

Sept. 4, 1951

J. E. DAYGER ET AL
PAPER FEEDING MECHANISM

2,566,932

Filed Sept. 25, 1948

10 Sheets-Sheet 1

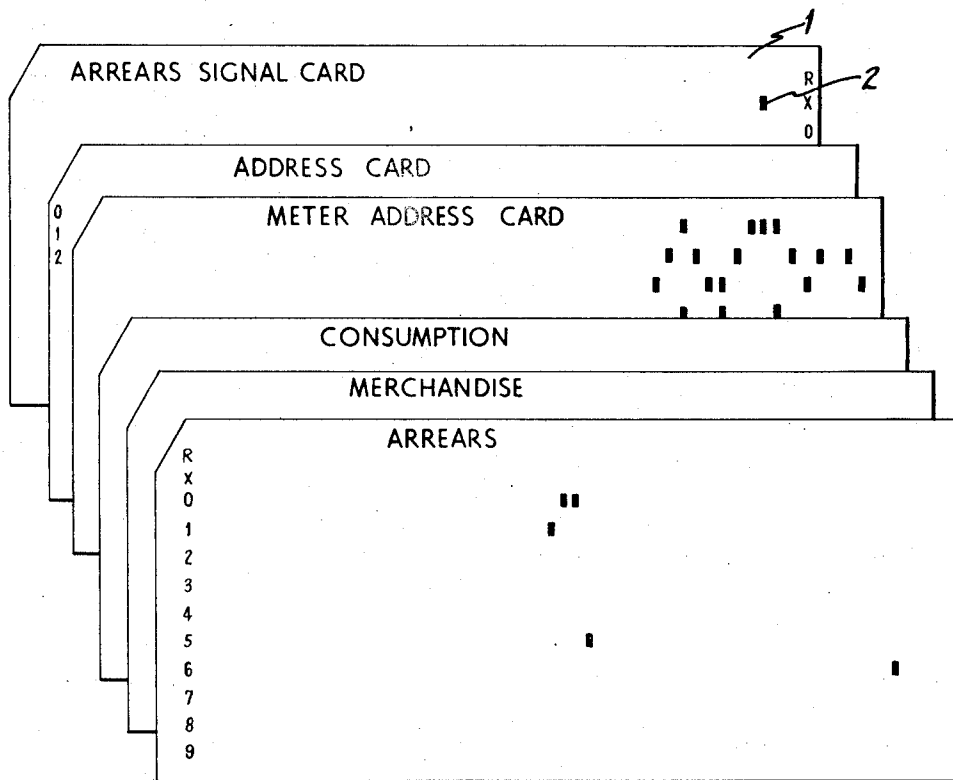


Fig. 1

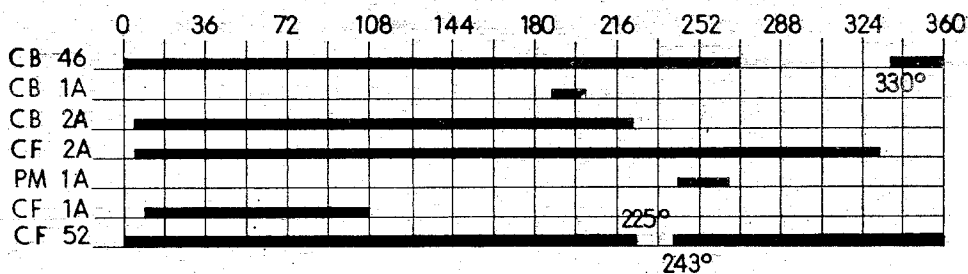


Fig. 2

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10 Sheets-Sheet 2

11 12 BILL FORM 12 57

0

2

5

MR J X DOE
153 MAIN ST
BINGHAMTON N Y CUST # 649

161 STATE ST
BINGHAMTON N Y

CONSUMPTION 1 23
MERCHANDISE 5 65
ARREARS 10 05

16 93

MR M T SPACE
353 FIFTH AVE

12

Fig. 2.

10

0

2

5

MR J X DOE
153 MAIN ST
BINGHAMTON N Y CUST # 649

161 STATE ST
BINGHAMTON N Y

CONSUMPTION 1 23
MERCHANDISE
ARREARS

9

REGISTER SHEET

Fig. 3.

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10 Sheets-Sheet 3

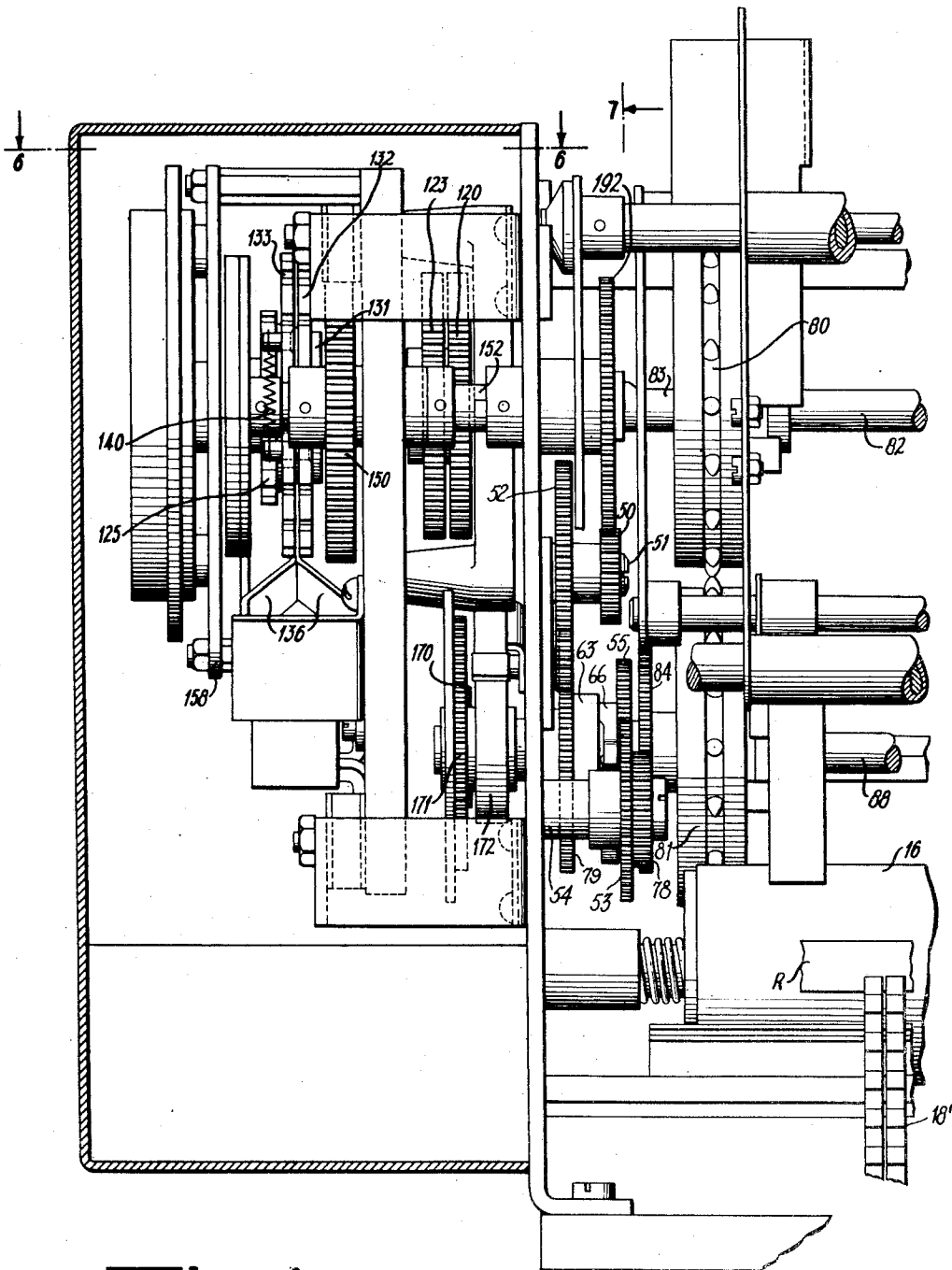


Fig. 4.

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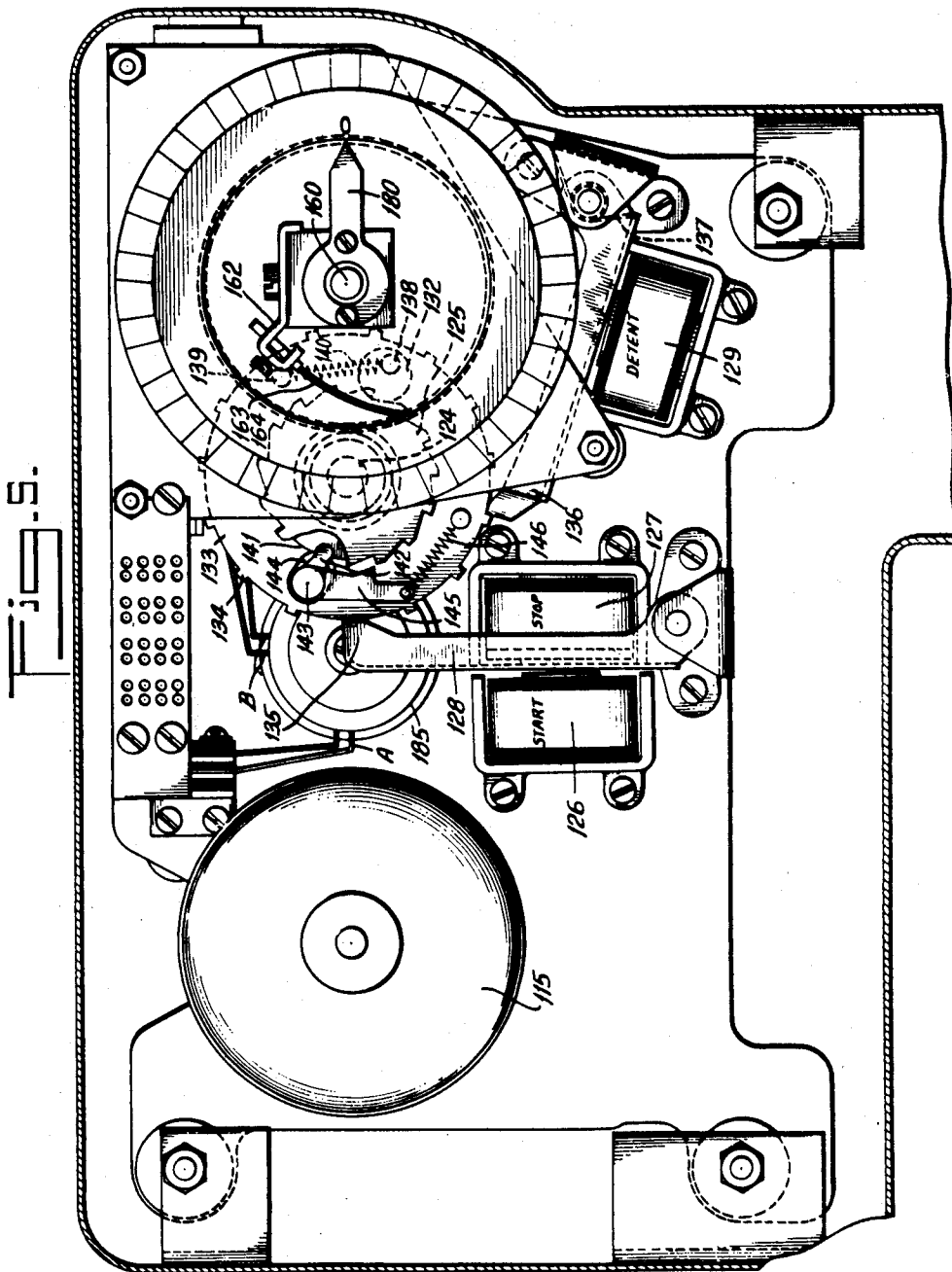
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10 Sheets-Sheet 4



