May 15, 1945. J. T. FERRY 2,376,241

CARD POSITIONING MEANS

Filed March 3, 1944 4 Sheets-Sheet 1

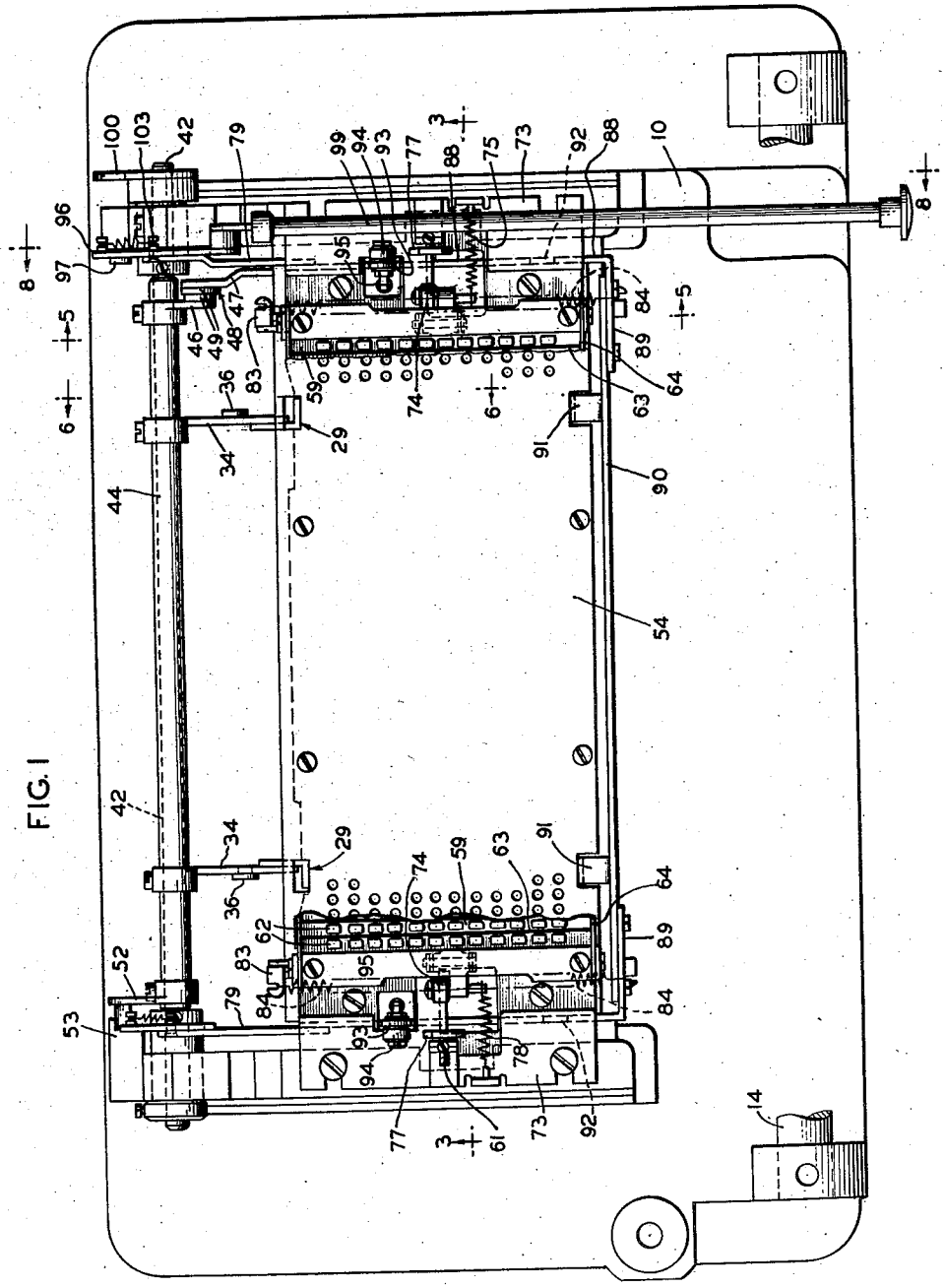

FIG. 1

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CARD POSITIONING MEANS

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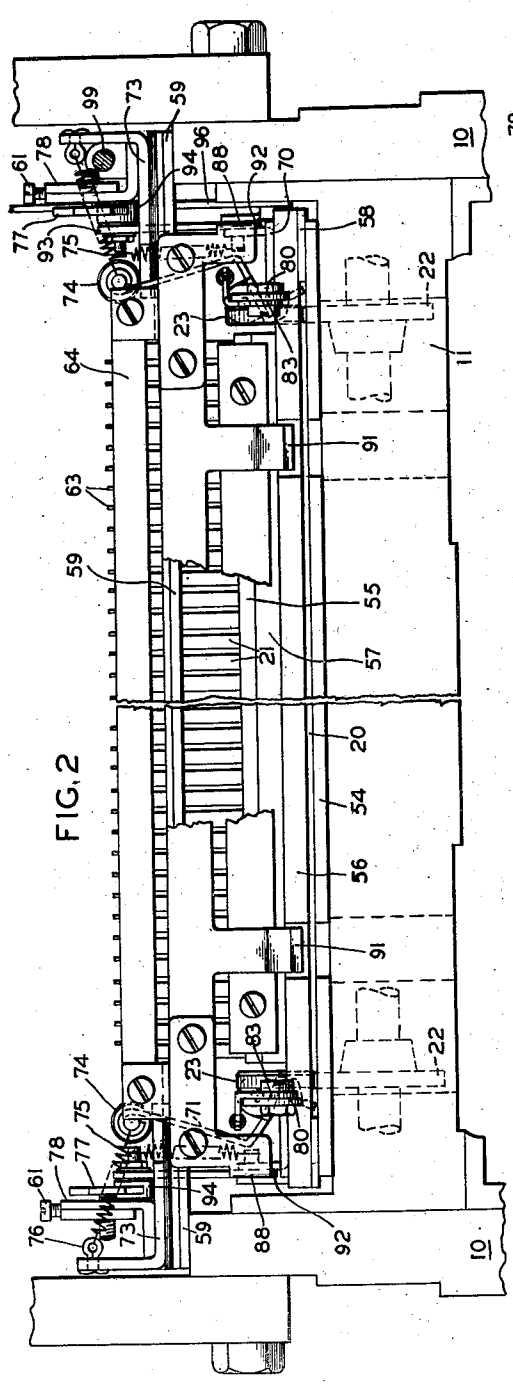

