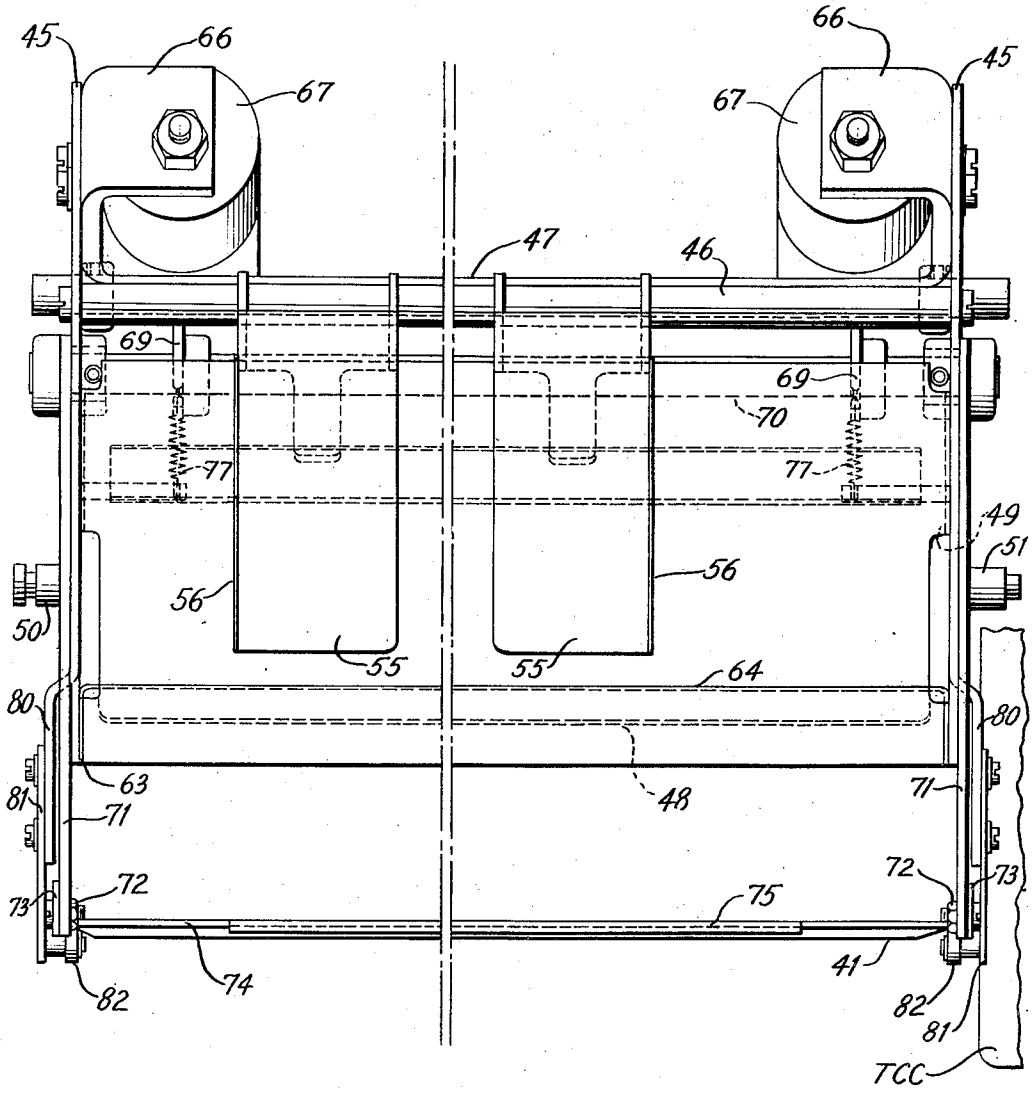
July 3, 1951 F. J. FURMAN 2,558,947

SHEET AND ENVELOPE FEEDING DEVICE

Filed May 27, 1948 10 Sheets-Sheet 1

Fig. 1.



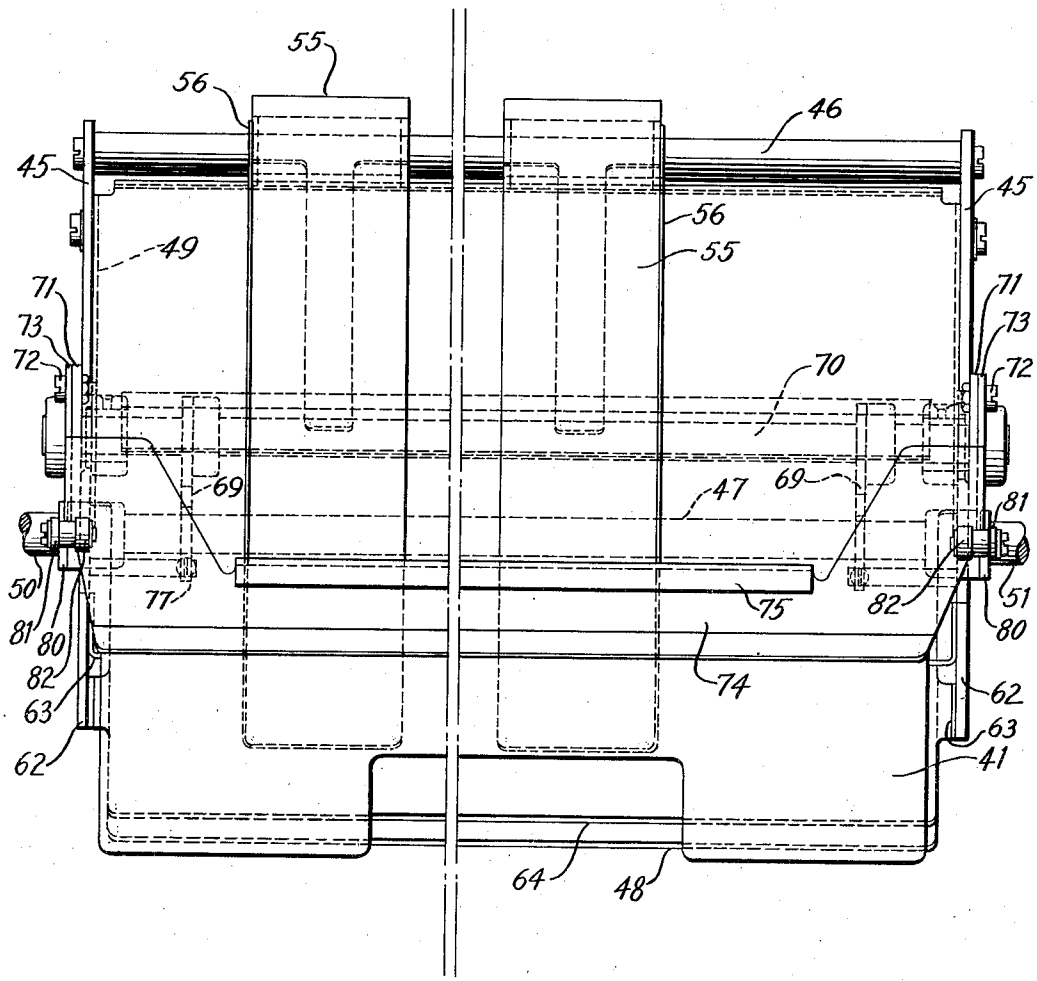
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SHEET AND ENVELOPE FEEDING DEVICE

Filed May 27, 1948 10 Sheets-Sheet 2

Fig. 2.



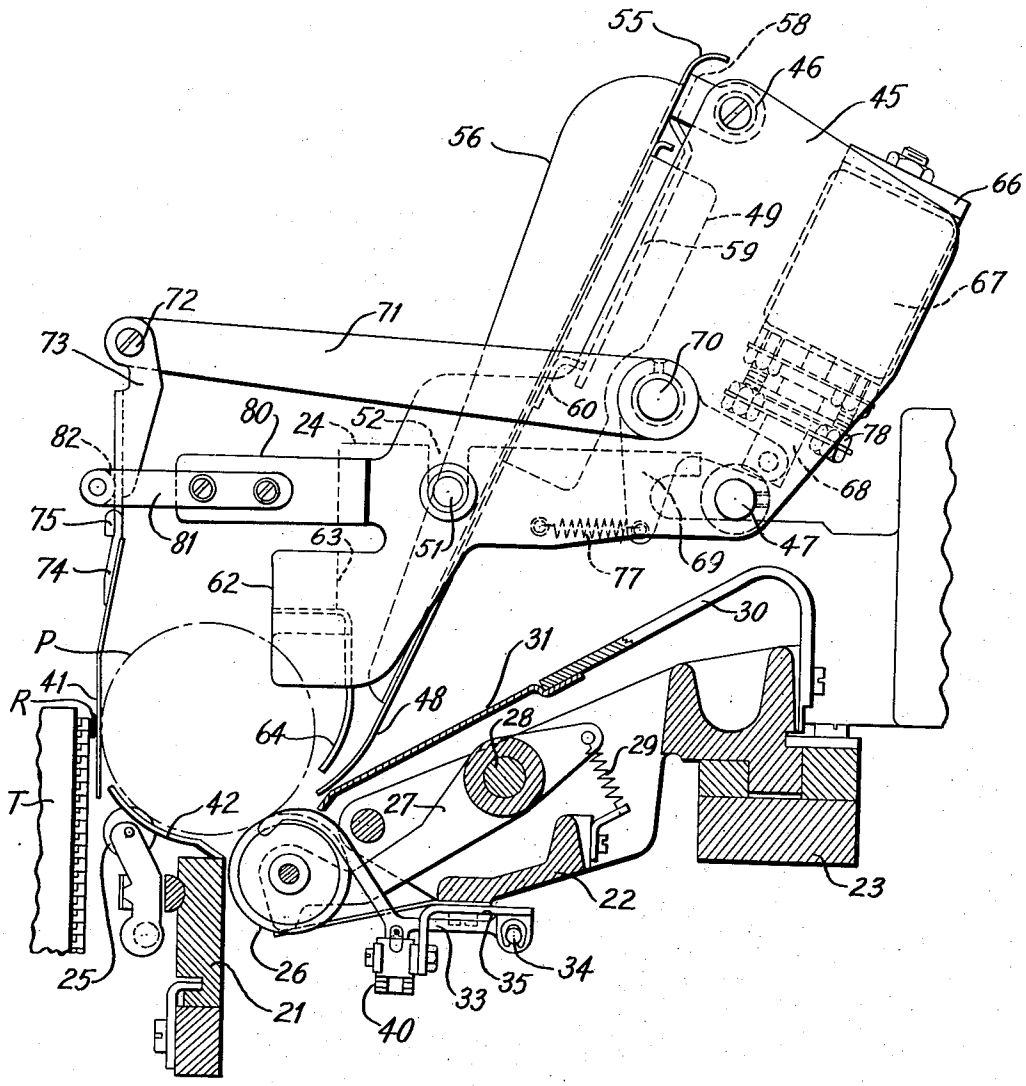
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SHEET AND ENVELOPE FEEDING DEVICE

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Fig. 3.



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SHEET AND ENVELOPE FEEDING DEVICE

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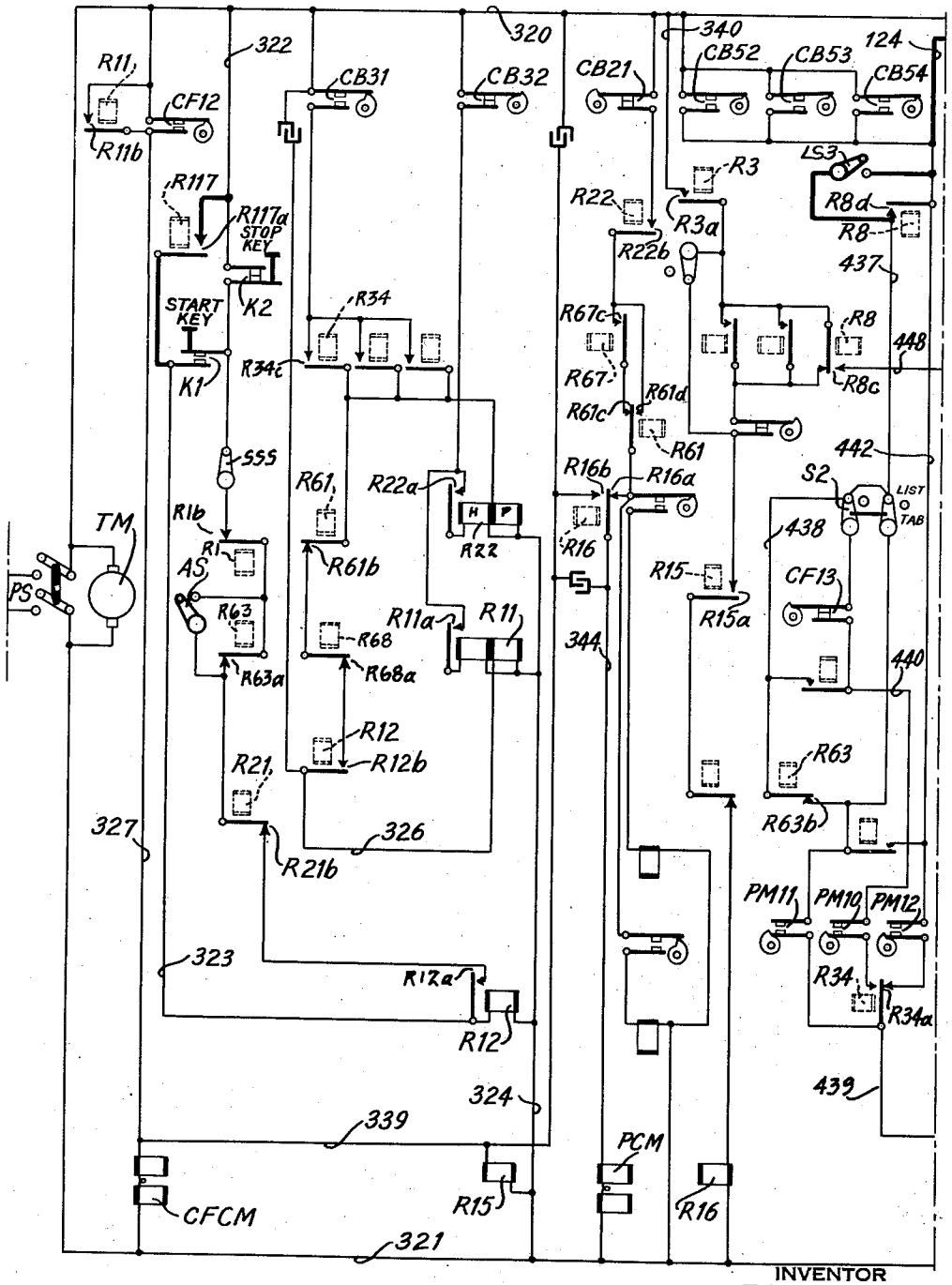


Fig. 3a.