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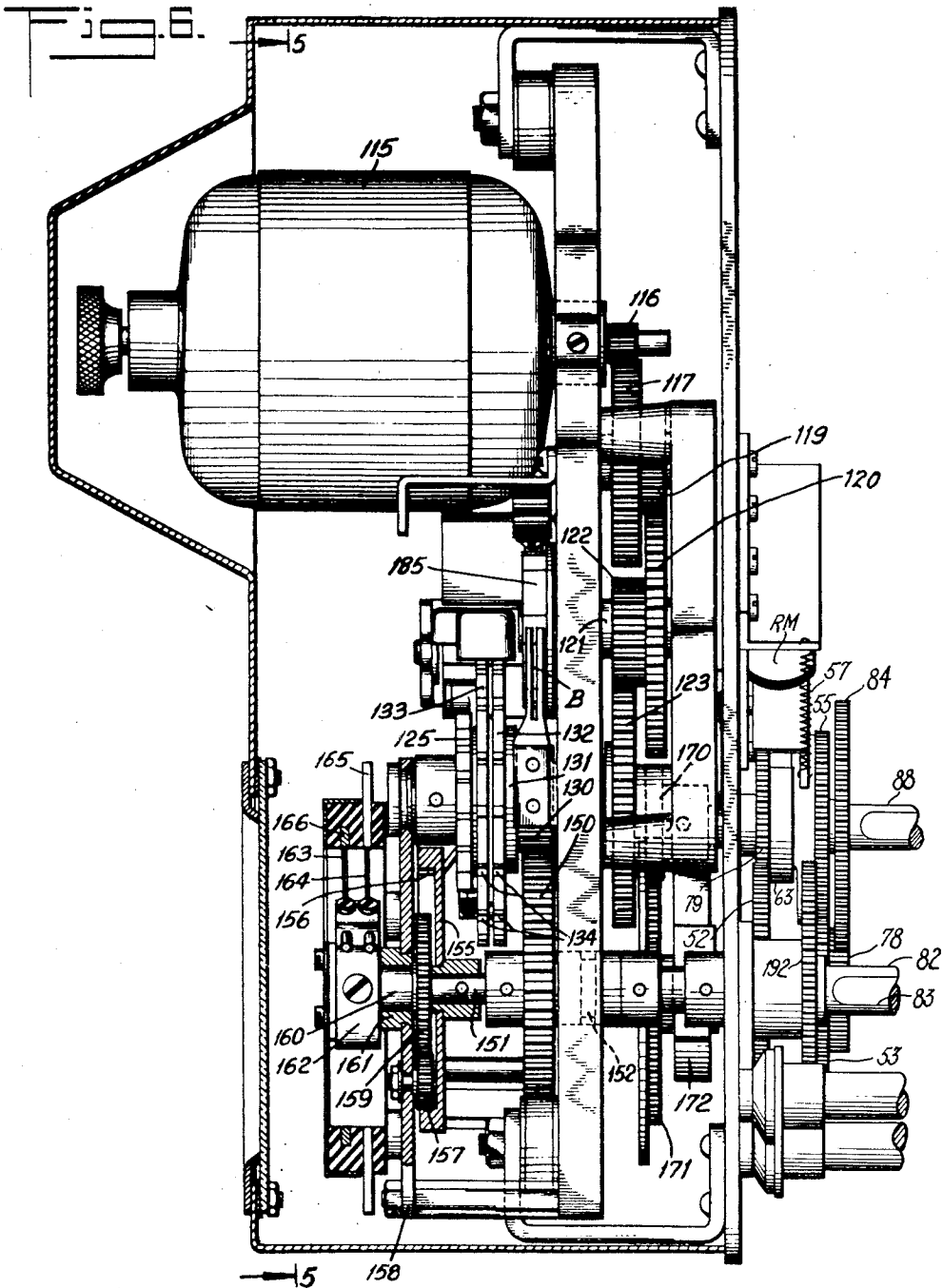
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10 Sheets-Sheet 5



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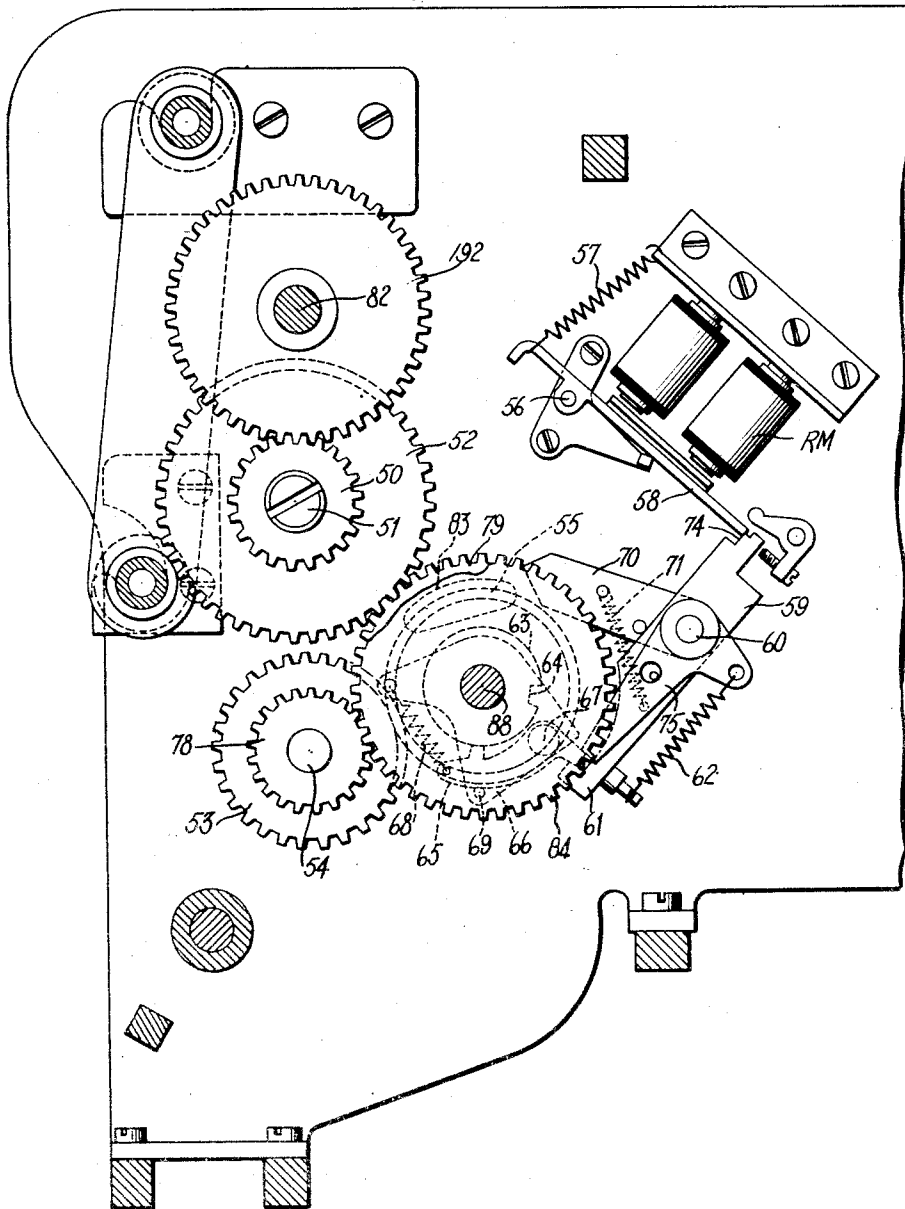
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10 Sheets-Sheet 6