FIG. 2

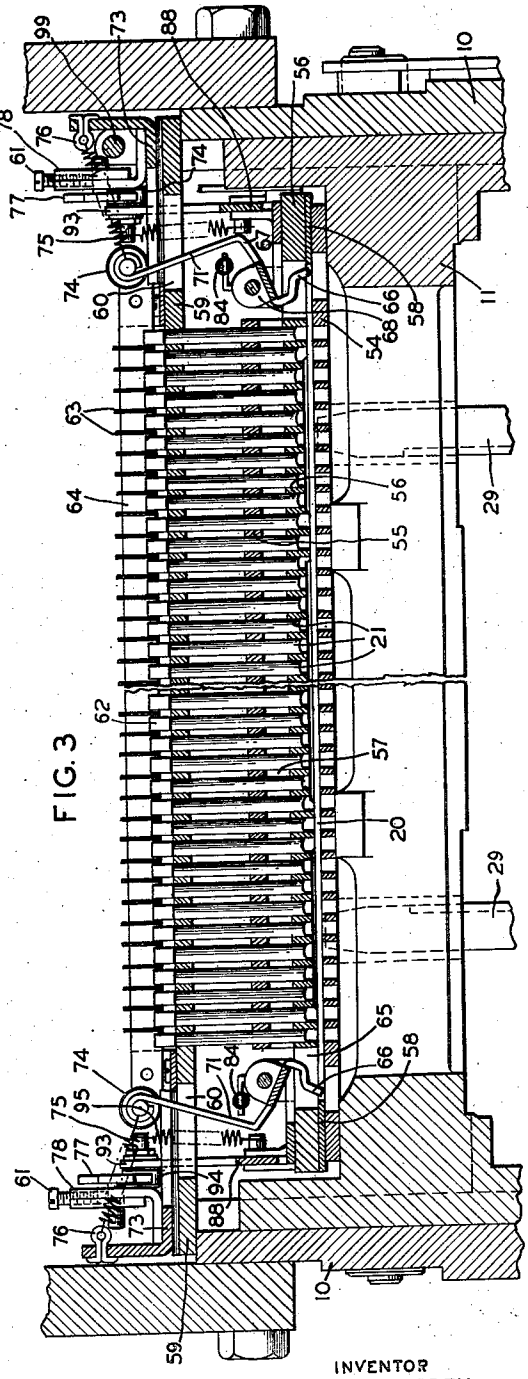

FIG. 3

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FIG. 4

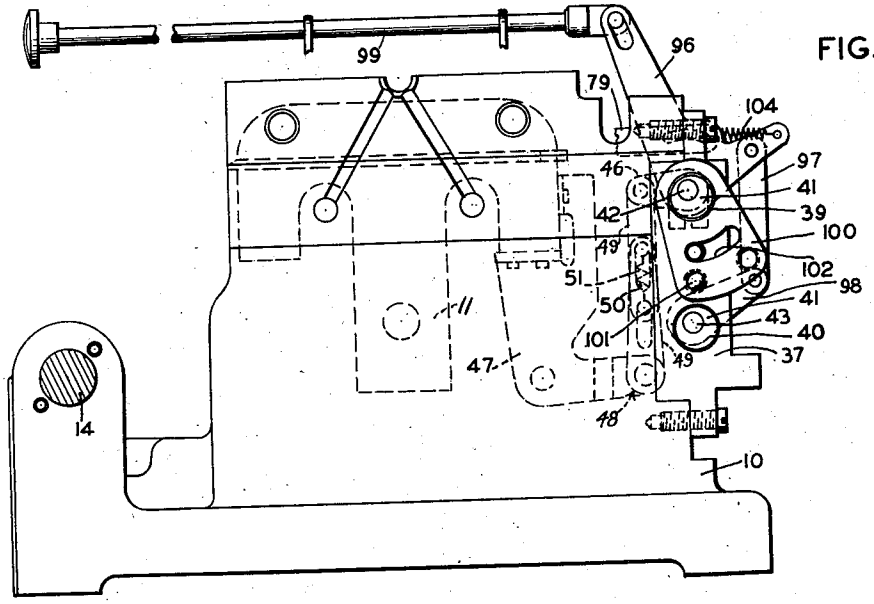
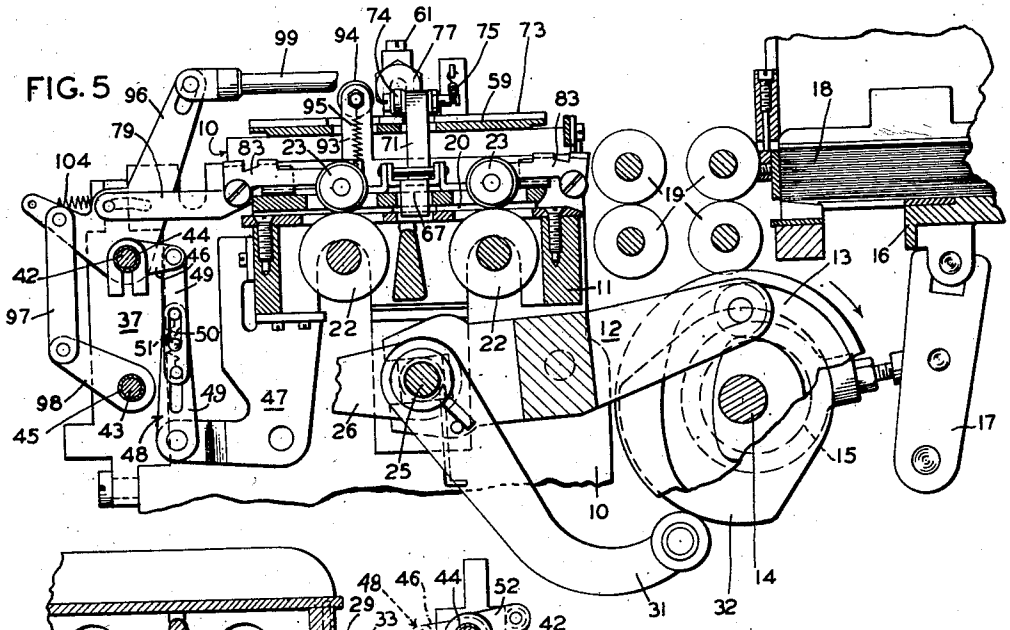


