Dec. 8, 1959 C. A. PARKER 2,916,129

FORM HANDLING DEVICE FOR BUSINESS MACHINES

Filed May 12, 1958 5 Sheets-Sheet 1

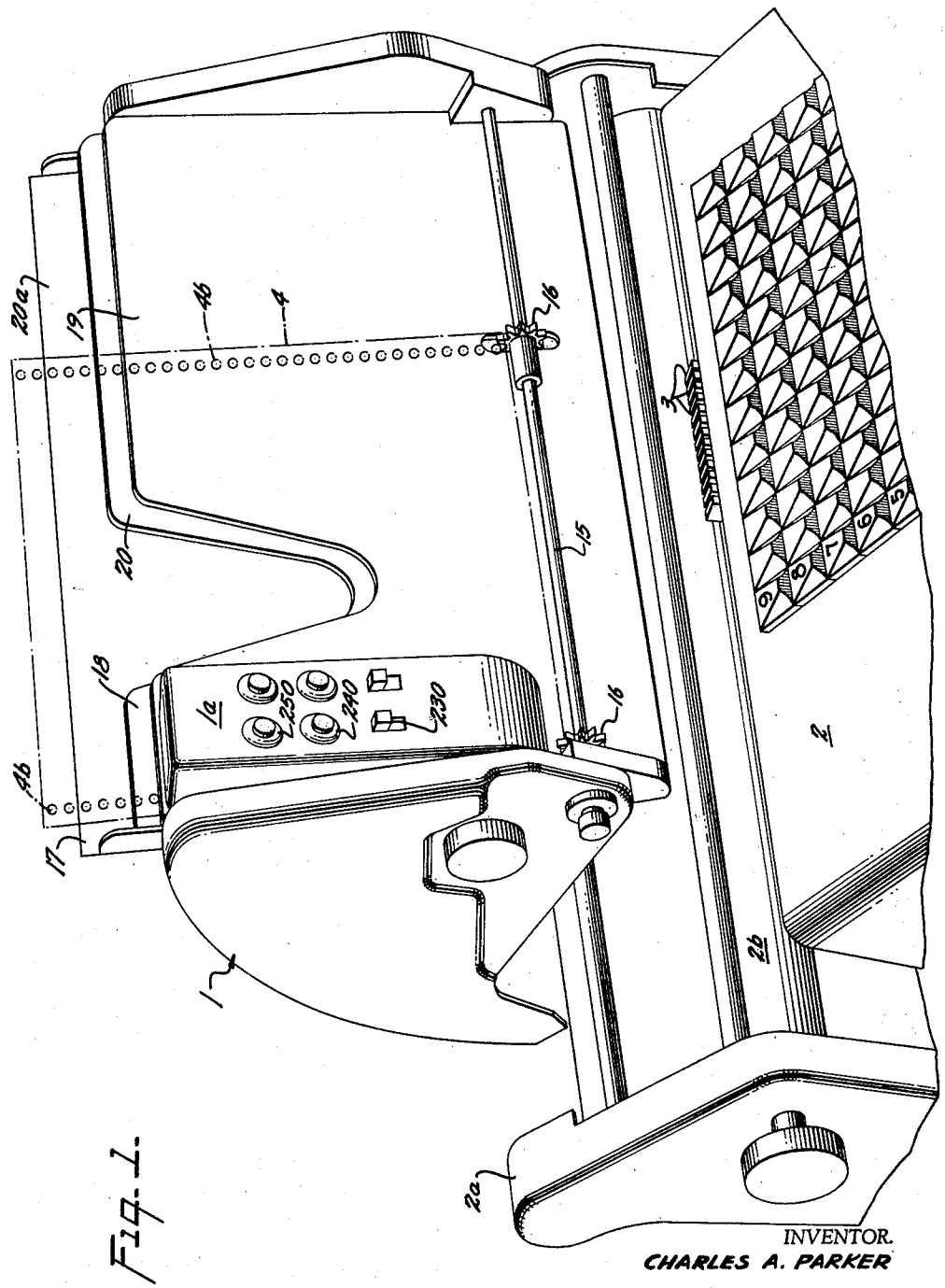


Fig. 1.

INVENTOR.
CHARLES A. PARKER
BY
Norman Friedman
ATTORNEY.