Fig-7-



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10 Sheets-Sheet 7

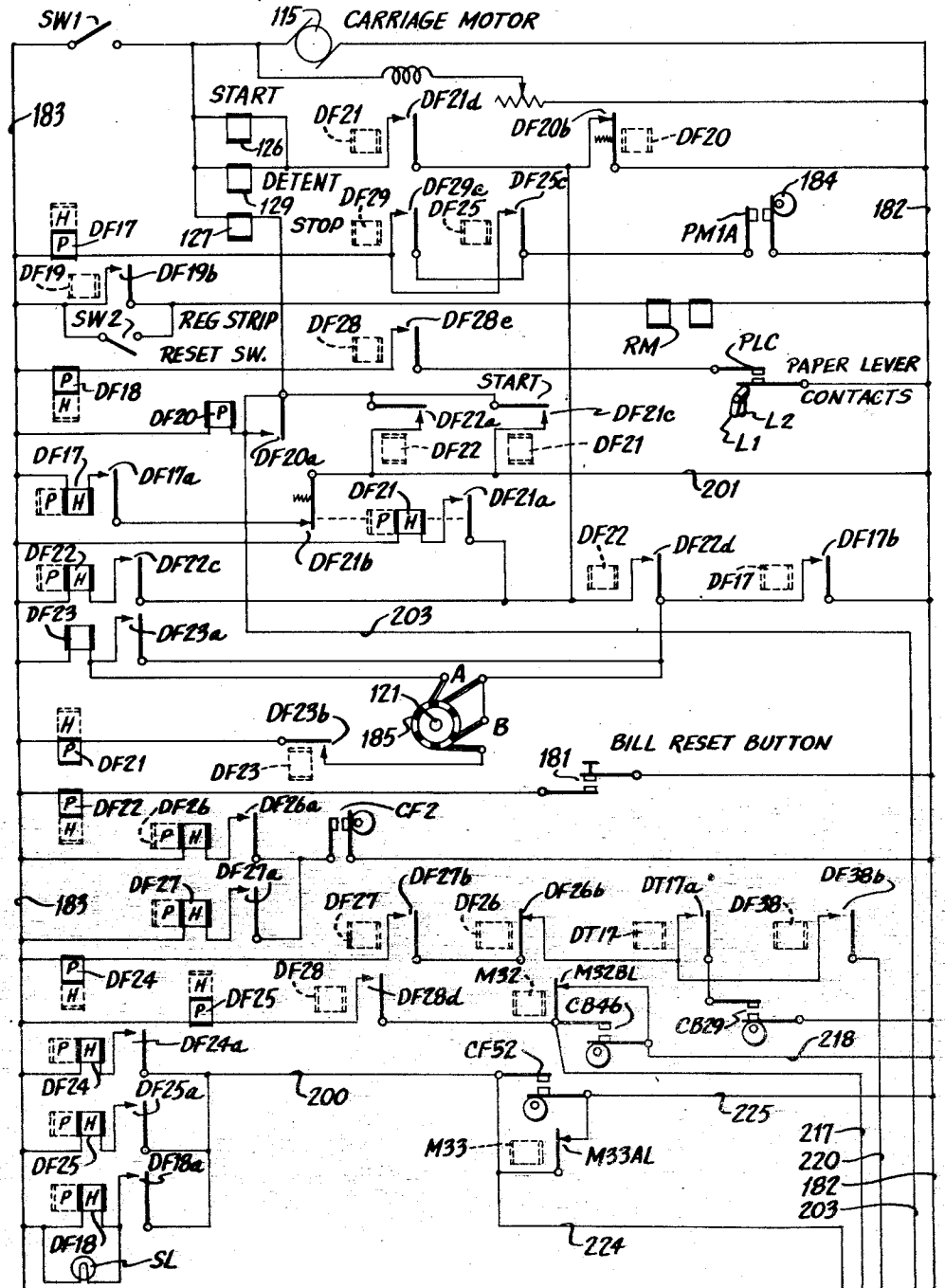


Fig. 9a. INVENTORS
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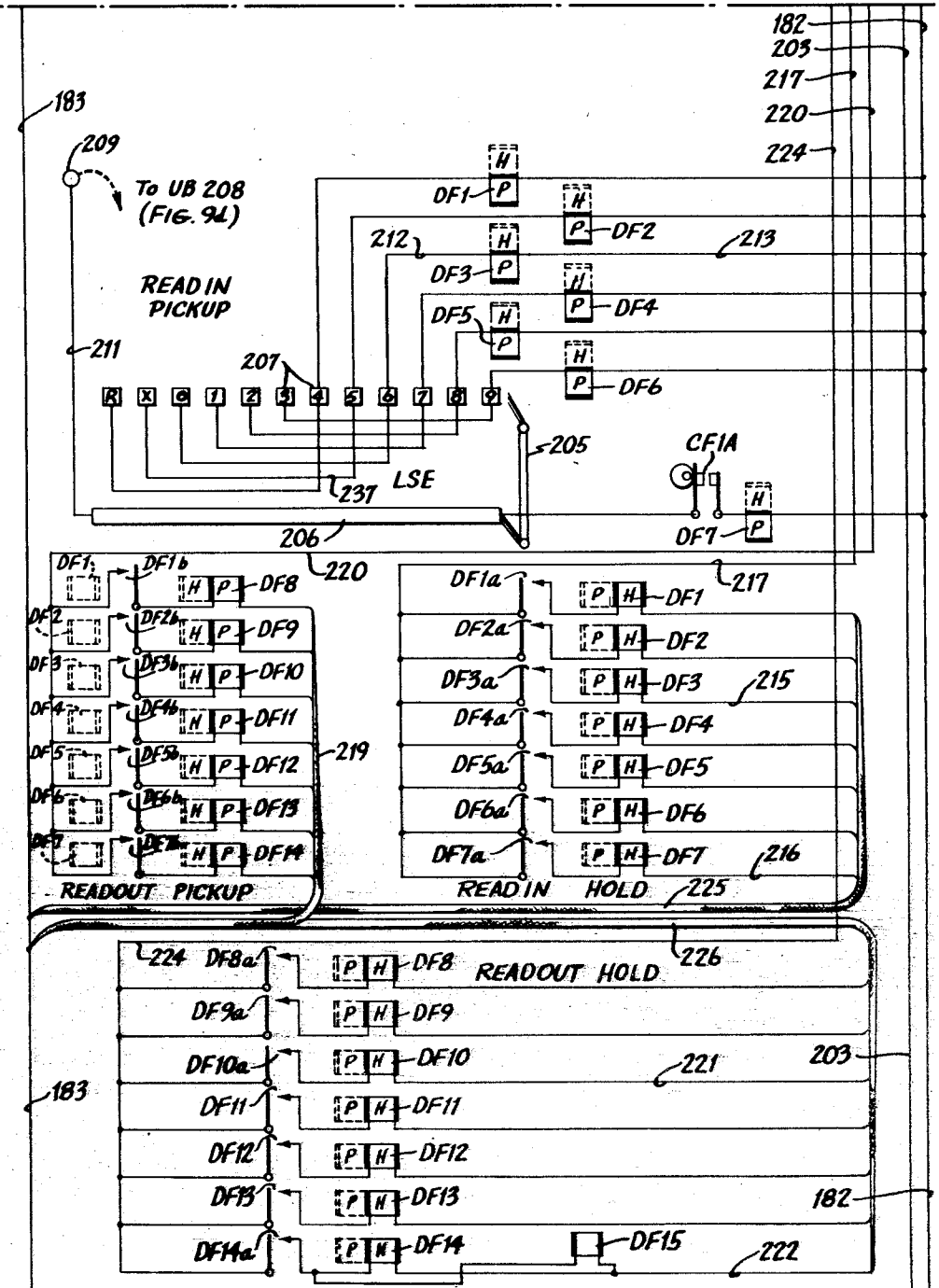


Fig. 9b

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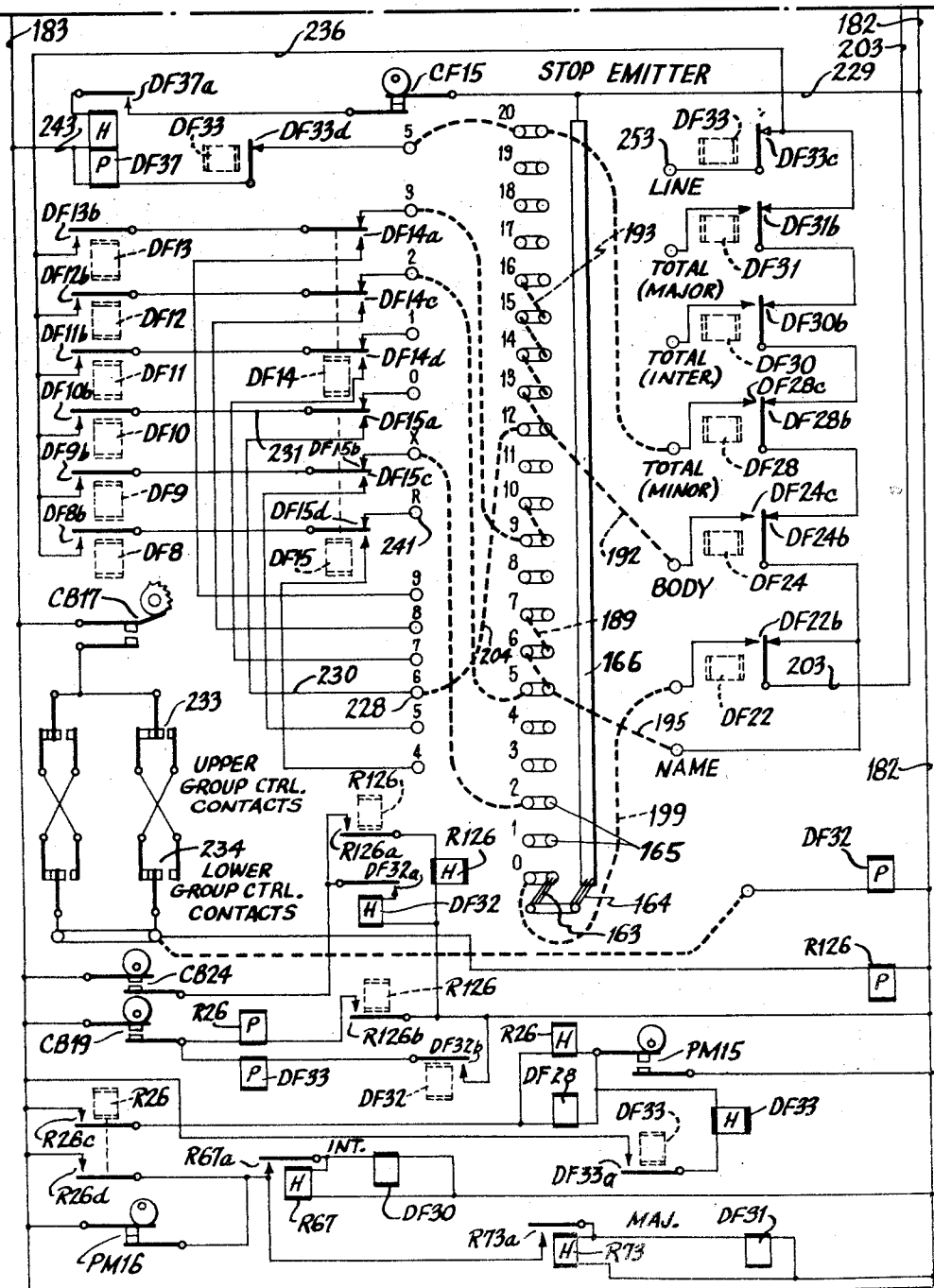
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10 Sheets-Sheet 9



19-9c-

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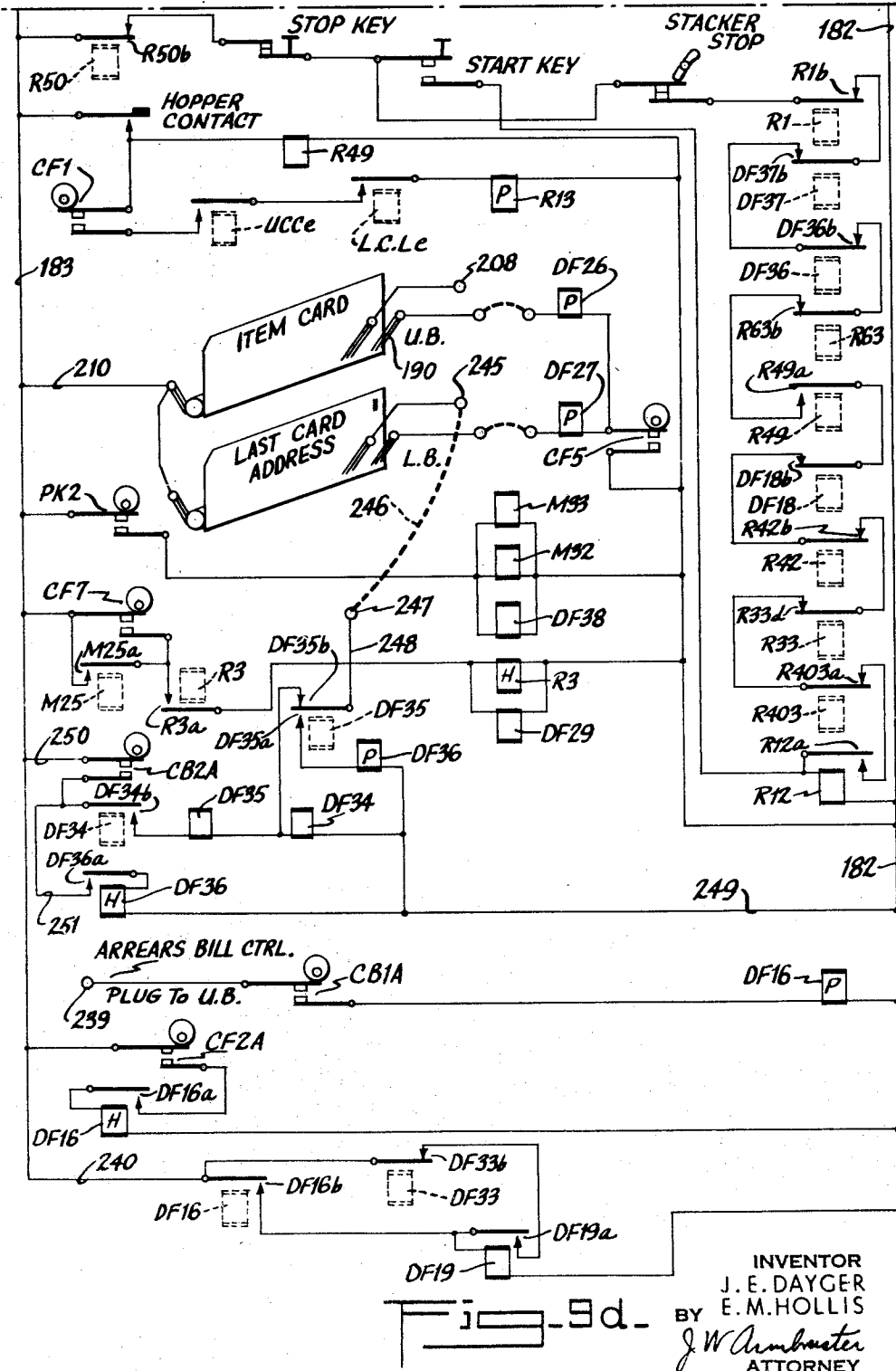
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UNITED STATES PATENT OFFICE

2,566,932

PAPER FEEDING MECHANISM

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Application September 25, 1948, Serial No. 51,282

10 Claims. (Cl. 197—133)

1

This invention relates generally to record feeding devices and more particularly to the automatic control of dual feeding devices so that selected items of a printed record such as a bill form are duplicated on a register sheet.

