

July 29, 1958

C. D. LAKE ET AL
HIGH SPEED PUNCH

2,845,122

Filed Dec. 24, 1954

3 Sheets-Sheet 1

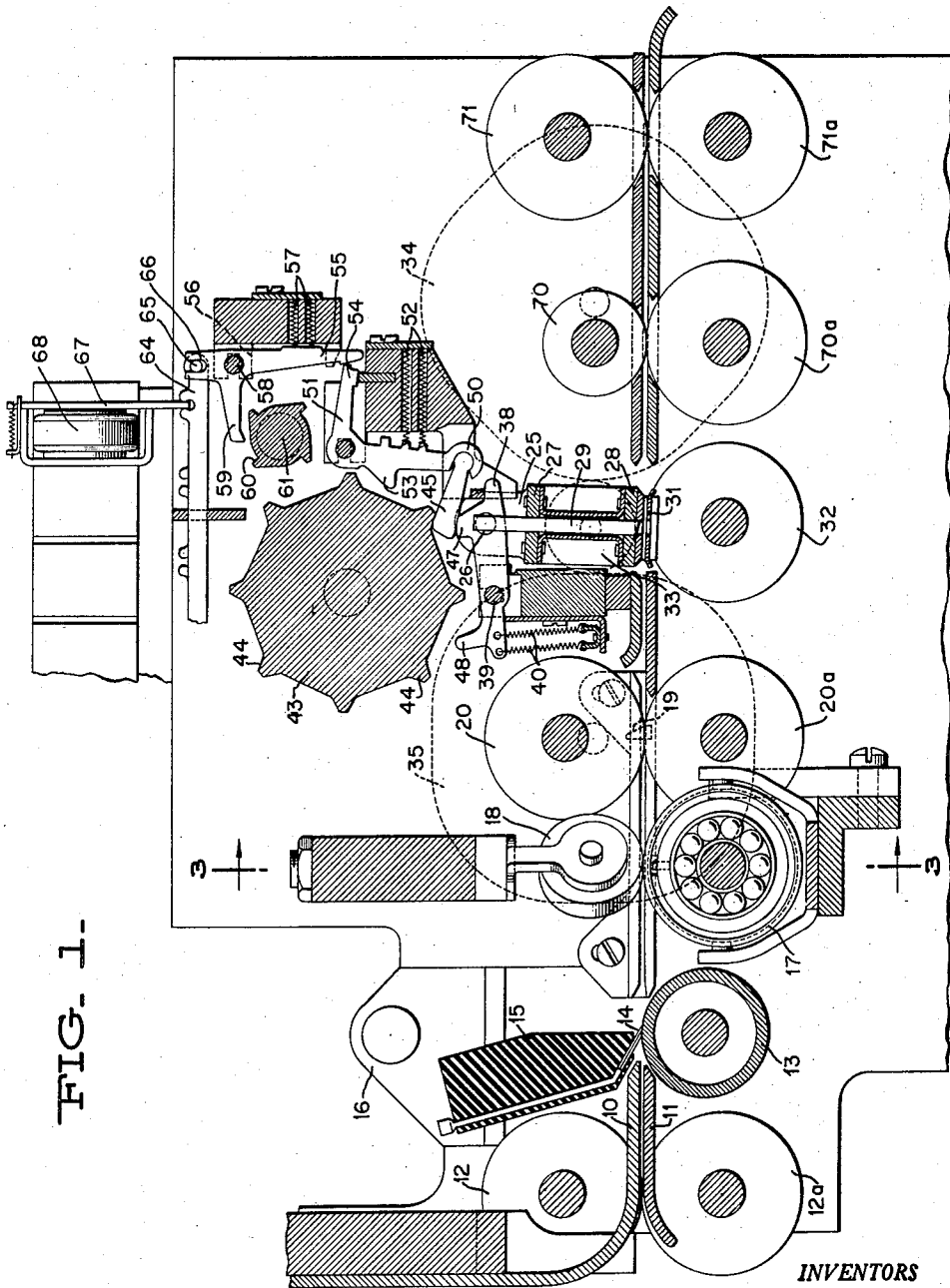


FIG. 1-

INVENTORS