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SHEET AND ENVELOPE FEEDING DEVICE

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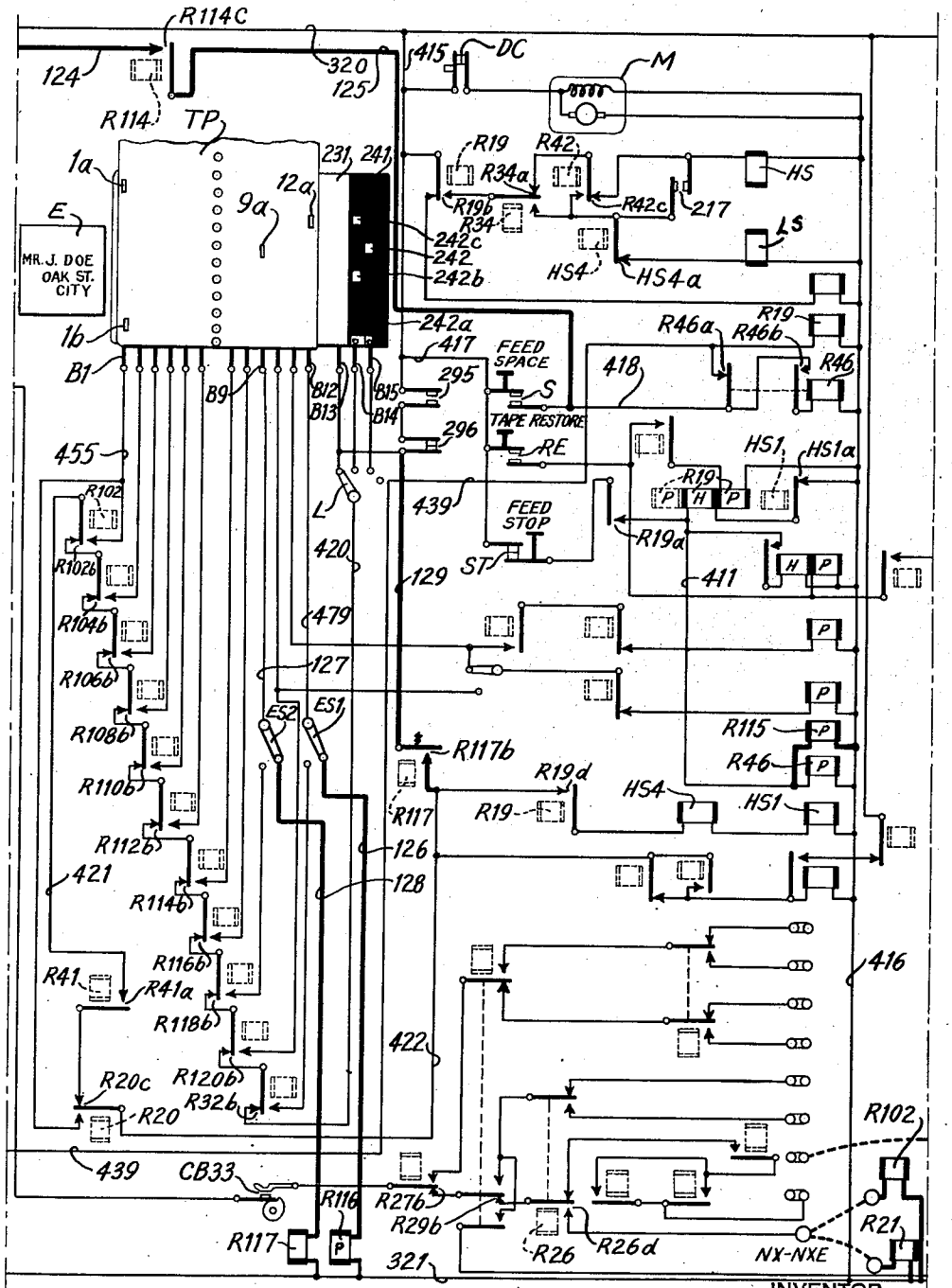


Fig. 3b.

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SHEET AND ENVELOPE FEEDING DEVICE

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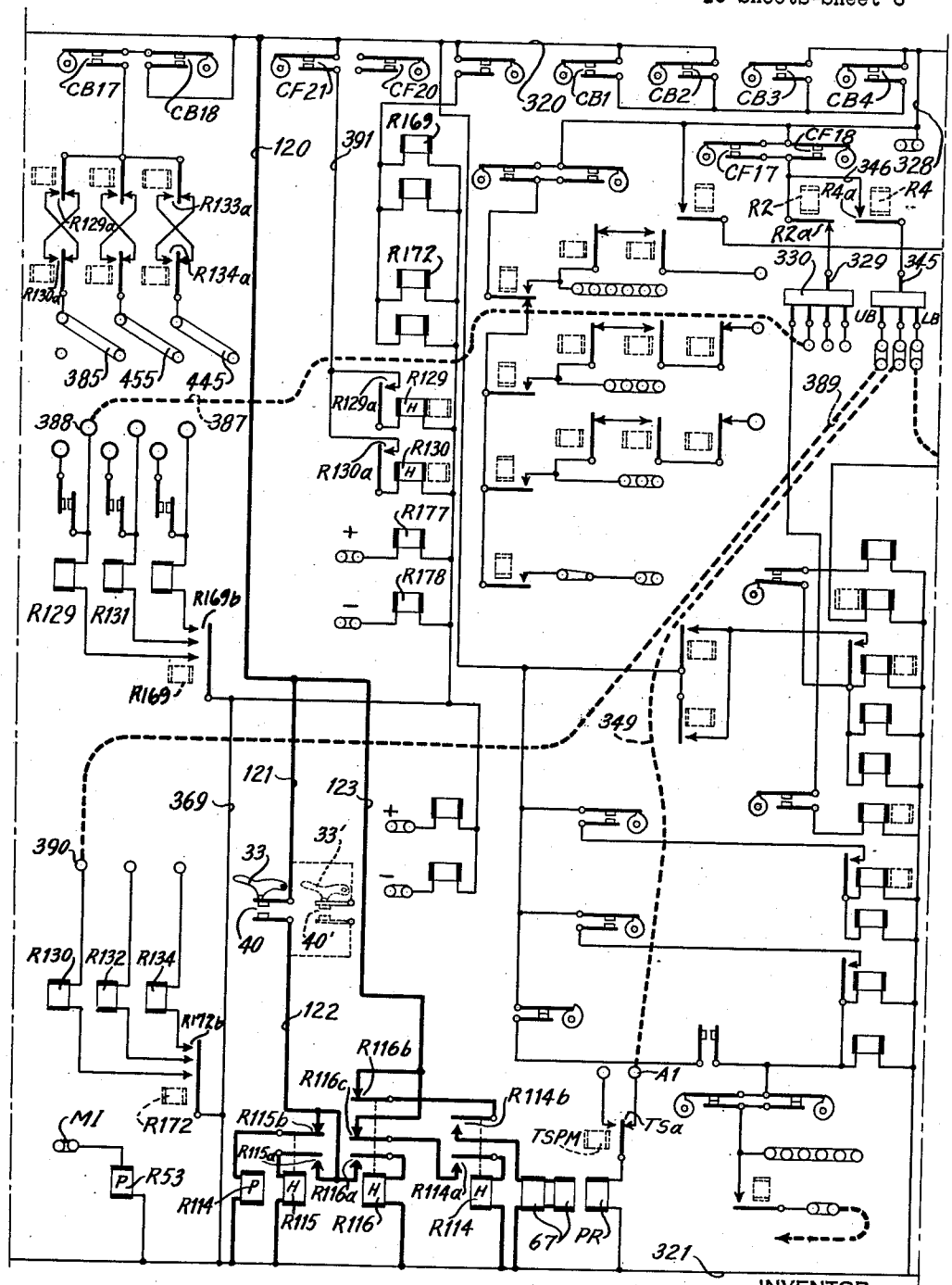


Fig. 3c.

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SHEET AND ENVELOPE FEEDING DEVICE

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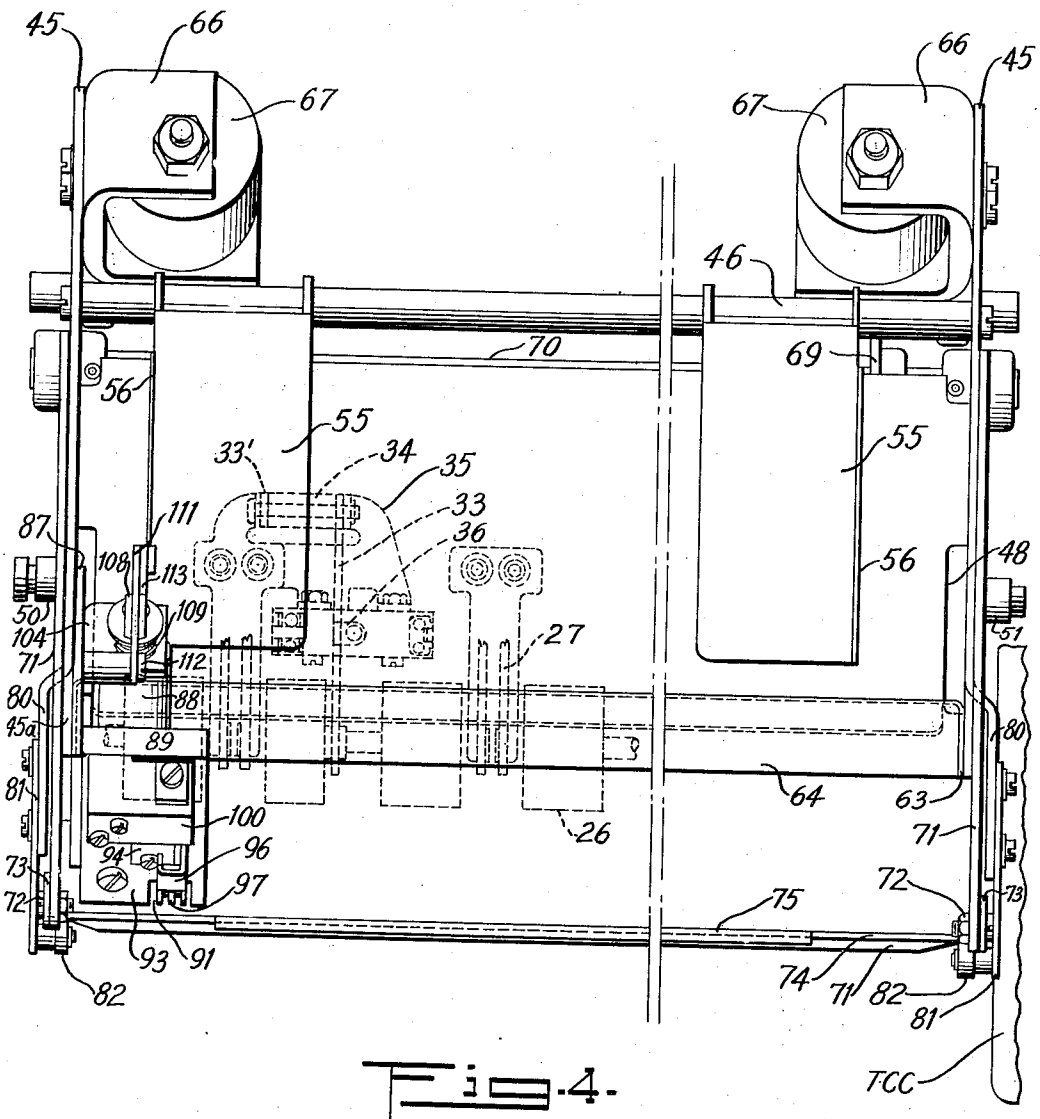


Fig. 4.

