

Sept. 3, 1935.

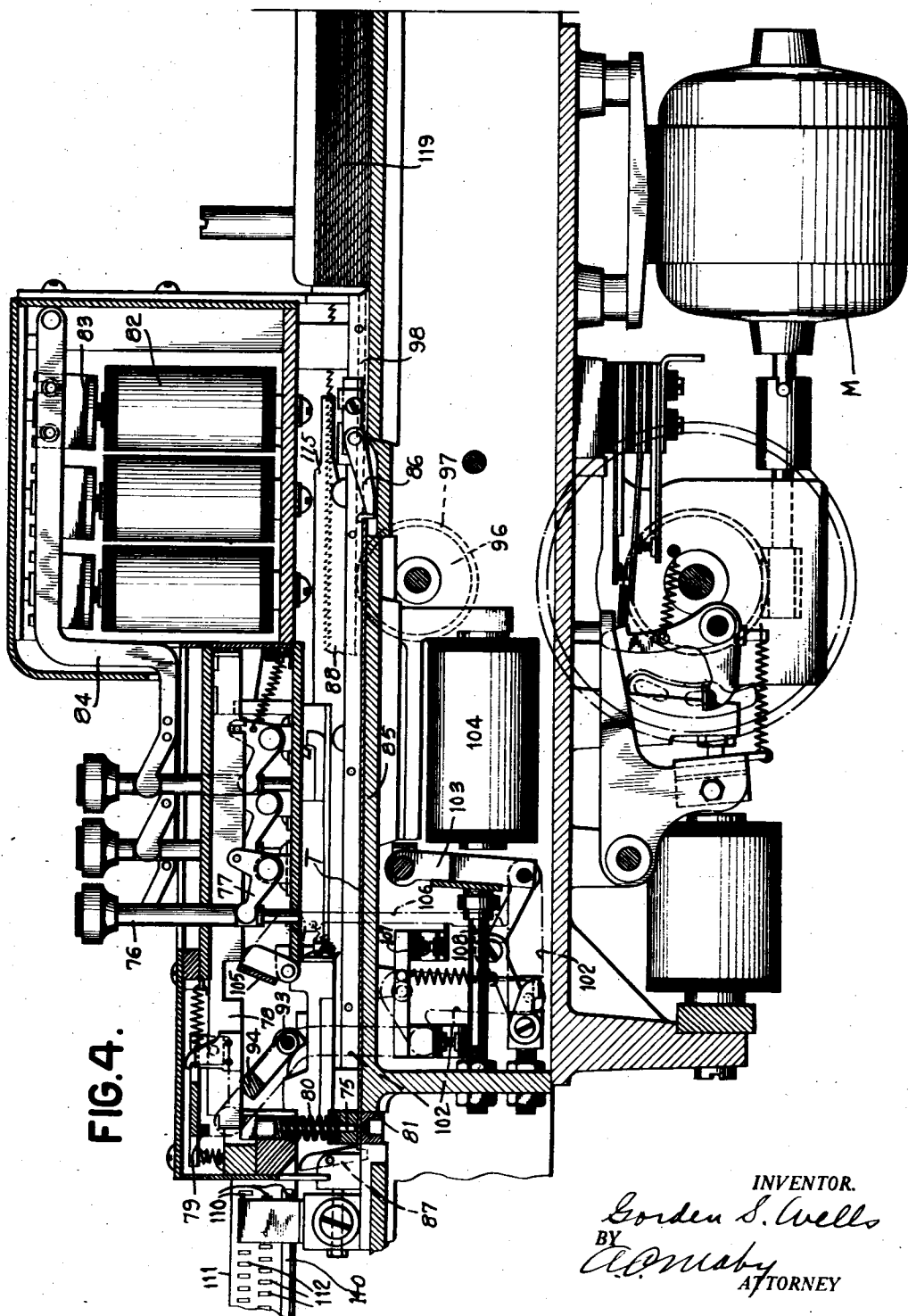
G. S. WELLS

2,013,530

TIME RECORDING PUNCH

Filed Oct. 24, 1934

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TIME RECORDING PUNCH

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FIG. 5.

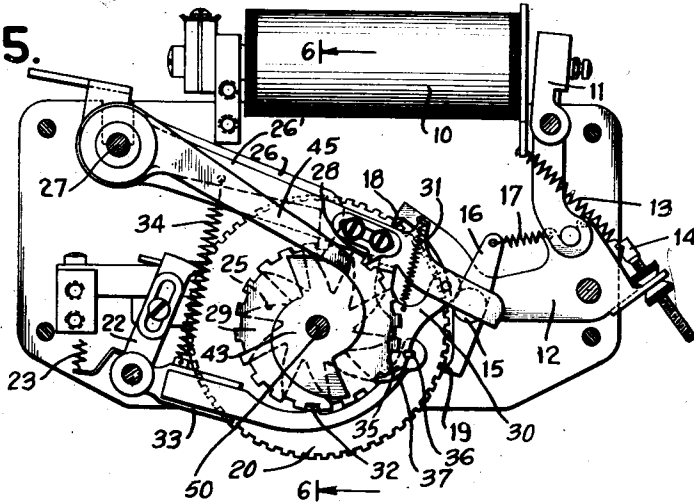


FIG. 7.

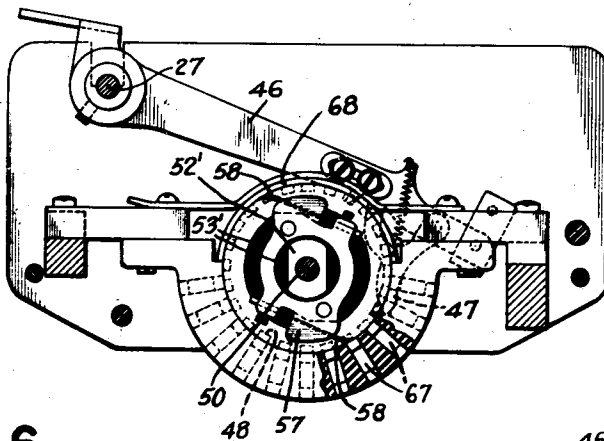


FIG. 6.