CLAIR D. LAKE
WESLEY PFAFF
BY *[Signature]*
ATTORNEY

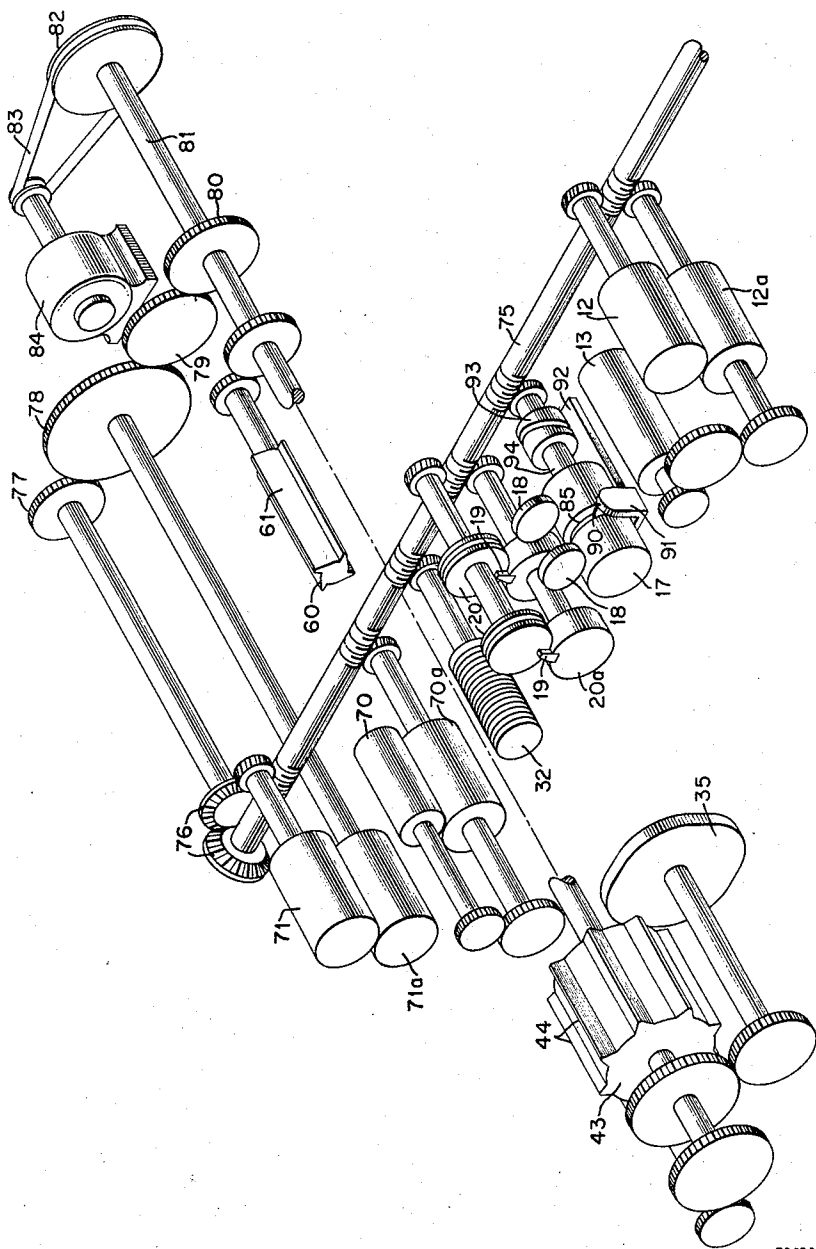
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3 Sheets-Sheet 2



