April 4, 1939. E. J. RABENDA 2,153,208

RECORD CONTROLLED MACHINE

Filed June 27, 1935 2 Sheets-Sheet 1

FIG.1.

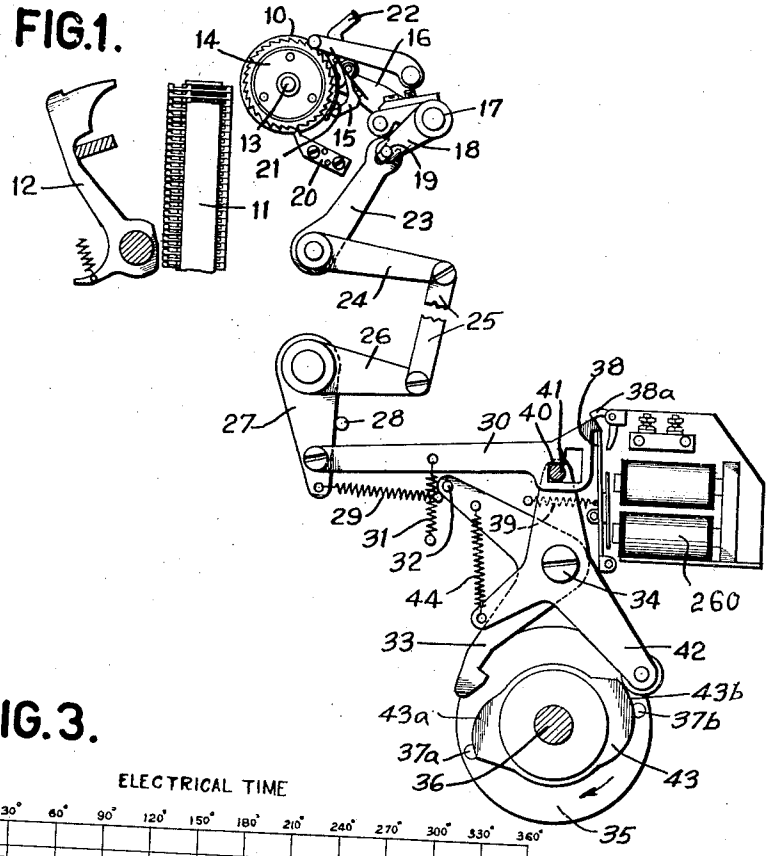
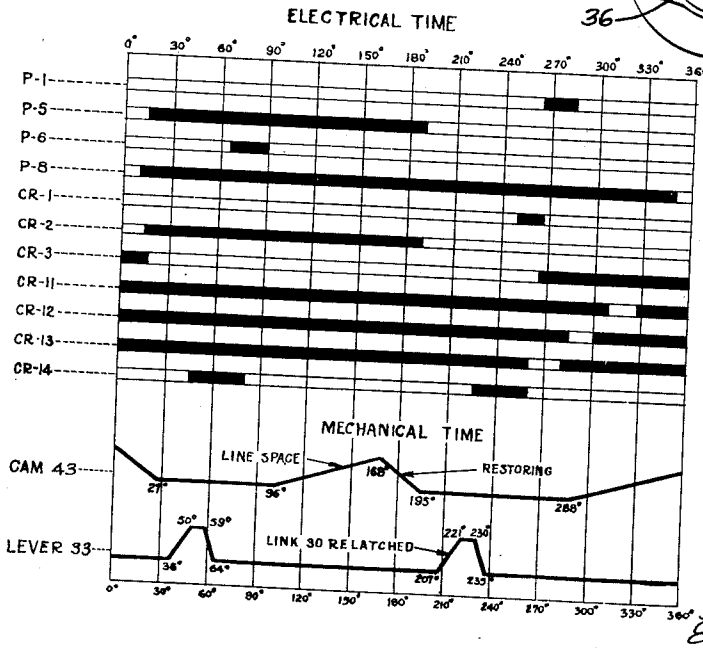


FIG.3.