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SHEET AND ENVELOPE FEEDING DEVICE

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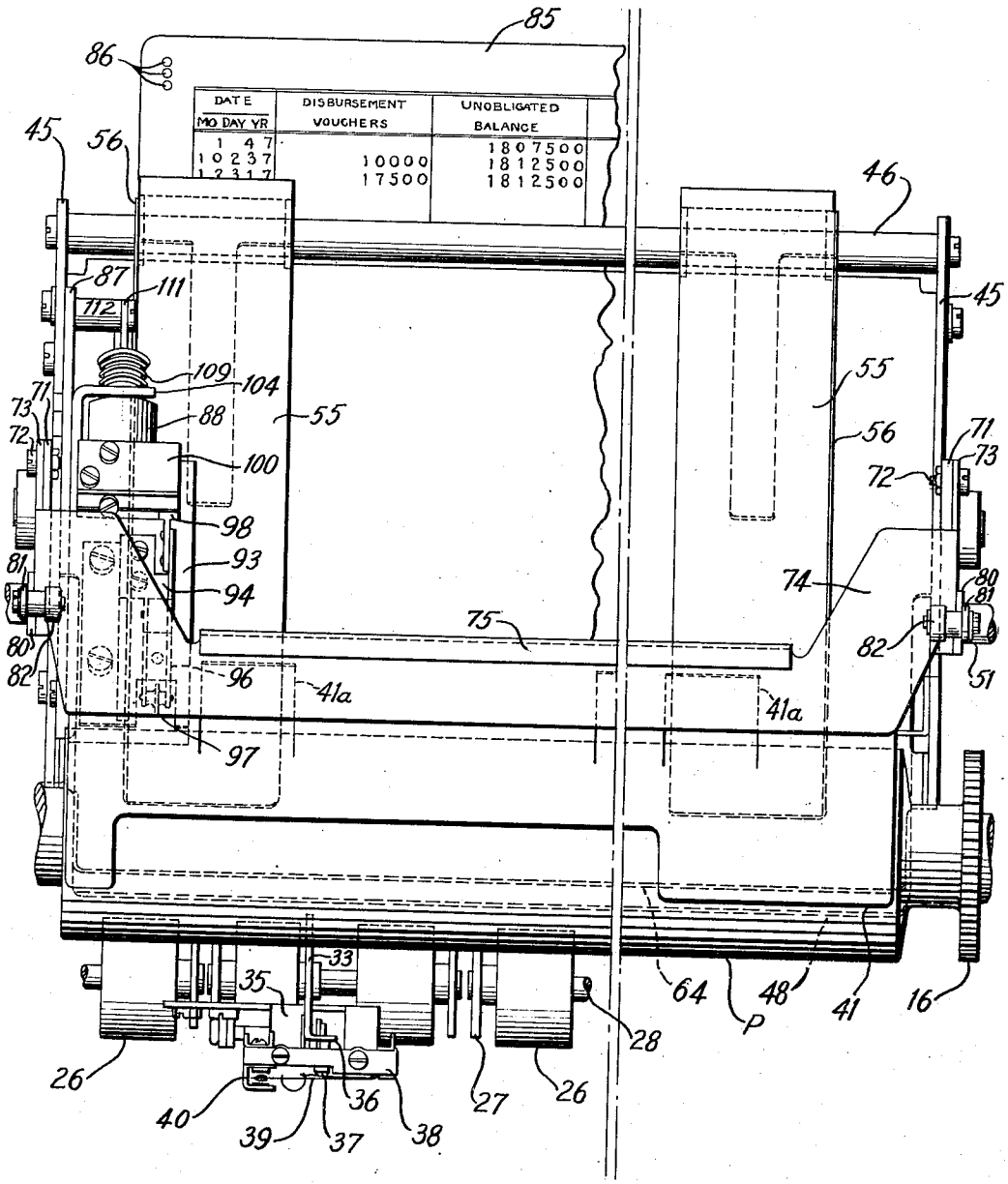


Fig. 5.

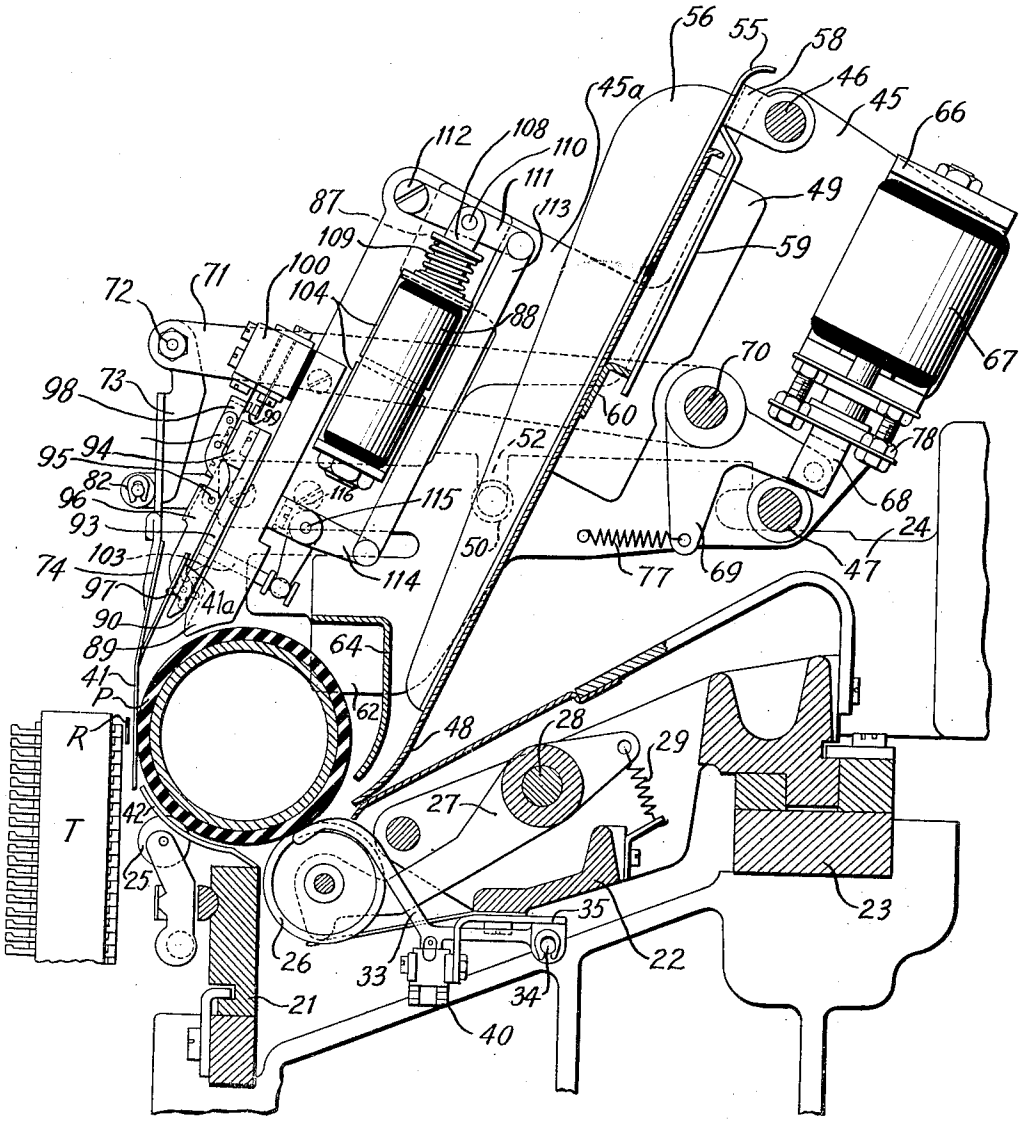
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Fig. 6.



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SHEET AND ENVELOPE FEEDING DEVICE

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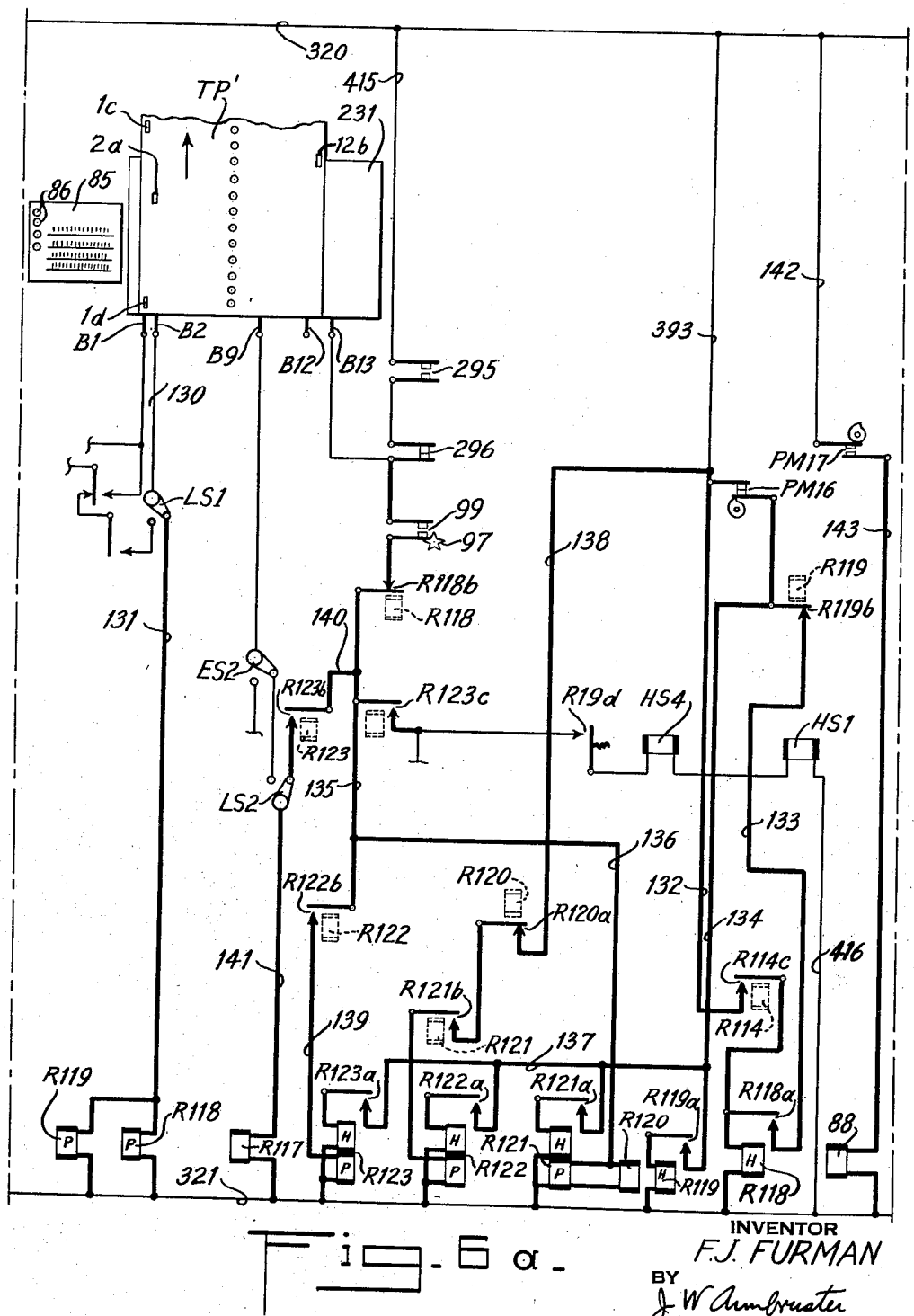


Fig. 6a.

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Patented July 3, 1951

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UNITED STATES PATENT OFFICE

2,558,947

SHEET AND ENVELOPE FEEDING DEVICE

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Application May 27, 1948, Serial No. 29,535

19 Claims. (Cl. 197—127)

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This invention relates in general to means for feeding sheets, envelopes and ledger cards and more particularly to devices for automatically inserting, locating and ejecting such sheets under control of automatically operated feeding devices in a tabulator.

The invention is illustrated as removable sheet feed attachments for a tape controlled carriage of the kind disclosed in copending U. S. application Serial No. 609,854, filed August 9, 1945, now Patent No. 2,531,885, dated November 28, 1950. In such platen rotating devices, an endless perforated tape is driven in synchronism with the feeding devices and is used as the control for positioning the record material. The length of the control tape is proportioned according to the length of he forms on a continuous record strip, and the control perforations therein are distributed in selected positions to predetermine the feeding start and stop positions, so that lines of printing impressions are put on the forms in a desired arrangement.

The main object of the present invention is to provide means for adapting such tape controlled feed devices for the handling of separate sheets, envelopes, or separate ledger sheets.

Another object of the invention is to provide sheet detection and guiding devices to adapt the kind of feed devices ordinarily handling continuous strip stationery to the handling of separate sheets.