An object of the invention is to provide an improved dual feeding arrangement to effect duplication of certain recorded account information such as accounts in arrears, and to avoid duplicated recordings of other accounts such as ordinary paid up accounts.

Another object of the invention is the provision of a common driver and separate clutching connections to dual pin feed shafts to call in the advancing means of an original strip and a duplicate strip under control of perforated records. As shown, each group of cards of an account in arrears is preceded by an arrears signal card which serves to operate connections for clutching the duplicate strip drive to the main drive, whereby copies of only arrears recordings are made. Since the register strip ordinarily remains stationary under the bill strip and the carbon, all impressions are made on the register sheet. However, all such impressions made on the register strip while its drive is declutched are ineffective because the strip is preprinted with blackened horizontal stripes which are spaced to agree with the height of the bill forms and be presented at the printing line when the strips are in the home position.

Another object of the invention is the provision of dual record strips adapted for selective duplication wherein the duplicate strip is preprinted with a regular series of darkened horizontal areas agreeing in position with the division of the original strip into forms.

Another object of the invention is the provision of novel overflow detecting devices for stopping the machine when items presented extend beyond one form length.

Another object of the invention is the provision of means for not only selecting the clutching of a second drive to move a second or duplicate sheet in synchronism with a first sheet, but also to select the starting point of clutching so that the second drive is brought into synchronism with the first. An X perforation in a special signal card is sensed by devices which control a stopping position such that the separate clutch parts of the two drives are brought opposite each other in clutching position. Other devices sense the same perforation to prepare to energize a clutch magnet to connect the two feed devices when they are in the home position.

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This device is an improvement on the paper feeding mechanism shown in Daly Patent No. 2,348,059 issued on May 2, 1944 and reference may be made thereto for construction and operation in general. In the patent the register strip received all impressions in a condensed form and was advanced by line spacing. In the present case, the register strip receives only selected data and is advanced by clutching its feeding means to the driver of the original or bill strip.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 shows a sample group of cards of an account in arrears.

Fig. 2 shows a portion of the bill strip or original record which is divided into forms one of which is illustrated.

Fig. 3 shows a portion of the register strip or duplicate sheet which is also divided into forms with dark bands separating them.

Fig. 4 is a front elevation view of the drive gearing, clutch mechanisms and stop emitter.

Fig. 5 is a side elevation view of the stop emitter.

Fig. 6 is a plan view of the drive motor and gearing, and the stop emitter in section.

Fig. 7 is a sectional elevation view taken along line 7—7 in Fig. 4 and showing the clutch mechanism for connecting the register strip drive to the bill form drive.

Fig. 8 is a timing chart.

Figs. 9a, 9b, 9c and 9d taken together form a wiring diagram of the electrical controls of the dual feeding devices as coordinated with parts of a tabulator.

In Fig. 1 is shown one group of perforated control cards the leading card 1 of which is an arrears signal card with an X perforation 2 denoting a group which is to be singled out for duplicate recording on the register strip. It is understood that the illustrative set of six cards is but one of a series of such groups, some of which relate to accounts in arrears and others not. Such groups are distinguished from each other by group control number perforations and thus total cycles are taken automatically and a bill strip is advanced from form to form as explained in Daly Patent No. 2,348,059. In the same column that the X perforation is found on the signal card, the other cards have code number

perforations for selectively stopping the bill and register strip feed to place the record materials in predetermined line positions to receive the impressions of name, address, bill address, items, totals, etc. wherever desired.

The record materials consist of a file sheet or register strip 10, Fig. 3, and an original strip 11, Fig. 2, with bill forms. Both materials are continuous strips, but the bill strip is provided with weakened lines 12 which adapt sections of the strip to be divided into separate bills which are sent to the customers. The register strip 10, Fig. 3, is the file sheet which receives the same impressions made on certain of the bill forms, for example the arrears forms.

Both strips are drawn from supply hoppers behind the machine and advanced forwardly and upwardly around the platen 16, Fig. 4. The register strip 10 is the inner sheet in direct contact with the platen and it has marginal perforations engaged by the pins of a pair of pin feed wheels 81 on a shaft 88. Bill strip 11 is the outer sheet and is drawn over the strip 10 on the platen and it also has marginal perforations and is engaged by the pin feed wheels 89 on the feed shaft 82. Therefore, both strips are guided so as to partially surround the platen 16 at the printing line and then be directed upwardly and rearwardly beneath adjustable guide plates.

Adjacent the bill form is a conventional inking ribbon R so disposed that when the differentially adjusted type bars 18' are struck by hammers to effect the printing impression, the imprint will be made on the bill form 11. For providing carbon imprints of such impressions on the register strip, a carbon sheet may be interleaved between the strips 10 and 11 or it may be provided by a carbon coating on the underside of strip 11.

In order to eliminate or make ineffective the carbon impressions on the register strip when it is held stationary, strip 10, Fig. 3, is preprinted or marked with darkened or black horizontal stripes or bands 9 which are spaced on the strip to agree with the spacing of the bill forms. In other words, there is a series of such darkened bands on the register sheet and they are spaced at regular intervals; in the present instance they are spaced apart distances equal to the distance between the weakened lines 12, Fig. 2.

With the parts in the normal starting positions, the register strip 10 is positioned so that the horizontal center line of a dark band 9 coincides with the printing line at the platen. Therefore, all impressions made on ordinary bills are not recorded on the register strip, because the impressions are obscured on the stationary dark receiving area. It is only when the drive for the register strip is clutched to the bill feed drive that the light area of the register strip moves up to the printing line and receives impressions which are duplications of the recordings on a particular bill as shown in Figs. 2 and 3.

When a total is recorded at the bottom of a bill form and related register strip portion, the register strip is advanced to bring the center of the next dark band to the printing line while the bill strip is advanced to the zero point on a new form.

The bill strip is advanced by a separate feed drive motor through a train of gears and a magnetic clutching mechanism, the latter having electrical commutator controls so that the bill form may be advanced to predetermined positions for the address, item and total lines.

The driving motor 115, Fig. 6, drives a pinion

116 meshing with gear 117, and to said gear is secured a pinion 119 driving a gear 120. To the gear 120 is attached a pinion 122 which drives a gear 123 secured to a shaft 124, Fig. 5. Attached to the shaft 124 is a ratchet clutch element 125. Since motor 115 is in continuous operation, the ratchet wheel 125 is also rotated constantly.

The clutch mechanism is of a special design which enables a differential extent of movement of the pin feed mechanism for the bill form and will now be described in detail. The electromagnetic control for the clutch consists of a start magnet 126 and a stop magnet 127, the energization of the start magnet 126 attracting an armature latch member 128 to release the clutch and the stop magnet 127 reversely attracting the armature latch member 127 to disengage the clutch. To further hold the parts of the clutch in normal position and to prevent retrograde movement there is provided a detent magnet 129 with an associated latch armature 136.

Loosely mounted upon the shaft 124 is an assembly which comprises a gear 130 (Fig. 6), a spacing disk 131, and a clutch disk 132. Mounted adjacent the disk 132 is a similarly shaped disk 133 pivoted on the shaft 124 but rotatable independently of the disk 132. Each of the disks 132 and 133 have external detent projections 134 and in the normal position of the parts the aligned projections 134 of the disks 133 and 132 are held by the cross plate 135 of the latch armature 128. The armature 136 of the detent magnet 129 is urged by a spring 137 so that it, in turn, cooperates with other aligned projections 134 of the disks 132 and 133 in the normal position of the parts.

To the disk 132 there is attached a spring stud 138 and to the detent disk 133 there is attached a spring stud 139 and a normally tensioned spring 140 is fastened to each stud 138 and 139 so that since the detent disks 132 and 133 are independently rotatable, it will be observed that energization of the start magnet 126 causes the armature latch 128 to be drawn outwardly to disengage it from the aligned pair of projections 134 of the disks 132 and 133, enabling the normally tensioned spring 140 to rock the detent disk 133 slightly clockwise. This takes place because of the fact that the detent disk 132 is now held immovable by the train of mechanism from such disk which overcomes the force of the spring 140 so that the resulting action is to rock the detent disk 133 slightly clockwise. Attached to the detent disk 133 is a disk 141 which is notched to receive the rounded end of a lever 142 which is pivoted upon a stud 143 secured to the detent disk 132. It will be seen that the stud 143 passes through an aperture 144 formed in the detent disk 133. Attached to the lever 142 is a clutch pawl 145 in the plane of the clutch wheel 125. Obviously, the slight clockwise rotation of the detent disk 133 when the clutch is released will cause the disk 141 to rock the pawl 145 to engage a tooth of the clutch wheel 125, this action being assisted by a spring 146 attached to the clutch pawl 145. In this manner the clutch is engaged and the detent disks 132, 133 rotatively displaced relative to each other with the projection 134 of the disk 133 slightly ahead in a clockwise direction of the projection 134 of the detent disk 132 it was previously aligned with. It is also pointed out that when the start magnet 126 is energized the detent magnet 129 is also

energized and is kept energized for a length of time which varies according to the different extent of movement given to the driven members of the clutch. When the driven member of the clutch has been given a predetermined extent of rotation in a clockwise direction, the stop magnet 127 is energized by means of electrical controls to be later described and at this time the start magnet 126 is deenergized as well as the detent magnet 129. Hence, the latch member 128 will be positively drawn to the right so as to engage one of the projections 134 of the disks 132 and 133. The first one to be engaged due to the relative displacement of such detent disks 132 and 133 is the projection 134 of the disk 133 and this will be engaged by the cross plate 135 on the latch member 128, thereby holding the detent disk 133 and the member 141. The tooth of the ratchet clutch disk 125 is still engaged with the clutch pawl 145 and this will rotate the disk 132 clockwise independent of the disk 133, but since the member 141 is now stationary the resulting action is to rock the latch pawl 145 slightly clockwise to disengage it from the ratchet clutch disk 125 and at this time the projection 134 of the disk 132 will be engaged by the cross plate 135 of the latch member 128. At the same time, the armature 136 of the detent magnet 129 will engage upwardly over the projections 134 of the disks 132 and 133, and rotation of the driven member of the clutch will have been terminated and effected in a differential manner.

The driving connections from the aforementioned clutch to the pin feed mechanism for feeding the bill form are shown in Figs. 4 and 6. It will be noted that the driven pinion 130, Fig. 6, of the clutch meshes with a gear 150 which is secured to a shaft 151. The shaft 151 has a coupling connection 152 with the shaft 82 which is the pin feed drive shaft for the bill form. Obviously, the differential rotation of the shaft 82 will, through associated pin feed wheels 80, drive the bill form to the predetermined extent.

Of the electrical controls for determining the extent of the feed of the bill form, one consists of a commutator arrangement best shown in Figs. 5 and 6. In general, the driven member of the clutch drives a rotating brush assembly of a commutator which includes the brush assembly, a common conductor ring and commutator spots or segments. This unit is known as the stop emitter or commutator. The pin feed driving mechanism for advancing the bill form is directly geared to the brush assembly and operates in synchronism therewith. The commutator segments are so arranged that each spaced segment represents a printing line of the bill form and each time the brush assembly passes a commutator segment, the bill form advances one line and does so until a commutator segment which is rendered effective for circuit connections is engaged by the brush assembly, and as will be subsequently pointed out this stops the feeding of the bill form.