Dec. 8, 1959 C. A. PARKER 2,916,129

FORM HANDLING DEVICE FOR BUSINESS MACHINES

Filed May 12, 1958 5 Sheets-Sheet 2

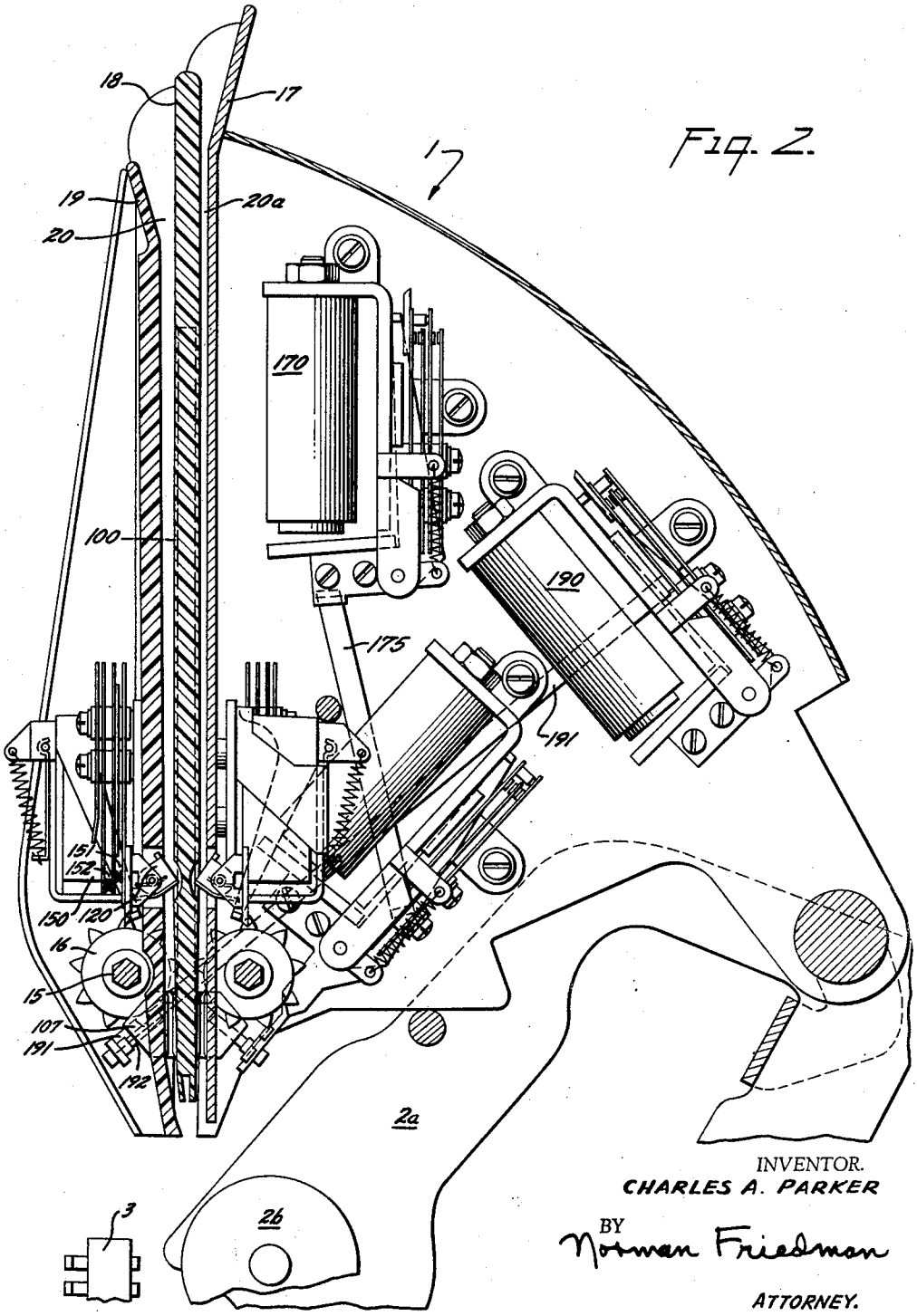


Fig. 2.

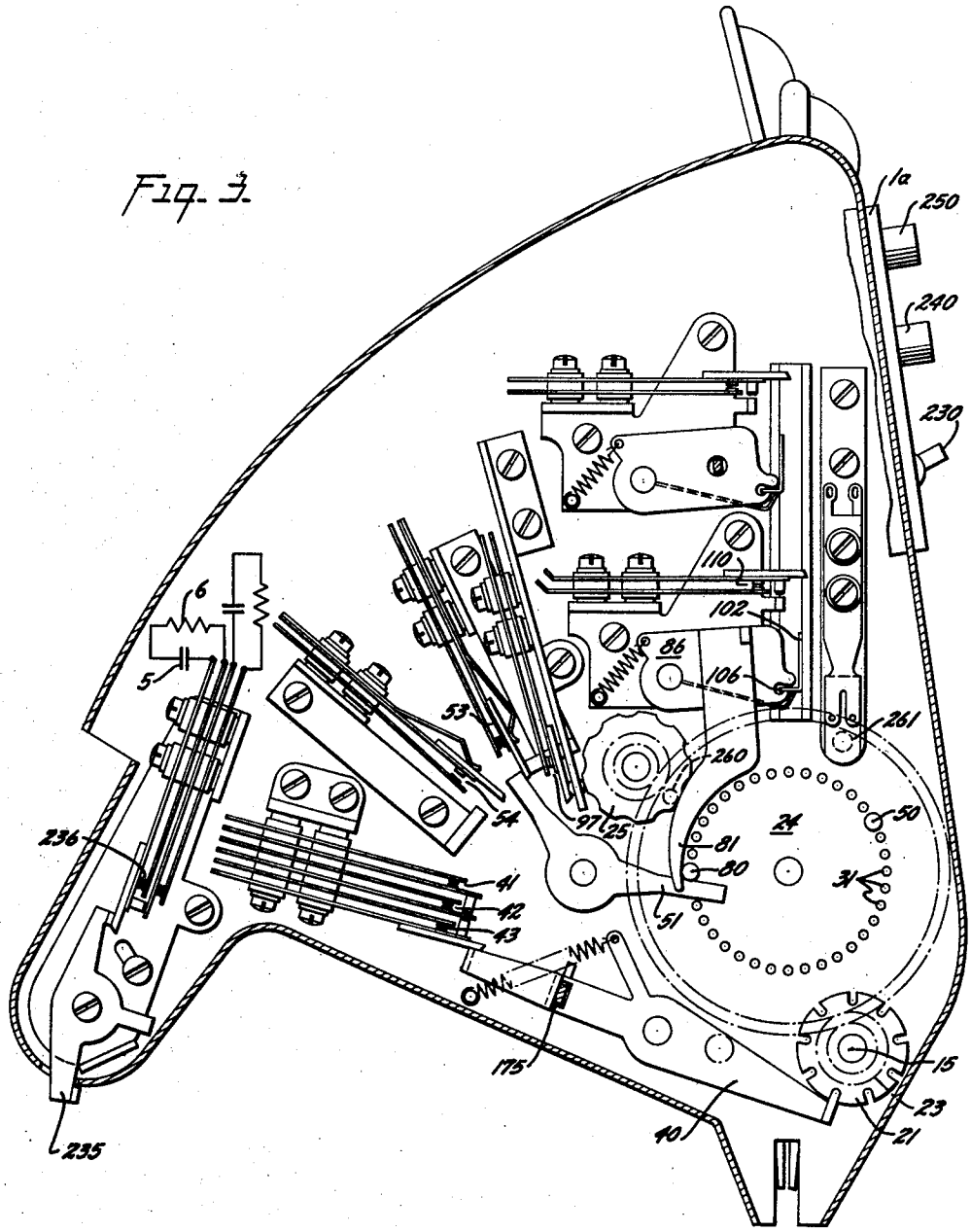
INVENTOR.
CHARLES A. PARKER
BY Norman Friedman
ATTORNEY.