INVENTORS
CLAIR D. LAKE
WESLEY PFAFF
BY *W. E. Hemminger*
ATTORNEY

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3 Sheets-Sheet 3

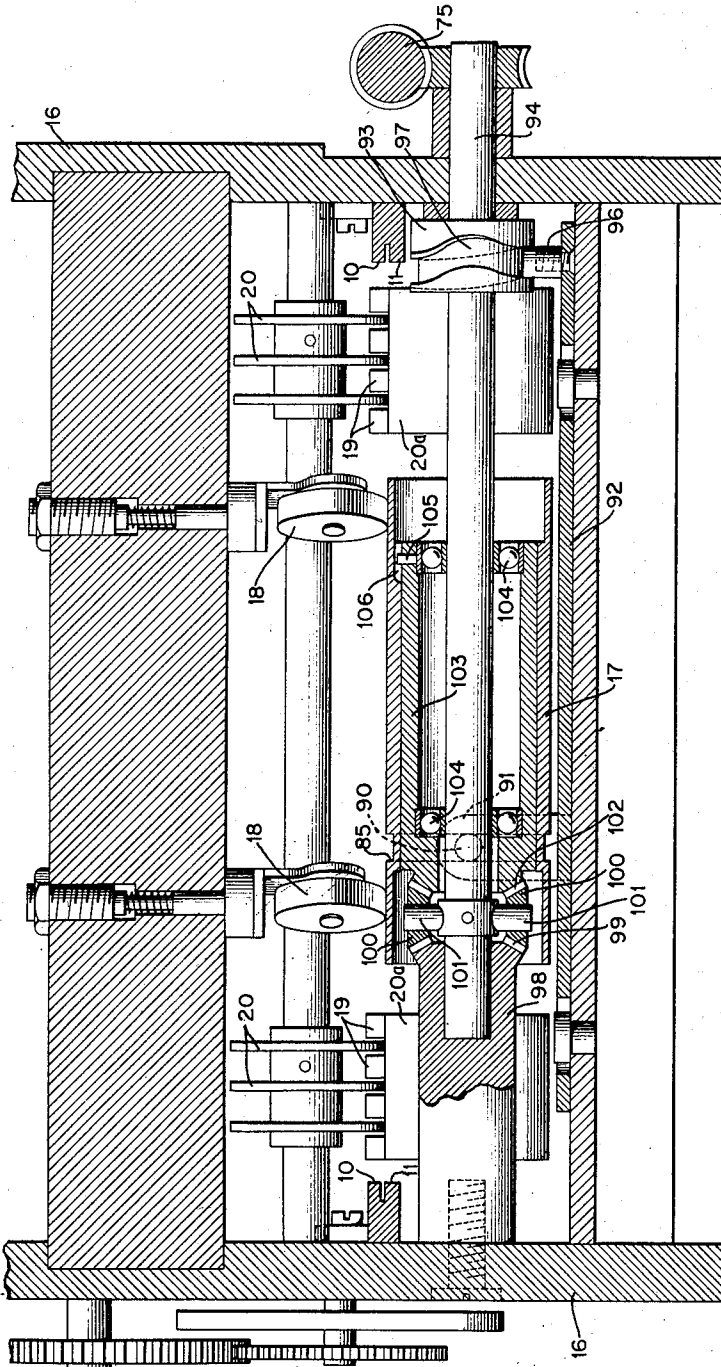


FIG. 3-

INVENTORS
CLAIR D. LAKE
WESLEY PFAFF
BY *W. H. Hemminger*
ATTORNEY

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2,845,122

HIGH SPEED PUNCH

Clair D. Lake, Binghamton, and Wesley Pfaff, Endicott, N. Y., assignors to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application December 24, 1954, Serial No. 477,456

16 Claims. (Cl. 164—113)

This invention relates to card punching machines, and particularly to such machines which punch or perforate accurately registered index points of the card as it moves through the machine.

In present day calculating, tabulating and the like business machines, data is conventionally recorded on punched statistical cards for later transcription. Card punching may be accomplished by moving the card through the card punching machine intermittently one index point position at a time, the card movement being arrested while each punching operation is performed. A machine of this character is disclosed in the George F. Daly Patent No. 2,448,781. This type of punch machine operation somewhat limits the maximum rate at which successive cards may be punched.

It is proposed in the Clair D. Lake et al. Patent No. 2,451,752 that higher card punching rates be attained by use of a machine wherein the cards are punched while continuing to move at constant velocity past the punching station. To this end, the punch and its associated die are pivoted to oscillate at card velocity and an interposer is selectively controlled to interconnect the punch and a pivoted oscillatory drive member throughout each punching cycle. Accurate index registration of the card at the punch position is prearranged by the use of relatively critically positioned and operating card hopper plate, picker knife, positioning stops, temporary lateral guides, and certain feeding roll tension adjustments. While this type of card punching machine effects substantial improvement in card handling capacity, it would nevertheless be desirable and beneficial to increase the card handling rate to an even greater extent than is readily feasible with a machine having the construction described.

It is an object of the present invention, therefore, to provide a new and improved card punching machine which possesses a substantially higher card handling rate than heretofore readily possible.

It is a further object of the invention to provide a novel card punching machine wherein a principal continuously rotating element accurately establishes critical timing of each punch operation and also furnishes the motivating force for the punch actuation.

It is an additional object of the invention to provide a card punching machine of simplified and improved construction with resultant lowered initial and maintenance cost and enhanced reliability of operation.