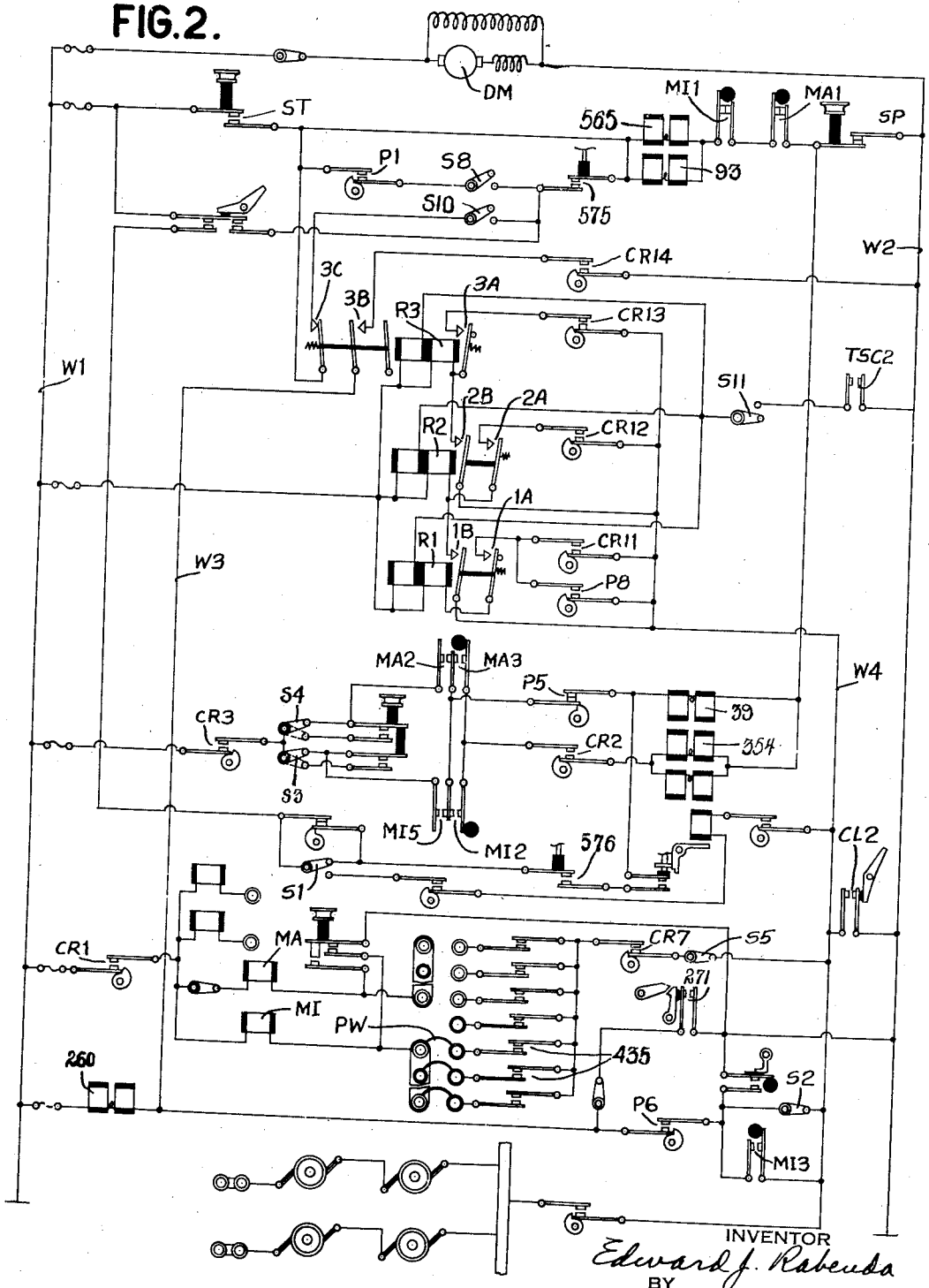
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April 4, 1939. E. J. RABENDA 2,153,208

RECORD CONTROLLED MACHINE

Filed June 27, 1935 2 Sheets-Sheet 2

FIG.2.