Dec. 8, 1959 C. A. PARKER 2,916,129

FORM HANDLING DEVICE FOR BUSINESS MACHINES

Filed May 12, 1958 5 Sheets-Sheet 3

Fig. 3.



INVENTOR.
CHARLES A. PARKER

BY
Norman Friedman

ATTORNEY.

Dec. 8, 1959 C. A. PARKER 2,916,129

FORM HANDLING DEVICE FOR BUSINESS MACHINES

Filed May 12, 1958 5 Sheets-Sheet 4

Fig. 4.

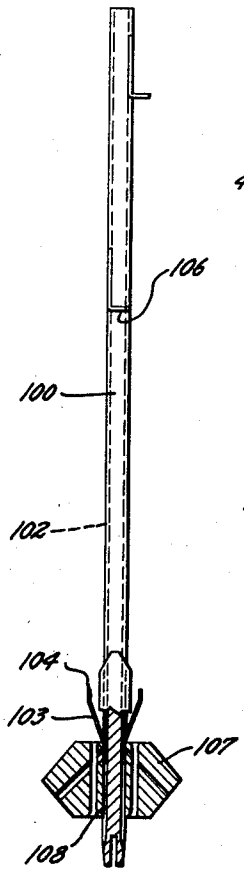


Fig. 5.

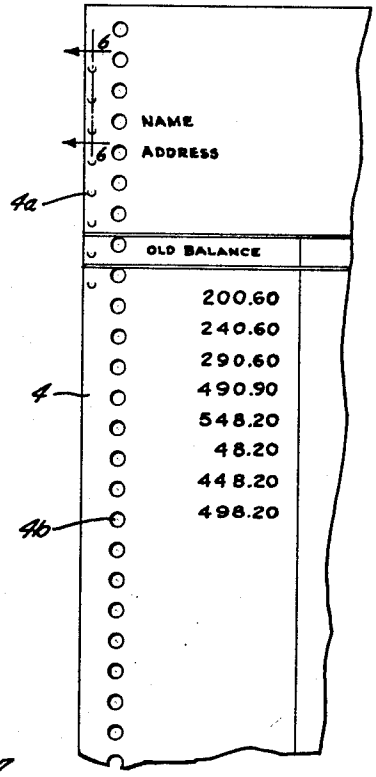
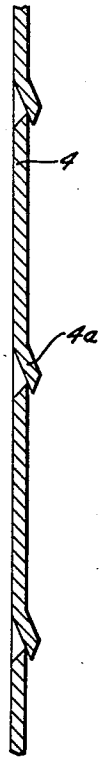


Fig. 6.



INVENTOR.
CHARLES A. PARKER

BY
Norman Friedman

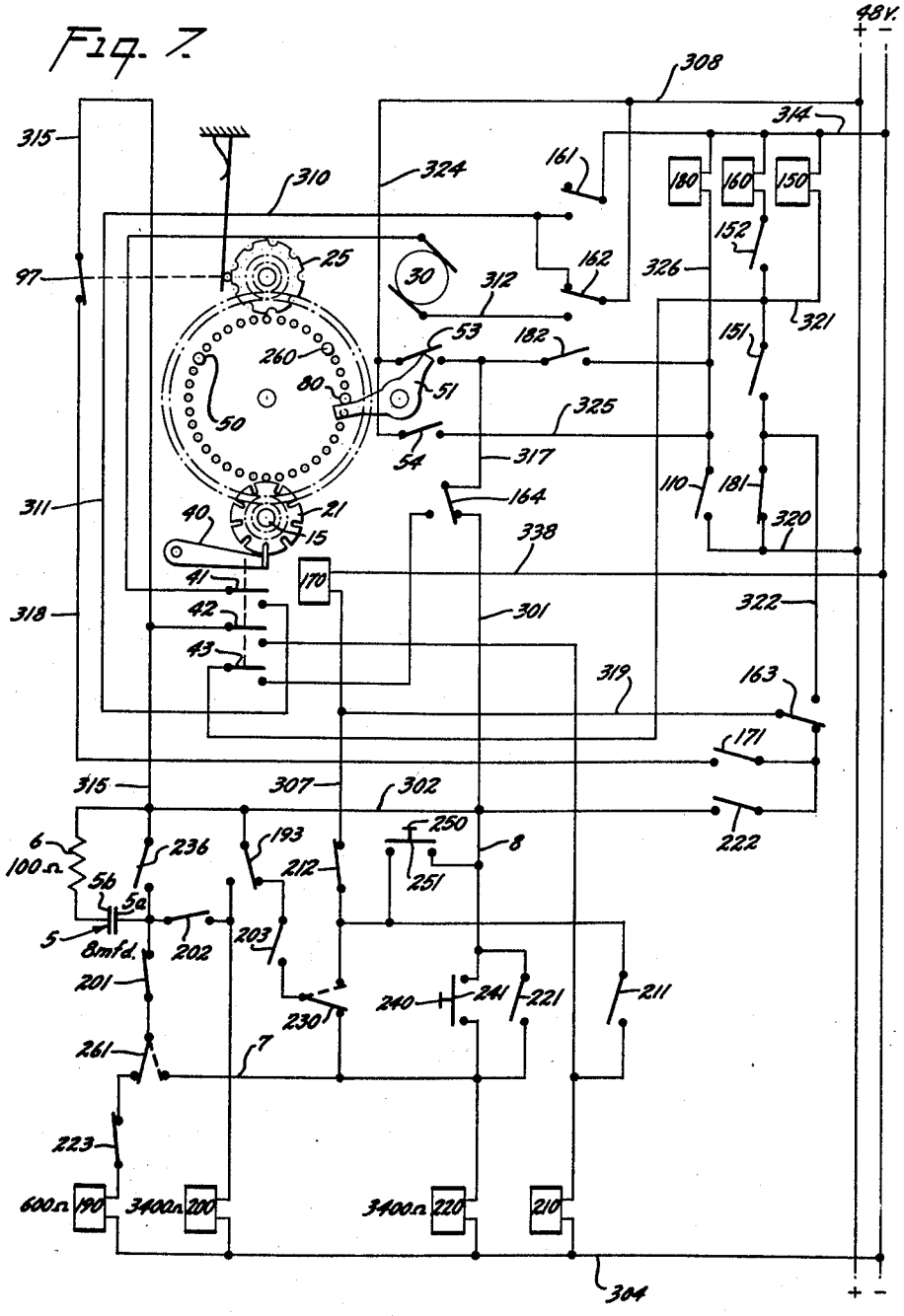
ATTORNEY.