It is yet a further object of the invention to provide a card punching machine having a new and improved card feeding mechanism of simplified construction which facilitates card handling and avoids critical placement and adjustments of the card-feed components.

It is a further object of the invention to provide in a card handling machine, a novel card feeding mechanism which furnishes dynamic card positioning with high accuracy of card registration.

A card punching machine embodying the invention includes a perforating means which has a first motion in unison with moving parts to be perforated and a second

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reciprocal motion between perforating and non-perforating positions. An actuating member rotates in unison with the card movement and includes a plurality of spaced actuators any of which may be selected to drive the perforating means between its perforating and non-perforating positions. An interposer is arranged to be selectively moved between a non-interposing position and an interposing position in engagement with the interposers and the perforating means.

Other objects and advantages of the invention will appear as the detailed description thereof proceeds in the light of the drawings forming a part of this application, and in which:

Fig. 1 illustrates an elevational cross-sectional view of a card punching machine embodying the present invention in a particular form;

Fig. 2 illustrates in greater detail the manner in which the synchronized or related movements of the movable components of the Fig. 1 arrangement is accomplished by geared interconnection thereof; and

Fig. 3 is an end view illustrating in elevational cross-sectional view the construction of the Fig. 1 machine as viewed along the plane 3—3.

Referring now more particularly to Fig. 1, the card punching machine here illustrated may be one component of a more extensive machine such as that disclosed in the George F. Daly patent to which reference has been made above. The machine includes card guides 10, 11 which receive cards from a card source, not shown, such as a card hopper from which cards are supplied by a reciprocating card picker, and guides the cards through the punching machine. A pair of driven feeding rolls 12, 12a, move the cards along the guides past one or more card reading or sensing stations comprised by an electrically conductive roller 13 and contact brush 14 supported by insulating material 15. It will be understood that the feed rollers 12, 12a and the contact roller 13, and other similar rollers hereinafter mentioned, are journaled in side plates 16 of the machine and are interconnected by suitable gearing to a source of driving power as will presently be described in greater detail.

The card upon moving longitudinally down the guide-ways is engaged by a feeding roller 17 which is geared to drive the card at higher than normal card velocity and is reciprocated laterally once each card cycle. The manner in which this lateral movement is accomplished will be considered in greater detail hereinafter in connection with Figs. 2 and 3. For the moment suffice it to say that the lateral motion of the drive roll 17, in conjunction with the angular positioning of cooperating idler rollers 18, produces lateral shift of the card against one side of the guide thereby accurately to align one edge of the card as the latter moves to the punch station. This lateral alignment of the card may be substantial in extent and makes it unnecessary to give previous consideration to lateral alignment of the card as it moves into the machine from a card source, thus eliminating the usual critical hopper plate, picker knife, and feed roll tension adjustments.

As the card leaves the feed rollers 17, 18 at higher than normal card velocity, for example twice normal card velocity, the leading edge of the card engages stop fingers 19 which radially project from the periphery of a feed roller 20a and between circumferential grooves provided in a cooperating feed roller 20. The stop fingers 19 insure dynamic card positioning or transitional registration so that the card thereafter is positioned for accurately registered index point punching at the punching station.

The stop fingers 19 follow the periphery of the feed roller 20a and leave a clear path for the moving card

so that the rollers 20, 20a move the card at normal card velocity further along through the guides 10, 11 to the card punching station. The cards to be punched are conventionally of rectangular configuration passing through the machine with their long axis perpendicular to the guides 10, 11 and conventionally have several hundred index points arranged in twelve rows of eighty columns, the columns running lengthwise of the card. Accordingly, it will be understood that the punching station shown in Fig. 1 is merely one of some eighty such stations positioned in side by side relation between the side plates 16 of the machine and aligned normal to the guides 10, 11.

Each such station is individually controlled in a manner to be described hereinafter. Each punch station includes a frame 25 supported by a pivot 26 to have oscillatory motion and provided with guide members 27, 28 which restrain a punch member 29 for reciprocal motion. The lower end of the frame 25 carries a die 31, and a roller 32 is provided below the die 31 but slightly spaced therefrom to support the die during a punching operation while permitting the die to oscillate with the frame 25. The roller 32 is circumferentially grooved to afford a means for removing chips, which are deposited in the grooves as punching occurs and are carried clear of the punching station as the roll turns for eventual removal from the roll as by the use of brushes (not shown) positioned on the lower side of the roll. A roller 33 is supported on the frame 25 and is engaged by oppositely disposed cams 34 and 35 which cooperate with the roll 33 to oscillate the frame 25 about point 26 in a pendulum fashion. The rate of angular oscillation is so selected that the cutting end of the punch 29 is moving at card speed while in contact with the cards.