From Fig. 6 it will be observed that to the shaft 151 there is secured a gear 155 having internal gear teeth 156 which mesh with a pinion 157 loosely mounted upon a stud carried by the frame plate 158. The pinion 157 meshes with a gear 159 which is attached to a stud shaft 160 rotatably mounted in a bearing 161 carried by the side frame 158. The brush assembly consists of a holder 162 attached to stud shaft 160 and carrying brushes 163 and 164 which contact with commutator spots or segments 165 and the common conductor ring 166. Obviously by the above ar-

range ment the brush assembly is driven synchronously with the driven member of the clutch and the bill form pin feed mechanism.

The pin wheel drive for the register strip is selectively connected to the bill form feeding means. For this purpose a clutch is provided between shafts 82 and 88, Fig. 7, the former being the shaft carrying the upper set of pin wheels 80 and the latter being the shaft carrying the pin wheels 81. The train of gearing for driving the clutch may be noted as follows:

Attached to shaft 82 is a gear 192 in mesh with a pinion 50 pivoted on screw stud 51 and integral with a gear 52. The last mentioned gear meshes with a gear 79 loosely pivoted on shaft 88, and gear 79 has fastened thereto a clutch disk 63. Adjacent the disk and also loosely mounted on shaft 88 is a plate 66 on which is pivoted a clutch pawl 65 pivoted at 67. Alongside plate 66 and fastened thereto is a gear 55 also loosely mounted on shaft 88. Gear 55 meshes with gear 53 which is one of a pair of idler gears pivoted on a stud 54. The other gear 73 of the pair meshes with a gear 84 fastened to shaft 88. The two gears 79 and 84 are similar in size and appear as one in Fig. 7. By means of the train of gearing it is arranged so that shaft 88 makes one revolution per bill form and therefore the clutch is of the single tooth variety with the tooth of the pawl engaging in single notch 64 of disk 63 whenever the clutch is tripped for duplicating purposes.

A spring 68 tends to engage the pawl with the clutch disk but the pawl is normally held out by the hooked end 61 of a release lever 59 which is pivoted on stud 60. Coupled to lever 59 is a restoring arm 70 with a spring 71 pulling between the two so that the upper shouldered end of lever 59 abuts against an armature lever 58 pivoted at 56 and pulled away from register feed magnet RM by a spring 57.

Whenever the magnet RM is energized to clutch the register strip pin wheel shaft 88 to the drive shaft 82 of the bill forms, lever 58 is attracted and rocked counterclockwise and the lower end is raised above the shoulder 74 thus freeing lever 59 to be rocked counterclockwise to release pawl 65. When released, pawl 65 is rocked clockwise by spring 68 and the tooth of the pawl is dropped into the notch 64 to key the shaft 88 to the rotating disk 63 for one or more revolutions. Thus, the register strip is advanced with the bill form for one or more selected bill printing cycles to print duplications of special account forms such as accounts in arrears.

Restoration of release lever 59 is accomplished by a lug 83 on the side of gear 79. The lug strikes the under side of the end of arm 70, rocking it clockwise and carrying lever 59 along therewith to shift shoulder 74 to the right of the end of armature lever 58. This relieves the pressure of the lever 59 against the armature 58 and leaves it free to be tripped. If magnet RM has been deenergized then lever 58 will drop behind shoulder 74, if not, then it is a sign that two bill forms are to be duplicated, and lever 58 remains lifted and lever 59 swings back counterclockwise to leave pawl 65 connected to the disk.

When the hooked end 61 swings up into restoring position and stays there, then as the pawl comes into the home position the short arm is engaged and the pawl is rocked counterclockwise and disengaged from the disk to stop the register strip feed. A rebound preventing lever 75 is loosely pivoted alongside lever 59 and pulled

by spring 62 to snap behind the short pawl arm and prevent vibration as the pawl is disengaged.

The foregoing sections of the description deal mainly with the mechanism of the machine and the parts about to be considered relate more to the electrical controls and the wiring shown in Figs. 9a-9d.

At the top of Fig. 9a it is seen that in addition to the usual power supply switch, a dual carriage switch SW1 is provided to connect the carriage motor 115 between the two main lines 182 and 183. For purposes of illustration, all other controls are shown wired between the two lines.

As a preliminary to the proper placement of printing lines on the forms, the stop emitter or commutator should start at the zero position as indicated by the pointer 180, Fig. 5. With the emitter properly located the bill forms can be assembled on the pin wheels with the start positions at the printing line and proper feeding will then ensue.

It may be possible that the emitter is not at the zero position in which case a reset key 181 (Fig. 9a) is depressed and a circuit will be made from the line 182 to the line 183 through contacts closed by the reset key 181 to energize the pickup coil of a relay DF22. Relay coil DF22 like many others is a dual-wound relay which consists of a pickup coil and a holding coil which are respectively designated P and H, which designation is also made for other similar coils. The holding coil of relay DF22 or DF22 (H) will be picked up by contacts DF22c, a stick circuit for DF22 (H) then extending back to the line 182 through such contacts and relay contacts DF20b now closed. Hence, depression of the reset key 181 will cause the energization and maintained energization of relay coil DF22 which will transfer its contacts DF22b (Fig. 9c) and close its contacts DF22a, DF22c and DF22d.

The start circuit which provides an electrical control whereby the clutch is engaged so that the stop emitter may be reset to its zero position will now be described. The energization of the relay coil DF22 closes its contacts DF22d to thereby close the circuit from the line 182 through relay contacts DF20b, through relay contacts DF22d, thence through A circuit breaker contacts (to be subsequently described), through relay coil DF23 to the line 183. A holding circuit for the relay DF23 is established through stick contacts DF23a, contacts DF22d, and contacts DF20b now closed, back to line 182. Relay coil DF23 will now close its contacts DF23b so that when the B circuit breaker (to be subsequently described) closes, an impulse will be directed from line 182, relay contacts DF20b, the DF22d contacts now closed, the B circuit breaker contacts, through DF23b contacts to the pickup winding of relay coil DF21. The latter closes its contacts DF21a to pick up and maintain relay coil DF21 (H) energized by a circuit from line 183, relay coil DF21 (H), relay contacts DF21a, and relay contacts DF20b to line 182.

The energization of the start relay DF21 (H) will close its contacts DF21d so that a circuit will be made from the line 182 through contacts DF20b now closed, through contacts DF21d now closed, thence through the start magnet 126 and also through the detent magnet 129 (both of these being held energized as long as contacts DF20b are closed) and switch SW1 to line 183. The energization of both of these magnets will cause the clutch to be engaged and the commutator will rotate from the position in which it is in, if

it is off the zero starting position, and will continue until the commutator brushes 163 and 164, Fig. 9c, are at the zero position at which time a circuit will be closed from the line 182, wire 229, through the common conductor ring 166, thence by brushes 163 and 164 through the 0 commutator segment 165 and wire 199, thence through relay contacts DF22b now transferred, and wire 203, Fig. 9a, to the stop magnet 127. This same impulse is also directed to relay coil DF20 and the latter opens its contacts DF20b to thereby open the stick circuits for the holding coils of relays DF21, DF22, relay coil DF23, start magnet 126 and detent magnet 129. Obviously, when the zero position of the commutator is reached, the energization of the stop magnet 127 will disengage the clutch and the commutator will remain at such normal starting position. The provision of the contacts DF22b, Fig. 9c, is to cause, by the opening of its right hand contacts, the ineffectiveness of the plug connections which may have been made and which are utilized to cause the energization of the stop magnet 127 when predetermined spacings of the bill form are to be made. The opening of such contacts, therefore, prevents such control when the reset key 181 is depressed to zeroize the commutator.

If reset key 181 is held depressed after the zero position of the commutator has been reached with the commutator brush on the insulating space between "0" and "1," the continued energization of relay DF22 will transfer its contacts DF22b to keep relay DF20 energized, since a stick or energizing circuit for the latter is provided in this instance by DF20a contacts, DF22a contacts and wire 201 to line 182. As long as DF20 is kept energized by holding key 181 depressed its DF20b contacts are open to prevent another impulse from being directed to relay DF23 to initiate a succession of resetting cycles.

There will now be described in connection with the circuit diagram the manner in which predetermined spacings of the bill form are effected with the normal operation of the tabulating machine and under control of previously made plugging connections.

The improvements are incorporated in the form of tabulating machine shown in the patent to Peirce, No. 2,042,324, dated May 26, 1936, and the patent to Mills, No. 2,079, 418, dated May 4, 1937, such a machine having a printing mechanism shown in the patent to Mills, No. 2,016,682, dated October 8, 1935, which printing mechanism is capable of printing numerals and alphabetic characters.

The tabulating machine is provided with a card feeding mechanism which is shown in Fig. 6 of the Peirce patent, No. 2,042,324 and cards are successively passed through the machine, first to the upper analyzing brushes and thence to the lower analyzing brushes so that for each cyclic operation of the machine after the first card cycle, a card passes the upper and lower analyzing brushes concurrently, during which time operation of the printing mechanism occurs under control of the card at the lower brushes. Tabulating machines of this type are provided with several one-revolution shafts which are adapted to carry cams which open and close contacts. The present tabulating machine includes an additional cam contact designated "PM1A" shown in the circuit diagram of Fig. 9a and which has the timing for each total and item entering cycle shown in Fig. 8. It will be noted that this cam closes its contacts at approximately 243° of the

cycle and the print drive shaft 134 therefor is rotated one revolution for each operation of the printing mechanism. As will be made clearer later on, cam contacts PM1A render the circuit breaker 185 operative at 243° of the tabulator print cycle. The circuit breaker 185 is driven by motor 115 and is not in any way mechanically operated by the tabulating machine.

In the present machine, the cards which are successively passed through the machine comprise: First, a signal card in the case of arrears accounts, then one or more successive address cards, which latter are followed by one or more item or detail cards. Upon the change in classification of the item cards a total is automatically taken as is well known and during such total taking operations as will later be described in detail the bill form feeding operation is initiated after printing a total and this initiates, with the plugging arrangement shown in the circuit diagram, Fig. 9c, the feeding of the bill form and stopping it at line 5 of the sheet shown in Fig. 2. Such plugging may be made in the presence or absence of code number perforation control of feeding which has independent control over the stopping positions of the stop emitter. During the next cyclic operation of the tabulating machine the name card now passes by the lower brushes and the printing mechanism is adjusted so as to print the name on line 5 of the bill form and through the carbon printing sheet upon the register sheet. During the cycle of operation in which the name is printed, cam contacts PM1A close at 243° after the printing operation so that a circuit is closed from the line 182, Fig. 9a, through contacts PM2A, thence through card lever relay contacts DF29a and the pickup coil DF17 of a start control relay. At the top of Fig. 9d the relay DF29 is seen to be in parallel with the usual lower card lever relay R3 for operating contacts throughout the tabulator. Such card lever contacts are provided in the machine to enable the circuit closure now being described only when cards are beneath the lower brushes and such form of card levers and associated contacts is well known. The relay DF17 not only operates its contacts DF17a to put a stick circuit through its holding coil and closed contacts DF21b, but it also has contacts DF17b in series with the A circuit breaker to call relay DF23 into operation. The latter closes its contacts DF23a so that a stick circuit extends back through the relay contacts DF17b to line 182. During the time the relay coil DF23 is energized and its contacts DF23b are closed, the B circuit breaker contacts close so as to extend the circuit from the relay contacts DF17b through the B circuit breaker contacts, thence through relay contacts DF23b to the pickup coil of start relay coil DF21.