Dec. 8, 1959 C. A. PARKER 2,916,129

FORM HANDLING DEVICE FOR BUSINESS MACHINES

Filed May 12, 1958 5 Sheets-Sheet 5

Fig. 7.



INVENTOR.
CHARLES A. PARKER
BY
Norman Friedman
ATTORNEY.

United States Patent Office 2,916,129 Patented Dec. 8, 1959

2,916,129

FORM HANDLING DEVICE FOR BUSINESS MACHINES

Charles A. Parker, East Orange, N.J., assignor to Monroe Calculating Machine Company, Orange, N.J., a corporation of Delaware

Application May 12, 1958, Serial No. 734,781

14 Claims. (Cl. 197—128)

The present invention pertains to form handling devices. More particularly, it relates to form handling devices of the type which automatically position a work sheet in proper line position for receiving printing impressions from a machine such as a typewriter or an accounting machine.

One such form handling device is disclosed in United States patent application Serial No. 485,782 filed February 2, 1955 by M. Oberholzer and W. Reber under the title "Front Feed Apparatus for Bookkeeping or Typewriting Machines," now Patent No. 2,831,560. As set forth therein the device, which is mounted on the shiftable carriage of a printing machine, includes a front feed chute into which the operator inserts a work sheet. Thereupon, the sheet is automatically fed downwardly to the proper line position for printing as controlled by suitable feed control designations or representations carried by the sheet. When the carriage is returned after printing, another feed control designation is applied to the sheet to govern the feeding thereof the next time it is to be used, and the sheet is automatically fed upwardly for either a single line spacing or for ejection. After posting is completed on the last line of the sheet and the carriage returned, the sheet is automatically ejected upwardly.

The prior art device described above possesses one particular shortcoming in that a full sheet, i.e., one which has been posted on all its available lines, if inadvertently inserted into the device will be fed downwardly to position its last line for printing and will remain there. Accordingly, the current printing will improperly be superimposed over the previous printing which already appears on the last line.

In accordance with the present invention, this situation is prevented by providing that a full sheet inserted into the form handling device will be automatically ejected immediately upon termination of downward feed thereof to its last line position.

It is therefore an object of the invention to provide an improved form handling device for a printing machine.

It is a further object to provide a form handling device which will prevent printing on a full sheet inserted into the device.

It is a further object to provide a form handling unit which will provide the operator with an indication that a full sheet has been inserted.

It is a more specific object to provide a form handling unit which will automatically eject an inserted full sheet immediately upon downward feed thereof to its last line position, thereby preventing printing on the sheet and indicating to the operator the fact that the sheet is full.

It is a further object to provide a form handling unit in which the above functions are achieved by the use of a small number of inexpensive components.

The above and other objects, features, and advantages of the present invention will be more fully understood from the following detailed description when considered

in connection with the accompanying drawings in which:

Fig. 1 is a perspective view of the form handling device of the invention mounted on the carriage of an accounting machine.

Fig. 2 is an enlarged transverse sectional right-hand view of the device taken through its right-hand end portion.

Fig. 3 is an enlarged transverse sectional left-hand view of the device taken through its left end portion.

Fig. 4 is a right side elevational detail of the sensing means for controlling automatic line positioning of a work sheet.

Fig. 5 is a fragmentary front elevation of a work sheet used with the form handling device.

Fig. 6 is an enlarged fragmentary sectional view taken on line 6—6 of Fig. 5.

Fig. 7 is a schematic wiring diagram of the electrical circuitry of the form handling device of the invention.

The present invention is an improvement over a form handling device of the type disclosed in patent application Serial No. 485,782 filed by M. Oberholzer and W. Reber. Reference is hereby made to said application for conventional details of structure not fully disclosed herein. To the extent practical, parts of the instant device which correspond to like or equivalent parts of the application device will be similarly numbered.

Referring now to Fig. 1, the form handling unit **1** is there shown rigidly mounted in any suitable fashion on the shiftable platen carriage **2***a* of an accounting machine **2** which may be constructed as disclosed in Patent No. 2,809,782 issued October 15, 1957 to H. M. Fleming. Differentially adjustable type members **3** of the machine are adapted to print digital values on a work sheet **4** held in front of platen **2***b* as controlled by operation of the machine. It will of course be realized that unit **1** may be suitably incorporated in any desired type of typewriting or accounting machine.

As disclosed in the Oberholzer et al. application, the form handling unit **1** is automatically operable to place the work sheet in proper line position for receiving printing impressions from type members **3**. The machine operator need merely insert the work sheet into the upper end of one or the other of two paper receiving chutes **20**, **20***a*. In response to sheet insertion, operation of sheet feeding mechanism is automatically initiated whereby the sheet is driven downwardly. The downward feed will be terminated in either one of two ways, depending upon whether the sheet is fresh, i.e., has never been printed on previously, or has been used before. In the case of a fresh sheet, the downward feed thereof will continue to a maximum extent until its first (or uppermost) available lines is positioned to receive printing, at which time the feed will be terminated in response to operation of a preset control means. However, if the sheet has previously received printing on one or more lines, it will contain corresponding feed control designations applied by suitable devices of unit **1** during the prior handling of the sheet. These designations comprise a series of tabs **4***a* (Figs. 5, 6) punched in descending order along one side of the sheet, the lowermost tab having been punched following the most recent line posting operation. As the sheet is fed downwardly, the said lowermost tab is brought into cooperable relation with a sensing means, the latter thereupon being operable to control termination of feed whereby the next blank line is positioned to receive entries. Since the particular type of control designation forms no part of the invention, other suitable designations may be employed if desired.