The punch 29 is pivotally connected to a crank arm 38 which is pivoted at point 39 and is normally biased by springs 40 to return the punch 29 from its card punching position. A reamer shaft 43 is longitudinally fluted to provide teeth or lobes 44 equally spaced around its circumference. The reamer shaft 43 rotates at constant angular velocity corresponding to the card velocity and the lobes 44 engage an interposer 45 whenever the latter is moved into the path of the lobes, thus to establish a driving interconnection between the reamer shaft and a projection 47 provided on the rocker arm 38. This driving interconnection moves the rocker arm 38 downwardly to drive the punch 29 through a card to be perforated. The rocker arm 38 is returned both by the bias force of the springs 40 and also by the action of a reamer lobe engaging a projection 48 provided on the arm. The rocker arm 38 accordingly is positively and rapidly restored, by the action of a reamer shaft lobe, to the non-perforating position of the punch 29.

The interposer 45 is pivotally supported on one end of an arm 50 of a bellcrank 51 normally biased by springs 52 to the interposing position. The bellcrank arm 50 is provided with a projection 53 which is engaged by the lobes 44 of the reamer shaft 43 and is driven by this engagement to the non-interposing position of the interposer 45 and against the bias of the springs 52. In the non-interposing position, the other arm 54 of the bellcrank latches with the lower end of an arm 55 of a latching bellcrank 56 biased to the latching position by springs 57. The bellcrank 56 is pivoted at 58 and its other arm 59 is engaged by the lobes 60 of a second reamer shaft 61, which has one half the number of lobes of the reamer shaft 43 but revolves at twice the angular velocity of the latter. Each engagement of the arm 59 with a lobe 60 of the reamer shaft 61 tends positively and rapidly to latch up the bellcranks 51 and 56. The latter are unlatched to initiate a cycle of punching operation by actuation of a latch bar 64 hav-

ing a pin 65 at one end which engages a groove 66 provided at one end of the bellcrank 56 as shown. The latch bar 64 is actuated by an extended end of the armature 67 by an electromagnet 68 to which a pulse of current is supplied each time a cycle of punching operation is to be initiated.

It is believed that the operation of the punching station will be apparent from the foregoing description. Briefly considered, a punching cycle of operation is initiated at a time that the bellcranks 51 and 56 are in latched engagement. Rotation of the reamer shaft 43 causes one of its lobes 44 to strike the projection 53 of the bellcrank 51 slightly to relieve the latch point between the bellcranks 51 and 56. A pulse of energization now being supplied to the electromagnet 68, its armature 67 is attracted and bellcrank 56 is rotated counterclockwise to unlatch the bellcrank 51. The latter is actuated by its bias springs 52 in a clockwise direction and moves the interposer 45 into the path of the lobe 44 which earlier had relieved the latching of the bellcranks 51 and 56. This lobe thereupon engages the interposer 45 and causes the latter to rotate the crank arm 38 in a clockwise direction, thereby driving the punch member 29 through a card which at that time is moving through the punching station. The punch member 29 while in this position moves with the card by virtue of the rocking motion transmitted to the punch frame 25 by the cams 34, 35 and intervening roller 33. Immediately thereafter, that lobe of the reamer shaft 43 which immediately precedes the actuating lobe engages the projection 48 of the crank arm 38 and cooperates with the springs 40 rapidly to restore the crank arm and punch member 29 to the non-perforating position of the latter. At the same time, that lobe of the reamer shaft 43 which immediately succeeds the actuating lobe engages the projection 53 of the bellcrank 51 and rapidly restores the interposer 45 to its non-interposing position. At this position, a lobe 60 of the reamer shaft 61 engages the arm 59 of the bellcrank 56 to insure rapid latching engagement of the bellcranks 51 and 56 immediately on movement of the last-mentioned lobe 44 out of engagement with the projections 53 of the bellcrank 51. The crank arms 51 and 56 thereupon move into latching engagement unless a new pulse of energy has been supplied to the electromagnet 68 to initiate an immediately subsequent cycle of punching operation. At the end of the downward stroke of the punch member 29 as previously described, and just after the punch has started on its return upward stroke, the roller 33 and cooperating cams 34 and 35 produce reverse oscillatory motion of the punch frame 25 so that the punch 29 is positioned above the succeeding index point of the card and is ready to punch this index point if a second cycle of punching operation is desired.