FIG. 5



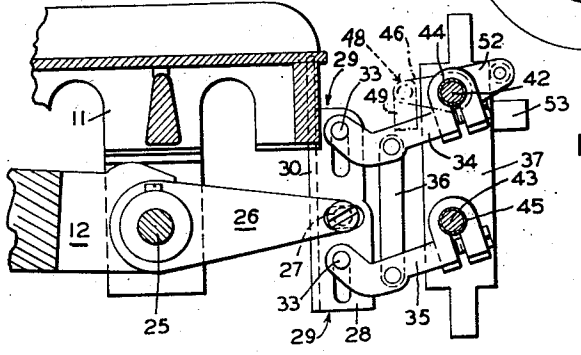


FIG. 6

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CARD POSITIONING MEANS

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FIG. 7

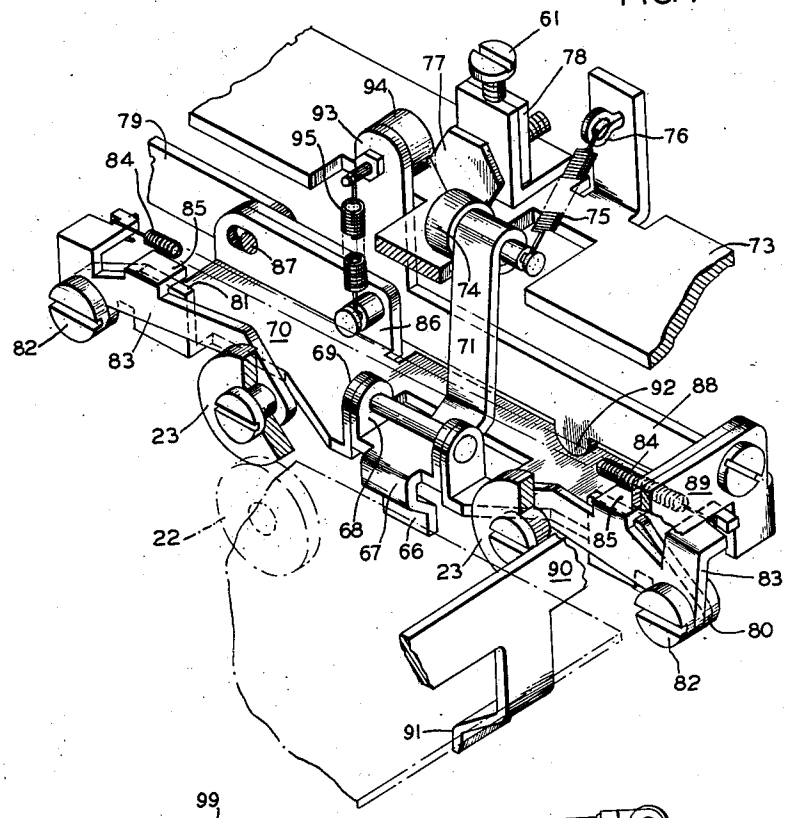


FIG. 8

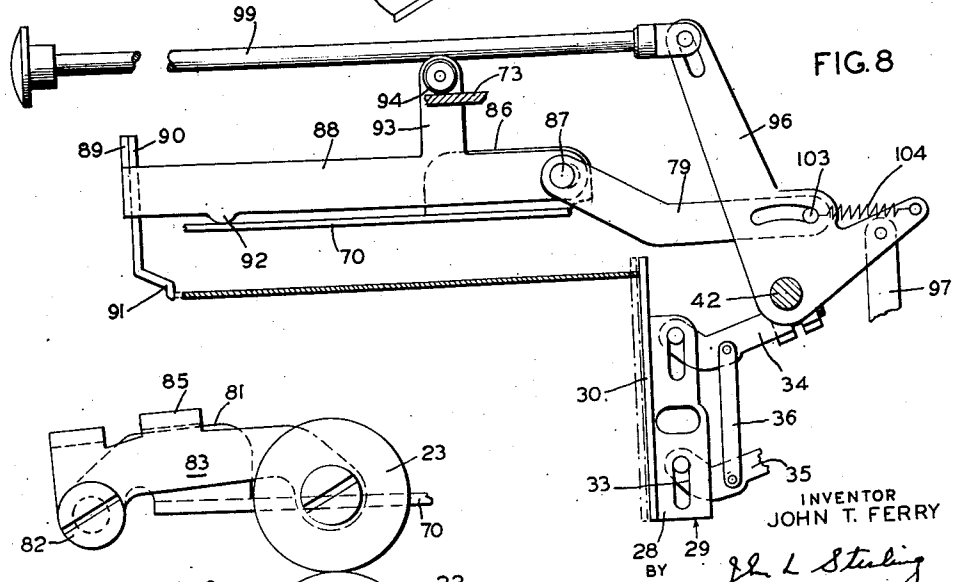
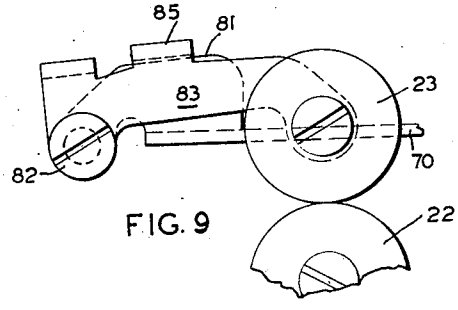


FIG. 9



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Patented May 15, 1945

2,376,241

UNITED STATES PATENT OFFICE

2,376,241

CARD POSITIONING MEANS

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Application March 3, 1944, Serial No. 524,935

21 Claims. (Cl. 164—111)

This invention relates to card positioning means, and in particular to a mechanism as applied to punches used in perforating cards employed in the operation of record controlled business machines.

Cards, as employed in the well known Powers tabulating machine, for instance, may be passed through a punching mechanism once to be initially perforated, or more than once to have added data punched therein from time to time. The precision of the sensing mechanism of the Powers machine referred to requires the perforations of the cards to be accurately aligned and without variation, so that the business machine controlled by the perforated cards will operate without interruption due to misaligned holes in cards successively fed thereto.

An object of the invention, therefore, is to provide means, in connection with a card punching mechanism, for positioning each card as it is fed into the die chamber, so that the holes punched therein will be properly aligned relatively to the holes punched in preceding and succeeding cards.

Another object is to synchronize the operation of the card positioning means with the operating cycle of the punch so that, when a card is fed into the die chamber of the punch, the feeding means is rendered ineffective, and the card is automatically adjusted to a position centrally of the die chamber by side and end edge engaging fingers influenced by the movement of the die. Changes in atmospheric conditions bring about space variations between the lines of perforations of the card and by centralizing the card in the die chamber, rather than by locating it with respect to one end or one side stop means alone, it has been found that these variations are diminished to the point of being negligible.

When the cards have been punched they are usually repunched for verification, and to this end the invention includes a "verify" setting of the card positioning means, so that off center perforation of the properly punched holes, in a direction column-wise of the card, will produce an elongated hole.

Another object is to provide a mechanism for positioning the card for initial punching which will be effective to relocate the card with respect to the center of the die or card chamber so that, upon second or verification punching, the holes initially perforated are properly elongated.

A still further object of the invention is to provide card positioning means, the limits of whose operations may be closely controlled, so that variations in the die chambers of different punch structures may be compensated for. The cards initially perforated in one punch may be again perforated in a different punch, but the holes will be aligned in all of the cards without regard to different punches used for perforation. Further, means are employed for automatically adjusting the stops at opposite edges of the cards when the punch mechanism is set for verification punching.