After printing has been completed on the line, the carriage is returned in any conventional manner. The carriage return movement will operate a switch **236** (Fig.

3) which is effective to cause punching of another tab, said tab controlling the automatic line positioning of the sheet the next time it is used. Following the punching operation, the paper feed means is automatically operated in reverse direction to drive the sheet upwardly. Depending on the setting of a two-position manually settable switch, the upward feed will either be terminated after a single line space of movement, or will continue until the paper is ejected, that is to say, until the paper is fed upwardly to the maximum extent permitted by its feed holes.

As best seen in Figs. 1 and 2, the sheet handling unit **1** includes three vertical closely spaced plates **17**, **18**, **19** which define front and rear paper receiving chutes **20** and **20***a* respectively. The instant description will deal only with paper inserted into the front chute **20**; however, it will be understood that, as disclosed in the aforementioned Oberholzer et al. application, substantially identical mechanism is provided for independently controlling a separate sheet of paper in chute **20***a*. Either or both chutes may contain paper. In the latter case, printing can be effected on the rear sheet through the medium of carbon paper interposed between the two sheets; or, the rear sheet may be wider than the front sheet and printing performed directly on that portion of the former which lies to the side of the latter.

Feeding of a sheet **4** in chute **20** is effected by means of a pair of spaced sprocket wheels **16** each engageable with preformed feed holes **4***b* of the sheet. Wheels **16** are secured to a shaft **15** which is adapted to be rotated in one or the other direction by a reversible motor **30** (shown schematically in Fig. 7) acting through a suitable drive train (not shown).

Fixed to the left-hand end portion of shaft **15** is a radially recessed detent wheel **21** (Fig. 3) which is normally engaged by the forward end of a spring urged detent lever **40** pivotally mounted on the left side framing plate of unit **1**.

The angular spacing of adjacent recesses of wheel **21** corresponds to the line spacing of a sheet, whereby detent lever **40** will accurately and positively locate the sheet in its various vertical positions. Lever **40** is adapted to be rocked clockwise to release shaft **15** by means of a relay **170** (Fig. 2) whose armature is connected to the lever by a link **175**. Such movement of lever **40** will also be effective to operate three normally open switches **41**, **42**, **43** which overlie the rear end thereof. Closure of switch **41** completes a circuit for motor **30** which will thereupon be energized to operate feed sprockets **16**.

Introduction of a work sheet into chute **20** will automatically initiate operation of the drive for the paper feed sprockets **16** to cause the sheet to be fed downwardly. For this purpose, a sensing member **120** projects into the chute a short distance above the sprockets, and will, upon being engaged by the lower edge of the sheet, be shifted to the rear to close a switch **151**. A circuit for a relay **150** will thereby be completed, the operating movement of whose armature serves to withdraw the sensing member from chute **20** so that said member will not interfere with downward movement of the sheet.

Operation of relay **150** will be effective to operate a relay **160** (Fig. 7), contacts **161** and **162** of the latter relay controlling the polarity (and therefore the direction of rotation) of motor **30**. When relay **160** is deenergized, the direction of motor rotation will be such as to drive sprockets counterclockwise (Figs. 1, 2) to feed a sheet upward; conversely, when the relay is energized, the motor will operate the feed sprockets clockwise to feed the sheet in descending direction.

Operation of relay **160** will establish a circuit for relay **170** which will withdraw detent arm **40** from engagement with detent wheel **21**, this movement of the arm closing switch **41** and thus initiating motor operation. In view of the energized condition of relay **160**, the sprockets **16** will be rotated clockwise and will feed the paper downwardly. It should be noted that the work sheet will have dropped to cooperable relation with sprockets **16** by the time the latter elements start to rotate.

If the sheet is free of any previous entries, it will be fed downwardly to a maximum extent to position its first line for printing, the feed being terminated under control of a pin **50** mounted on a control gear **24** (Fig. 3). Gear **24** is driven by a pinion **23** fast on shaft **15**, the incremental angular positions of said gear corresponding to the various line spaced positions of the work sheet. Gear **24** is provided with an annular series of apertures **31**, any one of which is adapted to receive pin **50** whereby the feed may be terminated at any preset selected line position. Gear **24** will rotate clockwise as the paper descends and in the course of such movement pin **50** will move into engagement with the forward arm of a bell crank **51**, rocking the latter clockwise to close a normally open switch **54** and thus complete a circuit for a relay **180**, the operation of which is effective to terminate the downward paper feed.

If the sheet has previously received entries, it will contain the aforementioned control tabs **4***a*, the lowermost of which is sensed to terminate the feed with the next blank line properly positioned to receive printing. The means for sensing said lowermost tab comprises an elongated strip **102** (Figs. 3, 4) which is guided at its lower end for vertical movement in guide channel **108** defined by respective opposed walls of a block **107** and a member **100**. The lower resilient end **103** of said strip is bent upwardly and outwardly, the free end **104** thereof being adapted to frictionally contact the rear face of a sheet within chute **20**. To insure that portion **104** will not obstruct the downward passage of the lower end of a descending sheet, sensing member **102** is normally disposed in a position somewhat lower than that shown in Fig. 4 whereby guide channel **108** will hold portion **104** closely adjacent to the main body portion of member **102**. As described in the aforementioned Oberholzer application, this function is performed by a pivoted member **86** (Fig. 3) whose slotted forward end is engageable with a horizontal offset **106** of member **102**. A depending portion **81** of member **86** is normally prevented from rocking counterclockwise by a pin **80** mounted on control gear **24**. When the paper has moved downwardly a distance sufficient to allow its lower end to clear sensing portion **104**, pin **80** of control gear **24** will no longer block member **86**, the latter thereupon being free to rock counterclockwise under the urge of a suitable spring and raise portion **104** to active sensing position. When the lowermost tab **4***a* encounters sensing portion **104**, it will shift member **102** in downward direction, closing a switch **110**. This will complete a circuit for the feed terminating relay **180** and the paper will come to rest in proper line position.

