc. The lowest point of the arc is such that its distance to the extreme lowest corner of the receptacle is slightly less than the width of a card as is illustrated in Fig. 7. The lower of the eject rolls 81 is located sufficiently forwardly of the receiving magazine with respect to the upper roll so that a card gripped between them will impinge on the guard at a point P slightly beyond the beginning of the said arc. It has been found in practice that the described stacking guard overcomes the previous difficulties of uneven stacking, shuffling or interleaving of the cards, and overthrow. It has also been found that the cards are in proper sequence even after the pile reaches the capacity of the magazine. The proper operation depends upon the distance of the guard from the bottom of the magazine, the form and location of the arcuate portion of the guard and the relative positions of the ejecting rolls 81.

Automatic control of "11" and "12" punches

The described construction is such that each of the receptacles 80 and 83 receive a single set of perforated cards during "2 trip" cycles. Sometimes it is desirable to identify each set of cards by special perforations. Such identifications may occur in a selected column of the "11" and "12" positions. Means are provided to automatically adjust a normally ineffective punch gag so as to effect the punching of a special perforation identifiable with each of the receptacles 80 and 83. Pivoted on the stud to which link 76 is attached is a lever 85 (Figs. 7, 8, 9, and 10) at whose mid point is pivoted a rearwardly extending link 86. Said link 86 is connected to an arm 87 (Fig. 7) which in turn is joined by a pin-in-slot connection to the slideable punch gag 88. The details of the gag 88 will be more fully described hereinafter. For the purposes of the present description it is sufficient to describe the mechanism for automatically adjusting the gag 88. The upper end of the lever 85 is connected by a link 90 to a stud rigid with the arm 73. For the purposes of description the gag 88 may be viewed as normally occupying a "13" position, which is non-existent in relation to a card in the punching chamber. It is to be understood that the gag is in the "13" position as long as members 63 and 73 occupy the positions illustrated in Fig. 7, that is when the machine is at "2 trip" normal or during "1 trip" cycles. When the special trip solenoid is energized lever 63 swings to the left and lever 85 is correspondingly swung thus shifting the gag 88 from its "13" position to its "12" position so that the first card will receive a special "12" perforation and will be discharged into receiver 80, for the movement of lever 63 is communicated through link 76 to arm 77 to open the card gate 78. When gear 68 has completed a half rotation cam 66 acting through the now elevated interponent 71 shifts arm 73 to the left and thus draws link 90 in the same general direction to give an additional movement to lever 85 and through link 86 shift the gag 88 to the "11" position. It will be remembered that latch 75 locks arm 73 in its shifted position so that the gag 88 is locked in its "11" position thus insuring the punching of a special "11" perforation in cards which travel over the card gate 78 into the receiver 83. Although the description refers to only one gag 88 it is evident that a plurality may be used if desired.

For the purpose of insuring accuracy and adjustments of the parts arm 73 is provided with an adjusting block at its upper end to determine the extent of movement of the said gag.

Punch gags

It is often desirable to have a series of cards punched with special perforations in the "11" and "12" positions. Such perforations may be controlled by special punch gags which may be either manually or automatically set or shifted. The automatic setting of special gags was described under the preceding heading. Various gags are illustrated at 88 or 91 in Figs. 2, 7, 9, 13 and 14. The last cited figure isometrically illustrates a manually settable gag 91. Each gag is constructed as a fork with widely separated tines which are of dimensions such that the tines will fit readily between the heads and toes of the interponents between the stops 32 and the punches 33. The under surface of each gag is provided with locating notches for the ends of the leaf springs 92 so as to hold the gags in any desired adjusted positions. The springs 92 can have a usual form which resembles an ordinary comb whose back is rigidly held between clamping bars as shown in Fig. 2. The lower tine of each gag is provided with an offset projection 93 for blocking relative upward movement of the "11" and "12" punches. The normal or ineffective position of the offsets 93 is that corresponding to a "13" position, that is rearwardly of the field of punch heads. The upper tine of each gag is provided with a projection for manually adjusting the gag to any of its three positions. In the case of the gag 88 of Figs. 7 and 9 this projection is in the form of an open slot which straddles a pin or cross bar on the arm 87.

Provision has been made for a gag for every column of punches. The described mode of mounting the gags applies to all except the extreme end. This gag is supported by an artificial or dummy interponent column 94 shown in Fig. 15 which consists of a suitably formed sheet metal guide or guard permanently attached at any convenient point to the main frame work.

It will be apparent to those skilled in the art that some of the gags 91 may be manually settable as described hereinabove and one or more

arranged to be automatically adjustable under control of a multiple trip key such as 25.