It will be apparent from the foregoing description of the punching station operation that the punch mechanism is immediately reset in two rapid steps. First, is the step wherein a lobe 44 strikes the projection 48 of the crank arm 38 rapidly drawing the punch member 29 free of the card; secondly, a lobe of the reamer arm 43 strikes the projection 53 of the bellcrank 51 rapidly restoring the interposer 45 to its noninterposing position and placing the bellcrank 51 in a relatch position at the same time that a lobe of the reamer 61 strikes the arm 59 of the bellcrank 56 and insures rapid relatching of the bellcranks 51 and 56. At the same time, the lobe of the reamer shaft 43 which engaged the projection 53 of the bellcrank 51 still holds the latch point of the bellcranks in relieved position and the electromagnet 68 is thereupon enabled to accept another punch impulse to initiate an immediately subsequent punch cycle of operation if such is desired. Otherwise, the latching of the bellcrank is completed until such time as a subsequent impulse is received by the electromagnet 68.

After a moving card has been punched at the punching

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station in the manner described, it moves on the through output feed rollers 70, 70a and 71, 71a for storage in a card hopper, not shown, or for further disposition.

It will be apparent from Fig. 2 that the several driving rolls are in general geared to a drive shaft 75 to be driven thereby, the drive shaft 75 being connected through bevel gears 76 and gears 77—80 to a drive shaft 81 which terminates in a belt pulley 82 connected through a belt 83 to a driving motor 84. It will be noted that the overspeed driving roller 17 is provided with a circumferential groove 85 which is engaged by pins 90 provided on the upstanding arms of a saddle 91. As will become more fully apparent from Fig. 3, the saddle 91 is arranged for movement with a plate 92 which is reciprocated by a pin positioned to engage a grooved cam 93 supported on and directly connected to a shaft 94 geared to the drive shaft 75. That the structure last described converts the rotary motion of the shaft 94 to an overspeed drive of the feed roller 17, accompanied by periodic lateral shift of the latter, will be apparent from Fig. 3 which illustrates this construction in greater detail.

Fig. 3 is a cross-sectional elevational view through the drive roller 17, and it will be seen that the plate 92 is provided with a pin 96 which engages the groove 97 of the grooved cam 93 by which to provide oscillatory motion of the plate 92 as already described. The remote end of the shaft 94 is journaled in a stud 98 secured at one end to a side plate 16 of the machine and formed at its opposite end as a stationary sun gear 99. A number of pinion gears 100 are journaled on shafts 101 carried by the drive shaft 94 and are in mesh with the fixed sun gear 99. The pinion gears also mesh with a movable sun gear 102 formed on the end of a sleeve 103 which is supported by ball bearings 104 for rotation about the drive shaft 94. The gear ratio between the sun and pinion gears is such that the sleeve 103 rotates at twice the angular velocity of the drive shaft 94. The sleeve 103 is provided with a radially extending pin 105 which engages a longitudinal groove 106 formed in the inner surface of the drive roller 17. Thus the overspeed rotation of the sleeve 103 is transmitted to the drive roller 17 through the pin and slot 105, 106, which also permits lateral displacement of the drive roller 17 under action of the grooved cam 93, pin 96, plate 92, saddle 91 and associated pin 90 engaging the groove 85 of the roller. As a earlier explained, the grooved cam 93 provides one cycle of lateral shift of the drive roller 17 for each card cycle.

It will be apparent from the foregoing description of the invention that a card punching machine embodying the invention has a relatively simple yet sturdy construction, a reliable mode of operation, and is capable of a high rate of card handling capacity. Each card is accurately and concisely indexed with relation to the punch station as the card passes through the machine, and the alignment and indexing provides dynamic card positioning or registration. The card punching is accurately and concisely timed by the action of the reamer shaft lobes which also furnish the driving power for driving the punch member and insuring its rapid return stroke. All actions of moving parts in the punch station are positive and subject to positive control and precise timing of their actuation. This insures high accuracy in the registration of index point perforation.