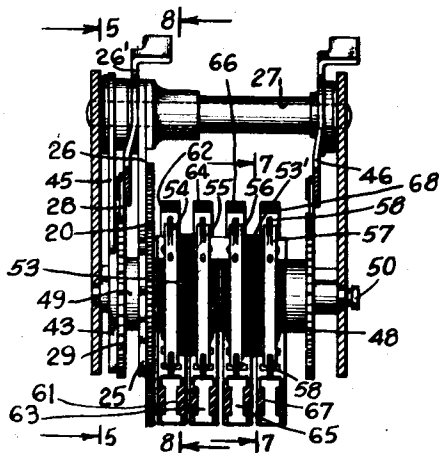
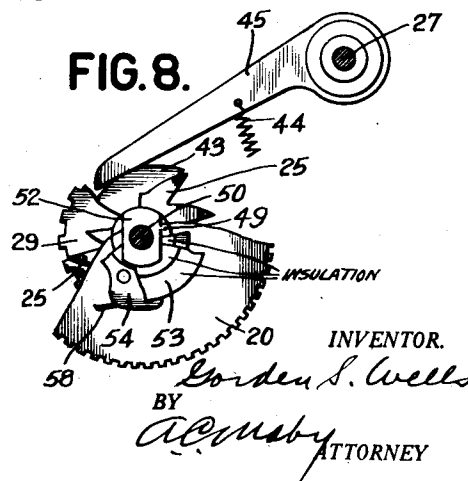


FIG. 8.



INVENTOR.

BY

ATTORNEY

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G. S. WELLS

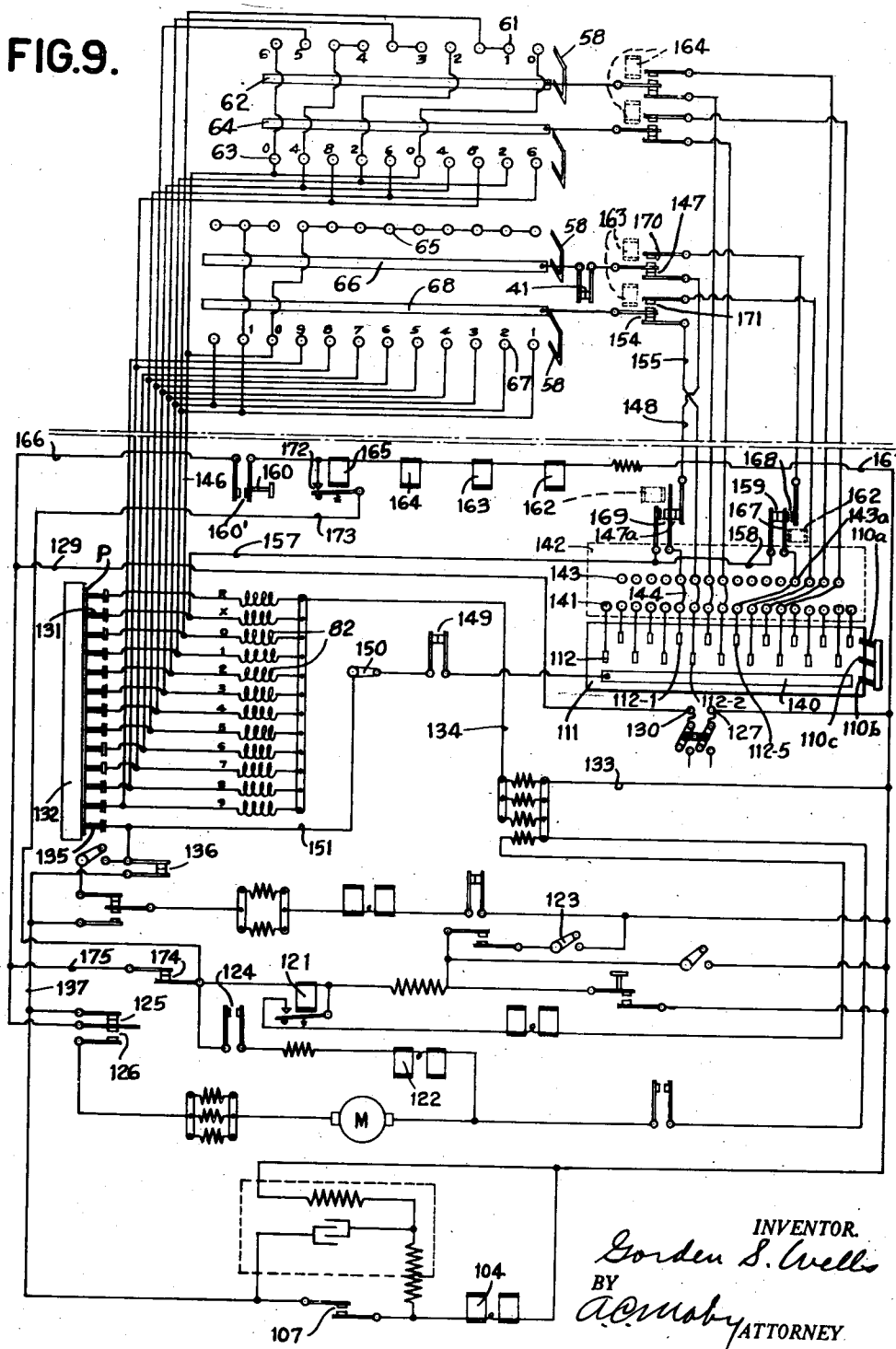
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4 Sheets-Sheet 4

FIG. 9.



INVENTOR.
Gordon S. Wells
BY
A. C. Maby ATTORNEY

UNITED STATES PATENT OFFICE

2,013,530

TIME RECORDING PUNCH

Gorden S. Wells, Binghamton, N. Y., assignor to
International Business Machines Corporation,
New York, N. Y., a corporation of New York

Application October 24, 1934, Serial No. 749,743

22 Claims. (Cl. 164—113)

This case relates to time recorders and particularly to a clock controlled card punch for making a time record.

The general object of the invention is to provide a simple electrically controlled time punch.

More specifically, the object is to provide a time-controlled electrical selector for selecting punches to make a perforated time record in a tabulating card.

Further, an object is to provide a time-controlled selector for selecting the punch according to its digit value to operate in a column selected by the punching machine.

Still further, an object is to cause automatic punching of the selected card columns under control of time selector units.

Another object is to automatically skip finish time columns when start time is recorded and to automatically skip start time columns when finish time is recorded.