Modification

It is sometimes desirable to have a simple type of punch in installations which do not warrant the more elaborate form just described. As is well known such punches are wholly mechanical (see Lasker Patent 1,305,557 above cited). The Bowden wires 31 are directly connected to the key stems as is diagrammatically illustrated in Fig. 17, otherwise the operation is exactly as described hereinabove. Punches of this type are usually provided with only sixteen keys. In the specific instance illustrated two of the keys 100 and 101 are used as trip keys. The trip key 100 is connected to the core of the Bowden wire 102 which in turn is provided with a terminal for rocking the lever 104 (Fig. 18) to withdraw the spring buffer supported trip latch 56 from the path of a lug on the above described clutch 69 to connect power shaft 22 to drive shaft 58 for operating the punch. The above description is that of the usual construction. The key 101 is connected to the core of the Bowden wire 103 to trip the clutch in exactly the manner above described. Said key is provided with a recessed collar for guiding and operating the slide rod 105 to rock a bell crank and draw the link 106 forwardly when said key is depressed. When said link 106 is drawn forwardly it is latched in this abnormal position by a spring urged latch 107 so that said link will remain in the abnormal position after pressure is released from said key. The forward movement of link 106 rocks the arm 77 to open the card gate 78 as above described. Each key 100 and 101 releases the clutch for a single operation and link 106 is restored to normal by the card gate springs as soon as cam 108 which is fixed to the main shaft 58 depresses the forwardly and downwardly extending arm of the latch 107. It is thus seen that key 100 directs a perforated card into the receptacle 83 and key 101 directs a perforated card into the receptacle 80. If desired special punch gags 91 may be provided to control any desired punches in the 11 and 12 positions, as above described.

What I claim as new and desire to secure by Letters Patent is:

1. In a machine of the class described the combination of a field of punches, manipulative devices for controlling said punches, record feeding and discharge mechanism for presenting blank records to said punch field and removing perforated records therefrom and a manipulative means for controlling alternate selection of each of a plurality of said punches as an incident to plural operations of said record feeding and discharge mechanism.

2. In a machine of the class described the combination of a field of punches, manipulative devices for controlling said punches, record feeding and discharge mechanism for presenting blank records to said punch field and removing perforated records therefrom and a manipulative means for controlling alternate selection of each of a plurality of said punches as an incident to plural operations of said record feeding and discharge mechanism including a movable punch gag.

3. In a machine of the class described the combination of a field of punches, manipulative devices for controlling said punches, record feeding and discharge mechanism for presenting blank records to said punch field and removing perforated records therefrom and a manipulative means for controlling alternate selection of each of a plurality of said punches as an incident to plural operations of said record feeding and discharge mechanism including a movable punch gag and a multiple position switch.

4. In a machine of the class described the combination of a field of punches, manipulative selecting means therefor, record feeding and discharge mechanism for presenting blank records to said punch field and removing perforated records therefrom and having a normal cycle of operation, and plural manipulative means for controlling the cycling of said mechanism whereby one of said manipulative means controls alternate selection of each of a plurality of punches as an incident to plural cycling.

5. In a machine of the class described the combination of a field of punches, manipulative selecting means therefor, record feeding and discharge mechanism for presenting blank records to said punch field and removing perforated records therefrom and having a normal cycle of operation, plural manipulative means for controlling the cycling of said mechanism whereby one of said manipulative means controls alternate selection of each of a plurality of punches as an incident to plural cycling and including an automatically positioned punch gag.

6. In a machine of the class described the combination of a field of punches, manipulative selecting means therefor, record feeding and discharge mechanism for presenting blank records to said punch field and removing perforated records therefrom and having a normal cycle of operation, plural manipulative means for controlling the cycling of said mechanism whereby one of said manipulative means controls alternate selection of each of a plurality of punches as an incident to plural cycling and including an automatically positioned punch gag and a multiple cycle controlling switch.

7. In a machine of the class described the combination of a field of punches, manipulative selecting means therefor, record feeding and discharge mechanism for presenting blank records to said field of punches and removing perforated records therefrom, plural discharge receptacles, and a manipulative device for controlling alternate selection of a pair of punches and the receptiveness of said discharge receptacles.

8. In a machine of the class described the combination of a field of punches, manipulative selecting means therefor, record feeding and discharge mechanism for presenting blank records to said field of punches and removing perforated records therefrom, plural discharge receptacles, and a manipulative device for controlling alternate selection of a pair of punches and the receptiveness of said discharge receptacles and including a floating lever.

9. In a machine of the class described, the combination of a field of punches, manipulative selecting means therefor, record feeding and discharge mechanism for presenting blank records to said field of punches and removing perforated records therefrom, plural discharge receptacles, and a manipulative device for controlling alternate selection of a pair of punches and the receptiveness of said discharge receptacles and including a floating lever controlled in part by a multiple cycle controlling switch.

10. In a machine of the class described the combination of a field of punches, manipulative

selecting means therefor, record feeding and discharge mechanism for presenting blank records to said field of punches and removing perforated records therefrom, plural discharge receptacles, and a manipulative device for controlling alternate selection of a pair of punches and the receptiveness of said discharge receptacles and including a floating lever controlled in part by a multiple cycle controlling switch and in part by a cam operated punch selecting lever.

11. In a machine of the class described the combination of a field of punches, manipulative selecting means therefor, record feeding and discharge mechanism for presenting blank records to said field of punches and removing and storing perforated records therefrom, and optionally operable means separate from said selecting means for controlling the punching of special perforations and for controlling said mechanism.