When gear **24** is in its normal unoperated position seen in Fig. 3, pin **80** abuts and maintains bell crank **51** in clockwise position, the latter thereby holding open a switch **53** which is resiliently biased toward closed position. As soon as downward feeding movement of the work sheet is initiated, pin **80** will be removed clockwise from engagement with the bell crank, allowing switch **53** to close. The switch will then remain closed until the sheet is subsequently restored to its starting position at which time pin **80** will once again engage bell crank **51** and open the switch.

Control gear **24** is also provided with a laterally protruding button **260** positioned so that it closes a transfer switch **261** when the paper is in position to receive printing on its last (or lowermost) line. The operation of switches **53** and **261** will be discussed in some detail subsequently in connection with the electrical contact circuitry of the invention.

After posting is completed on the line, the carriage is

returned in any suitable fashion. During a portion of the return movement, a lever **235** pivoted on unit **1** (Fig. 3) will engage a suitable cam surface provided on the fixed framing of the accounting machine and will be rocked clockwise to close a normally open switch **236**. Closure of switch **236** will complete a circuit for a punch relay **190** (Fig. 2) whose armature is connected by a link **191** to a punch member **192**. Punch member **192** is guided for longitudinal movement in an inclined hole of block **107** and will be actuated, upon operating movement of said armature, to form an index tab *4a* which will serve to control the subsequent insertion of the sheet into unit **1**. Immediately after the punching operation there will follow an automatically initiated upwardly directed feeding movement of the sheet. This upward movement will either be continuous to eject the sheet or will be limited to a single line spacing operation depending on the setting of a manually adjustable two-position switch **230** mounted on a control panel *1a* of unit **1** (Fig. 1).

ELECTRIC CIRCUIT DIAGRAM AND OPERATION (FIG. 7)

Paper insertion

As mentioned before, upon insertion of the sheet into chute **20**, sensing member **120** will be operated to close switch **151**. A circuit for relay **150** will be established as follows: line **314**, relay **150**, line **321**, switch **151**, normally closed contact **181** of relay **180**, line **320**. The energization of relay **150** will close a normally open contact **152** thereof completing a circuit for relay **160** through line **314**, relay **160**, contact **152**, switch **151**, normally closed contact **181** of relay **180**, line **320**. Transfer contacts **161** and **162** of relay **160** will accordingly be operated to adjust the polarity of motor **30** for downward paper feed. Two additional transfer contacts **163** and **164** of relay **160** will be operated, contact **163** completing a circuit for relay **170** through line **338**, **170**, line **319**, contact **163**, line **322**, contact **181**, line **320**. The energization of relay **170** will cause disengagement of detent arm **40** from detent wheel **21**, releasing shaft **15** for rotation and causing closure of switches **41**, **42**, and **43**. This completes a circuit for motor **30** as follows: line **308**, contact **162**, line **312**, motor **30**, switch **41**, line **311**, line **310**, contact **161**, line **314**. The motor will now operate to drive sprockets **16** clockwise as viewed in Fig. 2, and the paper will be fed in downward direction.

Termination of downward feed

Pin **50** will terminate the downward feed to position a fresh sheet of paper for printing on its first line in the following fashion. As the sheet approaches this position, bell crank **51** will be engaged and rotated counterclockwise in Fig. 3 (clockwise in Fig. 7) by the pin, closing switch **54**. This completes a circuit for the feed terminating relay **180** as follows: line **314**, relay **180**, line **326**, line **325**, switch **54**, line **324**, line **308**. The normally closed contact **181** of relay **180** will open and will break the above described circuits for relays **150** and **170**. However, even though relay **170** is now deenergized, detent arm **40** is at this time riding on the outer surface of detent wheel **21** and is thus still held in clockwise position. Switches **41**, **42**, and **43** therefore remain in closed condition, the motor remaining energized through switch **41**, relay **150** (and consequently relay **160**) remaining energized through switch **43** as follows: line **314**, relay **150**, line **321**, switch **43**, transfer contact **164** of relay **160**, line **317**, switch **53**, line **324**, line **308**. It will be recalled that switch **53** is permitted to close as soon as the downward paper movement commences. The feed continues for a short distance until detent arm **40** drops into the next recess of detent wheel **21** whereupon switches **41**, **42**, and **43** are permitted to open, breaking the motor circuit and the circuit for relay **150**. Contact **152** of the latter relay will now open, deenergizing relay **160** so that its contacts **161**, **162**, **163**, and **164** return to their normal condition shown in Fig. 7.

If the paper has previously been posted on, it will contain the punched index tabs *4a*, the lowermost of which will engage sensing member **102** to close switch **110** before pin **50** reaches bell crank **51**. A circuit for the terminating relay **180** will be established as follows: line **314**, relay **180**, line **326**, switch **110**, line **320**. Relay **180** will now control termination of the downward feeding movement in the same fashion as described in the preceding paragraph.

Punching

After posting on a line has been completed, the carriage is returned. During the return movement, lever **235** will maintain switch **236** closed for a period of time. A circuit for the punch relay **190** is accordingly established as follows: line **308**, line **324**, switch **53**, line **317**, transfer contact **164** of relay **160**, line **301**, line **302**, switch **236**, normally closed contact **201** of relay **200**, transfer switch **261**, normally closed contact **223** of relay **220**, punch relay **190**, and line **304**; whereby the punch member **192** is actuated to form an index tab in the work sheet. Transfer contact **193** of punch relay **190** will hence be operated and will establish a circuit for relay **200** as follows: line **308**, line **324**, switch **53**, line **317**, contact **164**, line **301**, line **302**, contact **193**, relay **200**, line **304**. The normally closed contact **201** of relay **200** will now open deenergizing the punch relay **190**, and a normally open contact **202** of relay **200** will now close to establish a holding circuit for this latter relay through switch **236**, its primary circuit having been broken by the normalizing of transfer contact **193**.