Another object of the invention is the provision of an automatically operated shield or sheet guide which deflects the leading edge of an inserted sheet away from the type and inking ribbon and guides it around the platen. Sheet detector devices are also provided to sense the introduction of a sheet and automatically drop said shield into position before the top of the sheet reaches the printing position. Then, as the body of the sheet is advanced under control of the tape to the first print receiving position, the tape controls the automatic withdrawal of the shield from in front of the type before the sheet stops. Therefore, the shield is under the joint automatic control of the sheet detector and the feed control tape.

Another object of the invention is the provision of improved ledger posting devices comprising a toothed wheel for riding along the margin of a ledger sheet and sensing the presence or absence of marginal perforations, each perforation denoting the presence of a line of print on the sheet. The wheel is connected to contact devices which are disabled when the leading edge of the card is

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under the wheel and become effective only starting with the perforation position related to the first line of print. As long as the wheel rotates, denoting the presence of one or more marginal perferoations, the contacts remain open and the feeding devices continue to advance the ledger sheet. Directly after the apperance of the last marginal perforation under the wheel, it is lifted on the imperforate marginal area and the contacts are closed to stop the automatic feed devices with the ledger sheet in position to receive a line of print directly under the last previously recorded line. As printing operations take place, a marginal perforation is punched for each line of print.

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 is a plan view showing the sheet and envelope guide and the automatic shield for dropping in front of the platen.

Fig. 2 is a front elevation view of the devices shown in Fig. 1.

Fig. 3 is a side elevational view partly in section showing the main carriage supports, the platen and the removable unit comprising the holder for fixed guides and tables and the automatic shield for the sheets and envelopes.

Figs. 3*a*, 3*b* and 3*c* together form a wiring diagram of the pertinent tabulator and tape unit connections with the new sheet feed controls shown by heavy lines.

Fig. 4 is a plan view showing the sheet guides and automatic controls to which are added the ledger posting punch and feed control devices.

Fig. 5 is a front elevation view showing the sheet guides in association with a ledger sheet punch and marginal hole detector located at the left side.

Fig. 6 is a sectional elevational view showing the ledger posting control devices associated with the automatic sheet inserting controls.

Fig. 6*a* is a wiring diagram showing in heavy lines the extra wiring connections needed to effect ledger posting control.

It is mentioned hereinbefore that the feed devices are driven by a tape controlled carriage of the kind disclosed in copending application Serial No. 609,854 to which reference may be made for details of the mechanical construction of such devices. In Figs. 1 and 4, it is noted that

the tape controlled carriage TCC is shown diagrammatically at the right and there has connection with the end of the platen P (Fig. 3) to rotate it to feed sheets upwardly in front of the type T and inking ribbon R arranged directly in front of the platen in the usual fashion.

The electrical controls associated with such automatic carriages and the control thereover by the perforated tape are given in detail hereinafter in connection with a description of the control wiring and the relay devices associated with the sheet detector and the automatic shield operating devices of the present invention.

Referring to Fig. 3, it is seen that the ordinary carriage frame comprises a number of cross bars 21, 22 and 23 secured at their ends to the main side frame castings 24, upon which are hung all of the paper feed devices. Guided in bearings in the side frames 24 is the shaft of platen P under which there are the pressure rollers 25 and 26. The large rear pressure rollers 26 are pivotally mounted on arms 27 fulcrumed at 28 on a shaft which reaches across the width of the feeding unit frame. Extending across the front of the platen P at the printing line is an inking ribbon R and in front of it is a series of type bars T which may be of the form shown, i. e., the kind adjusted under control of perforated record cards in a tabulator, or they may be in the form of the type in a typewriter or any other kind of recording device.

In order to guide the usual continuous record strip toward the platen P and the rear pressure rollers 26, the carriage is provided with a slanted table 30 to which is attached an extending table 31 reaching downward toward the intersection of the platen and the feeding roller. Another slanted table 48 is provided to guide individual sheets into the bight between the platen and pressure rollers 26.

In order to detect the appearance of a sheet or envelope the moment it is inserted by hand, the feeding devices are provided with a sheet detector or sheet lever 33, the movable end of which is located directly to the rear of the point of tangency between the platen and the rear pressure rollers 26. One or more of such detector levers may be provided across the machine, according to the position in which the sheets are to be inserted and according to the width of such sheets. Each lever is pivotally mounted on a rod 34 which is hung under a bracket 35 secured to the under side of the cross bar 22. In Fig. 4 it is seen that lever 33 is formed with a bail extension 33' at the fulcrum point for encircling rod 34 at both ends. This gives the lever stability and provides for accurate movement as it swings into and out of the path of the record sheets.

On the under side of lever 33 there is formed a tab 36 (Fig. 5) which rests on a plunger 37 situated in an insulation block 38 secured to the bracket 35. The lower end of the plunger rests on a flexible contact blade 39, one end of which is also secured to the insulation block 38 and the other end of which is movable to on and off positions in cooperation with the lower contact point of the pair of contacts 40.

When the detector lever 33 is positioned as shown in Fig. 3, it is rocked upward in a clockwise direction about pivot 34 by the spring pressure of the flexible contact blade, and is then positioned with the upwardly extending portion contacting the underside of the platen and extending into the path of the sheet. Then, when a sheet or envelope is inserted, the forward edge of it

strikes against the upper portion of the end of lever 33 and rocks the lever downward in counterclockwise direction, because the sheet extends in a direct line between the intersection of the platen, pressure rollers and the sloping end of table 48. Although the detector lever is moved a slight distance, it is sufficient to cause the plunger 37 (Fig. 5) to press down on the blade 39 and close the contacts 40. Closure of these contacts calls into operation the tape controlled feeding unit which then operates to rotate the platen in a clockwise direction to draw the sheet or envelope around to the printing position.

At the same time, that is, immediately upon closure of contacts 40, solenoids are operated to drop the sheet shield or guide 41 (Fig. 3) in between the platen P and the inking ribbon R, to deflect the leading edge of the sheet or envelope upwardly around the platen and away from the type bar T and the ribbon R. The fixed front guide 42 serves to direct the sheet around the lower part of the platen, but at the printing point it needs further guidance. The shield 41 is allowed to remain in the lowered position long enough to insure that the leading edge of the sheet is brought above the lower edge of the inking ribbon R, so that there is no possibility of the sheet abutting against the ribbon. When the leading edge of the sheet is advanced sufficiently, and just prior to positioning of the record material to receive the first record impression, then the operating solenoids for the shield are automatically deenergized to allow the shield to be raised, so that it does not interfere with the type action. The means for mounting and operating the shield are about to be set forth.

The entire sheet control assembly is held together as a removable unit between side plates 45 (Figs. 1 and 3). The side plates are held together and properly spaced by means of cross shafts 46 and 47 and the slanted sheet table or guide 48 which extends across the entire unit and is formed with overturned portions 49 (Fig. 6) secured to the inside of the side plates. In Fig. 1 it is noted that shaft 47 extends beyond both side frames and provides cylindrical projections for mounting the unit on the main frame. Also extending are shouldered studs 50 and 51 for engaging in notches cut in the top of the main frames 24 and noted in Fig. 3. There it is seen that studs 50 and 51 drop into notches 52, while the extensions of shaft 47 rest on the shoulder of the main frame, and thus the entire unit is held in position but made readily removable whenever it is desired to handle continuous form stationery instead of inserted sheets or envelopes.

Adjustable laterally across the front of paper table 48 is a pair of side guides 55 formed with flat portions resting on the surface of table 48 and also formed with upwardly extending sides 56 for cooperating with the side edges of an inserted sheet or envelope. Attached to the top of each side guide 55, and secured to the rear of the flat portion, is a bail formation 58 (Fig. 6) formed with ears encircling cross shaft 46 and slidable thereon laterally to carry the side guide into any one of a number of sheet locating positions. Extending from the bottom of bail 58 is a long straight spring portion 59 in contact with the edge of an angle strip 60 attached to the inside of table 48 and extending across the unit to provide a spring pressure bar. By means of the frictional contact between extensions 59 and angle strip 60 the side guides are held in any set positions.

The lower ends of side plates 45 are formed with projections 62 to which are attached the ears 63 of the fixed sheet guide 64 extending across the unit and curved to lead the advance edge of the sheet downward into the bight between the platen P and the rear pressure rollers 26.

Attached to the inner faces of the side plates 45 (Fig. 1) is a pair of brackets 66 each holding a solenoid 67 which is operated to raise and lower the shield 41. Extending downwardly from the solenoids 67 (Fig. 3) are plungers 68, each pivotally connected to a bell crank 69 fastened to a shaft 70 which extends across the unit. Outside the side plates 45 there is attached to the shaft 70 a pair of long horizontally extending arms 71. Pivotally mounted on the outer ends of said arms 71 at 72 are the side portions 73 of a cross member 74 extending across the entire width of the platen. In Fig. 2 it is seen that the central portion of member 74 is cut out and formed with a bent strengthening web 75.

Attached to the inner face of member 74 (Fig. 3) is the shield 41 which extends downwardly and is formed with a pair of depending side portions which are wide enough to deflect the advancing edge of sheets or envelopes of any width and keep them away from the ribbon R. The shield 41 is held in a normally raised position by means of a pair of springs 77 each attached at one end to the inside of the side plates and at the other end to the vertical leg of the bell crank 69, thus tending to rock the crank in a clockwise direction and operate arms 71 in the same direction to raise the shield to a position determined by the adjustable plunger regulating devices 78 associated with the solenoids 67. When the solenoids 67 are energized, the plungers 68 are raised, the bell cranks 69 are rocked in a counterclockwise direction against the tension of springs 77, and the arms 71 are lowered to drop the shield 41 into position to deflect the leading edge of the sheet away from the ribbon. As soon as the sheet or envelope is advanced sufficiently, the solenoids are automatically deenergized and the springs 77 are immediately effective to raise the shield.

In order to insure that shield 41 moves in a vertical direction, a pair of side guides are provided for it. Extending forwardly from the side plates 45 is a pair of offset extensions 80 to which is attached a pair of strips 81 each carrying a stud and inwardly projecting roller 82 which rides on the outer surface of the cross member 74 to prevent it from rocking outwardly far enough to place the shield 41 in a position to interfere with the ribbon.

It is noted that the description given hereinbefore is directed in the main to Figs. 1 to 3 and in these figures the sheet and envelope feed is shown without any ledger posting controls. Although it is possible to feed ledger sheets under such conditions, there would be the absence of automatic line finding control, which is desirable in connection with ledger sheets or cards. The portion of the description about to be taken up is concerned mainly with Figs. 4 to 6 which have all of the features common to the sheet and envelope feed devices of Figs. 1–3 and in addition thereto have other devices for punching marginal ledger control perforations and devices for sensing said perforations when a ledger sheet is reinserted for reception of additional printed information.

The ledger posting device is also formed as a removable unit and may be detached whenever it is desired to use the sheet feeding controls for the more elementary forms of sheets or envelopes.

For the purposes of providing a mounting surface for the ledger posting device, the left side plate 45 (Fig. 6) is formed with a vertically extending portion 45*a* to receive a supplemental side plate 87 carrying the posting control devices.

In Fig. 5, a portion of a ledger sheet or card 85 is shown bearing three lines of printed data and three marginal perforations 86 related thereto. It will be noted that the three perforations 86 are not in line with the corresponding printed lines but appear near the upper left corner of the ledger sheet. This difference in placement is caused by the position of the punch 103 (Fig. 6) which is about two inches above the printing line on the platen. The uppermost marginal perforation 86 is spaced away from the leading edge of the ledger sheet under the control of the perforated tape controlling the feeding operation of the carriage as explained hereinafter in describing the electrical controls. These electrical controls for governing feeding also operate to nullify the effect of the leading edge of the ledger on a detector star wheel 97 which rides over the margin of the sheet 85 to sense the number and placement of the marginal perforations 86. The control is so arranged that lifting of the wheel by the imperforate portion of the margin between the leading edge and the top marginal perforation does not exercise control. It is only after the wheel cooperates with the area of the first perforation 86 and one or more succeeding perforations that the control becomes effective to stop the ledger sheet in the position to receive a fourth line of print (in the example shown) when the wheel rides out of the third perforation and is lifted by the sheet portion directly below the third perforation.

Although in Fig. 5 the sheet is shown in phantom outline and resting on the paper table in an upright readable position, it is not inserted in such position but is turned upsidedown and facing in reverse with the marginal perforations at the left. The sheet 85 is inserted behind the platen P to trigger the detecting lever 33 (Fig. 6) and thereby initiate feeding operation which serves to rotate the platen clockwise to bring the top edge of the sheet around in front of the platen and up to a readable position wherein it also receives printing impressions.