12. In a machine of the class described the combination of a field of punches, manipulative selecting means therefor, record feeding and discharge mechanism for presenting blank records to said field of punches and removing and storing perforated records therefrom, and optionally operable means separate from said selecting means for controlling the punching of special perforations and for controlling said mechanism and including a floating lever.

13. In a machine of the class described the combination of a field of punches, manipulative selecting means therefor, record feeding and discharge mechanism for presenting blank records to said field of punches and removing and storing perforated records therefrom, and optionally operable means separate from said selecting means for controlling the punching of special perforations and for controlling said mechanism and including a floating lever controlled in part by a multiple cycle controlling switch.

14. In a machine of the class described the combination of a field of punches; manipulative selecting means therefor; record feeding and discharge mechanism for presenting blank records to said field of punches, and removing and storing perforated records therefrom including multiple storage receptacles; and optionally operable means for selecting a storage receptacle and selecting a punch identifiable with the selected storage receptacle.

15. In a machine of the class described the combination of a field of punches; manipulative selecting means therefor; record feeding and discharge mechanism for presenting blank records to said field of punches, and removing and storing perforated records therefrom and including plural storage receptacles; and manipulative means for simultaneously controlling the punching of special perforations and selecting the receptacle to receive the perforated records and including a floating lever controlled from an automatically actuated lever.

16. In a machine of the class described, the combination of a field of punches, key members for setting said punches, record feeding and discharge mechanism for presenting blank records to the said punch field and removing records therefrom, and a control member for alternately actuating a punch upon a single one of a pair of otherwise similar cards produced from a single punch setting.

17. In a machine of the class described, the combination of a field of punches, control means for setting punches in said field, mechanism for actuating said field members to punch a card according to a given punch setting, card feeding and discharge mechanism cooperating therewith, and a mechanism for setting a punch to punch an identifying record in a pair of otherwise similar cards, comprising a movable punch gag.

18. In a machine of the class described, the combination of a field of punches, control means for setting said punches, record conveying mechanism, and mechanism for controlling certain of said punches including in combination, a movable punch gag, and a multiple position switch whereby identifying holes are punched in certain cards according to the position of the gag and switch.

19. In a machine of the class described, the combination of a field of punch members, control mechanism for setting said punches, record card handling mechanism cooperating therewith and operating in a cycle with said punches, manually settable means for controlling the mechanical operation of the mechanism to determine whether a single cycle or a plurality of cycles of the punch shall occur with a single punch setting, and mechanism for setting an indicating punch when a plurality of cycles are made with a single setting.

20. In a machine of the class described, the combination of a field of punches, manually operable setting means for said punches, record handling mechanism cooperating with said punches, in cycle therewith, manually adjustable means for determining whether one or more cycles shall occur for a punch setting, comprising an automatically positioned punch gag and a multiple cycle controlling switch.

21. In a machine of the class described, the combination of a field of punches, manual means for setting said punches, record conveying mechanism cooperating with said punches, a plurality of card receiving receptacles cooperating with said card conveying mechanism and a manually adjustable mechanism for controlling the discharge of cards into one or both of said card receptacles.

22. In a machine of the class described, the combination of a field of punches, manually operable setting means therefor, record handling mechanism, a plurality of card receptacles cooperating therewith, mechanism for determining whether one or more cards shall be punched from a given punch setting, a mechanism operable simultaneously therewith to determine whether all cards shall be discharged into a single receptacle or whether the cards shall be divided among the various receptacles of the said plurality of receptacles.

23. In a machine of the class described, the combination of a field of punches, manually operable means for setting said punches, record handling mechanism cooperating with said punches comprising card conveying rolls and a plurality of card receiving receptacles, and automatically operable means for distributing several cards, punched from a single punch setting, among the several receptacles.

24. In a machine of the class described, the combination of a field of punches, manually operable means for setting said punches, record handling mechanism cooperating with said punches comprising card conveying rolls and a plurality of card receiving receptacles, automatically operable means for distributing several cards, punched from a single punch setting, among the several receptacles, and a manual setting means for determining whether a single

card shall be punched from a single punch setting or a plurality of cards from a single punch setting.

25. In a machine of the class described, the combination of a field of punches, manually operable means for setting punches therein, record handling mechanism including a plurality of card conveying rolls and a plurality of card receptacles, mechanism for causing a plurality of cards to be perforated from a single setting of said punches, automatic mechanism for identifying the successive cards from a single punch setting, and mechanism for discharging the identified cards separately into the several receptacles.

26. In a machine of the class described, the combination of a field of punches, manually operable punch setting means therefor, record handling mechanism cooperating with said punches comprising a plurality of card receptacles for punched cards, mechanism for causing the punching of a plurality of cards from a single punch setting, and automatically operable punching mechanism independent of said manual punch setting mechanism adapted to identify the successive ones of otherwise similar cards, and means enabled simultaneously therewith for discharging said identified cards into separate receptacles.

27. In a machine of the class described, the combination with a field of settable punches, manually manipulative means for setting said punches, and operating mechanism for causing repeated cycles of operation of the machine, of auxiliary punch setting mechanism rendered effective during alternate cycles of operation of the machine as an incident to operation thereof.

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