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UNITED STATES PATENT OFFICE

2,153,208

RECORD CONTROLLED MACHINE

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Application June 27, 1935, Serial No. 28,609

3 Claims. (Cl. 235—61.6)

This invention relates to record-controlled machines in general and in particular to means to control paper feeding operations.

The object of the invention is to provide a cycle controller for automatically causing the machine to perform a series of paper feeding cycles which take place in a predetermined order.

Another object is to provide a paper feed controlling means to enable the machine to print items upon predetermined lines of pre-printed forms or blanks which may be connected in a continuous strip.

A further object is to provide means whereby pre-printed forms or blanks may be used in standard record-controlled machines without the use of a special bill or sheet feeding attachment.

Various other objects, advantages, and features will be specifically pointed out in the following description and claims, or will be apparent from a study of said description and claims and the accompanying drawings.

In the drawings:

Fig. 1 is an elevation of the line spacing mechanism.

Fig. 2 is a wiring diagram.

Fig. 3 is a time chart.

The drawings illustrate how the present invention is incorporated in a machine like the one described in Patent No. 1,944,667 issued January 23, 1934 to John Royden Peirce. It will be understood, however, that the present invention may be used in other machines without alteration in principle as the embodiment hereinafter to be described is purely illustrative in nature.

Fig. 1 illustrates the paper feeding mechanism described in the above patent. This paper feeding mechanism, or line-spacing mechanism, as it is usually called, is arranged to advance the sheet or strip on which the type bars make their impressions as an accompaniment to each item and total printing operation.

The numeral 10 designates the usual platen which supports the record sheet or strip and cooperates with type bars 11 and printing hammers 12 to effect printing of numerals and letters as described in the patent. The platen 10 is mounted on platen shaft 13 which is rotatably mounted in the usual paper carriage (not shown). Mounted on shaft 13 is a line-spacing ratchet 14 arranged to rotate the platen 10 when actuated by a feed pawl 15. The latter is pivotally mounted on an arm (not shown) which is pivoted on shaft 13 and has a pin and slot connection to an arm 16. The arm 16 is secured by an adjustable connection to a shaft 17 journaled in the paper carriage. Secured to the ends of shaft 17 are two arms like 18 which support a cross rod 19, the shaft 17, arms 18, and rod 19 thus forming a bail rockably mounted in the paper carriage. Obviously, rocking of this bail in a counterclockwise direction (Fig. 1) will cause pawl 15 to rotate the ratchet 14 and hence platen 10 in a clockwise direction and thereby line space the record sheet or strip.

The amount of movement imparted to ratchet 14 is limited in a forward direction by a block 20 fixed to the carriage frame. This block has a tendency to force pawl 15 toward the center of shaft 13 and thereby not only limits movement of the pawl in a forward direction, but also prevents overthrow of the platen due to inertia.

The pawl 15 is spring urged into contact with a flange or shroud 21 which can be selectively set circumferentially of ratchet 14 by means of a finger piece or lever 22 of which the shroud is part. Thus the point at which pawl 15 engages ratchet 14 and the amount of line spacing movement imparted to the platen can be regulated by hand in a well known way. Conveniently the lever or finger piece 22 may be set by hand in either of two positions to enable single or double line spacing to be effected by an invariable movement of the bail comprising elements 17, 18, 19.

Pivotally mounted on the framework of the machine, which also slidably supports the paper carriage, is an arm 23 slotted at its free end to embrace rod 19. By this connection the paper carriage may be moved transversely of the type bars 11 without distributing the connection between arm 23 and the bail 17—18—19. Rigidly connected to arm 23 is a second arm 24 extending horizontally and connected by a link 25 to an arm 26 also pivotally mounted in the framework of the machine. Rigidly connected to arm 26 is a downwardly extending arm 27 normally held against a stop pin 28 by means of a spring 29. A link 30 is pivoted to arm 27 and is urged by a spring 31 so as to tend to engage with a pin 32 carried by a restoring lever 33 pivoted on a stud 34.