An object is also to delay or prevent time punching when the time selector units are changing their positions.

Still another object is to provide an electrical time selector including lower and higher denominational orders of contacts, predetermined pairs of which are simultaneously sensed; these paired contacts having arbitrary values assigned to them.

Still further objects are to provide for interchangeable and adjustable selection of the time columns to be punched; to provide the time control as an attachment to an existing punching machine; to utilize a punching machine in the combination which perforates the columns in succession, one column after another; and to provide a manual control for determining whether start or finish time columns of the card are to be punched.

Other objects will be brought out in the following parts of the specification and will be apparent from the drawings.

Fig. 1 is a plan view of the punching unit and the clock unit attached thereto.

Fig. 2 is a perspective view of the card carriage escapement and skip bar and diagrammatically shows the card in relation to the skip bar.

Fig. 3 is a detail of the time punch selector showing sixth minute cut-out contacts.

Fig. 4 is a vertical section through the punching machine.

Fig. 5 is a section on line 5—5 of Fig. 6.

Fig. 6 is a section on line 6—6 of Fig. 5.

Fig. 7 is a section on line 7—7 of Fig. 6.

Fig. 8 is a broken section along line 8—8 of Fig. 6, and

Fig. 9 is a circuit diagram.

The machine comprises punch unit A and secondary clock unit B electrically connected by wires in cable C, as shown in Fig. 1.

The punch unit A is of the type adapted to perforate the card columns one after another.

The machine has several different uses but for illustration assume it is utilized for ordinary pay-roll recording. The card T is a tabulating card, shown in Fig. 2, and has from left to right, columns assigned to the department number, man number, the date, the start time, the finish time, and elapsed time. Each card is identified by name and number. When a workman starts work, he takes his card from a card rack and hands it to the punch unit operator who inserts it in the punch unit.

The department, man number, and date may be prepunched or the operator may manually operate the machine to punch in this data. In the present case, assume the operator depresses the keys to punch the department and man number and that the date is automatically punched under pattern card control. When the date punching is completed, the first of the start time columns moves into punching position and the start columns are then automatically perforated, according to the time, under selective control of the secondary clock unit B. Following the punching of the start time, the first of the finish time columns moves to punching position. The machine automatically skips these columns and the card is automatically moved to its last column position to be removed. The card punched with the start time may then be returned to the employee to be replaced in the card rack.

When the workman finishes his job, he again hands the card to the punch operator who places it in the punch unit, depresses a finish key, and then operates the space key to feed the card to the first date column whereupon the pattern control automatically advances the card to the start column. Here mechanism comes into play to automatically skip the start columns and bring the first finish column of the card to punching position. The finish columns are then automatically time punched in code and the card moved to last column position to be removed. The completed card may be retained by the punch operator to be sent to the accounting department.

The time control for selecting the punches will first be described in detail. Referring to Figs. 3 55

and 5 to 8, clock unit B includes the usual magnet 10 which receives an impulse each minute from a time system.

When the magnet receives an impulse, it is energized to rock its armature 11 counterclockwise (as viewed in Fig. 5). The armature is pivotally connected to a bell crank 12 which is rocked clockwise by aforesaid action of the armature. A spring 13 connected to screw 14 fixed to bell crank 12 resists rocking of the armature and bell crank. Pivoted to the bell crank at 15 is an actuating pawl 16 which at its rear is connected by a light spring 17 to the bell crank. The forward end of the bell crank is formed with a pawl nose 18 and the forward end of pawl 16 similarly formed with a pawl nose 19. Both these pawl noses coact with a disk 20 having sixty teeth. Also coacting with the teeth of disk 20 is a pivoted holding dog 22, constantly urged towards the disk periphery by a spring 23.

When bell crank 12 rocks clockwise, as above described, pawl nose 18 is lifted out of engagement with disk 20 while pawl nose 19 moves upwardly and drags along the periphery of the disk 20, being held in engagement with the disk by light spring 17, until nose 19 enters the tooth notch above the one previously engaged thereby. Now when the magnet 10 is deenergized, spring 13 rocks bell crank 12 counterclockwise, causing pawl nose 19 to move disk 20 clockwise and pawl nose 18 to reengage the disk to prevent overrunning of the latter beyond a single tooth space. Holding dog 22 impositively latches the disk against rotation except by downward movement of pawl nose 19.

In above manner, disk 20 is advanced one tooth every minute. To the side of disk 20 is fixed a cam 25 having ten teeth, each representing a six minute interval. A cam follower 26 freely rotatably mounted on a shaft 27 coacts with the teeth of cam 25.

Rigidly secured to the follower 26 is a member 26' carrying a dog 28 engaged with a disk 29 having twenty teeth. Member 26' also carries a pivoted actuating pawl 30 for engaging disk 29 and which is biased towards the disk by a light spring 31 between the pawl and said member. The disk is normally locked by a tooth 32 on a pivoted arm 33 which is connected by a spring 34 to member 26'.

As cam 25 rotates, follower 26 rises against resistance of spring 34 and through member 26' lifts dog 28 out of engagement with disk 29 while dragging pawl 30 upwardly out of one tooth of the disk to engage the next higher tooth. Pawl 30 has an inclined surface 35 which as the pawl rises engages the right side of a stud 36 (as viewed in Fig. 5) at the outer end of locking arm 33 and is cammed outwardly until it passes the stud, after which spring 31 moves the pawl inwardly. When follower 26 drops off a peak of cam 25, spring 34 forces the follower 26, member 26', and pawl 30 downwardly. During this downward movement of the pawl, the cam surface 37 of the pawl engages the left side of the stud 36 and cams the lever 33 downwardly and away from disk 29, thus releasing tooth 32 from the disk and permitting the pawl to advance the disk one tooth space.

In above manner, cam 25 every six minutes moves twenty-tooth disk 29 one step. In one hour, the ten points of cam 25 will advance disk 29 ten steps or half a revolution.

To prevent initiation of a time punching operation while the twenty-tooth disk 29 is in motion, the high point of a tooth of cam 25 engages a

lower spring blade 39 (see Fig. 3) separating it from an upper spring blade 40 to open normally closed contacts 41 carried by the blades.

This action occurs at each sixth minute impulse and the manner in which the opening of contacts 41 prevents starting of the time punching operation will be later explained in connection with the circuit diagram. When the sixth minute impulse transfer movement is completed, the high point of cam 25 moves sufficiently to disengage lower contact blade 39 and thus allow contacts 41 to close. The time punching operation may then be permitted to take place.