Attention is also directed to the use of the two circuit breakers A and B. The purpose of this arrangement is to provide a full and correctly timed start impulse to the start relay DF21 so that the clutch pawl 145 will engage a tooth of ratchet wheel 125 at the proper time. The two circuit breaker contacts A and B are shown in Fig. 5 and the commutator 185 therefor is secured to the stud shaft 121 which is driven by the driving motor 115. Contacts PM1A are located in the tabulator, and A and B circuit breaker contacts are driven by motor 115 so that it is necessary to provide the correct timing of an impulse and this is effected by setting the commutator of the circuit breakers.

As a preliminary to the start circuit through

the circuit breaker contacts, relay contacts DF17b in series therewith must be closed in a manner about to be explained. Cam contacts PM1A are effective to call in start control relay DF17 either when a card is under the lower brushes as indicated by closure of relay contacts DF29a, or on the last card cycle when cards run out as indicated by closure of relay contacts DF25a. Near the top of Fig. 9a it is noted that contacts DF29a and DF25a are connected in parallel, but both are in series between relay DF17 and cam contacts PM1A.

As already noted, relay DF29 is connected in parallel (Fig. 9d) with the usual lower card lever relay R3 and as long as cards are under the lower brushes circuits will be established thereto.

Relay DF25 is called in by a minor group change and is held beyond the cycle in which the change is sensed and into the next card feed cycle which is useful to hold on run out cycles. As explained more fully hereinafter, a relay DF28 is energized by a minor group change. This relay DF28 has contacts DF28b in series with the pickup coil of relay DF25. The circuit for picking up relay DF25 includes line 183, Fig. 9a, relay DF25, contacts DF28d, cam contacts CB46, wire 218 and line 182. Relay DF25 then closes contacts DF25a for a holding circuit and contacts DF25b for the operation of the start relay DF17 on runout cycles. The holding circuit passes along line 183, holding coil DF25, contacts DF25a, wire 200, cam contacts CF52, wire 225 and line 182. The start circuit includes line 183, relay DF17, either contacts DF29a or DF25b, cam contacts PM1A and line 182. Relay DF17 then closes contacts DF17a to prepare a holding circuit for a holding coil through the normally closed contacts DF21b of the main start relay DF21. The holding circuit includes line 183, relay DF17, contacts DF17a, relay contacts DF21b and wire 201 to line 182.

Summarizing the start conditions, it is noted that cam contacts PM1A close to call in relay DF17. The A circuit breaker contacts sense this condition and cause the energization of the interlock control relay DF23 and then when the B circuit breaker contacts close a correctly timed impulse will be sent to the start relay coil DF21.

Assuming that the desired synchronization has been obtained and start relay coil DF21 has been energized, the hold coil DF21 (H) energizes through the closure of relay contacts DF21a, the stick circuit for the hold coil being maintained through contacts DF21a and relay contacts DF20b back to line 182. At the same time, an impulse will be sent by the closure of contacts DF21d to both the start magnet 126 and the detent magnet 123, thereby initiating the engagement of the clutch after printing the name on the bill form and register sheet. Since, in the previous total taking operation the sheet was advanced to line 5 of the bill form, the brush assembly of the commutator will advance to the next position and with the present plugging arrangement commutator segment 6 of the group of spots 165 is effective to terminate feeding of the bill form after it has spaced one line, this being effected by circuits now to be described in detail.

When relay coil DF21 (P) is picked up by the circuit arrangement previously described, it will close its stick contacts DF21a providing a stick circuit for DF21 (H) extending back to line 182 through DF21a contacts and DF20b contacts now closed. It should be noted also that relay coil

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DF21 (H) will maintain contacts DF21d closed, thus causing detent magnet 129 and start magnet 126 to be retained energized by a circuit extending back to line 182 through relay contacts DF21d and DF20b. When relay coil DF21 (H) is energized it also closes its relay contacts DF21c which are in the stick circuit of relay DF20, the stick circuit for relay DF20 extending back to line 182 through relay contacts DF20a and DF21c.

When the stop emitter (top of Fig. 9c) is controlled from a line selection perforation in a card, then relay connections DF8—DF15 are effective to cause stopping control. In the absence of such card control, other functional controls are effective for calling in the stop relay DF20 and stop magnet 127. In order to stop at a selected line a plug connection may be made from any spot 165 to the "Line" plug socket 253. In the present instance it may be assumed that a plug wire is assembled between the "6" spot 165 and the Line socket 253.

Upon the passage of the brush holder of the stop emitter from the "5" contact spot 165 to contact spot 6, a circuit will be closed from line 182 through wire 229 and the common conductor ring 166, through the brush assembly 163, 164 when contact spot 6 is engaged, and thence by means of a plug connection to socket 253 a circuit will be extended to contacts DF33c closed except when sensing a signal card, and thence through contacts DF31b, DF30b, DF28b, DF24b and DF22b all in the normal closed position, wire 203, Fig. 9c, through the stop relay coil DF20 to the line 183, the impulse also being directed to the stop magnet 127.

When relay coil DF20 energizes it closes its stick contacts DF20a to thereby provide a stick circuit for the relay coil DF20 and the stop magnet 127 back to line 182 through the relay contacts DF20a and DF21c now closed.

The energization of relay coil DF20 will open its contacts DF20b to deenergize relay coil DF21 (H), the start magnet 126 and the detent magnet 129. Deenergization of relay coil DF21 (H) will open its contacts DF21c to deenergize relay DF20 and the stop magnet 127.

This action (energization of stop magnet 127 and deenergization of start magnet 126 and detent magnets 129) moves armature 128 into position to declutch the clutch mechanism and stops the brush of the commutator as the brush 163 just passes the sixth spot to contact the next insulating space. The bill form is now at the sixth printing line.

During the cycle of the tabulating machine in which the first address card is used to control the operation of the printing mechanism, a printing operation will take place so as to print this data on line 6 of the bill form. After such printing, cam contacts PM1A again close to cause a repetition of the feeding of the bill form to the next line, this being effected by means of the plug connection 189 and a feeding of the bill form will then take place to line 7.

After printing the third line of the address, feeding of the bill form ensues in the manner just described but due to the plugging connection shown (and assuming the absence of a meter address card and absence of plugging to spots 6 and 7) spacing operations are effected to space the bill form to line 12 of the bill form. The circuit for effecting the feeding of the bill form from line 7 to line 12 will now be described in detail.

It is optional to initiate the feeding of the bill

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form to the first line of the item imprint area by a control about to be described.

In general, the feeding of the bill form from the last address line to the line receiving the first amount of the bill is initiated upon the passage by the lower brushes of the last address card and concurrently the first item card past the upper brushes. This is determined by a control coordinated with the same column of all the cards. All of the name and address cards are perforated at the X index point position of this controlling column, but the item cards are not, and if two successive name and address cards are so perforated the control will be inoperative. However, upon the feeding of the last address card past the lower analyzing brushes and the first item card past the upper brushes, the control will be operative to cause the spacing of the bill form to the first body line which receives the first item print.

This control is shown diagrammatically in Fig. 9d and it will be seen that the upper and lower contact rollers of the upper and lower analyzing brushes, respectively, are connected to the line 183 by a wire 210. Brushes 190 are coordinated with the X index point position so that upon the passage of two successive name and address cards having perforations at the X index point position, relay coils DF26 and DF27 will both be energized, the circuit being continued to the line 183 through card feed cam contacts CF5 which are closed at the time the X index point position is analyzed. Relay coils DF26 (P) and DF27 (P) will pick up respective hold coils DF26 (H) and DF27 (H), Fig. 9a, the stick circuit extending back to line 182 through cam contacts CF2. The cams controlling the card feed contacts designated CF, of which CF5 and CF2 are two, are driven by a shaft which is rotated during card feed operations. This shaft corresponds to the shaft designated 385 in the patent to Peirce, No. 2,043,324 in Fig. 4 thereof which shows similar CF cams and contacts. Contacts DF27b are closed upon the energization of the relay coil DF27 and contacts DF26b are opened by the energization of the relay coil DF26 so that it will be seen from the circuit shown that under such conditions heading control relay coil DF24 will not be energized.

However, when the last address card which bears a perforation at the X index point position passes by the lower brushes to energize relay coil DF27 and when the first item card concurrently passes by the upper brushes and which does not bear a perforation at the X index point position, relay coil DF26 will not be energized so that upon the closure of relay contacts DF27b, relay coil DF24 (P) will now be energized, the circuit being extended to line 182 through a customary digit transfer contact DF17c (closed at X time) and cam contacts CB29. The pickup coil of relay coil DF24 will close its contacts DF24a to thereby cause the energization of the hold relay coil DF24 (H) and the hold coil will continue to keep contacts DF24a closed as long as cam contacts CF52 remain closed and contacts M33AL in the case of multi-line printing. From Fig. 8 it will be observed that card feed contacts CF52 will maintain relay coil DF24 (H) energized during the remaining part of the cycle and also for a greater portion of the next cycle, since it is desirable to keep relay coil DF24 energized and its contact DF24b, Fig. 9c, transferred to enable the spacing of the bill form to

the maximum extent determined by the width of the sections of the bill form.

During the tabulating machine cycle that the last address card controls to print the last line of the address, the clutch for the bill form spacing mechanism will be engaged in the manner previously described and the brush assembly of the commutator will move from contact spot 7 to contact spot 8, etc., but since such contact points have not been plugged for circuit connection it will be ineffective and the brush assembly will continue to move to make contact with contact point 12 and at this time the circuit will be closed from the line 182 through the commutator and extended by a plug connection 192 so that the circuit will be continued through contacts DF24c now transferred, thence through relay contacts DF22b and wire 203, Fig. 9a, to the relay coil DF20 and the stop magnet 127. Thus, bill form spacing operations will terminate when line 12 of the bill form has been presented to the printing line.

After this, successive item cards pass through the machine and by means of cross plug connections 193 the bill form is spaced line by line as the items represented by the item cards are printed. Such operations continue and in the present example five lines have been allocated for receiving such item imprints and these will vary with each customer's bill. When the last item card has passed by the upper brushes, the first name card for the succeeding bill passes by the upper brushes and automatic group control in the machine ensues in a well known manner. This control initiates total taking and total printing operations and upon taking the total the bill form is spaced from the last printed line to line 20 in the present example so that the total may be printed on line 20 of the bill form.

The spacing of the bill form to line 20 in the present example is initiated by the well known auto group control. This form of control is a well known part of the tabulating machine in which the present improvements are incorporated and is fully shown and described in the aforementioned patent to Mills, No. 2,079,418, dated May 4, 1937. In general, the tabulating machine is provided with group control devices for sensing and comparing the group number perforations on successive cards under the upper and lower brushes. All of the name, address and item cards of each group are perforated to represent the same account number. Obviously, when the last item card such as an arrears card passes by the lower brushes the first name card of the succeeding group passes by the upper brushes and with the well known group control described in the aforementioned patent, a minor group control magnet designated MI in the above patent to Mills is energized.

In order that operations to be subsequently explained are properly timed with the group control mechanism it is preferable to utilize in the present machine the group control circuits fully shown and described in the patent to D. W. Rubidge et al. 2,340,772, dated February 1, 1944. Recourse may be had to such disclosure for a complete understanding of the group control mechanism but for convenience in reference, the group control circuits involved in the present machine are illustrated in Fig. 9c.