Other objects and structural details of the invention will be apparent from the following description when read in connection with the accompanying drawings, in which

Fig. 1 is a plan view of the die portion of a card punch with which is associated card positioning means disposed at four sides of the die;

Fig. 2 is a view in front elevation of that part of the punch mechanism illustrated in Fig. 1;

Fig. 3 is a vertical section on the line 3—3 of Fig. 1 showing the mounting of card end engaging fingers;

Fig. 4 is a view in end elevation of the mechanism shown in Fig. 1 looking at the right side of the latter;

Fig. 5 is a section on line 5—5 of Fig. 1 showing the die chamber and card positioning devices, the view being extended to include card feed mechanism not otherwise illustrated;

Fig. 6 is a section on line 6—6 of Fig. 1 showing the rear card stop and its relation to the die holder;

Fig. 7 is a view in perspective showing one end of the punch and illustrating the mounting of the card positioning means thereon;

Fig. 8 is a partial section on the line 8—8 of Fig. 1 showing the front stop adjustment for verification, the stop being closed; and

Fig. 9 is a side view of a feed roller lift means.

The general structure of the punch mechanism is shown and described in Patent No. 2,124,178 and other patents referred to therein. The mechanism herein shown and described brings out the novel features of the invention, and the general relation thereof to the mechanism at present incorporated in the "Powers" gang punch employed in perforating tabulator cards of the type used in "Powers" card controlled business machines. Only a sufficient part of the punch mechanism is shown to illustrate the operation of the present invention. If desired, the invention may be applied to any other machine where positioning of a card is a factor in its use as a controlling agent for business machines.

The general structure of the punch is shown in

Fig. 3 of Patent 2,124,178. In Fig. 5 of this application only the general parts are illustrated that are deemed essential to an understanding of the present invention. The punch mechanism includes a base 10 in which a die holder 11 is vertically reciprocated by a die operating lever 12, which in turn is rocked by a die cam 13 fixed to a clutch driven main punch shaft 14. Operation of main punch shaft 14 causes picker cam 15 to reciprocate picker 16 through a picker arm 17 to feed the bottom card from a supply magazine 18 to the feed rolls 19. The latter are driven through a suitable gear train from the shaft 14 which corresponds to shaft 15 of Patent 992,246, Fig. 5 thereof showing the use of a gear train for driving feed rolls, eject rolls, and intermediate skid rolls in synchronism. The feed rolls 19 pass the card into the die or card chamber 20 where it is punched when a control trip is operated following "set-up" of the data to be punched in the card, in the manner set forth in Patent 2,124,178. This "set-up" is accomplished by the selective latching down of set bars which prevent upward movement of punches 21 (Fig. 3) the unlatched punches being lifted by the card in the die chamber as the die rises. After the card is punched it is passed from the die chamber through suitable discharge rolls to a hopper by the intermediate or die rolls 22 when the latter are engaged by the upper pressure rollers 23, as will be hereinafter explained.

The end of the die operating lever 12 engages a cross bar 25 on the die holder, the bar having secured thereto spaced stop arms 26 extending rearwardly for pin and horizontal slot engagement as at 27 with side flanges 28 of rear card stops 29. The latter are disposed in suitably spaced notches along the back edge of the die holder 11, and present card abutting faces 30 which may be extended above the flanges 28, but are later placed slightly below the level of the die chamber to permit punched cards to be ejected when the die is in a low position (Fig. 6). The cross bar 25 is rocked by a cam lever 31 under influence of a stop cam 32 secured on shaft 14. The cams 13 and 32 coordinate the vertical reciprocating movements of the die holder and the rear card stops 29. In accordance with the invention, the latter are mounted for horizontal movement during vertical reciprocating motion and to this end are joined, in the side flanges 28 thereof, by pin and vertical slot connections 33 with the forward ends of upper and lower stop control arms 34 and 35, respectively, connected by links 36.

As the die holder 11 rises, the rear stops 29, in addition to the vertical movement imparted thereto by arms 26, are moved forwardly by arms 34 and 35 through the medium of a structure including shaft brackets 37 fixed to base 10 adjacent the ends of the die mechanism. Each bracket (Fig. 4) has an upper and a lower bore 39 and 40, respectively, in which are journaled trunnions 41 into which the ends of upper and lower shafts 42 and 43, respectively, are fixed in eccentric relation to the axes of said trunnions. Each eccentric shaft in a major portion of its length extends through, and provides a mounting for, upper and lower rotatable sleeve shafts 44 and 45, respectively. Each sleeve shaft, adjacent its ends, has clamped thereto one of the rear stop control arms 34, 35 so that, upon rocking movement of the sleeves 44 and 45, the rear stops 29 are moved forwardly and rearwardly in accordance with the vertical movements of the die holder. The upper sleeve shaft 44 has attached near one end thereof a link arm 46 connected to a stop bracket 47 through a yieldable link 48. The bracket is mounted on the die holder 11 and vertical movement of the latter rocks the upper sleeve, and a like movement is imparted to the lower sleeve through the link 36 connecting arms 34 and 35 clamped to said sleeve shafts. The yieldable link 48 consists of upper and lower strip pieces 49 joined by pin and slot connection 50 and tensioned in extended position by a spring 51. As the die holder rises, the stop bracket 47, link 48, and link arm 46, rock the upper sleeve shaft 44 clockwise in Fig. 6, until a stud bearing limit arm 52 engages a stop block 53 formed on the adjacent bracket 37. Continued movement of the die holder is permitted by the relative yield of said link pieces 49. The rocking motion of the sleeve shafts 44 and 45 causes the arms 34 and 35 to move the rear stops 29 forward, so that a card in the die chamber will be pushed against front stops to be later referred to.