Fixed to the side of disk 29 is a two point cam 43. Held against this cam by a spring 44 is a follower 45 (Figs. 6 and 8) which is fast to one end of shaft 27. Rigidly carried by shaft 27 at its opposite end is a member 46 (Figs. 6 and 7) provided with an actuating pawl 47 coacting with a twenty-four tooth hour disk 48. In the same manner as cam 25 causes step-by-step movement of disk 29, cam 43 through follower 45, member 46, and pawl 47 causes a movement of disk 48 through one tooth space each time follower 45 drops off a point. As disk 29 makes half a revolution each hour, cam 43 fixed to the disk 29 will traverse one of its two steps past follower 45 once per hour. Follower 45 will in turn cause hour disk 48 to advance one tooth per hour.

The mounting of disks 20, 29 and 48 is as follows: Disk 29 has a round hub sleeve 49 rotatably mounted on a stationary shaft 50 carried by the frame. Sixty tooth disk 20 is rotatably mounted on hub sleeve 49. The round sleeve terminates in a non-circular portion 52 to non-rotatably receive a collar 53 of insulating material. To opposite sides of collar 53 are fixed brush holders 54 and 55 (see Fig. 6).

The twenty-four tooth disk 48 also has an angular hub portion 52' (Fig. 7) rotatably mounted on stationary shaft 50. On this hub portion is secured the insulating collar 53' to which is secured a pair of brush holders 56 and 57.

Each brush holder carries a pair of brushes 58, one brush diametrically opposite the other.

Surrounding brush holder 54 is a stationary commutator having a semi-circle of ten equally spaced contacts 61 and a semi-circular metal band 62 forming a common return. During one half a revolution of brush holders 54, one of its brushes 58 is wiping the common return 62 and the other brush 58 successively engages contacts 61 while on the other half of the revolution of holder 54, the function of the two brushes is reversed.

Similarly brushes 58 of brush holder 55 are arranged to coact with a commutator having ten contacts 63 and a common return 64.

In a similar manner, brushes 58 of brush holder 56 coact with a commutator having a semi-circle of twelve contacts 65 and a common return 66 and brushes 58 of brush holder 57 coact with twelve contacts 67 and a common return 68.

As explained above, sixty-tooth disk 20 moves one step each minute. Under control of ten step cam 25 fixed to disk 20, the twenty-tooth disk 29 is advanced one step every six minutes. Accordingly, the brush holders 54 and 55 which rotate with disk 29 are moved one step every six minutes. Under control of two point cam 43 fixed to twenty-tooth disk 29, the twenty-four tooth disk 48 is advanced one step every hour.

Accordingly, brush holders 56 and 57 which rotate with disk 48 move one step every hour.

The brushes 58 of brush holders 54 and 55 and

the coacting commutator contacts 61 and 63 form the minute punch selectors, while the brushes of holders 56 and 57 and the contacts 65 and 67 wiped thereby form the hour punch selectors.

Reference to the circuit diagram (Fig. 9) shows how the minute and hour punch selectors are arranged for properly selecting the punches in accordance with minutes and hours.

Of the minute selector, contacts 61 control the punching of the tens denomination of the minutes while contacts 63 control the punching of the units denomination of the minutes. Since the brushes coacting with these contacts step along at six minute intervals, the reading of the minutes is by six minute increments; thus, 00, 06, 12, 18, 24, 30, 36, 42, 48, and 54. At the beginning of an hour, the brushes of brush holders 54 and 55 are concurrently sensing a pair of contact points 61 and 63, both connected to a "0" punch operating control. After six minutes have elapsed, the brushes step along in unison to the next pair of contacts 61 and 63, respectively connected to the "0" punch operating control and the "6" punch operating control. At the next six minute interval, the brushes step to a pair of contacts 61 and 63, respectively connected to the "1" punch control and the "2" punch control. Thus, by a combination of the contacts 61 and 63 in each position of the brushes 58 of the minute selector, a selection is made of the punch controls for punching one of the six minute intervals, 00, 06, 12, 18, etc.

In a similar manner, the hour punch selector functions to select the controls for the hour punching. The hours are to be punched as 1, 2-12. Contacts 65 control the punching of the tens order and contacts 67 the punching of the units order of the hour time. The brushes of holders 56 and 57 also move in unison, one step per hour and concurrently sense a pair of contacts 65 and 67 to select the punches according to the hour. Thus, at 6 o'clock, the hour selector brushes feel a pair of contacts 65 and 67, respectively connected to the "0" punch control and the "6" punch control. At 10 o'clock, the brushes concurrently sense a pair of contacts 65 and 67, respectively connected to the "1" punch control and the "0" punch control.

In order to fully explain the manner in which the hour and minute punch selectors of the clock unit B coact with the punch unit A to cause the time to be perforated in the tabulating card, a brief description of the essential parts of the punch unit will be given with reference to Figs. 1, 2, and 4.

The punching unit is of the type shown in Patent No. 1,914,263. Punches 75 are arranged in a single column extending transversely of the machine, as indicated in Fig. 1, with each punch corresponding to a different one of the index point positions of a column of the tabulating card T.

Depression of a key 76 rocks a connected bell crank 77 to advance an interposer bar 78 above an aligned punch. When hammer 79 is depressed, it engages interposer bar 78 to in turn depress the associated punch 75 against resistance of coil spring 80. The punch coacts with a die 81 to perforate the card located between the die and the punch.

Keys 76 may be manually depressed by the operator or may be automatically depressed by the action of control magnets 82. Energization of a magnet 82 attracts its armature 83 to rock a lever 84 downwardly. The lever 84 is pivoted

to a key 76 and the lever when rocked downwardly depresses the key to cause punching in the same manner as upon manual operation of the key.