The devices for punching the marginal posting control holes 86, and for sensing said holes to govern the stoppage of the sheet in position, are mounted as a unit on the extension 45*a* (Fig. 6) extending forwardly from the left side plate 45 already mentioned in connection with the sheet and envelope feeding devices. Attached to the extension 45*a* is the rectangular plate 87 which carries a solenoid 88 for operating the punch. Also carried by plate 87 is a rectangular block 89 formed with a slot 90 for receiving and guiding the left marginal portion of the ledger sheet 85. The slot 90 is defined by means of a plate 93 fastened on the slanted front face of the block 89 but spaced away from the face at the right side to provide the slot opening. Curved tab portions 41*a* cut and bent out from the shield 41 guide the upper edge of the ledger sheet into the slot 90 when the shield is down. Extending on the outer face of plate 93 is a bearing block 94 on which is provided a pivot 95 for a lever 96 formed in the shape of a bail with a pair of downwardly extending arms, the lower end of which carries a small toothed wheel 97. The wheel projects into a cut out portion 91 in plate 93 and is so positioned that the teeth thereof, when rotated, extend into the

slot 90 and therefore into the path of the marginal edge of the ledger sheet. Wheel 97 is so positioned relative to the bottom of the slot and relative to the location of one of the side guides 56 that it is in alignment with the procession of posting control perforations 86 and rotatable thereby when a previously printed sheet is inserted. Rotation of the wheel does not cause contact closure or feed control; it is only when the wheel is lifted on the imperforate marginal section allotted to perforations, that control contacts are operated thereby. When a new sheet is inserted, the wheel 97 and the lever 96 holding it are rocked outwardly and held there as the sheet advances a short distance, and this lever movement is used to control stopping the sheet in position to receive a line of print on the first recording line.

At the top end of lever 96 there is secured an extension 98 which cooperates with one blade of a pair of contacts 99 extending from an insulation block 100 fastened to the upper end of block 89. These contacts 99 are closed by clockwise rotation of lever 96 about pivot 95 and this is an indication that an imperforate marginal portion of the ledger sheet is passing under and lifting the wheel 97.

The initial closure of contacts 99 by the top marginal edge of the ledger sheet is made ineffective by a delay in the initial timing to be described hereinafter. However, once the sheet position is reached wherein marginal perforations are supposed to be present when the sheet has lines of print, then the contacts 99 are effective to control stoppage of the sheet feeding devices, so that the sheet is put in position differentially to receive a printing impression. When one or more marginal perforations 86 appear under the wheel 97, one or more teeth of the rotating wheel drop into said perforation or perforations, and the result is that the lever 96 swings counterclockwise to again open contacts 99.

The length of time that the contacts 99 are held open during the feeding movement of the ledger sheet is determined by the number of marginal perforations therein and, therefore, the number of lines of print already on the sheet. As long as perforations appear under wheel 97, the teeth thereon rock into said perforations successively and the wheel is merely rotated without having any swinging action on the lever 96. However, as soon as the bottom perforation on the sheet passes above the center of the wheel, the tooth following the tooth in the perforation is raised on the surface of the ledger sheet and cams the lever 96 outwardly to rock it in a clockwise direction and again close contacts 99. This second closure of contacts 99 by a ledger sheet is used to control the feeding devices to stop them when the sheet is positioned far enough beyond the wheel 97, so that the last marginal perforation is one line space above the position of the punch 103, which is situated in block 89, above the wheel 97 and operated by means about to be described.

Fastened to the inner face of plate 87 is a pair of brackets 104 for carrying a punch operating solenoid 88. Extending upwardly out of solenoid 88 is a plunger 108 around which is wound a compression spring 109 serving to hold it in an upwardly extended position. At the upper end the plunger 108 is pivotally connected at 110 to a lever 111 fulcrummed at 112 on the side of plate 87. On the free end of lever 111 there is articulated the upper end of a link 113, the lower end

of which is pivotally connected to a bell crank 114 pivoted on a rod 115 extending through a bearing block 116 fastened to the side of block 89. The lower end of the vertical arm of bell crank 114 is formed with a ball-shaped extension engaging in an annular notch formed around the inner end of the punch 103. A perforation coinciding with the punch position is formed in the auxiliary plate 93 which therefore acts as a die plate for the punch when it is extended outwardly through the ledger sheet.

As an incident to each printing operation, the solenoid 88 is energized and attracts the plunger 108 which in its downward movement carries link 113 along in the same direction, thereby rocking bell crank 114 clockwise and pushing the punch 103 toward the left through the ledger sheet 85 and cutting one of the marginal perforations 86.

As shown in the wiring diagrams, Figs. 3*a*—3*c*, and 6*a*, the electrical controls of the sheet and ledger feed devices are coordinated with the tape feed controls and the controls of an alphabet printing tabulator. The tabulator is of the type described in United States Patents Nos. 2,079,418 and 2,172,067 and 2,199,547, to which reference may be made for details of construction. Before describing the manner in which the sheet feed and ledger feed controls function and the influence thereon by the control tape and the ordinary tabulator control, it is believed well to outline the usual tabulator operations.

In such machines a motor TM (Fig. 3*a*) operates through two main clutches, the card feed control clutch CFCM for card feeding and the print clutch magnet PCM for control of the printing devices. A number of CF cam contacts operate only when the card feeding clutch is engaged. Certain PM contacts operate only when the printer clutch is engaged. Other CB contacts operate all the time that the motor TM is active.

Associated with the start key contacts K1 (Fig. 3*a*) and the stop key contacts K2 is a pair of control relays R11 and R12 for setting up running circuits and holding circuits for the card feed clutch magnet CFCM which is held in operation as long as cards continue to feed and as long as the group number perforations thereon agree.

In listing operations a card passes the lower brushes LB (Fig. 3*c*) in synchronism with the upward movement of the type bars. Magnets PR operate stop pawls to locate the type bars in positions corresponding to the data punched in the card and, at a predetermined time, hammers are tripped to record the information on the record material. Therefore, listing operation requires energization of the card feed clutch magnet CFCM to advance the cards, and energization of the printer clutch magnet PCM for raising the type bars. It is noted in Fig. 3*a* that relay R15 is connected to card feed clutch magnet CFCM by a wire 339 so that the relay is operated to call in relay R16 to prepare printing connections when cards are feeding.

The printer clutch magnet PCM is called into operation under control of relays R15 and R16 when switch S1 is set for listing operation. The printer operating circuit includes line 320, contacts R11*b* or CF12, wires 327, 339 and 343, contacts R16*b*, wire 344, printer clutch magnet PCM and line 321.

Adjustment of the type bars is regulated by impulses carried to magnets PR (Fig. 3*c*) from

the lower brushes LB. A printing control circuit involves line 320, contact breakers CB1—4, wire 328, timer contacts CF17 and CF18, wire 346, lower card lever relay contacts R4a, common brush 345, contact drum 347, through the card and a lower brush LB, the brush socket, plug wire 349, socket A1, normally closed contact TSa, magnet PR and line 321.

Group control devices are provided for separately considering different classes or groups of cards as distinguished by different group number perforations for different groups. Consecutive cards are compared; one card being read at the upper brushes UB while the preceding card is read at the lower brushes LB. As long as the card readings are alike, the card feed continues to function. When the machine senses that the two group readings are not alike, the card feed unit stops while the tape control unit ejects a record sheet or envelope.

The comparing circuits are connected by plug wiring between control pickup coils and certain upper and lower brushes devoted to sensing group number perforations. An example of the comparing circuits is as follows: line 320 (Fig. 3c), cam contacts CB1—CB4, wire 328, timer contacts CF17 and CF18, contacts R2a, common brush 329, contact roller 330, through the perforation in the card sensed by upper brush UB, plug wire 387 connected from a socket in line with the upper brush to a socket 388 in line with the pickup coil of relay R129, contacts R169b and wire 369 to line 321. As long as group numbers agree, a companion circuit to that already traced is set up at the same time through a pickup coil of a related relay R130 as energized through the lower brushes by the following circuit: line 320 (Fig. 3c), cam contacts CB1—CB4, wire 328, contacts CF17 and CF18, wire 346, contacts R4a, common brush 345, contact roller 347, through a perforation in the card sensed by the lower brush LB, a plug wire 389 connected to socket 390, pickup coil of relay R130, contacts R172b, wire 369 and line 321.

Relays R129 and R130 have holding coils and contacts in series therewith for sustaining the comparing circuit connections. The holding circuit includes line 320, cam contacts CF20, CF21, wire 391, contacts R129a, the holding coil of relay R129, wire 386, wire 369 and line 321. In a similar fashion the other pairs of holding coils are picked up and held as a part of the comparing control.

Referring to the upper left corner of Fig. 3c, it is seen that the pairs of comparing relays are associated with pairs of contacts so arranged that, when a related pair, such as relays R129 and R130, are energized at the same time, they fail to provide a circuit path. However, should one or the other be energized alone, showing that there is a disagreement in the group control perforations, then a circuit is established for initiating group control operation. Assuming that there is a disagreement in the group numbers in the highest order and that relay R129 is energized before relay R130, then the following circuit is established for setting up a minor control operation: line 320 (Fig. 3c), cam contacts CB17, CB18, the left contacts R129a, the right contacts R139a, a plug wire connection between the socket 385, plug wire to socket MI, pickup coil of relay R53, and line 321. A holding circuit is established for relay R53 and it operates other contacts in series with a minor control relay R61. Associated with relay R61 are two other minor control relays R63 and R65 which are energized along with it. These relays have contacts throughout the machine for controlling the suspension of card feeding, the initiation of total taking, etc.

Referring to Fig. 3a, it is seen that the minor control relay R61 has contacts R61b in series with the pickup coil of relay R11 for governing the continuance of operation of the card feed clutch magnet CFCM. When the minor control is exercised, the contacts R61b are opened to prevent energization of the pickup coil of relay R11. In this manner the card feed mechanism is stopped when succeeding cards are not punched alike in the group control field.

The foregoing sections of the description dealing with the wiring and electrical controls are concerned, in the main, with the devices usually found in tabulating machines. The following portions of the specification are devoted to the features of the tape control of record feed and the way the controls are coordinated with the tabulator.

Many of the controls in the tape feed unit are arranged in the part of the wiring diagram shown in Fig. 3b. There it is seen that the motor M is in continuous operation by means of a circuit which is established from line 320, through wire 415, the tape door contacts DC, motor M, and wire 416 to line 321. Associated with motor M are two clutches, the one being controlled by the low speed magnet LS which is energized alone for line spacing and overflow skipping, and the other clutch is called in by magnet LS and the high speed interposer magnet HS which is energized to clutch other gearing to skip upon the printing of a total. Much of the wiring in Fig. 3b is concerned with the operation of one or both of these two clutch control magnets, and stopping the platen P and tape drum 231 to which the clutches are connected.

Also shown in Fig. 3b is a diagrammatic representation of the tape feed drum 231 holding the control tape TP with a commutator 241 extending to control line spacing in addition to the other spacing controls exercised by feed control indicia in the tape in association with fifteen tape sensing brushes B1 to B15.

As an accompaniment to every printing operation ,it is desired to effect controls for line spacing the record such as envelope E and also for advancing the control tape TP to move in synchronism therewith. On every printing operation the PM cam contacts are operated and certain of these are devoted to control for line spacing. In Fig. 3a, it is shown that three such cam contacts PM10, PM11 and PM12 are situated in parallel connections and all in series with wiring leading to the pickup coil of a relay R19 which controls selection of the low speed clutch magnet LS. These three PM cam contacts are timed differently to control the time that the line spacing operation takes place with respect to printing. The PM11 cam contacts are closed at a time while the type bars are moving upward and thereby cause an advance of the platen before printing takes place. Therefore, spacing which is controlled by the PM11 cam contacts is referred to as upstroke spacing.

The other two cam contacts PM10 and PM12 are timed to close when the type bars are moving downward after printing has taken place. The spacing accompanying control by contacts PM10 is referred to as downstroke spacing accompanying the restoration of the printing bars. Contacts PM12 are used for space skipping and are

effective whenever a tape brush is selected for what is usually a plural line movement of predetermined length.

The operation of line spacing is not only affected by the timing of the PM cams but it is also influenced by the setting of switch S2 (Fig. 3a) for listing or tabulating operation. When the switch is set for listing control there is an upstroke spacing operation on every listing cycle and on every totaling cycle. For final total cycles there is an upstroke spacing operation for the first and second total printing cycles.

Downstroke spacing accompanies every total taking cycle when the switch is set for listing. When the switch is set for tabulating there is a downstroke spacing operation after every major total recording, and upon the printing of final totals there is a downstroke space after the second total cycle.

The timing of the line space control impulses is made accurate with respect to the tape feed because the wheels for circuit breaker contacts 295 and 296 are geared directly to the tape feeding drum 231 and proportioned to turn one revolution for each cycle of the tape feed. The wheels have teeth for operating the breaker contacts 295, 296 to close 24 times in each cycle of operation of the tape feed wheel and commutator cylinder 241. When operating for single line spacing, the impulse through contacts 295 and 296 is used directly to terminate spacing. For multiple line spacing, the second or third closure of contacts 295 and 296 creates an impulse passing through the commutator segments 242c or 242 to stop the feed platen after two or three line spaces of movement. For space skipping, when the length of feed is determined by the location of a perforation in the tape TP, circuit breakers 295 and 296 also govern the time that the impulse is sent through the tape brush, for they are adjusted to close after each possible perforation position is at the brush line and thereby prevent sparking at the tape.

The common commutator segment 242a is normally positioned to be slightly advanced beyond the brushes B14 and B15, so that when feeding is initiated they make no contact until segments 242c or 242 are encountered.