The die and punch mechanism (Figs. 2 and 3) consists of the die holder 11 supporting the die 54 and the upper and lower punch guide plates 55 and 56, respectively. The latter are separated by side spacer bars 57, while the die 54 and lower guide plate 56 are separated by end spacer strips 58 to form between them the die or card chamber 20. The upper ends of the base 10 support the punch holder 59 in which are provided end openings 60 through which the card positioning members extend. The punch holder and guide plates 55 and 56 position the punches 21 which rise with the card occupied die and guide plates unless arrested by the set bars, not shown, to perforate the card. The punches 21 are suspended by their laterally sheared heads 62 in the punch holder 59, in which they are prevented from turning by the cross strips 63 held in place by bracket supported bar means 64.

The invention takes advantage of the movement of the die 54 relatively to the stationary punch holder 59 to position the card in the direction of its length, and to also position a front stop automatically after a card has entered the die chamber. The mechanism for doing this, being substantially the same at opposite ends of the die, it is believed that a description of one end will suffice. The die 54 and guide plate 56 are provided with an opening 65 (Fig. 3), into which the depending end 66 of a card finger 67 extends to engage the end edge of a card disposed in the die chamber. The card finger 67 (Fig. 7), is hung near its upper end by ears 68 pivoted between tabs 69 of a roller bracket 70 fixed to the lower punch guide plate 56. The upper strip portion 71 of the finger 67 projects through the opening 60 in the punch holder 59 and terminates above an adjusting plate 73 in position to hold a roller 74 in rolling contact with the upper surface of said plate. The roller is urged against the plate by a tension spring 75, connecting it to an eye 76 fixed in vertical portion of said plate. The tendency of the spring is to rock the card finger clockwise, as seen at the right end of Fig. 3, but it is prevented from doing so until the die holder rises, at which time the spring, in maintaining contact of the roller with the stationary plate 73, causes card engaging movement of the lower end 66 of the finger 67 until the roller 74 engages a limiting stop 77 threaded into a bracket 78 fixed on the plate 73. The threaded mounting of the stop 77 and its set screw 61

affords a fine adjustment, so that movement of the roller is closely controlled. This adjustable mounting of both card fingers 67 at opposite ends of the die provides for the quick and accurate positioning of each successive card in the die chamber as the latter rises. The relatively short card engaging end 66 of each finger 67 will act in reverse as the power arm of a lever to raise the roller 74 off the plate 73, so that the cards will not buckle if the lengthwise dimensions thereof vary slightly from the expected standard to which the fingers normally operate in centering the card in the chamber.

The relative movement between the die and punch holder is also employed to automatically disengage the card chamber feed and skid rolls 22, 23, and to lower a front card stop or gauge after a card has entered the card chamber. The inner edge of roller bracket 70 (Fig. 7) at the front and rear ends thereof, is provided with flanges forming eyes 80 and rests 81, to the former of which is pivoted as at 82, pressure roller arms 83 joined by a tension spring 84 and having lift tabs 85 for engagement with the rests 81. The pressure rollers 23, carried in the free ends of said roller arms 83, are lifted out of engagement with the lower feed rollers 22 by contact of the rests 81 with the tabs 85 shortly after the die holder begins to rise (Fig. 9), so that a card that has been drawn into the card chamber by the rollers 22, 23 in contact, is freed for positioning action. The outer edge of roller bracket 70 is flanged as at 86 and has pivoted thereto through a pin and slot pivot connection 87 a rearwardly extending link 79 and a forwardly extending front stop arm 88 the turned end 89 of which, cooperating with a like end of the opposite arm, supports the front stop bar 90. The latter has spaced depending front stops 91 (Fig. 2) formed integral therewith, which, in raised position, admit a card to the die chamber, but rock to closed position as the die holder rises. The front stop arm 88 is provided on its under edge with a lobe 92 and on its upper edge with a vertical extension 93 carrying a roller 94 yieldably urged into contact with the upper surface of the adjusting plate 73 by a spring 95. When the die holder is at lowest position the roller 94 bearing on adjusting plate 73 holds the front stops raised or in open position, and the lobe 92 is spaced from the upper surface of the roller bracket 70. As the die rises, the spring 95 keeps the roller 94 in contact with the plate 73 until the lobe 92 engages the surface of bracket 70. The front stops have thus been closed by the upward movement of the die. The front and rear stops are substantially opposite each other laterally of the die or card chamber, while the end positioning fingers are opposite each other lengthwise of the chamber.