Referring to Fig. 9c, reference character 233 refers to the upper group control contacts and 234 designates the lower group control contacts. It is known that upon an agreement in perfora-

tions in the same card column of the cards at the upper and lower brushes, contacts 233 and 234 will be simultaneously shifted from normal position and will not close a circuit path. If either of the contacts 233 or 234 is transferred first and before the other contacts, the following circuit will be made: from line 183, through cam contacts CB17, through contacts 233 and 234, one of which is transferred and the other is at normal position, thence through the pickup coil of relay coil R126 to line 182. Relay coil R126 closes its contacts R126a, picking up the hold coil of relay R126 through the stick contacts CB24. The hold coil of relay R126 will close its contacts R126b to pick up a relay coil R26 by a circuit from line 183 to cam contacts CB19, pickup coil of relay R26, relay contacts R126b to the line 182. Hence, during the cycle in which a change in group designations is sensed, relay coil R26 will be energized. The pickup coil of relay R26 will close its contacts R26c, closing a stick circuit from the line 183 through relay contacts R26c, the hold coil of relay R26, and cam contacts PM15 to the line 182. Because of the timing of the PM15 contacts, relay coil R26 will be energized for the remainder of the cycle in which a change in group designations is sensed and for a greater part of the next cycle, which is the total taking and total printing cycle. In the present machine a pair of relays DF32 and DF33 are connected to be operated as the ordinary group control relays are operated and correspond respectively to relays R126 and R26. There is also another relay DF28 shunted across relay R26. In effect the two dual feed control relays DF28 and DF33 have the same timing and action as the ordinary minor control relay R26, the difference being that the two have contacts in the special dual feed controls of the present invention as explained throughout this specification.

Relay DF28 closes contacts DF28d, Fig. 9a, to call in the pickup coil of another total control relay DF25 which is held operative longer than relay DF28. The pickup and holding circuits for relay DF25 are described hereinbefore with reference to action on the start controls and relay DF17 by contacts DF25c in series therewith.

After the total has been printed the start circuit for engaging the clutch for spacing the bill form will be energized during the total taking cycle the same as in printing items, it being understood that contacts PM1A also close during the total taking cycle. The bill form will then be spaced from line 20 to the next commutator segment to which a plug connection has been made. By means of a plug connection such as wire 195 from the "5" spot the impulse is directed to the stop relay DF20 and the stop magnet 127 by the circuit connection previously described in detail. The next successive section of the bill form will now be in position for receiving the printing of the name of the next group.

It is also desirable that upon the passage of the last item card of the last group that the bill form be spaced from the total printing position to the next section and from the circuit diagram it will be observed that lower card lever contacts R3a, Fig. 9d, would be open and relay DF29 deenergized upon the passage of the last card by the lower brushes. The transmission of the start impulse to the start control relay DF17, Fig. 9a, and in turn to the start relay DF21 is effected under such circumstances through the closure of relay contacts DF25c instead of through card lever relay contacts DF29a which are now open.

Hence, during the total taking operation for the last group the bill form will be spaced to line 5 of the next bill form.

At this point it is well to point out a basic difference between the present machine and the devices of Daly Patent No. 2,348,059. In the feed control of the patent, the card had no means of selecting the extent of paper feeding advance. In the present instance, a column of perforations in the cards is devoted to code perforations for the selection of line positions on the bill form. A carriage plugboard (top of Fig. 9c) is provided which is used to select desired positions to stop the advance of the forms to receive address, item and total lines in predetermined places on the forms. There are plughubs 0-9 and X, R corresponding to all possible perforation positions in the line selection column of the cards. Opposite these are the 0-20 plughubs representing the line positions of the stop emitter 165, 166, already described. The additional functionally controlled plughubs Name, Body, Total (Minor, Inter. and Major) and Line are arranged with transfer contacts to take precedence over card controlled line selection. The record feeding devices are started near the end of each tabulator printing cycle and the feed is stopped by the emitter with the emitter brushed between commutator spots 165.

The line selection feature provides means whereby each card by a code perforation therein is adapted to select the line of the bill form which is to receive the printed data of the card. The bill and register strips will advance from any line to any other line in a forward direction. For example, if the cards are punched with line selection code holes 2, 3 and 6 and are fed in the order given, by plugging it is possible to print the data from such cards on lines 5, 9 and 12, respectively, on the bill form. In other words, the code hole values need have no relationship to the line values, other than that they are both in ascending order.

In order to illustrate the operation of line selection by a card exercising control over the stop emitter it is believed best to take an example and trace the effects all the way through. Assuming that the machine is in operation, that some cards of a group are already fed and some lines already printed on a bill form, and a card is advanced under the upper brushes UB with a "6" perforation in the line selection column. Also assume that the "6" plughub of the carriage plugboard, Fig. 9c, is connected by wire 204 to the "12" spot 165 of the stop emitter. Then the following circuit connections are made to exercise feed stoppage after printing.

As the card passes under the upper brushes UB, there is moved in synchronism therewith, the brushholder 205, Fig. 9b, of a line selection emitter LSE which is mounted on any card feed shaft. The brushes of emitter LSE move over common contact strip 206 and spots 207 in the order 9, 8, 7, etc. as the related perforation positions of the line selection column pass under the plugged brush UB. When the "6" position is reached and a perforation detected, then a circuit is established as follows: line 183, Fig. 9b, wire 210 to common roller and through card at upper brushes and brush UB connected to socket 208, a plug wire to socket 209, Fig. 9b, wire 211, contact strip 206, brushes and brush holders 205, "6" spot 207, wire 212, pickup coil of relay DF3, wire 213 and line 182. A relay DF7 is also picked up because it is in series with common strip 206 and a pair of cam contacts CF1A closed during the passage

of the 4 to 9 perforation positions. By arranging the relays DF1-6 to be energized without relay DF7 for the five positions R, X, 0, 1, 2, and 3, and with the relay DF7 for the five positions 4-9, it is possible to cut down to seven the number of relays used for the twelve positions.

Relays DF3 and DF7 are held by circuits through their holding coils as shown on Fig. 9b. Relay DF3 closes contacts DF3a and relay DF7 closes contacts DF7a and then, since both holding coils are connected to line 183 by wires 215 and 216 and cable 225, parallel circuits are directed therethrough to wire 217, Fig. 9a, cam contacts CB46 and wire 218 to line 182. Contacts CB46 hold the circuits until the selection is transferred to another set of relays DF8-14, Fig. 9b, which relays DF10 and DF14 are picked up by the closure of contacts DF3b and DF7b. On multi-line printing operations contacts CB46 are shunted for one or more extra cycles by the relay contacts M33BL which together with contacts M33AL are operated as set forth in the line printing control Patent No. 2,426,049, issued on August 19, 1947, to E. J. Rabenda et al.

The circuits through the readout pickup magnets DF10 and DF14 are in parallel through the cable 219 connected to line 183 and contacts DF3b and DF7b connected to wire 220. Wire 220, Fig. 9a, is connected to one side of relay contacts DF38b closed by the picker knife relay, and then through the usual digit transfer contacts DT17a closed late in one cycle and continuing closed until the mid point of the next cycle, finally the circuit passes through cam contacts CB29 and line 182.

Holding connections are established for the readout coils of magnets DF10 and DF14, Fig. 9b, to hold the selection until the related card is past the lower brushes and printing effected thereby. Relays DF10a and DF14a are closed and the holding coils called into operation by parallel circuits through wires 221 and 222 to cable 226 and line 183. Both holding circuits go through the common wire 224, Fig. 9a, cam contacts CF52 and wire 225 to line 182. Arranged in shunt with the holding coil of relay DF14 is another relay DF15 which is used as an auxiliary line selection device.

Referring to the top of Fig. 9c it is seen that the two effective relays DF10 and DF15 close a circuit path to the "6" plug socket 223 which is plugged by wire 204 to the stop emitter "12" spot 165. When the twelfth line is reached on a form as indicated by the advance of the stop emitter brushes 163, 164 to the "12" spot, then a stop circuit is initiated as follows: line 182, wire 229, common contact strip 166, brushes 164, 163, the "12" spot 165, plug wire 264, socket 228 and wire 230, relay contacts DF15a (relay DF14 is used for the other three digits 7, 8 and 9), wire 231, relay contacts DF10b, wire 238, and then a series connection through relay contacts DF31b, DF30b, DF28b, DF24b and DF22b, respectively, for other functions taking precedence over line selection but now in the normal closed position, wire 263, Fig. 9a, the coil of the stop control relay DF20, and stop magnet 127 to line 183. Then stop magnet 127 is effective, as explained with reference to Fig. 5, to stop the record feeding clutch and the stop emitter.

The foregoing sections referred to a mid operation cycle as an example of card controlled stopping; now it is to be assumed that starting conditions are in effect. Assume that an ar-

rears group of cards are entered as shown in Fig. 1 with the arrears signal card punched at X in the line selection column and an address card punched "2," a meter address card punched "3" detail cards punched "6," and plugging made as shown in Fig. 9c with the minor total control plugged to line 20 which is also an overflow control.

After placing the cards in the machine, two cards are run and a control change occurs. The two start cycles and the idle total cycle will cause advance of the feed so that the bill strip 11 can be placed on the pin wheels with the carriage reset to the "0" spot. The register strip 10 is placed on its pin wheels with the black stripe 9 at the printing line with the register clutch latched in the home position. Now the reset button is pressed and the paper carriage advances to the first hot emitter position which has been prepared.

As the signal card 1 passed the upper brushes UB, the line selection circuit was operated through the "X" punching 2. The circuit was as follows: line 183, Fig. 9d, wire 210, the common roller and through card 1 in the "X" hole by brush UB connected to socket 208, a plug wire to socket 209, Fig. 9b, wire 211, contact ring 206, brush holder 205, "X" spot 207, wire 237, "5" spot 207, relay DF2 and line 182. Relay DF7 is not picked up at this time because its timing is limited by cam contacts CF1A to the 4-9 positions.

Relay DF2 then holds and picks up relay DF9 which is also held and closes its contacts DF9b (top of Fig. 9c) in series with normally closed contacts DF15b and the X socket which is plugged to the "2" spot 165 of the stop emitter.

By means of the foregoing connections, the carriage is stopped at the "2" position after feeding is initiated on the idle total cycle by the pickup of relays DF17, DF23, DF21 and the start and detent magnets 126 and 129.

This stop by the emitter is not for printing purposes and occurs on an arrears group for spacing control and aligned clutching of the register strip.

Concurrent feeding of the register strip with the bill strip is also controlled by the "X" perforation 2 in the arrears signal card 1. In other words, the signal card not only selects dual feeding by clutch operation but also selects the place for clutching of the duplicate feed devices. The arrears bill control hub 239, Fig. 9d, is plugged to the upper brush socket 208 along with the plugging to socket 209, Fig. 9b, already described.

The clutch operation initiating circuit includes line 183, Fig. 9d, wire 210, through the common roller and signal card "X" hole, and brush UB of the line selection column, socket 208, a wire to socket 239, cam contacts CB1A closed at the X time, pickup coil DF16 and line 182. Relay DF16 is held through contacts DF16a and CF2A until the next card feed cycle. Relay DF16 also closes contacts DF16b to pick up control relay DF19 by the circuit: line 183, wire 240, relay contacts DF16b, relay DF19 and line 182. Relay DF19 is held by its own contacts DF19a in series with contacts DF33b which hold until there is a change of card groups.

Relay DF19 also closes contacts DF19b, Fig. 9a, in series with the register strip clutch magnet RM. This causes release of the clutch pawl 65, Fig. 7, and engagement of the notch of disk 63 at about the "2" spot position on the stop emitter and the register strip is then ready to be

advanced in step with the bill to duplicate the arrears account and be disengaged only on the next unequal impulse or group change action on relay DF33 marking the end of the billing group.