The card feeds the width of one column space at each punching operation. The feeding means is under control of an escapement mechanism which is of the type disclosed in Patent No. 1,426,223. Briefly, the card rests on frame surface 85 and is engaged at the right side (as seen in Fig. 4) by a pusher 86 and at the left side is engaged by an abutment 87. Both the pusher and the abutment are carried by a rack bar 88 mounted to slide in the frame. The pusher, abutment, and rack bar may for convenience be termed the card carriage or feeder. As shown in Fig. 2, the teeth of rack bar 88 are engaged by a pair of pawls 89 and 90, the former normally free of the rack teeth 91 of the bar and the latter normally engaged with the rack teeth. A lever 92 fast to shaft 93 is connected to both pawls to operate them in reverse directions. The shaft 93 carries a bail 94 (Fig. 4) underlying all the interposers 78 so that depression of any of the latter upon a punching operation rocks the bail and thereby shaft 93 to cause lever 92 to lift pawl 90 out of engagement with the rack teeth 91 and to lower pawl 89 into engagement with the rack teeth. When the pawl 90 is released, it shifts under the influence of spring 95 to a point above the next rack tooth 91.

After the hole has been punched in the card, interposer 78 and bail 94 rise and shaft 93 rocks clockwise (as viewed in Fig. 2) to release pawl 89 from the rack teeth and to rock pawl 90 downwardly on top of said next tooth 91. A spring motor 96 now acts through its pinion 97 meshed with the teeth 98 on the lower edge of the rack bar 88 to advance the bar until it is stopped by the seating of pawl 90 in said next rack tooth 91. The above described movement of the rack bar 88 for one tooth space advances the card transversely one column at a time.

In the present case, the card is inserted in the machine by the operator. This is done when the card feeder is in the position shown in Fig. 1 by placing the card on surface 85 between the pusher 86 and abutment 87. A thumb piece 100 (Fig. 1) on a bar 101 fast to rack bar 88 is then engaged by the operator to move the card feeder to the extreme right, the escapement pawls freely permitting retraction of the rack bar. In such movement, teeth 98 of the escapement bar operate pinion 97 to energize spring motor 96. In its retracted position, the card feeder locates the card in the position shown in Fig. 4 with its first, or extreme left hand column under the column of punches 75, each index position or hole receiving position of the card column being directly beneath a different one of the column of punches.

The punch operating means is of the type shown in Patent No. 1,373,930. Briefly, hammer 79 which depresses the punches is operated by a linkage 102 connected to the armature 103 of punch magnet 104. The magnet is energized whenever an interposer is moved forward to operative position.

For this purpose, a bail 105 engages all the interposers so that when any of the latter are advanced, the bail rocks counterclockwise (as viewed in Fig. 4) and lifts a link 106 to close a pair of contacts 107. When the punch operating linkage 102 is actuated by the energization of the punch magnet, a lug 108 on the linkage kicks the link 106 away from contacts 107 permitting the latter

to open and break the circuit through the punch magnet.

A column selector is provided in the punching machine. This selector includes three brushes 110 carried by bar 101 which is fixed to the escapement rack 88. The brushes move along a stationary column commutator 111 fixed to the punch machine frame. The contacts 112 of the commutator bar (see circuit diagram, Fig. 9) are spaced along the bar at distance equal to the width of a card column. Thus, when the card is fed one column space, the two upper brushes 110 will move from one contact 112 to the adjacent one. The lower brush moves along a common return bar 140. The operation of the column commutator effects a selection of the card columns to be perforated under clock control while the minute and hour selectors control the digits to be punched in the selected column.

In addition to the digit keys 76, there is the usual "X" key 114 operation of which causes the card feeding means to feed the card several columns under control of a skip bar 115 which is carried by the side of the escapement rack (Fig. 2). The primary purpose of the depression of the "X" key 114 is to cause column skipping mechanism to take effect and incidentally to cause the punching of an X or eleventh index point position of the card column under the punches.

When the "X" key is depressed, in a known manner, it moves a lifter arm 116 forwardly. The forward end of arm 116 is beveled to coact with the upper edge of skip bar 115 to elevate the arm when it is moved forwardly. The arm passes beneath escapement pawl 90 so that the rise of the arm when moved forwardly, lifts pawl 90 out of engagement with the rack teeth 91. Spring motor 96 thereupon is free to actuate the escapement bar 88 and the card feeder carried thereby to the left (as viewed in Figs. 1, 2, and 4). The card feeder advances until a depression 118 in the skip bar reaches the lifter arm 116 whereupon the latter drops and the pawl 90 reengages the escapement bar to stop further advance of the card. For further details of the skip mechanism, recourse may be had to Patent No. 1,426,223.

A pattern card section D of the type disclosed in Patent No. 1,878,935 is provided in the punch unit. The pattern card is fed by the escapement mechanism in unison with the feed of the card T in the punching section. The operation of the pattern card section will be briefly explained later in connection with the circuit diagram.

The punch unit is provided with a motor M adapted to automatically feed cards one at a time from supply stack 119 and with automatic ejecting mechanism including a card flipper 120. However, for the purposes of the present invention, the automatic feeding and ejecting mechanism is not necessary and is disabled by opening certain switches.

The coaction of the punching unit A and the clock unit B will now be brought out with reference to the circuit diagram, Fig. 9.

For the purposes of this case, motor M, automatic ejector control relay 121, and clutch magnet 122 are to be disabled.

For this purpose, switch 123 is opened to break the circuit path through ejector control relay 121 to thereby disable the ejecting mechanism. The contacts 124 which are closed by the action of the ejector remain open and consequently clutch magnet 122 cannot be energized. The clutch magnet when energized causes opening of normally closed contacts 125 and closing of contacts

126. Since the clutch magnet circuit is now opened, the contacts 126 remain open and prevent making of the circuit through motor M. The punch unit is thus in condition for manual and clock controlled operation without interference by the automatic feeding and ejecting mechanism.

As an example, assume that employee 225 of department 415 presents his card to the punch operator at 9:07.

The operator inserts the card T in the punching section and pushes finger piece 100 to the right (as viewed in Fig. 1) to locate the card carriage and the card in first column position. The operator then manually depresses the proper keys 76 for punching in succession the department and man number columns of the card. Depression of a key, as previously explained, closes contacts 107. A circuit is thereupon completed as follows:

From terminal 127, through punch magnet 104, contacts 107, normally closed contacts 125, and line 129 to terminal 130.

Energization of punch magnet 104 causes the key-selected punch pin 75 to perforate an index point position of the card column then under punch column. Following the punching of the hole, the escapement mechanism functions to feed the next card column under the punches.