Whenever a group indication or listing cycle is taken, a circuit is initiated to start the platen moving for upstroke line spacing as follows: from line 320 (Fig. 3a), the circuit is directed through cam contacts CB52, relay contacts R8d, wire 437, wire 438, minor control contacts R63b normally closed, cam contacts PM11, wire 439 (Fig. 3b), the pickup coil of relay R19 and wire 416 to line 321. The pickup coil then operates to close associated contacts R19a for setting up the holding circuit for relay R19 through the stop contacts ST and the normally closed disabling contacts HS1a.

Relay R19 then closes contacts R19b in series with the low speed clutch magnet LS. The circuit for starting the rotation of the platen follows a path through line 320, wire 415, contacts R19b, lower contacts R34b closed as soon as the feed unit is made effective, normally closed contacts HS4a, magnet LS and wire 416 to line 321.

After the platen has been turned through an arc equal to one line space, the circuit breakers 295 and 296 close to send an impulse through relays for disabling the clutch magnet LS. The line spacing stop circuit is as follows: line 320, wire 415, circuit breakers 295 and 296, switch L set to select single spacing, wire 420, the normally closed left contacts R32b, the normally closed series of brush relay contacts R102b to R120b inclusive, wire 421, normally closed relay contacts R41a and R20c, wire 422, relay contacts R19d, control relays HS4 and HS1, and wire 416 to line 321. Relay HS4 acts to terminate the line spacing operation by opening the contacts HS4a in series with the clutch magnet LS. The spacing control relay R19 is also deenergized by the operation of relay HS1 which opens contacts HS1a in series with relay R19.

A number of downstroke line space initiating circuits are made as an aftermath of printing operations in listing and tabulating. Considering first the circuit established after item recording; the connections can be traced from line 320 (Fig. 3a), through cam contacts CB53, relay contacts R8d, wire 437, switch S2 in the list position, cam contacts CF13, wire 440, cam contacts PM10, relay contacts R34b closed whenever the skipping selection devices are dormant, wire 439 (Fig. 20b), relay pickup R19, wire 416 and line 321. The space selecting relay R19 then operates to call into action the low speed clutch magnet LS as already described with relation to upstroke spacing.

When the tabulator is set for tabulating operations and switch S2 (Fig. 3a) has been moved to the right of the position shown, then the line space starting circuit follows a somewhat different path, in that the cam contacts CF13 are out of the circuit path. Instead, the circuit continues through wire 438 and through the major space control relay contacts R59b and then over to wire 440 and continues on from cam contacts PM10 as already described.

After the platen starts rotating as the result of an impulse from the downstroke selection circuits, it is stopped by closure of the platen circuit breakers 295 and 296, through circuit connections already described hereinbefore with relation to stopping the feed after one, two or three line spaces of upstroke spaces.

At the lower right hand corner of Fig. 3b, it is noted that there is a series of nine plug sockets extending from a cascade of contact connections narrowing down to a single line interrupted by cam contacts CB33. These plug connections are directional selecting devices for selecting one or the other of the tape sensing brushes to determine the stopping point of the record strip according to changes in group numbers, and also to skip portions of the record which would be otherwise imprinted upon under control of record cards erroneously placed in association with cards of a different account.

The circuit connections are established by means of combinations of contacts operated by one or more of the relays R27, R29, R25 and R26 indicative of card changes and errors in grouping.

If an error in group control numbers should be detected while detail cards are being analyzed, then relay R26 becomes active to close contacts R26d. Since there is a connection to the normally closed contacts R29b and R27b, plug socket NX—NXE is made effective to carry an impulse to initiate sheet space skipping by calling in relay R102 for controlling both starting and stopping of the sheet as pointed out hereinafter.

The foregoing sections of the description of wiring deal mainly with the electrical controls for governing the operation of the tabulator and tape feeding controls cooperating therewith. The section of the description about to be taken

up is related mainly to the novel controls for the sheet and envelope feeding devices and the ledger posting devices.

On the four sheets of drawings representing the wiring, the connections for the new controls are shown in heavy lines to distinguish them from the ordinary wiring. Three of these sheets (Figs. 3*a*, 3*b* and 3*c*) are concerned mainly with the electrical control needed when handling inserted sheets and envelopes. The fourth sheet (Fig. 6*a*) shows the extra controls necessary when handling ledger sheets. It is understood that along with the electrical controls shown on Fig. 6*a*, use is also made of the controls shown in Figs. 3*a*, 3*b* and 3*c* when governing the insertion of ledger sheets. In other words, for sheet and envelope control, only those devices shown in the heavier lines on the three sheets, Figs. 3*a*, 3*b* and 3*c* are needed, while more extensive control is necessary, represented by all four sheets of wiring, when ledger posting control is desired.

Before going into the description relating to controls for governing sheet and envelope insertion it is believed well to point out the dimensional relationship between a sample sheet or envelope and the control tape TP perforated so as to work with it. Referring to the upper left corner of Fig. 3*b* it is seen that an envelope E is placed along side a related portion of a control tape TP. Although the record material here is shown as an envelope bearing three lines of print it will be realized that the same control applies to a sheet suited to receive one or more lines.

In the diagrammatic representation of the envelope E and the tape TP there is a vertical relationship which applies to their actual position as found in the machine. If an imaginary line is drawn across the top of the envelope E and continued across the tape TP then this association is representative of the synchronized positions of both sheets of material at the same time. In other words, when the top of the envelope is at the printing line on the platen, then the imaginary line across the tape TP is directly under the line of tape sensing brushes B1—B12. This relationship is carried out also by the perforations appearing in the tape TP. It is noted that the first or uppermost perforation 1*a* shown in the first position on the tape (i. e., in alignment with the first brush B1 at the left) is shown at a position advanced with respect to the top of the envelope E. This perforation 1*a* represents one of several "home" positions of the tape and is a stopping position for the tape. When the previously handled envelope was ejected, the tape advanced so that B1 dropped into perforation 1*a*, and a circuit was completed to stop the feeding devices. The vertical distance between perforation 1*a* and the first line of print on envelope E represents the distance that the envelope must travel from the point of insertion to the printing line. Before the envelope reaches the printing line, a perforation 12*a* is sensed in the tape and this is used to deenergize the solenoids 67 which were activated to lower the shield, so that the shield is raised before the envelope arrives at the print receiving position. It will be remembered that the advancement of both envelope E and tape TP is initiated by the closure of contacts 40 (Fig. 3) as operated by the sheet detection lever 33, and that the solenoids for lowering the shield were energized at the same time.

Soon after the shield is raised out of the printing position by the controls called into operation by perforation 12*a* (Fig. 3*b*) another tape perforation 9*a* is encountered, and this is the control for stopping the envelope in position to receive the first line of print. From then on the tabulator continues to function to print line after line interspersed with line spacing operations until there is a disagreement between groups of cards showing that data relating to a new account is coming up for recording. Then the machine automatically goes into an envelope ejection and tape feeding operation which is terminated by the appearance of another home position perforation 1*b* under the related tape sensing brush B1 which controls devices for stopping the tape. Meanwhile the envelope has been ejected because in length it is shorter than the extent of feed governed by the space between the home perforations 1*a* and 1*b*. In other words, the space on the tape between perforations 1*a* and 1*b* is related to one piece of record material, such as envelope E, and all the other control perforations such as 9*a* and 12*a* within that area, govern the other functions related to envelope feeding.

Assuming that the tabulator is conditioned with the first address card about to go under the lower brushes and that all the proper plug wire connections have been made for the group control devices and that the switches governing sheet feeding as distinguished from ledger card feeding have been set, then upon the insertion of a sheet or envelope the controls are effective as follows. Upon the insertion of an envelope, the detector lever 33 (Fig. 3*c*) is rocked and contacts 40 are closed to set up a circuit through the pickup coil of relay R114. The complete circuit includes line 320, wires 120 and 121, contacts 40, wire 122, normally closed relay contacts R115*b*, the pickup coil of relay R114 and line 321. The relay then closes contacts R114*a* to set up a holding circuit and at the same time other contacts R114*b* are closed to provide a circuit through the solenoids 67 which, it will be remembered with reference to Fig. 3, are used to drop the shield 41 between the platen and the ribbon. The holding circuit includes line 320, wire 120, wire 123, normally closed relay contacts R116*c*, relay contacts R114*a*, and the holding coil of relay R114 and line 321. The circuit for the solenoids 67 comprises line 320, wires 120, 123, normally closed relay contacts R116*b*, the normally open relay contacts R114*b* now closed, solenoids 67 and line 321.

Relay R114 in addition to causing the operation of the shield for deflecting the leading edge of the envelope, also initiates operation of the tape control feeding devices so that the platen is rotated to move the entering envelope towards the print receiving position. The circuit for initiating a sheet feeding operation may be traced from line 320 (Fig. 3*a*) through the cam contacts CB52, CB53 and CB54, wire 124 (Fig. 3*b*), relay contacts R114*c*, wires 125 and 418, normally closed relay contacts R46*a*, starting control relay R19 and wire 416 to line 321. The energization of relay R19 operates in the ordinary way to effect clutching as though the feeding space key S had been depressed and there is started a space skipping operation which is terminated when the tape sensing brush B9 detects the perforation 9*a*. However, during the feeding operation a number of other controls are effective.

A relay R115 is provided as a form of interlock between the feeding device and the solenoid control relay R114. The object of these devices is to break the pickup circuit through the insertion detection contacts 40 and relay R114 dur-

ing the insertion of one envelope to prepare the connections for the appearance of the second envelope. As soon as sheet feeding is started, relay R19 closes contacts R19*a* and a circuit is directed through the pickup coil of relay R115 which is wired in parallel with an ordinary control relay R46 as shown in Fig. 3*b*. The circuit includes line 320, wires 415 and 417, the closed feed stop contacts ST, relay contacts R19*a*, wire 411, the pickup coil of relay R115, wire 416, and line 321.

Referring to the bottom of Fig. 3*c* it is seen that relay R115 not only breaks the connections to the pickup coil of relay R114 by open contacts R115*b*, but it also sets up a holding circuit by the closure of contacts R115*a*. The holding circuit includes line 320, wires 120 and 121, detector contacts 40 closed as long as an envelope is around the platen, wire 122, contacts R115*a*, the holding coil of relay R115 and line 321. As soon as the end of the envelope passes under the platen showing the need for preparation for reception of a second envelope, then the contacts 40 open and relay R115 is again deenergized and connections are reestablished to relay R114 to prepare for a feed initiating operation in connection with the second envelope.

As shown in Fig. 3*c* a second pair of contacts 40' is shown in dotted lines as arranged in shunt around the detector contacts 40 already mentioned. These extra contacts may be provided in one or more positions across the length of the platen in the event that narrow sheets are to be used in different positions on the platen. As many contacts are provided as desired so that sheet insertion detection extends across the entire carriage.

Before the envelope reaches the first printing line, the tape TP (Fig. 3*b*) moving in synchronization therewith places the perforation 12*a* under the sensing brush B12 to effect electrical controls for deenergizing the solenoids 67 so that the shield is withdrawn. This is done at a point when it is sure that the leading edge of the envelope is beyond interference with the ribbon and the type. The control includes the relay R116 which controls contacts R116*b* (Fig. 3*c*) already noted as being in series with the solenoids 67 and normally closed to provide a holding circuit for the solenoid to keep the shield in a lowered position during the initial portion of the envelope inserting cycle.

The circuit for energizing the pickup coil of relay R116 includes line 320 (Fig. 3*b*), wire 415, circuit breaker contacts 295 and 296 in the tape feeding unit, the common brush B13, a conductive portion of the tape drum 231, sensing brush B12 extending through perforation 12*a*, wire 479, switch ES1, wire 126, the pickup coil of relay R116 and line 321. As shown at the bottom of Fig. 3*c* the relay R116 performs three operations. By the closure of contacts R116*a* it provides a holding circuit for the relay, by the opening of contacts R116*b* it deenergizes the solenoids 67 to raise the shield, and by the opening of contacts R116*c* it deenergizes the relay R114 to prepare for control by a second envelope. All this is done while contacts 40 remain closed by the presence of a sheet or envelope around the platen. The holding circuit for relay R116 includes line 320, wires 120 and 121, contacts 40, wire 122, relay contacts R116*a*, the holding coil of relay R116 and line 321.

As the envelope and tape continue to feed (Fig. 3*b*), a predetermined line is reached which is selected to receive the first line of print such as the "name" line on the envelope and this is correlated with the position of the perforation 9*a* on the tape TP. The perforation 9*a* is used to call into operation a relay 117 which performs the functions of stopping the envelope feed and initiating operation of the tabulator to feed the record cards so that the data thereon may be sensed to control the printer. The circuit for the pickup coil of relay R117 is as follows: from line 320, through wire 415, circuit breaker contacts 295 and 296, common brush B13, contact drum 231, tape sensing brush B9 extending through perforation 9*a*, wire 127, switch ES2, wire 128, the pickup coil of relay R117 and line 321.

Relay R117 then closes contacts R117*b* in series with the high speed relays HS1 and HS4 which are used to break certain of the tape feeding controls to stop the feeding operation. The circuit through these devices includes line 320, wire 415, circuit breaker contacts 295 and 296, wire 129, relay contacts R117*b*, relay contacts R19*d*, relays HS4 and HS1, wire 416 and line 321.