Lever 33 cooperates with a restoring disc 35 secured to a shaft 36 which is driven continuously by the drive motor at the rate of one revolution for each card cycle and total cycle of the machine. Disc 35 has two pins 37*a*, 37*b* on opposite sides of shaft 36. Normally movement of link 30 downwardly into contact with pin 32 is prevented by a latch 38 which engages a shoulder or nose formed in the link 30 as shown in Fig. 1, latch 38 being held in this position by a spring 39.

Secured to latch 38 is the armature of an elec-

tromagnet 260 hereinafter to be termed the paper feed magnet. When the latter is energized at the proper time link 30 is released and is drawn by gravity and spring 31 downwardly into contact with pin 32.

Link 30 has an L-shaped slot 40 into the horizontal part of which projects a pin 41 carried by one arm of a three-armed lever 42. The latter is pivoted on stud 34 adjacent lever 33. One arm of lever 42 carries a roller engaging a double-lobed cam 43 secured to shaft 36 adjacent disk 35. A spring 44 has the effect of holding the roller on lever 42 in contact with cam 43 and also holds lever 33 in the path of pins 37a, 37b. Since shaft 36 is running continuously, it is obvious that pin 41 will oscillate in the horizontal part of slot 40 twice for each revolution of shaft 36, that is, twice per machine cycle.

When magnet 260 is energized at the proper time, latch 38 is drawn to the right releasing link 30 which is then urged downwardly by its spring 31 with the result that pin 41 will enter the vertical part of slot 40 when said pin reaches the position opposite to that of Fig. 1, thereby coupling link 30 and lever 42 together.

When the pin 41 moves to the left, link 30 will be moved in the same direction, rocking arm 27 to the left. This causes link 25 to move downwardly rocking arms 23, 24 clockwise and bail 17—18—19 counterclockwise, thereby, through feed pawl 15, rotating ratchet 14 and platen 10 clockwise either one or two line spaces according to the setting of finger lever 22.

Pin 41 thereafter moves back to its extreme right-hand position thereby positively restoring link 30 and parts actuated thereby to their normal positions. Shortly after pin 41 reaches its right-hand position, one of the pins 37a, 37b engages the bell crank 33 and rocks the latter clockwise to lift link 30 and disengage pin 41 from the vertical part of slot 40 thereby permitting latch 38 to relatch the link 30 in its normal position. An armature knock-off lever 38a is operated by the link 30 in its vertical movement to positively start latch 38 toward latching engagement with link 30 in case residual magnetism should be strong enough to prevent spring 39 from moving latch 38 into latching engagement with link 30.

The cam actuated contacts P6 (Figs. 2 and 3) are operative only during printing cycles, whether the cycle be a listing cycle or a total printing cycle, and close at the point where pin 37a is holding link 30 in fully restored position in which position the shoulder engaged by latch 38 is lifted slightly clear of the end of the latch. Closure of contacts P6 at this point energizes paper feed magnet 260 by a circuit from line wire W1, magnet 260, contacts P6, switch S2, and card lever contacts CL2 (closed when cards are in analyzing position), to line wire W2. Thereafter the pin 37a passes out of contact with arm 33 and permits link 30 to drop as pin 41 is in its right hand position when magnet 260 is energized. Pin 41 enters the upper end of the vertical part of slot 40 with the result that the line spacing mechanism will be operated from the 96° position to the 168° position of shaft 36 (Fig. 3). The paper is thus line spaced at least once for each item or total and this operation takes place a short time before the item or total is printed.

During total printing cycles, total spacing contacts 271 close after the total is printed and have the same effect as contacts P6. In this case, the cam lobe 43b and pin 37b operate the line spacing mechanism. Thus, when finger lever 22 is in the single line space position, the paper is line-spaced both before and after each total and again before the next item is printed so that items are separated from each other by a single line space while the first item after a total will be separated from the total by two line spaces. When finger piece 22 is set for double spacing, the items will be double spaced from each other while the total will be separated from the next item by four line spaces.