After the department and man items have been punched in the workman's card T by manual operation of keys 76, the first of the date columns reaches punching position. The date is pre-punched on a pattern card P in the same columns as those of card T which are to receive the date punching. The card P feeds with respect to sensing brushes 131 in synchronism with the feed of card T with respect to the punch pins 75. When a date-punched column of the pattern card reaches brushes 131, one of the latter senses the date perforation and makes contact with a common contact roll 132. A circuit is then completed, without manual intervention, through the punch magnet 104, as follows:

From terminal 127, through lines 133, 134, the magnet 82 connected to the brush 131 sensing a perforation in the pattern card, the latter brush, contact roll 132, common return brush 135, contacts 136, line 137, contacts 125 and line 129, to terminal 130.

Energization of the magnet 82, selected by above circuit, operates the keys 76 to cause a punching operation.

The date columns are thus automatically punched under pattern card control and the card T, as a result, is automatically fed to locate the first of the start columns in punching position.

As previously assumed, the card was presented to be punched at 9:07. Consequently, at this time, the hour selector brushes 58 have moved nine steps from the 12 o'clock position and tens order hour brush 58 is engaging a commutator contact 65 hooked up to a "0" line while units order hour brush 58 is engaging a contact 67, marked "9".

In the minute section of the time selector, the brushes 58 have moved one step from a 00 minute position to a 06 minute position and consequently, tens order minute brush is engaging a commutator contact 61 connected to a "0" line while the units order minute brush is engaging a commutator contact 63 marked "6".

The time is to be punched as tens of hours, unit hours, tens of minutes, and unit minutes. Accordingly, the first of the start columns is to be controlled by tens order contacts 67, the second

by units order contacts 65, the third by tens order contacts 63, and the fourth by units order contacts 61.

When the first of the start columns of the card reaches the punch line, one brush 110a of the column selector is engaging a contact 112-1 of the column commutator 111 which corresponds in order to the first of the start columns. Another brush 110b is constantly wiping a common return contact bar 140. Connections are made from each contact point 112 to sockets 141 of a plugboard 142. On the same plugboard are aligned plug sockets 143. Plug wires 144 provide interchangeable connections between sockets 141 and 143 so that punching of the time may be selectively located in any desired group of card columns.

The pattern card P is unperforated in the columns corresponding to the time columns of card T. Therefore circuits cannot then be formed through the sensing brushes 131 of the pattern section.

With the time selector parts in positions as described, the arrival of the first start column of the card in punching position automatically establishes the following circuit:

From terminal 127, through lines 133, 134, magnet 82-0, one of the lines 146, tens order hour selector contact 65 (ninth from the right), brushes 58, common return element 66, sixth minute cut out contacts 41 (see also Fig. 3), normally closed contacts 147, line 148, normally closed contacts 147a, plug socket 143, plug wire 144, plug socket 141, contact 112-1 of the column selector, brushes 110a and b, common return bar 140, closed contacts 149, switch 150 (closed for clock control selection), line 151, contacts 136, line 137, contacts 125, and line 129 to terminal 130.

Magnet 82-0 is energized by above circuit and the punching mechanism operated as a consequence to perforate the "0" position of the first start column.

At this point, the purpose of the sixth minute cut out contacts 41 may be made clear. Twenty-tooth disk 29 moves under control of cam 25 one step every sixth minute. When disk 29 moves from the 54th to 60th minute, its cam 43 causes the hour disk 48 to move one step through follower 45, shaft 27, lever 46, and pawl 47. During either of the transfer operations from cam 25 to disk 29 and from cam 43 to disk 48, it is desirable to delay punching in order to prevent an incorrect punch registration of the time. For this purpose, cam 25 opens sixth minute cut out contacts 41 at each sixth minute in the manner previously explained. Accordingly, the circuit through higher order selector contacts 65 cannot be made and none of punch controlling magnets 82 can be energized until contacts 41 close at the end of the 6th minute interval. Since the higher order or first column of the start or finish columns cannot be punched, the card and the column selector remains stationary, and punching in the other orders is also prevented.

With sixth minute cut out contacts 41 closed, the above described circuit is effective to cause punching in the first start column. The card feeder then moves one column space, causing column selector brush 110c to engage the column selector contact 112-2. As a result, a circuit is automatically established from terminal 127 through lines 133, 134, magnet 82-9, a lead 146, units hour selector contact 67-9, brush 58 (now engaging this contact), the other brush

58, bar 88, normally closed contacts 154, line 155, and through the plugboard connections to column selector contact 112-2. From this point on the circuit is completed as previously described.

The above circuit energizes magnet 82-9 to cause a "9" hole to be punched in the second start column.

In a similar manner, circuits are successively completed through the tens order minute selector contacts 61-0 and the units order minute selector contact 63-7 so that the third and fourth start columns of the card successively receive "0" and "7" perforations. The first finish card column is now in punching position and column selector brush 110a is engaging column selector contact 112-5. This contact is wired to plug socket 143a to which is connected a skip control. The circuit for the skip control is automatically completed when the first finish card column reaches punching position, as follows:

From terminal 127, through lines 133, 134, magnet 82-X, line 157, line 158, normally closed contacts 159, socket 143a, the plug connections to column selector contact 112-5, and from then on as in the previous circuit.

Energization of magnet 82-X results from above circuit to cause an X hole to be punched in the first finish column and also to move the skip lifter 116 forward into a depression 118 of the skip bar 115. The skip lifter maintains this forward position while the rack 88 advances because of the X punching operation to the next column. As a result, skip bar 115 has advanced to the left (Fig. 2) and the lifter now engages a high portion of the skip bar, thereby releasing escapement pawl 90 to cause the card carriage to move to the left. The skip bar maintains the escapement pawl 90 released until the card carriage and card reach last column position, whereupon the operator may remove the card. (The contour of the upper edge of the skip bar in relation to the card columns is indicated in Fig. 2).

Summarizing the start time punching operation; the operator places the card in the punch machine and through thumb handle 100 moves the card feeder to first column position. The department and man number are then punched in the card by manual operation of keys 76. The date is then automatically punched under control of pattern card P. The tens and units orders of both the hour and minute selectors then automatically cause punching of the start columns, and this is followed by an automatic X punching and a skipping of the finish columns.

When the workman finishes the job, he presents his card to the punch operator who, as before, places it in the machine and moves it to first column position.