Ejection or line spacing after punching

Relay **200** includes a second normally open contact **203** which, upon energization of said relay, will establish a circuit for initiating either ejection of the paper or a single line spacing thereof, depending on the setting of switch **230**. If the switch is set to its upper position as shown in Fig. 3 (corresponding to the full line position of Fig. 7), contact **203** completes a circuit for the ejection control relay **220** through line **308**, line **324**, switch **53**, line **317**, contact **164**, line **301**, line **302**, contact **193** (now normalized since relay **190** is deenergized), contact **203**, switch **230**, relay **220**, line **304**. A normally open contact **222** of relay **220** now establishes a circuit for relay **170** as follows: line **308**, line **324**, switch **53**, line **317**, contact **164**, line **301**, contact **222**, contact **163**, line **319**, relay **170**, and line **338**; and detent arm **40** will be disengaged from detent wheel **21** to initiate motor operation in the manner heretofore described. As the carriage continues its return movement, switch **236** will open, breaking the circuit for relay **200** whereby the actuating circuit for relay **220** through contact **203** is opened. However, relay **220** will be held energized by its normally open holding contact **221** through the following circuit: line **304**, relay **220**, contact **221**, lines **8** and **301**, contact **164**, line **317**, switch **53**, and lines **324** and **308**.

Since relay **160** is in deenergized condition, the direction of motor rotation will be such as to drive the work sheet in upward direction. The sheet will be continuously driven until pin **80**, rotating counterclockwise (Fig. 3) engages bell crank **51**, opening switch **53** and thereby breaking the above described holding circuit for relay **220**. Contact **222** will open causing the circuit for relay **170** to be broken, and the motor drive will be terminated when detent arm **40** drops into the next slot of detent wheel **21**.

If switch **230** is set to its lower position (corresponding to the broken line showing in Fig. 7), the punching operation will be followed by an upward feed of the paper which will be limited to a single line space. When contact **203** closes, it will complete a circuit for relay **170**

as follows: line 308, line 324, switch 53, line 317, contact 164, lines 301 and 302, contact 193, contact 203, switch 230, normally closed contact 212 of relay 210, line 307, relay 170, line 338. Upward feeding movement will accordingly be initiated; however, the closing of switch 42 by detent arm 40 will complete a circuit for relay 210, opening contact 212 and causing deenergization of relay 170. The feed will terminate when arm 40 drops into the next recess of the detent wheel.

It has been found that on certain occasions switch 42 will energize relay 210 with such rapidity that the detent wheel has not advanced sufficiently far to prevent the detent arm 40 from reengaging with the same detent recess from which it was just disengaged. If this happens, it will be apparent that the paper will not advance. To prevent this from occurring, there is provided a cam wheel 25 (Figs. 3, 7) which is driven from control gear 24 and is effective to cyclically close a switch 97. As described in the Oberholzer et al. application, the lobes of cam wheel 25 are positioned to maintain switch 97 closed when detent arm 40 is aligned with a recess of the detent wheel and also for a short distance thereafter. Consequently, even though the circuit for relay 170 through contact 212 may have been broken by a very rapid operation of relay 210, another circuit for relay 170 will exist as follows: line 338, relay 170, line 319, contact 163, normally open (but now closed) contact 171 of relay 170, line 318, switch 97, lines 315, 302, and 301, contact 164, switch 53, lines 324 and 308. This circuit through switch 97 will be held closed by cam 25 until the detent wheel 21 has been rotated an amount sufficient to prevent the detent arm from re-entering the same recess of the wheel. Cam 25 will now permit switch 97 to open; however, since the detent arm is at this time riding on the outer surface of the wheel, motor operation will continue until the arm engages with the succeeding recess.

Ejection of full sheet upon carriage return

After posting has been completed on the last line of the work sheet, a carriage return movement will initiate ejection of the sheet. This ejection operation will not be preceded by a punching operation and will occur regardless of the setting of switch 230. Earlier, brief mention was made of transfer switch 261, which is operated by button 260 of control gear 24 only when the sheet stands at last line position, this condition of the switch being shown in broken lines in Fig. 7. Accordingly, when the carriage return switch 236 now closes, a circuit for the ejection relay 220 will be established as follows: line 308, line 324, switch 53, line 317, contact 164, line 301, line 302, switch 236, contact 201, switch 261, line 7, relay 220, and line 304. It will be seen from an inspection of Fig. 7 that the punch relay 190 will not be operated in view of the operated condition of switch 261, and further that the circuit for relay 220 is independent of switch 230. Relay 220 will thereupon operate to initiate ejection of the paper as described earlier. Switch 236 will reopen as the carriage continues its return movement and switch 261 will be returned to normal position as soon as the upward movement of the paper commences; however, holding contact 221 of relay 220 will continue energization of the relay until the eject operation is terminated by the opening of switch 53.

Ejection of full sheet immediately after downward feed to last line

If a full work sheet is inserted into a conventional form handling device constructed in accordance with the foregoing description, the sheet will be fed downwardly and will come to rest (as controlled by a tab 4*a*) with the last line positioned to receive printing. Since the sheet already has been posted on the last line, it is apparent that the new posting will be superimposed on the last posting. In accordance with the present invention, this undesirable result is avoided by the provision of means for automatically operating the eject relay 220 as soon as the downward feed of the full sheet to its last line position is terminated. The sheet is consequently ejected immediately whereby a second posting on the last line is prevented and the operator is made aware that a new sheet should be begun.

For this purpose a capacitor 5 is connected in parallel with switch 236, a current limiting resistor 6 being provided in series with the capacitor. Capacitor 5 is normally discharged, and upon being charged the charging current will be effective to operate relay 220. Plate 5*a* of the capacitor is normally connected to the minus side of the line through contact 201, switch 261, contact 223 of relay 220, relay 190, and line 304. Its other plate 5*b* is adapted to have access to the positive side of the line through resistor 6, line 302, line 301, contact 164, line 317, switch 53, and lines 324 and 308. Switch 53 being normally open, the capacitor 5 will be uncharged. It will be recalled from the prior description under the heading "Paper Insertion" that the direction control relay 160 (and therefore its contact 164) is operated prior to the commencement of downward feed and that as soon as the feed commences switch 53 is closed. In view of the operation of contact 164 prior to the closing of switch 53, the last described circuit between plate 5*b* and the positive side of the line will remain broken during the downward paper feed. As the full sheet moves into its last line position button 260 will operate switch 261 before relay 160 is deenergized and normalizes contact 164 upon termination of downward feed. Plate 5*b* is therefore now connected to the positive line, while plate 5*a* is connected to the negative side of the line through relay 220 as follows: contact 201, switch 261, line 7, relay 220, line 304. The charging current drawn by capacitor 5 through relay 220 will be sufficient to operate the relay, the latter thereupon being effective to control ejection of the paper as hereinbefore set forth.