At the beginning of a cycle of operation of the drive shaft 14 a card occupies the card chamber and is abutting the rear card stops, having been fed thereto on the previous cycle and held against the closed rear card stops by the action of the die rolls 22, 23. As the die holder begins to rise under influence of its cam 13, the die rolls separate to leave the card floating in the die or card chamber and simultaneously the front stops 91 close. The yieldable link 48 rocks the sleeve shafts 44, 45 until the limit arm 52 strikes the stop block 53 and the rear stops move forward to push the card against the closed front stops and position it widthwise of the die chamber. Simultaneously, the rising movement of the die holder causes the end positioning fingers 67 to move inwardly against the card until arrested by the limiting stops 77 to centrally position the card in the chamber. The card is then held at four sides centrally of the chamber and is punched by continued rise of the die. During descent of the die the rear stops are lowered, the front stops are raised, and when the die rolls contact, the card is fed out of the die chamber thereby. Simultaneously, with this descent of the die, the link 48 causes rearward movement of the rear stops 29 as they are lowered from card detaining position by the stop arms 26.

When a group of cards has been punched they are often verified by re-punching, the latter being done by punching the cards at a position slightly offset, in a direction longitudinally of the column, from the original punching location. In order to accomplish this, the present mechanism includes eccentric control bell cranks 96 fixed to the upper solid shaft 42 near opposite ends thereof, the right bell crank (Figs. 1, 4, and 8), through a link 97, being joined with an eccentric control arm 98 which is fixed to the lower solid shaft 43. Both shafts 42, 43 are rocked by movement of a push rod 99 secured to the upper end of the bell crank 96 and slidably supported in suitable brackets for longitudinal adjustment from the front of the machine. When the rod is in the position shown in Fig. 4, regular punching occurs and when the rod is pushed rearwardly for "verify" punching, the upper and lower solid shafts are placed under torsional stress and rock the eccentric trunnions 41 clockwise, and thus move the upper and lower shafts 42, 43 and their sleeve shafts 44 and 45 rearwardly a distance equal to the amount that the verification punching is to be offset from the original punching location to produce perforations elongated in a direction longitudinally of the column.

In order that the front stops may be moved to compensate for the "verify" punching, each link 79 has a pin and slot connection 103 with each bell crank 96, the pin of each link being connected by a spring 104 with the rear leg of its associated bell crank. When the latter swings rearwardly to "verify" position, the spring yields to allow movement of the bell crank independently of link 79 after the front stop arm 88 is pulled to its rearward limit as defined by the pin and slot connection 87. The movement of the push rod, and consequent operation of the eccentric trunnions to retract the rear stop carrying shaft, is also limited by a control plate 100 (Fig. 4) fixed to one of the eccentric trunnions 41 and arranged to be yieldably held by a spring urged detent ball 101 in the adjacent shaft bracket 37, at the limits of its swinging movement, as defined by its pin and slot connection 102 with said bracket.

While I have disclosed the use of a front stop against which the card is pushed by the rear stop, it has been found that under certain conditions the use of the front stop alone will satisfactorily locate the card for original and verification punchings, and I do not wish to be limited to the use of both front and rear stops to accomplish card positioning at different locations. While I refer to front and rear stops, and to end stops, it is to be understood that these terms are employed for convenience of description and they may be used interchangeably de-

pending upon the conditions imposed in different machine structures.

While I have described what I consider to be a convenient means of carrying out my invention, it is obvious that many changes may be made therein without departing from the scope of the invention as stated by the claims.

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

1. In a card perforating machine having relatively movable coacting punch and die members, the combination with a card chamber in one of said members, of means for feeding a card to and from said chamber including pressure rolls in contact for card feeding operation, means for separating the rolls to free the card during relative movement of said members, and means controlled by said movement for positioning the freed card in the chamber for perforation.

2. In a card perforating machine having relatively movable coacting punch and die members, the combination with a card chamber in one of said members, of means for feeding cards to and from said chamber including pressure rolls in contact for card feeding action, means for separating the rolls to free the cards during relative movement of said members, and adjustable means controlled by said movement for positioning the freed cards at different locations in the chamber for perforation.

3. In a card perforating machine having relatively movable coacting punch and die members, the combination with a card chamber in one of the members, of means for feeding a card to and from said chamber including pressure rolls in contact for card feeding operation, means for separating the rolls to free the card during relative movement of said members, and card positioning means controlled by said movement for engaging the contiguous edges of the card to locate the latter in the chamber for perforation.

4. In a card perforating machine having relatively movable coacting punch and die members, the combination with a card chamber in one of the members, of means for feeding cards to and from said chamber including pressure rollers in contact for card feeding operation, means for separating the rollers to free the card during relative movement of said members, means controlled by said movement for positioning the freed card in the chamber for perforation, and adjustable means for limiting the action of said card positioning means.

5. In a card positioning mechanism for use in a card machine having relatively movable coacting parts including a card support, the combination with said support, of side and end card engaging members, and means controlled by the relative movement of said coacting parts for actuating said card engaging members to position a card at a predetermined location on said support.

6. In a card positioning mechanism for use in a card machine having relatively movable coacting parts including a card chamber, the combination with said chamber, of card engaging members, means for moving said members toward and away from each other for centering a card therebetween in the chamber during relative movement of said coacting parts, and means for adjustably limiting the movement of the card engaging members toward each other.

7. In a card perforating machine having relatively movably coacting punch and die members, the combination with a card chamber in one of the members, of a rear stop, means for feeding a card against said stop, a front stop, and means operable by the relative movement between said punch and die members for automatically closing the front stop and actuating said rear stop to push a card in the chamber against said closed front stop.