The operator then depresses a special finish key 160 (see Figs. 1 and 9) which closes the following circuit:

From terminal 127, through line 161, relays 162, 163, 164, and 165, finish key contacts 160', and lines 166 and 129 to terminal 130.

Relay 162 shifts contact-carrying blade 167 to open X-punching contacts 159 and to close first column finish time contacts 168. Relay 162 also opens first column start time contacts 147a and closes X-punch contacts 169.

Relay 163 opens contacts 147 and 154 and closes contacts 170 and 171.

The effect of opening X-punch contacts 159 and closing X-punch contacts 169 is to shift 75

the X-punching circuit from the first finish column to the first start column.

The effect of opening contacts 147a and closing contacts 168 is to transfer the tens order hour selector control from the first start to the first finish column.

The effect of opening contacts 147 and 154 and closing contacts 170 and 171 is to transfer the tens and units orders hour selector control from the first two start columns to the first two finish columns.

Relay 164 functions similarly to relay 163 to transfer the minute selector control from the last two start to the last two finish columns.

Relay 165 closes shunt contacts 172 to by-pass finish key contacts 160' permitting the operator to release the finish key immediately after its depression.

The holding circuit for relays 162, 163, 164, and 165 then is completed from shunt contacts 172 through line 173, last-column cut-out contacts 174, and line 175 to terminal 130.

Contacts 174 are opened by the escapement rack 88 when the latter moves to last column position so that the relays 162, 163, 164, and 165 will be deenergized when the feed of the card is completed.

After operating finish key 160, the operator spaces the card along by operating the usual space key until the first date column of the card is in punching position. The pattern card section D here takes control to cause the card to automatically advance until the first start column is in punching position. The X-punching circuit is then automatically made through magnet 82—X, line 157, contacts 169, (now closed), the plug connections to column selector contact 112—1, brushes 110a and b, and from this point on the same as the previously described X punch circuit.

As a result, magnet 82—X is energized to cause the skip lifter 116 to move forward. As seen from Fig. 2, the first start column is in line with a depression 118 of the skip bar 115. When magnet 82—X is energized, it causes an X-punching operation to occur. This in turn results in feeding the card and escapement rack one column to the left. The upper edge of the skip bar corresponding to the next three start columns is straight, thereby elevating the advanced lifter arm 116 to cause the card carriage to advance the card until the first finish column is in punching position. In this position, skip bar 115 has a depression 118, as previously explained, causing lifter arm 116 to drop and the escapement pawl 90 to stop automatic card feed.

The time is then successively punched in the finish columns under control of the hour selectors which now function to select the punches through the upper set of contacts 170 and 171 and the minute selectors which select the punches through the upper set of contacts in the minute section.

The operator may now depress the usual release key R (Fig. 1) to move the card to the last column position. When the escapement bar 88 reaches this position, a lug 180 thereon (Fig. 2) rocks a lever 181 to open contacts 174, thus breaking the holding circuit through relays 162, 163, 164, and 165.

In brief, the finish time punching operation proceeds as follows:

The operator inserts the card in the machine and then depresses finish key 160 to close contacts 160' and energize relays 162, 163, 164, and

165. Relay 165 closes contacts 172 to establish a holding circuit for said relays, permitting the operator to release the finish key.

Relay 162 transfers the X-punching and skip control circuit from the first finish to the first start column so that when the first start column reaches punching position, an X-hole is punched and the start columns automatically feed past the punching position. Relays 163 and 164 transfer the time selector controls from the start to the finish columns. The latter are automatically time punched and the card feeder moved to the last column position to open contacts 174 and break the holding circuit through relays 162, etc.

The card is then removed by the operator.

It will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and explained and in its operation may be made by those skilled in the art without departing from the invention. It is the intention, therefore, to be limited only by the claims which are as follows:

I claim:

1. In a machine for punching columns of a card in code with a denominational order time record, each order to be punched in a different card column; the combination of punches, dies therefor, means for feeding the card between the punches and dies to locate the card columns successively, one after another, in punching position, selecting means for controlling the punches to perforate each column in succession with a selected time value in the order of the record corresponding to said column, and a clock device for governing operation of the selecting means to select values corresponding to the time.

2. In a machine for punching columns of a card in code with a denominational order time record, each order to be punched in a different card column; the combination of punching mechanism for perforating the card columns in succession, one column after another, each with its order of the record, selecting means for simultaneously selecting the values in each order of the record to be punched, a clock device for governing operation of the selecting means according to the time, and means for causing the selecting means to control the successive card column punching operations by the punching mechanism according to the simultaneously selected values.

3. In a machine for punching columns of a card in code with a denominational order time record, each order to be punched in a different card column; the combination of punching mechanism for perforating the card columns in succession, one column after another, each with its order of the record, selecting means for selecting the time values in each order of the record to be punched, a clock device for governing operation of the selecting means according to the time, and electrical connections between the selecting means and the punching mechanism for causing the selecting means to control the successive column punching operations by the punching mechanism according to the selected time values.

4. In a machine for punching columns of a card in code with a denominational order time record, each order to be punched in a different card column; the combination of punching mechanism for perforating the card columns with said record, a clock device, means governed by the clock device for automatically selecting the time value punched by said mechanism in

each card column, and means for automatically and successively selecting the card columns to be perforated by the mechanism with the selected time values of the record.

5 5. In a machine for punching denominational order columns of a card with a denominational order time record; the combination of a value selector, a clock device for governing operation of the value selector according to time, a column selector, and punching mechanism jointly controlled by the value selector and the column selector for perforating the card columns with a time record made up of the selected values.

15 6. In a machine for punching denominational order columns of a card with a denominational order time record; the combination of punching means including punches for punching the card columns with the time record, a selector for controlling the punches to punch the card columns with selected values, a clock device for operating the selector to select time values, and a column selector operated by the punching means for selecting the card columns in which the punches perforate the selected values.

25 7. In a machine for punching denominational order columns of a card with a denominational order time record; the combination of a column of punches for successively punching the card columns, one column after another, means for feeding the card column by column to the punches to be perforated, a time-set selector for governing operation of the punches according to selected time values in each order of the record, and means movable synchronously with the card feeding means to cause the punches to perforate each of the selected values only in the card column corresponding to the denominational order of the selected value.

40 8. In a machine for punching denominational order columns of a card with a denominational order time record; the combination of means for selecting the time values in each order of the record, a clock device for governing operation of the selecting means, card punching mechanism for perforating the card columns with the time record, and means for causing the punching mechanism to successively receive the values of said record from the selecting means, one order value after another.