It is claimed:

1. A card punching machine comprising, perforating means having a first movement in unison with moving cards to be perforated and a second movement between perforating and non-perforating positions, actuating means rotatably moving in timed relation to said first movement of said perforating means and including plural successively presented actuators each effective upon selection mechanically to drive said perforating means in at least one direction between said perforating and non-perforating positions thereof, and means for selectably interconnecting

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said actuators and said perforating means to effect selectable cycles of perforation operation.

2. A card punching machine comprising, perforating means movable both in unison with moving cards to be perforated and between a first perforating position and a second non-perforating position, actuating means rotatably moving in timed relation to said perforating means and including spaced energy impulsing regions each selectably effective mechanically to drive said perforating means to said first position and effective to restore said perforating means to said second position, and means for selectably interconnecting said impulsing regions of said actuating means and said perforating means selectably to initiate cycles of perforation operation.

3. A card punching machine comprising, perforating means pivoted for movement in unison with moving cards to be perforated and including a punch member restrained for reciprocable movement between perforating and non-perforating positions, actuating means rotatably moving in timed relation to said perforating means and including plural successively presented spaced actuators each effective upon selection mechanically to drive said punch member in at least one direction between said perforating and non-perforating positions thereof, and means for selectably interconnecting said actuators and said punch member selectably to initiate cycles of perforation operation.

4. A card punching machine, comprising, perforating means having a first movement in unison with moving cards to be perforated and a second movement between perforating and non-perforating positions, actuating means including a toothed member moving in related manner to a movement of said perforating means for supplying motive power from selectable teeth of said member to said perforating means for positive motivation of said perforating means in at least one direction between its said perforation and non-perforation positions, and means for applying the motive power of any selected tooth of said toothed member to said perforating means to initiate a cycle of perforation operation.

5. A card punching machine comprising perforating means having a first movement in unison with moving cards to be perforated and a second movement between perforating and non-perforating positions, actuating means including an effectively toothed member moving in related manner to said first motion of said perforating means for supplying motive power from any selected tooth of said member to said perforating means for driving said perforating means in at least one direction between said perforating and non-perforating positions, and means selectably interposable between the teeth of said member and said perforating means for interconnecting said actuating and perforating means to effect selectable cycles of perforation operation.

6. A card punching machine comprising, perforating means having a first movement in unison with moving cards to be perforated and a second movement between perforating and non-perforating positions, actuating means including an effectively toothed member moving in related manner to said first motion of said perforating means for supplying motive power from any selected tooth of said member to said perforating means for driving said perforating means between said perforating and non-perforating positions, means including an interposer member reciprocable from a non-interposing position to an interposing position between any selected tooth of said toothed member and said perforating means to drive said perforating means to said perforating position thereof, and means coacting with teeth of said toothed member preceding and succeeding said selected tooth for restoring said perforating means to its said non-perforating position and said interposer member to its non-interposing position.

7. A card punching machine comprising, perforating means having a first movement in unison with moving

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cards to be perforated and a second movement between perforating and non-perforating positions, actuating means including an effectively toothed member moving in related manner to said first motion of said perforating means for supplying motive power from any selected tooth of said member to said perforating means for driving said perforating means between said perforating and non-perforating positions, means including an interposer member normally biased to move from a non-interposing position to an interposing position between any selected tooth of said toothed member and said perforating means to drive said perforating means to said perforating position thereof, means for restraining said interposer member in said non-interposing position but selectably actuable to release said interposer member to initiate a perforation cycle of operation, and means coacting with teeth of said toothed member preceding and succeeding said selected tooth for restoring said perforating means to its said non-perforating position and said interposer member to its non-interposing position.

8. A card punching machine comprising, perforating means having a first movement in unison with moving cards to be perforated and a second movement between perforating and non-perforating positions, actuating means rotatably moving in timed relation to said first movement of said perforating means and including plural successively presented actuators each effective upon selection mechanically to drive said perforating means in at least one direction between said perforating and non-perforating positions thereof, and means controlled by and moving in timed relation with said actuating means for selectably mechanically interconnecting said actuators and said perforating means to effect selectable cycles of perforation operation.

9. A card punching machine comprising, perforating means having a first movement in unison with moving cards to be perforated and a second movement between perforating and non-perforating positions, actuating means rotatably moving in timed relation to said first movement of said perforating means and including plural actuators effective upon selection to actuate said perforating means between said perforating and non-perforating positions thereof, and means impulse-actuated to latched position by said actuating means and moving upon selectable release in time controlled relation established by said actuating means for selectably interconnecting said actuators and said perforating means to effect selectable cycles of perforation operation.