The carriage is now standing at the 2nd line and is advanced to the next hot stop emitter spot by a list cycle while feeding the signal card through the lower brushes at which time the address card is feeding under the upper brushes. Since a "2" was assumed punched in the line selecting column of the address card, and since the "2" socket 241, Fig. 9c, is plugged to the "5" line spot 165, the feed devices will stop accordingly.

The "2" is sensed in the line space emitter LSE, Fig. 9b, and relays DF5 and DF12 are picked up and held. The setup of the circuit for holding relay DF12 is such that it is held for two printing cycles through the cam contacts CF52, Fig. 9d.

At the time the address card is fed into the lower set of brushes for first line printing, the meter address card is fed through the upper brushes and stops between zero and one. However, the meter address card is punched "3" and this line selection code number must be sensed and stored for future use without interfering with the "2" line selection control in effect at the time. This is accomplished by relay contacts DF38b, Fig. 9a, which are in series with wire 220, Fig. 9b, and the readout pickup coils of relays DF8—DF14 to prevent them from being energized until the picker knife contacts PK2, Fig. 9d, close in series with relay DF38 indicating that the second address card is being advanced down from the upper brushes.

After the addresses are printed, the detail cards "Consumption," "Merchandise" and "Arrears," are fed in, and the "6" line selection perforations therein are plugged to select lines 12, etc., on the record materials.

Assuming that there are ten detail cards instead of three, then there will be an overflow condition. In jumping on the stop emitter, Fig. 9c, from the last detail spot 165 to the "20" spot it is found that the minor control contact DF28c is not closed and we have an overflow condition instead of a total condition. Since the next card advanced under the upper brushes is a "6" punched detail card, and since plugging from "6" is to line 12, etc., the stop emitter and record materials advance from line 19 of one form to line 12 of the next form.

If it is desired to stop bill printing to identify all overflow bills, then the "20" spot of the emitter will also be plugged to the "S" plug socket. The circuits for stopping the machine when the emitter brush touches spot "20" on an overflow condition is as follows: line 183, Fig. 9c, wire 243, pickup coil DF37, normally closed relay contacts DF33d (opened on a group change to prevent an overflow circuit), socket S, a wire to spot "20," brushes 163, 164, contact ring 166 and wire 229 to line 182. Relay DF37 is held by a circuit including line 183, wire 243, holding coil DF37, contacts DF37a, cam contacts CF15 closed until the middle of the next cycle, wire 229 and line 182. Near the bottom of Fig. 9c it is seen that relay DF37 has normally closed contacts DF37b in the stop key circuit to relay R12 of the usual tabulator running controls.

When the machine is again started, listing takes place for the remainder of the ten detail cards and then a group change is detected. Then both relays DF28 and DF33 are energized. Relay DF28 closes contacts DF28c to make the "20"

spot of the emitter effective as the stopping position for total recording. At the same time relay DF33 is effective to open contacts DF33b, Fig. 9d, to deenergize relay DF19 which then opens contacts DF19b, Fig. 9a, in series with the clutch magnet RM. Deenergization of magnet RM, Fig. 7, and restoration of lever 59 puts the hooked end 61 in the path of pawl 55 so that when the feed devices are restarted to go beyond line 20, the bill form passes the zero point and the register strip clutch is latched up with the register strip presenting a blank form with the dark stripe at the printing line where it remains until another arrears signal card is sensed.

It is at times desirable to stop the machine to identify or study special account groups such as Government account cards. Such cards are double punched in one reserved column and a detector circuit is provided to read and control from such double punchings. In Fig. 9d the stopping control may be traced as follows: line 133, wire 210, the common roller and through the first hole in the card by the lower brush LB, socket 245, wire 246, socket 247, wire 248, normally closed relay contacts DF35b, relay DF34, wire 249 and line 182. Relay DF34 then calls in relay DF35 by the closure of contacts DF34b in series with relay DF35 and the cam contacts CB2A closed for the first half of the cycle and connected to line 183 by wire 250.

Relay DF35 then shifts its contacts to open contacts DF35b and close contacts DF35a in series with the pickup coil of another relay DF36 which is energized by the second hole in the Government account card. A sustaining circuit for relay DF36 is established through line 183, wire 250, cam contacts CB2A, wire 251, relay contacts DF35a, holding coil DF36 and wire 249 to line 182. Relay DF36 has normally closed contacts DF36b, Fig. 9c, in series with the many other stop controls of the regular tabulator circuit. Opening of contacts DF36b stops the machine for manual identification and treatment of the bill.

In addition to the automatic advance of the register strip under control of the X punching in an arrears signal card, there are two other manual means for advancing the register strip. In two instances the clutch magnet RM must be energized first in order to connect the pin wheel shaft 88 of the register drive to the main drive. It is already explained that relay DF19, Fig. 9a, closes contacts DF19b in series with magnet RM to effect automatic clutch operation for dual feeding. Now it may be noted that switch SW2 is in shunt with contacts DF19b and can be closed at any time early in a bill feed operation to cause clutch connection for dual feeding. As a third control, a knob is fastened to the outer end of shaft 88 for manual advance of the register strip.

A sheet stop and signal device is provided under control of paper levers cooperating with both record materials to detect exhaustion of one or the other or both. Relay DF18, Fig. 9a, is called into operation by the closure of lever contacts PLC. There are two levers operating on the contacts, lever L1 resting on the bill strip so that when it is exhausted, the lever rocks and closes contacts PLC. The other lever L2 rests on the register strip so that when it is exhausted it also closes contacts PLC.

The pickup of the machine stop and strip exhaustion signal is withheld until a bill form is completed by interposing total and group control relay contacts DF28e between paper lever

contacts PLC and relay DF18. As a total is printed, relay contacts DF28e close, and if paper in either strip is in a short length behind the platen, lever contacts PLC are also closed and the pickup coil of relay DF18 is energized.

Near the bottom of Fig. 9a it is seen that a holding circuit for relay DF18 and a signal lamp SL passes through contacts DF18a, wire 200, cam contacts CF52 and wire 225. In order to stop the machine, the normally closed contacts DF186, Fig. 9c, are opened in series with the usual stop key circuit for maintaining the tabulator in operation by means of relay R12.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred 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 for recording on multiple strips, a driving means, means for feeding an original strip, a clutch between said driving means and said feeding means, a stop emitter with connections to said feeding means to move in synchronism therewith, electrical means cooperating with said emitter and clutch for predetermining the recording positions on the original strip, means for feeding a second strip, a second clutch for connecting the feeding means of the second strip to the feeding means of the first strip, and means for operating said second clutch to secure duplicate recordings.

2. The combination set forth in claim 1 in which the machine is controlled by records certain of which bear a special indicium as an indication of data to be duplicated from one or more records, means for sensing said indicium, and means under control of said sensing means for controlling said operating means of the second clutch to effect dual feeding and duplicate recording.

3. The combination set forth in claim 2 wherein said second clutch includes a one tooth disk for driving the clutch, and means under control of the sensing means for controlling said electrical means to adjust the two feeding means to such a relative position that said disk is in position to be engaged for dual feeding.

4. In a printing machine for recording on a bill form strip and a duplicate register strip as controlled by groups of record cards certain of which groups are for accounts in arrears and distinguished by a leading signal card with a special indicium, said register strip being prepared with dark horizontal stripes at all home position lines as a non-printing measure, means for feeding said bill strip to predetermined positions to receive certain card data on certain lines of each bill form, means for sensing said special indicium, means for feeding said register strip, means for connecting said register strip feeding means to the bill strip feeding means, and means under control of said sensing means for operating said connecting means, whereby a duplicate record is made of bills or accounts in arrears.

5. The machine set forth in claim 4 wherein said connecting means includes a clutch disk driven by said bill strip feeding means and a clutch pawl attached to said register strip feed-

ing means, and means under control of said sensing means for controlling said bill strip feeding means to move said disk to a position wherein said pawl is engaged.

6. In a machine for printing on a plurality of record materials as controlled by records bearing data indicia and a column of code indicia for control of line selection of said materials, means for feeding said materials including a feed control emitter with a plurality of contact spots representative of lines on said materials, means for setting up a line selecting relationship between each of said code indicia and said line selecting spots of the feed control emitter, means for sensing said code indicia, means under control of said sensing means for controlling said setting means to make effective a particular one of said relationships to space the materials to a line related to a certain code indicium, said feeding means including a clutch for feeding the material other than the original material, and means under control of said records for operating said clutch for selectively duplicating certain recorded data on material other than the original material.

7. The combination set forth in claim 6 wherein said records are arranged in groups wherein duplicating control and heading records are distinguished by X indicia and the groups are distinguished by group number indicia, means for feeding said records in succession under said sensing means, heading control devices made effective by X to no X changes detected in said records, group control devices made effective by group number changes detected in said records, and means for setting up a line selecting relationship between the feed control emitter and both said heading control devices and said group control devices, whereby record material spacing is jointly controlled by code indicia, heading indicia and group number indicia.

8. The combination set forth in claim 1 in which the machine is controlled by records certain of which bear a special indicium as an indication of data to be duplicated, means for sensing said indicium, means under control of said sensing means for controlling said operating means of the second clutch to effect dual feeding and duplicate recording, a manually operated switch for making effective said operating means of the second clutch, a reset button, and means under control of the button for operating the clutch of the original strip after the clutch for the second strip has been operated, thereby ejecting both the first and second strips.

9. In a machine for feeding a pair of record strips, feeding means for the first of said strips, driving means, a clutch interposed between said driving means and said feeding means, a start magnet for engaging the clutch, a stop magnet for disengaging said clutch, a line selecting stop emitter comprising, a movable brush driven synchronously with the said feeding means, and contact points successively engaged by said brush, multiple pluggable circuit connections between said stop magnet and selected contact points for energizing said stop magnet through said brush and any of the plugged contact points, means for

energizing said start magnet after each printing operation to engage said clutch to initiate the operation of said feeding means and including means to retain said clutch engaged, thereby moving said brush until the latter contacts with the next contact point plugged and through the related plug connection to said stop magnet energizes the latter and disengages the clutch at a line position of the strip predetermined by the said next contact point plugged, feeding means for the second strip, a clutch for the second strip, said second clutch being interposed between the feeding means for the first strip and the feeding means for the second strip whereby the second strip is selectively moved with the first strip, and means for operating said second clutch selectively for duplicate recording.

10. In a machine under control of cards with line selecting code indicia for feeding a record strip on which a series of items and a total thereof are printed by item and total printing operations, means for feeding said strip, driving means, a clutch interposed between said driving means and said strip feeding means, a start magnet for engaging the clutch, a stop magnet for disengaging said clutch, a line selecting stop emitter comprising, a movable brush driven synchronously with the driven element of said clutch, and contact points successively engaged by said brush, pluggable circuit connections intermediate selected contact points and said stop magnet for energizing said stop magnet through circuit connections to any of the plugged contact points, relay contacts also intermediate said contact points and said stop magnet, means for sensing said code indicia, relays energized under control of said sensing means to close said contacts to make a certain one of said contact points effective for a certain card cycle, a single impulsing means operable after each printing operation for energizing said start magnet to engage said clutch and including means to retain said clutch engaged, thereby moving said brush until the latter contacts with the next contact point plugged and becomes effective through said intermediate relay contacts to energize said stop magnet and disengage the clutch at a line position of the strip predetermined by the said next contact point plugged and in series with the relay contacts selected by code indicia on the card, means cooperating with said stop emitter for detecting an overflow of items of one account, and means under control of said detecting means for stopping the machine.

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