50 9. In a machine for code-punching denominational order columns of a card with a denominational order time record; the combination of a plurality of orders of value selectors, one selector for each order of the time record, a clock device for governing operation of said selectors, card punching mechanism, and means for causing the different orders of selectors to successively and in denominational order control the punching mechanism to punch the card with the selected values of the time record.

60 10. In a machine for code-punching denominational order columns of a card with a denominational order time record; the combination of punching mechanism for successively punching the card columns, one after another, denominational order selectors for selecting values in each order of the record to be punched, a clock device for simultaneously setting said selectors, and means for successively rendering the selectors, one after another, and in denominational order effective to control the successive card column punching operations according to the selected time values.

75 11. In a machine for code-punching a card with the values of a denominational order time

record; the combination of a plurality of orders of selectors, each having a plurality of elements corresponding to different values, the different elements of said orders of selectors having fixed relationships corresponding to predetermined denominational order values, a clock device for effecting concurrent step-by-step selection of related elements of different orders of said selectors, punching mechanism, and means for controlling operation of said punching mechanism 10 by the concurrently selected elements of said selectors to effect punching of a time record in the card.

12. In a machine for code-punching denominational order columns of a card with the values of a denominational order time record; the combination of a plurality of orders of selectors for selecting values in each order of the record to be punched, each selector having a plurality of contacts corresponding to different values, the contacts of one selector being paired with the contacts of another selector to cause paired contacts to correspond to a predetermined, multi-denominational, arbitrary time value, feelers for concurrently sensing paired contacts, a clock device for effecting step-by-step operation of the feelers to successively sense different paired contacts corresponding to different arbitrary time values, card punching mechanism, and electrical connections between the selectors and the punching mechanism for causing the punching mechanism to punch the card columns with the values selected by the feelers.

13. In a machine for code-punching a card with start and finish time records; the combination of means for selecting the values of the records to be punched, a clock device for governing operation of said selecting means, card punching mechanism including punches controlled by the selecting means to punch the card with the selected time values, and means for automatically governing operation of the punching mechanism according to whether the selected values are for a start or a finish time record.

14. In a machine for code-punching columns of a card with start or finish time records; the combination of means for selecting a value to be punched, a clock device for governing operation of the selecting means, punching mechanism including punches controlled by said selecting means for punching the card in accordance with the selected value, and means controlled by operation of the punching mechanism for causing the punches to punch the value in one card column or another according to whether the record is a start or finish time record.

15. In a machine for code-punching columns of a card with the values of a time record; the combination of means for selecting the values of the record to be punched, a clock device for governing operation of the selecting means, punching mechanism for successively punching the card columns, one after another, and controlled by said selecting means for punching the card columns one after another with the selected values, means for determining whether the punching mechanism is to punch the record into one set of card columns or another according to whether the record is a start or finish time record, and means for automatically skipping the start columns when the finish columns are to be punched and automatically skipping the finish columns when the start columns are to be punched.

16. In a machine for code-punching start or finish columns of a card with the values of a

- time record, the combination of means for selecting the values in each order of the record to be punched, a clock device for governing operation of the selecting means, punching mechanism for successively punching card columns, one after another, and controlled by said selecting means for punching the card, column by column, in accordance with the selected values, means for automatically skipping the finish columns when the start columns are punched, and a means controlled by the operator for automatically causing the start columns to be skipped when the finish columns are to be punched.
17. In a machine for code-punching a card; the combination of a column of punches, a card carriage for carrying a card past the column of punches to be successively punched column by column, means for automatically moving said carriage to skip certain columns of the card past the punches, means for pre-selecting different columns to be skipped, means for operating the selecting means to change its selection of the column to be skipped, and a device cooperating with the selecting means and automatically effective when the pre-selected card column reaches the column of punches for causing said skipping mechanism to operate.
18. In a machine for code-punching a card with a time record; the combination of means for selecting the value of the record to be punched, a clock device for shifting said selecting means at timed intervals, punching mechanism controlled by the selecting means to punch the card with the selected value, and means for delaying operation of the punching mechanism during shifting of the selecting means.
19. In a machine for punching start and finish columns of a card with time records; the combination of electrical selectors for selecting time values, a clock device for time-setting the selectors, a column selector for selecting the card columns to be punched, variably settable electrical connections between the value selectors and the column selector, punching mechanism jointly controlled by the value selectors and column selector for punching the start card columns in one setting of the electrical connections, and means for shifting the setting of the electrical connections to cause the value selectors and column selector to control the punching means to punch the finish time card columns.
20. In a machine for punching start and finish columns of a card with time records; the combination of punching mechanism for successively punching the card columns, one after another, a value selector for governing operation of the mechanism according to selected values, a clock device for time-setting the value selecting means, a column selector connected with the value selector for causing the value punching operation to occur in selected card columns, column skip mechanism for causing the punching mechanism to automatically skip the start card columns when finish time is recorded and to skip the finish card columns when start time is recorded, connections between the column selector and the skip mechanism for determining on which columns the skip mechanism is to take effect, and means for adjusting said connections to cause the skip mechanism to take effect on the start or finish columns according to whether start or finish records are to be punched.
21. The machine as defined in claim 20, means for adjusting the connections between the value selector and column selector to change the column selection, and a common control for the adjusting means of said skip mechanism connections and the adjusting means of said value selector connections.
22. In a machine for code punching start and finish columns of a card with start and finish time values; the combination of a column of punches for punching one card column at a time, each punch having a different code value, means for feeding the card column after column to the punches, magnets, one to each punch, energized to cause the punches to operate, circuits, one for energizing each magnet, selectors, each including a plurality of contacts corresponding to different time values and connected in circuits of corresponding values, a clock device, feelers operated by the clock device, each to successively sense the contacts of one selector, to thereby select the circuits for operation, a column selector having a plurality of column contacts corresponding to different card columns and successively connected in common in the magnet circuits, electrical connections between the value contact feelers and the column contacts corresponding to start card columns to complete the selected magnet circuits when feeding means moves the start columns to punching position, and means for shifting said electrical connections from the column contacts corresponding to start columns to the column contacts corresponding to finish columns to cause the selected magnet circuits to be completed when the finish columns reach punching position.