So far the description has been devoted mainly to bringing out clearly the timing of the line spacing operations in the normal operation of the machine in adding, listing, and printing totals of items as this timing is of importance in understanding the detailed operation of the invention involved herein.

The cycle controller includes a series of relays, designated R1, R2, R3; a series of cam actuated contacts designated P8 and CR11 to CR14; a pair of contacts TSC2 which close during total cycles when the total switch operates, and two switches S10, S11. Contacts P8 are operative only during printing cycles while contacts CR11 to CR14 are always operating when the machine is in operation. In order to understand how the cycle controller functions, a specific example will be given.

It will be assumed that the following is typical of the data punched in the record cards which control the machine:

Smith John S.
Account No. 753
Sales District 140 (Chicago)
Business Code 146 (Hardware)
Credit Rating 2 (Good—Slow payer)
Aggregate Sales 1934—1,500.00

The cards which the machine prints are to constitute a file of customers names in alphabetical order with their account numbers, sales districts in which they are located, class of business, credit rating, and last years aggregate sales shown on each index card. The perforated record cards may be in any desired order and need not be in alphabetical order.

The plug sockets of the analyzer corresponding to the columns of the punched record cards in which the name appears will be plugged directly to the printer magnets of alphabet type bars in the manner described in the Peirce patent. The columns in which the account number and credit rating appear in the punched cards will be plugged to the "list only" plug sockets of part of the numerical bank of type bars. With this arrangement the name, account number, and credit rating will all be printed on one line, but the account number and credit rating will not be accumulated in the orders of the accumulator corresponding to the numerical type bars printing the account number and credit rating.

The columns of the punched cards containing the sales district, business code, and aggregate sales will be plugged to the "add only" plug sockets of the group of type bars selected to print the account number and credit rating. With this arrangement the code numbers designating the sales district and class of business, and the aggregate sales will be accumulated separately in the orders of the accumulating mechanism corresponding to the type bars which are used to print the account number and credit rating, but the sales district, business code, and

aggregate sales will not be printed during a listing cycle.

Each punched card is to constitute a one card group and the machine is to minor control in accordance with the account number which is different for each punched card representing a customer. Accordingly the group control contacts 435 (Fig. 2) corresponding to the columns of the card in which the account number is punched are connected to minor control relay MI by plug wires PW to render the minor group control relay active.

Since the account number is different for each customer card, one or more of the contacts 435 will close during each listing cycle and the closure of cam contacts CR1 toward the end of such cycle (Fig. 3) will establish a circuit through minor control relay MI as follows: Line wire W1, contacts CR1, minor control relay magnet MI, one or more of plug wires PW and contacts 435, contacts CR7, switch S5, and card lever contacts CL2, to line wire W2. This causes contacts MI1 to open the circuit to card feed clutch magnet 565 and stop feeding of the punched record cards, while contacts MI2, MI5 close to initiate a total cycle as described in the Peirce patent by energizing the total switch magnet 354.

Contacts TSC2 are in the total switch described in the Peirce patent and close when magnet 354 is energized during the latter part of the listing cycle. With switch S11 in the closed position, contacts TSC2 energize all three relays R1, R2, R3 in parallel.

During the listing cycle the following data will be printed on the card form in printing position, this being preceded by the usual line spacing operation due to closure of contacts P6 as described above:

John Smith 753 2

Also during this listing cycle the numbers 140, 146, and 1500.00 will be accumulated but not printed.