8. In a card perforating machine having relatively movable coacting punch and die members, the combination with a card chamber in one of the members, of means for feeding a card to and from said chamber including pressure rolls in contact for card feeding operation, means for separating the rolls to free the card, a front stop, means for moving the front stop to card abutting position, a rear stop against which the card is fed, means for moving said rear stop to push the card against the front stop, and said roll separating means and said rear and front stop actuating means being operable in coordination by the relative movement between said punch and die members.

9. In a card machine having relatively movable coacting members, the combination with a card chamber in one of the members, of a stop, means for feeding a card against said stop, another stop, means for closing said other stop, means for actuating said first mentioned stop to push a card in the chamber against said other stop, and said closing and actuating means being controlled by the relative movement of said members.

10. In a card machine having relatively movable coacting members, the combination with a card chamber in one of the members, of means for feeding a card to said chamber including pressure rolls in contact for feeding operation, a first stop against which the card is fed, a second stop, means for separating the rolls to free the card, means for moving said second stop to closed position, means for actuating said first stop to push the freed card against said second stop, and said stop operating means and roll separating means being controlled by the relative movement of said coacting members.

11. In a card positioning mechanism for use in a card machine having relatively movable coacting parts including a card support, the combination with said support, of card positioning members, means controlled by the relative movement of said coacting parts for actuating said card positioning members to place a card at a predetermined location on said support, and means for adjusting said positioning members to place a card at a different location upon operation of said controlled actuating means.

12. In a card positioning mechanism for use in a machine having a card support, the combination with said support, of a first stop against which a card is fed, a second stop, means for closing said second stop, means for actuating the first stop to locate the card in one position against the second stop, and means for movably adjusting both stops to locate the card in another position against said second stop.

13. In a card positioning mechanism for use in a machine having a card support, the combination with said support of a stop against which a card is fed, means for moving said stop to locate the card in a predetermined position, and means for movably adjusting the stop to locate the card in another position when said stop is shifted by said moving means.

14. In a card perforating machine having relatively movable coacting members including a

card chamber, the combination with said chamber, of card engaging fingers mounted on one of said coacting members for swinging movement toward and away from each other for centering a card in the chamber therebetween, means for maintaining an end of each finger in movable contact with the other of said coacting members to swing the fingers during relative movement between said members, and adjustable means for limiting the swinging movement of said fingers.

15. In a card perforating machine having relatively movable coacting members including a card support, the combination with said support, of a stop pivotally mounted on one of said coacting members for vertical movement, an extension on said stop for engagement with the other of said coacting members to move the stop upon relative movement of said members, and means for limiting the movement of the stop in one direction.

16. The combination with a machine employing cards in its operation including relatively movable coacting members and a card chamber in one of said members, of a laterally movable shaft, a sleeve shaft on said movable shaft, a card stop associated with said card chamber and carried by said sleeve shaft, means controlled by the movement of one of said members for rocking said sleeve shaft to reciprocate the stop, and means for shifting said movable shaft to vary the limits of reciprocation of said stop.

17. The combination with a machine employing cards in its operation including relatively movable coacting members and a card support on one of the members, of a first card stop pivotally mounted on one of said coacting members for vertical movement, means on said stop engaging the other coacting member for controlling the movement of said stop upon relative movement of said members, a shaft, a second card stop associated with said support and carried by said shaft, and means controlled by the relative movement of said coacting members for rocking said shaft to reciprocate said second card stop to locate a card on the support against said first card stop.

18. The combination with a machine employing cards in its operation including relatively movable coacting members and a card support on one of the members, of a first card stop pivoted to one of said members for vertical movement, means on the stop engaging the other coacting member for controlling the movement of said stop upon relative movement of said members, a laterally movable shaft, a sleeve shaft on said movable shaft, a second card stop associated with said support and carried by said sleeve shaft, means controlled by the relative movement of said coacting members for rocking said sleeve shaft to move said second stop to locate a card on the support in one position against said first card stop, and means for shifting said movable shaft and said first stop to locate a card on the support in another position against said first card stop when the sleeve shaft is rocked.

19. In a card positioning mechanism for use in a card machine having relatively movable coacting parts including a card support, the combination with said support, of card positioning fingers mounted at the opposite ends of said support, means for moving the fingers toward and away from each other for centering a card therebetween during relative movement of said coacting parts, means for adjustably limiting the movement of said card engaging fingers toward each other, a first card stop pivotally mounted on one of said coacting parts for vertical movement, means on said stop engaging the other coacting part for controlling the movement of said stop upon relative movement of said parts, a shaft, a second card stop associated with the support and carried by said shaft, means controlled by the relative movement of said coacting parts for rocking said shaft to reciprocate the second card stop to locate a card on the support against said first card stop, and means for shifting said shaft for adjusting the operating positions of said first and second card stops to locate a card at a different position on said support.

20. In a card machine having relatively movable coacting members including a card chamber in one of said members, the combination with said chamber of means for feeding a card to and from the chamber and means controlled by the relative movement of the members for positioning the card in the chamber.

21. In a card machine having relatively movable coacting members including a card chamber in one of said members, the combination with said chamber of means for feeding a card to and from the chamber and means controlled by the relative movement of the members for positioning the card in the chamber and controlling the feeding operation of said card feeding means.

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