10. A card punching machine comprising, perforating means having a first movement in unison with moving cards to be perforated and a second movement between perforating and non-perforating positions, actuating means rotatably moving in timed relation to said first movement of said perforating means and including plural actuators effective upon selection to actuate said perforating means between said perforating and non-perforating positions thereof, means impulse-actuated to latched position by said actuating means and moving upon selectable release in time controlled relation established by said actuating means for selectably interconnecting said actuators and said perforating means to effect selectable cycles of perforation operation, and perforation cycle controlling means impulse-actuated to latch and controllably unlatch said last-named means by energy-impulses supplied by said actuators and by additional impulsing means moving in unison with said actuating means.

11. A card punching machine comprising, fixed guide means extending along said machine to provide an edge guide for cards moving therethrough, rotationally driven feed roll means having longitudinally reciprocal motion for displacement toward said guide means during each card feed for initially drivingly moving cards at accelerated rate simultaneously longitudinally and transversely of said guide means to provide positive alignment of an

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edge of each card with said guide means, means moving at normal card rate for indexing the leading edge of each of said aligned cards at a preselected point longitudinally of said guide means and thereafter additionally moving said each card along said guide means, and card punching means positioned a preselected distance from said preselected point to provide accurately registered index point punching of said cards.

12. A card punching machine comprising, fixed guide means extending along said machine to provide a positional aligning surface for the edge of cards moving therethrough, rotationally driven feed roll means having longitudinal displacement toward said guide means during each card feed and being driven to provide higher than normal card transfer velocity for initially moving cards simultaneously longitudinally and transversely of said guide means to provide positive alignment of an edge of each said card with said guide means, means moving at normal card transfer velocity and including movable stop members engaging the leading edge of each card at a preselected point longitudinally of said guide means for decelerating cards moving from said feed means and accurately indexing said leading edge at said preselected point, and card punching means positioned a preselected distance from said preselected point to provide accurately registered index point punching of said cards.

13. A card punching machine comprising, card guide means, means including at least one angled idle roller and a cooperating laterally reciprocating driving roller for initially moving said cards simultaneously longitudinally and transversely of said guide means to provide positive alignment of an edge of said card with said guide means, means for indexing the leading edge of each of said aligned cards at a preselected point longitudinally of said guide means and thereafter additionally moving said card along said guide means, and card punching means positioned a preselected distance from said preselected point to provide accurately registered index point punching of said cards.

14. In a card machine, fixed guide means extending along said machine to provide edge-guide alignment for cards moving therethrough, feed roll means rotationally driven at such angular velocity as to provide card transfer thereby at a forward velocity tending to be higher than normal, means for displacing said feed roll means longitudinally toward said guide means during the transfer of a card thereby to provide positive alignment of an edge of each card with said guide means, and means moving at normal card transfer velocity and including movable stop members engaging the leading edge of each card at a preselected point longitudinally of said guide means for decelerating cards moving from said feed roll means and accurately indexing said leading edge at said preselected point.

15. In a card machine, fixed guide means extending along said machine to provide edge-guide alignment for cards moving therethrough, feed roll means rotationally driven at such angular velocity as to provide card transfer thereby at a forward velocity tending to be higher than normal, means responsive to each rotation of said feed roll means for effecting displacement of said feed roll means longitudinally toward said guide means during the transfer of a card thereby to provide positive alignment of an edge of each card with said guide means, and means moving at normal card transfer velocity and including movable stop members engaging the leading edge of each card at a preselected point longitudinally of said guide means for decelerating cards moving from said feed roll means and accurately indexing said leading edge at said preselected point.

16. In a card machine, fixed guide means extending along said machine to provide edge-guide alignment for cards moving therethrough, feed roll means rotationally driven at such angular velocity as to provide card trans-

fer thereby at a forward velocity tending to be higher than normal, cam means rotated in unison with said feed roll means and cam follower means mechanically coupled to said feed roll means for effecting displacement of said feed roll means longitudinally toward said guide means during the transfer of a card thereby to provide positive alignment of an edge to each card with said guide means, and means moving at normal card transfer velocity and including movable stop members engaging the leading edge of each card at a preselected point longitudinally of said guide means for decelerating cards moving from said feed roll means and accurately indexing said leading edge at said preselected point.

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