The other control effected by relay R117 is shown in Fig. 3*a* and there the contacts R117*a* are normally open, but arranged in shunt around the start key contacts K1 so that when relay R117 operates it closes a circuit through the start key connections and calls into operation relay R12 which in turn effects operation of relay R11 and that in turn closes contacts R11*b* in series with the card feeding clutch magnet CFCM so that card feeding and sensing is started and carried on in the usual way.

After card feeding is started, the cards continue to feed in succession under the upper brushes UB, and then the lower brushes LB where they are analyzed to control the printer. As an incident to the printing of each line of print, a line spacing operation is caused in the usual way.

Printing of data such as a three line address on envelope E continues until there is a change of group number or an error in number perforations on a heading card. In either instance there is a group change, indicating that printing should stop and card feeding should stop while the envelope is ejected.

The circuit for the group change or error detecting devices can be followed from line 320 (Fig. 3*c*), through cam contacts CB17 and CB18, and then through any of the contacts R129*a*—R133*a*, or contacts R130*a*—R134*a*, closed at times not coordinated with each other, thus indicating a change in group number, and then to a plug socket 445 and through a plug wire to the pickup coil of relay R26, one of the coils of which is shown near the bottom of Fig. 3*b* and used to control suspension of the card feed in the tabulator and ejection of the envelope along with a return of the tape TP to the home position.

Upon a group change and energization of relay R26, two relays R21 and R102 (near bottom of Fig. 3*b*) are energized to eject the envelope, and bring the tape to a starting position. The circuit for the two relays includes line 320 (Fig. 3*a*), wire 340, card lever relay contacts R3*a*, wire 447, relay contacts R8*c* closed by the initial card feed of the tabulator, wire 448 (Fig. 3*b*), cam contacts CB33, normally closed contacts R27*b* and R29*b*, relay contacts R26*d* closed by the group change, plug socket NX—NXE, and plug wires to both relays R21 and R102, and line 321.

When relay R21 is energized it opens contacts

R21b (Fig. 3a) which has the effect of deenergizing relays R12 and R11, and there results the opening of contacts R11b in series with the card feed clutch magnet CFCM which is deenergized and then stops the card feed.

At the same time that relay R102 selects a stopping control brush it also initiates tape skipping and envelope ejection because relay R34 (not shown) is deenergized and contacts R34a (Fig. 3a) are allowed to close when relay R102 is picked up. Contacts R34a are in a circuit for establishing tape feed clutch connections to initiate feeding as follows: line 320 (Fig. 3a), cam contacts CB54, wire 442, cam contacts PM12, relay contacts R34a, wire 439 (Fig. 3b), the pickup coil of relay R19 and wire 416 to line 321. Relay R19 then acts to close contacts R19b in series with the high speed clutch interposer magnet HS. The feed initiating circuit includes line 320, wire 415, contacts R19b, contacts R34a, normally closed contacts R42c, magnet HS and wire 416 to line 321. Interposer magnet HS then closes contacts 217 to call in the clutching magnet LS. Magnet LS then operates to close the clutch connections between the motor and the platen drive shaft to rotate the platen and at the same time advance the feed control tape TP.

Energization of relay R102 (Fig. 3b) causes closure of contacts R102b, thus placing tape brush B1 in a stopping control circuit which is completed upon the sensing of oncoming tape perforation 1b in the first column. After the envelope E has been ejected, and when the following circuit is established through the tape, the feed clutch connection is broken and the tape stops in one of the "home" positions. The stopping circuit includes line 320, wire 415, circuit breakers 295, 296, common brush B13, the conductive portion of the tape drum 231, through the perforation 1b in the tape and through brush B1, wire 455, contacts R102b, wire 421, contacts R41a, contacts R20c, wire 422, contacts R19d, relays HS4 and HS1, wire 416 and line 321. Relay HS1 then opens contacts HS1a in series with holding coil of relay R19, thereby deenergizing the relay and causing it to open contacts R19b in series with the clutch magnet LS and interposer magnet HS so that tape skip feeding is terminated.

The foregoing section of the description of the electrical controls deals mainly with the devices used in conjunction with the sheet or envelope feed devices of Figs. 1–3. The section about to be presented relates to the ledger sheet handling controls for the devices of Figs. 3–6. There is quite a number of similar parts used for both, because the ledger sheet also cooperates with a sheet insertion detection lever 33 (Fig. 6) and quires a pair of solenoids 67 for operating a shield 41. Therefore, the wiring controls already described with reference to Figs. 3a, 3b and 3c, are also used to control the insertion of ledger sheets and, in addition thereto, there are the controls of Fig. 6a involving the star wheel contacts 99 for posting line determination and solenoid 88 for punching marginal holes 86.

Initially, the insertion of a ledger sheet causes the same operations as the insertion of a sheet or envelope, i. e., contacts 40 (Fig. 3c) are closed and relays R114, R115 and R116 cooperate to initiate feeding and operate solenoids 67 to lower the shield. Furthermore, tape TP' (Fig. 6a) for the ledger sheet controls has a perforation 12b for calling in the pickup coil of relay R116 (Fig. 3b) for withdrawing the shield.

Instead of a perforation such as 9a (Fig. 3b), tape TP' (Fig. 6a) has a perforation 2a for calling in relays R118 and R119 to delay action of the star wheel contacts 99 until the imperforate tape edge of the ledge sheet is past the star wheel and the wheel is in position to run over the part of the margin where posting control perforations 86 are to be found.

A number of delay relays R120, R121 and R122 are provided (Fig. 6a) and operated under control of the star wheel contacts to delay stoppage of the ledger sheet feed after the star wheel passes over the last marginal perforation 86. The reason for such delay is the spacing between the star wheel 97 (Fig. 6) and the punch 103. It is necessary to advance the sheet 2⅔ line spaces beyond the point at which the absence of a marginal perforation is detected under the star wheel. This is done to put the last marginal hole beyond the star wheel, one line space beyond the punch 103, and the sheet is then ready to receive another marginal perforation when a line is printed.

The card feed auto start relay R117 (Fig. 3b) instead of being under control of the ninth column tape sensing brush B9 as with envelopes, is placed in series (Fig. 6a) with the star wheel contacts 99 by switch LS2 so that, in the case of handling ledger sheets, the tabulating cards are advanced for sensing only after the star wheel 97 is raised over an imperforate marginal area which occurs when the sheet is advanced sufficiently to place the previously printed matter just beyond the printing line.

Assume now that a ledger sheet 85 (Fig. 6a) has been inserted, and that the detector lever contacts 40 (Fig. 3c) have initiated feeding and caused the shield to drop. Next, the perforation 12b (Fig. 6a) is sensed and relay R116 (Fig. 3b) opens contact R116b (Fig. 3c) to deenergize the solenoids 67 and allow the shield to be raised. The ledger sheet 85 continues to advance until the perforation 2a (Fig. 6a) calls a pair of relays R118 and R119 into operation just before the leading edge of the ledger sheet gets under the star wheel for the line finding start conditions. The circuit includes line 320, wire 415, circuit breaker contacts 295 and 296, common brush B13, tape drum 231, brush B2 extending through perforation 2a, wire 130, switch LS1, wire 131, the pickup coils of relays R118 and R119 and line 321. Relay R118 is a faster operating device than R119 for reasons about to be explained.

The holding coil of relay R118 is picked up prior to the action under control of brush B2. This early energization of relay R118 is by means of relay R114 which, it will be remembered by reference to Fig. 3c, is called in by insertion contacts 40 directly upon presentation of a sheet. Relay R114 closes contacts R114c and the holding coil of relay R118 is energized as follows: line 320, wire 393, wire 132, contacts R114c, holding coil R118 and line 321. Then relay R118 operates early in sheet insertion operation to open contacts R118b in series with the star wheel contacts 99 to insure that posting control does not start prematurely, and also to close contacts R118a for the following holding circuit: line 320, wire 393, normally closed printer cam contacts PM16, normally closed relay contacts R119b, wire 133, relay contacts R118a, relay coil R118 and line 321. This circuit holds the contacts R118b open until the 2a tape perforation is effective to indicate that the leading edge of the ledger sheet is at the star wheel.

Due to the quick action of the pickup coil of

relay R118 before relay R119 opens contacts R119b, relay R118 holds contacts R118b open beyond the time of sensing the 2a perforation and until the tape unit circuit breakers 295 and 296 open to extend the ineffective condition of star wheel contacts 99 until the leading edge is beyond the wheel.

The holding circuit for relay R119 is maintained to disable relay R118 and thereby make the star wheel contacts effective until a printing operation takes place and printer cam contacts PM16 open. The circuit includes line 320, wire 393, cam contacts PM16, wire 134, relay contacts R119a, the holding coil R119 and line 321.

If there is no marginal perforation 86 near the top of the leading edge of ledger sheet 85 (i. e., if the sheet is a new one with no previously printed lines on the sheet) then the transfer coil R120 is energized immediately after relay contacts R118b close as an incident to the passage of the leading edge of the sheet beyond the star wheel. The circuit comprises line 320, wire 415, circuit breaker contacts 295 and 296, star wheel contacts 99, relay contacts R118b, wires 135 and 136, relay R120 and line 321. Then relay R120 breaks the normally closed contacts R120a to provide a preliminary delay in the energization of relay R122 which is energized by relay R121 when the tape circuit breaker contacts 295 and 296 open to deenergize relay R120.

If one or more marginal perforations 86 are detected, the star wheel contacts 99 remain open and the circuit through relays R120 and R121 is delayed until the star wheel 97 rides up on the first imperforate marginal portion to close contacts 99 and call in relays R121, R122 and R123 successively to cause stopping at the posting line.

The first of the delay relays R121 is picked up along with the energization of relay R120 with which it is connected in parallel. The coil of relay R120 is adapted to operate faster than the pickup coil of relay R121 in order to prevent picking up the second relay R122 through normally opened contacts R121b when the other contacts R120a in series therewith are opened by the absence of a perforation in the first marginal position. The circuit for picking up both relays R120 and R121 is the one previously described passing through the star wheel contacts 99 and relay contacts R118b which are allowed to close due to the action of relays R119 and R118 directly after sensing the tape perforation 2a.

Relay R121 not only closes contacts R121b to pick up relay R122 but it also establishes a holding circuit for itself through the closure contacts R121a. The holding circuit includes line 320, wire 393, printer cam contacts PM16, wire 134, wire 137, relay contacts R121a, the holding coil of relay R121 and line 321.

The pickup coil of delay relay R122 is energized after the tape circuit breaker contacts 295 and 296 have opened and deenergized the relay R120. The circuit is then from line 320 through wires 393 and 136, normally closed relay contacts R120a, relay contacts R121b, the pickup coil of relay R122 and line 321. Then relay R122 operates to set up a holding circuit through its contacts R122a and also closed contacts R122b to pick up relay R123. The holding circuit for relay R122 includes line 320, wire 393, cam contacts PM16, wires 134 and 137, contacts R122a, through the holding coil of relay R122 and line 321.

The circuit for the pickup coil of relay R123 is completed when the tape circuit breaker contacts reclose on the next regular space cycle operation of the tape drum. The pickup circuit is from line 320, through wire 415, circuit breaker contacts 295 and 296, star wheel contacts 99, the normally closed relay contacts R118b, wire 135, delay relay contacts R122b, wire 139, the pickup coil of relay R123 and line 321.

A holding circuit is established through relay R123 as follows: line 320, wire 393, cam contacts PM16, wires 134 and 137, relay contacts R123a, the holding coil of relay R123 and line 321.

The delays caused by the successive energization of relays R121, R122 and R123 have postponed the stopping action of contacts R123c under control of the last delay relay for a time which is equivalent to one and two-thirds spaces after the absence of a marginal perforation is first detected. As already mentioned, this space is needed to bring the ledger sheet into a position wherein the last marginal perforation is brought from the position under the star wheel to a position at the punch.

The feeding devices are brought to a stop by the energization of high speed relay coils HS1 and HS4 wired in series with the contacts R123c of the final delay relay. The stopping circuit is as follows: from line 320 through wire 415, circuit breaker contacts 295 and 296, star wheel contacts 99, normally closed contacts R118b, relay contacts R123c, relay contacts R119d closed during feeding operation, relays HS4 and HS1, and wire 416 to line 321.

The relays HS1 and HS4 operate in the usual fashion to control the clutches of the tape feeding unit to bring the feeding devices to a halt as explained hereinbefore. The platen stops with the ledger sheet so positioned that the last marginal perforation 86 is under the punch and the last posting line of print is at the printing line. Since the sheet is advanced one more step before printing takes place, the sheet is properly positioned before printing so that a blank sheet space is presented at the printing line and a blank marginal area is presented to the punch for perforation after the line of print is recorded. This preliminary upstroke line spacing operation is selected by the ledger posting switch LS3 (Fig. 3a) which is shown to cause a shunt connection around the ordinary relay contacts R8d. These contact points R8d are associated with the normal controls detecting the advancing of the first card in the tabulator and when they are shunted a circuit is completed through connections extending through the feeding control relay R19 shown in Fig. 3b. The feeding clutch connections are established for one line space operation thereby advancing the ledger sheet one space along with the upstroke of the print bars. Therefore the sheet is advanced with the last printed line one line space above the printing line and the sheet is located to receive a line below the line last posted and a new marginal perforation 86 (Fig. 6a) is punched directly below the last marginal perforation.