The closure of contacts TSC2 in the usual way, following a group change, causes all three relays R1, R2, R3 to become energized by three parallel circuits through the switch S11 and left hand coils of the relays. Thus the A and B contacts of all of these relays close while contacts 3C open. Contacts P8 close during the total cycle before contacts TSC2 are re-opened, whereby relay R1, through its contacts 1A and the right hand or holding coil of such relay, keep the latter energized by a holding circuit extending from line wire W1, the right hand coil of relay R1, contacts 1A and P8, wire W4, and contacts CL2, to line wire W2. Somewhat similar holding circuits for relays R2, R3 are established through their right hand coils by means of contacts 1B, 2B, except that the holding circuits for R2, R3 do not pass through contacts P8 but are made directly to wire W4. The holding circuit for relay R2, for example, extends from wire W1, through the right hand coil of relay R2, contacts 1B, wire W4, and contacts CL2, to wire W2. Contacts CR11, CR12, CR13 all close before the contacts P8 open (Fig. 3) so that relays R1, R2, R3 are kept energized throughout the total cycle by the successive and combined action of contacts TSC2, P8, CR11, CR12, CR13 and the relay contacts 1A, 1B, 2A, 2B, and 3A. Thus, after contacts TSC2 and P8 open the relays R1, R2, R3 are nevertheless kept energized by holding circuits through their right hand coils, their A contacts, and the contacts CR11, CR12, CR13 in series.

Contacts CR14 close twice during the total cycle, first before the total is printed and then after the total is printed. This causes two line space operations, cam contacts CR14 having the same effect as the cam contacts P6 in energizing magnet 260. During the total cycle the numbers 140, 146, and 1500.00 will be printed below the numbers 753 2 as the first three were accumulated and are now printed on the following line by a total printing operation.

As a result of the listing cycle and total cycle the following will be printed on the index card or form:

John Smith 753 2
140 146 1500.00

The next operation to be performed is to feed the card form on which the above data has been printed out of printing position and feed the next form into printing position. This is done by the line spacing mechanism under control of relays R1, R2, R3 and associated parts included in the cycle controller.

With switch S8 open and switch S10 closed, relay R3 has the effect, by holding open its contacts 3C, of preventing automatic resumption of card feeding operations after the total cycle has been completed. Since contacts 575, 576 remain open as long as the card feed clutch magnet 565 and magnet 93 are deenergized, as will be understood by reference to the Peirce patent, the printing mechanism is also prevented from operating. Motor DM, however, is still running and the continually running cam contacts designated CR1, etc. continue to operate as does the cam 43 and disk 35 (Fig. 1).

Three cycles of shaft 36 and three cycles of the drive shafts now take place which may be characterized as idle cycles of the machine so far as card feeding, listing, adding, and total printing are concerned.

The contacts CR11, CR12, CR13 are timed to keep relays R1, R2, R3 energized through contacts 1A, 2A, 3A during substantially the entire part of the first of the three idle cycles (see Fig. 3). Relay R3, through its contacts 3B, also connects cam contacts CR14 to the magnet 260, and contacts CR14 are timed to cause two impulses of current to pass through magnet 260 during the first idle cycle. These impulses occur at times when the pins 37a, 37b (Fig. 1) are holding link 30 above latching position (see Fig. 3) so that two line spacing operations take place during the idle cycle. The circuit in each case extends from line wire W1, magnet 260, contacts 3B, and contacts CR14 to line wire W1. Contacts CR11 open after contacts CR12, CR13, reclose, hence relay R1 is deenergized during the first idle cycle but relays R2, R3 remain energized.

Substantially the same operations take place during the remaining two idle cycles, relay R2 becoming deenergized during the second cycle, and relay R3 during the third with two line spacing operations during each of these cycles. When relay R3 is deenergized, its contacts 3C close and have the same effect as contacts P1 under normal conditions of operation of restarting card feeding and analyzing by reenergizing magnets 93, 565. A listing cycle now follows during which the data on the next perforated card is partly printed and partly accumulated as described above.

As a result of the operation of the cycle controller the card forms are line spaced nine times,

of which six take place during the three idle cycles, two take place during a total cycle, and one during the listing cycle. With finger lever 22 set for double spacing and with the standard feed of one sixth of an inch per line, the card forms will be fed three inches for each punched record card passed through the analyzing mechanism. Since the card forms are three inches high, it is plain that the next card form will be fed into position to receive the first line from the next punched record card.

It will be noted that the relays R1, R2, R3 are double coil relays of which one is a pick-up coil and the other a holding coil. The contacts 1B and 2B are provided so that the single set of cam contacts P8 can hold all three relays energized during the parts of the total cycle when CR11, CR12, CR13 open and yet permit the relays to become deenergized in predetermined order during the idle cycles. Otherwise all the relays would become deenergized during the total cycle.

By setting finger lever 22 to single spacing position narrow forms one and one-half inches high may be printed upon. On the other hand, if it is desired to handle larger forms or index cards, the line spacing mechanism can be changed to be capable of triple spacing or one or more additional relays like R2 can be added with additional cam contacts like CR12.

When normal operation of the machine is desired and the cycle controller is not to be used, switch S11 is placed in the open position and switch S10 is opened. Switch S8 is the usual automatic restart switch and will be closed only when automatic resumption of card feeding is desired after each total during normal operation of the machine.

The cycle controller is not limited to the precise modes of operation described above in preparing index cards under control of a single punched card, but the data from a whole group of cards can be printed on a single blank form. This is done by plugging the machine for group indication and operating the machine "tabulating". Suppose it were desired to list on the 3" x 5" card forms the total of John Smith's purchases for 1934. All of the items on John Smith's cards representing individual purchases during 1934 would be accumulated under group control by account number while the sales district and business code would be group indicated by entering them in a separate part of the accumulating mechanism during the first card cycle of the group. The name, account number and credit rating would be listed on the card form during the first cycle without change in the plugging of the machine as first described above. Switch S1 would be set in its lower position so that printing would be suppressed after the first card cycle of each group. The cycle controller would operate exactly as described above and the only difference in result would be that instead of aggregate sales to John Smith being printed on the card form from a single punched card, this data would be accumulated and printed under control of a series of item cards each relating to John Smith and punched with account No. 753.

The present invention provides a means whereby occasioal special indexing or form printing jobs may be performed economically on the standard tabulating machine without a special bill feeding attachment. It is especially valuable in places where only one tabulating machine is included in the punched card equipment and there is not enough billing or form work to justify the expense of installation of a bill feeding attachment.

The relays R1, R2, R3 and the other parts of the cycle controller cost a trifling sum in comparison with any satisfactory bill feeding attachment and may easily be installed in existing machines without change in the wiring or mechanical construction.

The cycle controller described herein is of special advantage where it is desired to annually prepare indexes showing customers' credit ratings, salesmen's records and for similar purposes as it enables printing the index cards on the tabulating machine directly from the punched item cards representing individual sales without a bill feeding attachment thus saving both the clerical expense of typewriting the index cards and the cost of a bill feeding attachment.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single embodiment it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a machine controlled by perforated accounting and statistical records wherein said records control printing of items on work sheets, line spacing mechanism operable to feed the work sheet in progressive steps to space items on the work sheet, a circuit for controlling the operation of said mechanism with means to close said circuit at predetermined intervals, a series of relays operable to render the circuit closing means effective a predetermined number of times, and means controlled by the records for rendering the relays operative.

2. In a record controlled machine, line spacing mechanism, means to operate the line spacing mechanism with a magnet to initiate a cycle of operation of the said mechanism; a cycle controller for said line spacing mechanism including a series of relays interconnected to control the magnet to cause a succession of line spacing cycles when said relays are operated seriatim, main control circuits for said relays, and circuit closing means in said circuits for operating the relays seriatim; and further means for rendering said circuit closing means effective to control the relays seriatim.

3. In a record controlled machine, line spacing mechanism, means to operate the line spacing mechanism with a line spacing control magnet to initiate operation of said mechanism; a cycle controller comprising a circuit closing device connected to said magnet and adapted to energize the magnet periodically when connected to said magnet, a series of relays for controlling the number of operations of the line spacing control magnet, said relays being operative to connect the circuit closing device to the magnet when said relays are energized, said relays being interconnected to maintain the circuit closing device connected to the magnet until all the relays have been deenergized, and a series of circuit closing devices in circuit with said relays and operative to deenergize the relays seriatim; and means to initially energize said relays to start operation of the cycle controller.

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