Not only does relay R123 determine the time of stopping of the ledger sheet through the closure of contacts R123c, but it also operates through contacts R123b to perfect a circuit through the card feed auto start relay R117 to energize the card feeding clutch magnet in the tabulator. The circuit for relay R117 includes line 320, wire 415, circuit breaker contacts 295 and 296, star wheel contacts 99, relay contacts R118b, wire 140 and relay contacts R123b, ledger posting control switch LS2, wire 141, and relay R117 connected to line 321. Relay R117 then operates to close contacts R117a (Fig. 3a) ar-

ranged in shunt around the start key contacts K1 and circuits are prepared thereby through relays R11 and R12 to call the card feed clutch magnet CFCM into operation as already pointed out. It is understood that the tabulator cards have been drawn into the tabulator through the preliminary starting cycles so that the first card is ready to pass under the lower brushes LB in the usual fashion before the ledger sheet is inserted.

In Fig. 6a it is noted that all the holding circuits for the initiating and delaying relays R119, R121, R122 and R123 are in series with the printer cam contacts PM16 so that upon the first printing operation and consequent opening of said contacts, all the relays are dropped and conditioned to be ready for the subsequent insertion of another ledger sheet.

Along with the printing of each line of print, the punch control solenoid 88 is operated to perforate a marginal hole 86 for each line of print. The circuit includes line 320, wire 142, printer cam contacts PM17 closed for each printing cycle, wire 143, solenoid 88 and line 321.

One or more lines of print are impressed on the ledger sheet according to the number of record cards relating to the same group. When there is a group change, the operation of the feeding devices is initiated and the ledger sheet 85 is ejected and the tape TP' continues to feed until the home position perforation 1d passes under the tape sensing brush B1 and then connections are established for stopping the feed unit in the same manner as described in connection with the sheet and envelope feed described hereinbefore.

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 printing by impressing type against an inking ribbon and a record sheet, a platen for feeding said sheet, pressure rollers cooperating with said platen, feeding devices controlled by a perforated tape for operating said platen, a detecting lever with a portion extending between said platen and pressure rollers and operable by the leading edge of an inserted sheet, detector contacts operated by said lever, means under control of said contacts for initiating operation of said tape controlled feeding devices to operate the platen to advance the sheet, a shield extending across the machine between the ribbon and the platen for deflecting the leading edge of the sheet away from the ribbon, means for raising and lowering said shield, a pair of solenoids for operating said lowering means, means under control of said detector contacts for energizing said solenoids to lower said shield into deflecting position, a holding circuit for said solenoids, means under control of said tape for breaking said holding circuit when the leading edge of said sheet advances beyond the ribbon and before the sheet reaches the printing position, and means under control of said tape for stopping the feeding devices when the sheet reaches the first printing position.

2. A machine of the kind set forth in claim 1 wherein there is provided means for skipping space on said record sheet and record card group change devices for initiating operation of said skipping means, and wherein the tape is provided with three control perforations for each tape portion corresponding to a sheet, one perforation calling into operation the means for breaking the holding circuit for the sheet lowering solenoids and thus raising the shield, the second perforation calling into operation the means for stopping the feeding devices and thus terminating the feeding operation so that printing and line spacing may take place, and the third perforation acting to terminate the skipping operation initiated by said group change devices upon a group change of the record cards.

3. A machine of the kind set forth in claim 1 wherein said shield is supported on a pair of side arms, said arms being connected to cranks operated by said separate solenoids, and a pair of side guides comprising rollers cooperates with one face of said shield.

4. In a card controlled machine for printing address data by pressing type against an inking ribbon and an envelope, a platen and pressure rollers for feeding said envelope, feeding means controlled by a perforated tape for rotating said platen, means for detecting the envelope upon insertion, means under control of said detecting means for initiating operation of said feeding means to advance the envelope toward the first recording position, a shield adapted to be positioned between said ribbon and platen, means for moving said shield, means under control of said detecting means for controlling said moving means to drop the shield between the ribbon and platen, means under control of the perforated tape for controlling said moving means to raise the shield before the envelope reaches the first recording position, other means under control of said perforated tape for stopping said feeding means when said envelope reaches the first recording position, printing control devices operable under card control for printing lines of address data on said envelope, means for line spacing said envelope between line impressions, group change devices operable upon a change in card groups relating to different data, means under control of said group change devices for initiating operation of said feeding means to eject said envelope and other means under control of said perforated tape for stopping said feeding means and placing said tape in a starting position.

5. In a card controlled machine for printing by impressing type against an inking ribbon and a ledger sheet, a platen and cooperating pressure roller for feeding said ledger sheet, feeding means controlled by a perforated tape for rotating said platen to advance the record sheet, a detecting lever mounted under said platen and operated upon insertion of a sheet, detector contacts operated by said lever, means under control of said contacts for initiating operation of said feeding means, a shield, means for moving said shield to place it between said ribbon and platen to deflect the leading edge of the ledger sheet away from the ribbon, means under control of said detector contacts for operating said moving means to lower the shield into an effective position, means under control of said perforated tape for operating said shield moving means to raise the shield after the leading edge of the sheet passes above the ribbon, posting control contacts, a lever for operating said contacts, a star wheel mounted on said

lever and positioned to cooperate with marginal perforations in said ledger sheet, means under control of said posting contacts for stopping said feeding means when the ledger sheet is advanced far enough to present a blank line directly under the previously printed matter, printing devices, line spacing means for advancing the sheet for each line of print, a punch for perforating a marginal perforation, means under control of the printing devices for operating said punch, group change devices, means under control of said group change devices for initiating operation of said feeding means to eject the sheet, and means under control of said perforated tape for stopping said feeding means after the tape reaches the home position.

6. A machine of a kind set forth in claim 5 wherein the operation of the posting contacts is delayed under two conditions, a means is provided under control of the perforated tape for initially rendering the posting contacts ineffective so that the leading edge of the ledger sheet although it causes closure of said contacts fails to cause stoppage of the feeding means, and secondly a means is provided including relay devices called into operation by the second closure of the said posting contacts, said relay devices delaying the stopping action of said feeding controls whereby the ledger sheet is advanced from the star wheel detecting position to one line space beyond the perforating position.

7. In a printing machine wherein type press a record sheet against a platen to effect an impression thereon, means for feeding said sheet between the platen and the type, a shield for deflecting the leading edge of the sheet away from the type, means for moving said shield in and out of the deflecting position, means under control of the sheet for controlling said moving means to put the shield in the deflecting position early in the sheet feeding cycle, and means under control of the feeding means for controlling said moving means to take the shield out of the deflecting position after the leading edge of the sheet is advanced beyond the area betwen the platen and the type.

8. The combination set forth in claim 7 wherein said shield moving means includes a pair of solenoids with plungers connected to the side arms of a bail whereon said shield is held for movement.

9. In a printing machine wherein type press an inking ribbon against a record sheet to effect an impression thereon, means for feeding said sheet, a shield for deflecting said sheet away from said ribbon, means for moving said shield, means for detecting the insertion of a sheet, means under control of said detecting means for controlling said moving means to put the shield between said ribbon and said sheet, means for automatically determining when the leading edge of the sheet is above the ribbon, and means under control of said determining means for controlling said moving means to remove the shield.

10. In a machine for feeding sheets with marginal perforations denoting the progress of printing thereon, means for feeding the sheet, a star wheel the teeth of which fit into said perforations, said wheel being rotated idly as long as the advancing sheet operates it, but raised by the appearance of an imperforate marginal area, means for supporting said wheel for pivotal and swinging movement, and means under control of the raised wheel for stopping operation of said feeding means, whereby the sheet is positioned to receive printing directly under previously printed matter.

11. In a device for feeding a ledger sheet provided with marginal perforations denoting the extent of printing thereon, means for feeding said sheet, detector contacts, a lever for operating said contacts, said lever being operated upon insertion of said sheet, means under control of said contacts for initiating operation of said feeding means, posting control contacts, a posting control lever for operating said control contacts, a star wheel pivotally mounted on said lever in the path of said marginal perforations, the teeth of said wheel fitting into said perforations whereby the wheel is revolved thereby and the control lever is actuated to close said control contacts only when said wheel rides up on an imperforate marginal area of said sheet related to the printing position directly under the last printed line, and means under control of said posting control contacts operated by said control lever and star wheel for controlling said feeding means to stop the ledger sheet in position to receive a printing impression directly under the last recorded line.

12. In a sheet feeding device, a tape with indicia for controlling the advance of the sheet, means for sensing said indicia, means under control of said sensing means for operating to feed the sheet, a shield for guiding the sheet, means for operating the shield, a sheet detecting means for sensing the insertion of a sheet, means under control of said detecting means for controlling said sheet feed operating means and said shield operating means, and means under control of said tape sensing means for restoring said shield operating means.

13. In a card controlled tabulator for printing on a sheet of record material advanced in synchronism with a feed control tape which is perforated in different positions in a plurality of columnar positions to govern the starting and stopping positions of the record material, in combination, a platen, means under control of said tape for rotating said platen to line space and feed the record material, printing means with type, card controlled means for adjusting said type and impressing them against a ribbon and said material on said platent, a lever operated by the leading edge of an inserted sheet, electrical contacts operated by said lever, a movable shield for deflecting the leading edge of the sheet away from said type and said ribbon and around said platen, and electrically controlled means under control of said contacts for moving said shield into the deflecting position as soon as a sheet is inserted.

14. The combination set forth in claim 13 wherein there is provided means for controlling the differential adjustment of a ledger sheet bearing marginal perforations denoting the extent of printing thereon comprising a punch operated with said printing means to punch a marginal perforation for each line of print, a star wheel for riding on the margin of said ledger sheet to be either turned idly by engagement of teeth of the wheel with advancing marginal perforations or raised when an imperforate marginal portion passes under the wheel, a lever on which the said wheel is pivoted, contacts closed by said lever when the wheel is raised, and devices under control of said contacts for stopping said platen rotating means to position said sheet to receive a line of print either on the first line or directly under previously printed lines.

15. The combination set forth in claim 14

having two delay devices cooperating with the star wheel contacts, the one delay device being operated under control of the feed control tape to delay the effect of the contacts until the leading edge of the ledger sheet is past the wheel, and the second delay device being operated by the star wheel contacts to delay stoppage of the platen rotating means until the last marginal perforation is one line space beyond the punching position.

16. The combination set forth in claim 13 including means under control of said perforated feed control tape for controlling said electrically controlled means to withdraw said shield as soon as the leading edge of the sheet is past the ribbon and before the sheet is stopped to receive a printing impression.

17. The combination set forth in claim 13 including electrical means operated by three control perforations in the feed control tape, the one control means serving to stop the rotating means to locate the tape in the home position after a sheet is ejected, the second control means serving to control the electrically controlled means to withdraw the shield as soon as the leading edge of the sheet is past the ribbon, and the third control means serving to determine the stopping position of an inserted sheet to locate the first printing line thereon.

18. In a machine for printing by impressing type against an inking ribbon and a record sheet, a platen for feeding said sheet, pressure rollers cooperating with said platen, automatic feeding devices for operating said platen, a detecting lever with a portion extending between said platen and pressure rollers and operable by the leading edge of an inserted sheet, detector contacts operated by said lever, means under control of said contacts for initiating operation of said feeding devices to operate the platen to advance the sheet, a shield extending across the machine between the ribbon and the platen for deflecting the leading edge of the sheet away from the ribbon, means for raising and lowering said shield, a pair of solenoids for operating said lowering means, means under control of said detector contacts for energizing said solenoids to lower said shield into deflecting position, a holding circuit for said solenoids, and means under control of said automatic feeding devices for breaking said holding circuit when the sheet advances beyond the ribbon and before it reaches the printing position.

19. In a card controlled machine for printing by impressing type against an inking ribbon and a ledger sheet which has indicia denoting the progress of printing thereon, a platen and cooperating pressure rollers for feeding said ledger sheet, automatic feeding devices for rotating said platen to advance the sheet, a detecting lever mounted under said platen and operated upon insertion of a sheet, detector contacts operated by said lever, means under control of said contacts for initiating operation of said feeding devices, a shield, means for moving said shield to place it between said ribbon and platen to deflect the leading edge of the ledger sheet away from the ribbon, means under control of said detector contacts for operating said moving means to lower the shield into an effective position, means under control of said automatic feeding devices for operating said shield moving means to raise the shield after the leading edge of the sheet passes above the ribbon, posting control contacts, a lever for operating said contacts, means for sensing said ledger sheet indicia, means under control of said indicia sensing means for operating said lever to operate said posting control contacts, means under control of said posting contacts for stopping said feeding devices when the ledger sheet is advanced far enough to present at the platen a blank line directly under previously printed matter, printing devices, line spacing means for advancing the sheet for each line of print, means for adding a progress indicium on said sheet for each line of print, means under control of the printing devices for operating the last mentioned means, group change devices, and means under control of said group change devices for initiating operation of said feeding devices to eject the sheet.

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