As soon as relay 220 operates, its holding contact 221 will establish a short circuit discharge path for the capacitor as follows: line 7, switch 261, contact 201, capacitor 5, resistor 6, line 302, line 8, contact 221. The discharge path will be interrupted by the normalizing of switch 261 immediately upon the commencement of upward movement of the paper. Plate 5*b* of the capacitor is still connected to the positive line through contact 164 and switch 53; however, the circuit between plate 5*a* through relay 190 to the negative side of the line has previously been broken by operation of normally closed contact 223 of relay 220 when the latter relay was energized by charging of the capacitor. The ejection operation will be concluded by opening of switch 53 which will, as described before, result in deenergizing of relay 220, and will therefore re-establish the circuit from the negative line through relay 190 and contact 223 to plate 5*a*; but since switch 53 opens first and thereby breaks the positive circuit for plate 5*b* before the closing of contact 223, the capacitor will remain uncharged.

It should be noted that under certain conditions capacitor 5 will be charged through relay 190. For example, consider a situation in which the paper, upon insertion, is fed to an intermediate line position. As stated hereinbefore, plate 5*a* normally has access to the negative line. At the termination of the downward feed, contact 164 will be returned to its normal position shown in Fig. 7 and will thereby complete the circuit from plate 5*b* to the positive line. Capacitor 5 will thereupon charge through the punch relay 190. Such a charging of the capacitor, however, will be ineffective to operate said relay for the following reasons. The components here under discussion are of the values shown in Fig. 7, namely, relay 200, 3,400 ohms; relay 190, 600 ohms; capacitor 5, 8 mfd.; resistor 6, 100 ohms. Of course, these values merely represent one specific embodiment since those skilled in the art can readily arrive at different combina-

tions of values which will be operative to function in the same fashion. It will be apparent therefore that the RC time of the charging path through relay **220** will be considerably greater than the RC time of the path through relay **190**. Further, relay **220** when energized has only its contacts as a mechanical load whereas relay **190** must operate punch **192** in addition to its contacts. For these reasons, the charging pulse through relay **220** is capable of operating this relay, while the charging pulse through relay **190** is insufficient to energize this latter relay to perform its intended functions.

In addition to operating relay **220** as described before, capacitor **5** performs another useful purpose in connection with a line spacing operation automatically initiated after punching. Briefly reviewing this sequence of operations, it will be recalled that when the carriage is returned switch **236** operates the punch relay **190** which, through its contact **193**, operates relay **200**, the latter relay deenergizing relay **190** and establishing a circuit for relay **170** through contact **203**. It will be remembered that relay **200** will remain operated only so long as switch **236** is held closed, and that the switch is operated by lever **235** which is moved to operated position by a cam surface on the machine frame during return movement of the carriage. It is desirable that the carriage return movement be as rapid as possible in order that the overall machine operation be speeded up. It has been found however that when the carriage return speed is increased above a certain point, switch **236** will open (and will therefore break contact **203**) before relay **170** has had sufficient time to disengage detent arm **40** from wheel **21**. Capacitor **5** will overcome this disadvantage by allowing relay **200** to remain energized for a period of time sufficient to enable relay **170** to perform its intended function, as follows. So long as switch **236** is closed, a discharge path for the capacitor will exist through the switch. By the time switch **236** again opens, relay **200** will of course be operated whereby its normally closed contact **201** is now open, interrupting the negative circuit to plate *5a* through relay **190**. Furthermore, normally open contact **202** of relay **200** will be closed. Accordingly, the opening of switch **236** will interrupt the discharge path and will cause the capacitor to be charged through line **304** and relay **200**, the charging current being of sufficient amount and duration to keep relay **200** energized long enough for its contact **203** to allow relay **170** to disengage detent arm **40** from wheel **21**. When the work sheet is subsequently ejected by operation of relay **220**, contact **221** will permit the capacitor to discharge as set forth earlier.

Manually initiated ejection and line spacing

Means are provided whereby a sheet may be either line spaced or ejected under control of the operator without the necessity of returning the carriage. For this purpose there are provided on the control panel **1***a* (Fig. 1) two push buttons **240** and **250**. Depression of button **240** will initiate ejection, and depression of button **250** will initiate a line spacing operation.

Referring to Fig. 7, operation of button **240** will close a switch **241** to complete a circuit for the ejection relay **220** as follows: line **304**, relay **220**, switch **241**, line **8**, line **301**, contact **164**, switch **53**, and lines **324** and **308**; and the relay will control ejection of the paper in the manner hereinbefore set forth.

With reference to the line space button **250**, depression thereof will close a switch **251** to complete a circuit for relay **170** as follows: line **338**, relay **170**, line **307**, normally closed contact **212** of relay **210**, switch **251**, line **8**, line **301**, contact **164**, switch **53**, and lines **324** and **308**. Relay **170** will disengage detent arm **40**, closing switches **41**, **42**, and **43** and thereby initiating motor operation. Switch **42** will complete a circuit, described earlier, for relay **210**, opening contact **212** to break the circuit for relay **170**. Therefore, detent arm **40** will be free to engage with the next slot of detent wheel **21** upon completion of a single line space movement of the paper, and relay **210** will be normalized upon opening of switch **42**.

Should the operator still have button **250** depressed at the time the line space operation is completed, relay **170** would again be energized through contact **212** and the paper line spaced. To prevent this, a normally open contact **211** of relay **210** insures that a depression of line space button **250** will result in only a single line space movement of the paper regardless of how long the button is held depressed. When relay **210** is energized through switch **42**, a holding circuit therefor will be established through contact **211**. This holding circuit is as follows: line **304**, relay **210**, contact **211**, switch **251**, and thence through lines **8** and **301**, contact **164**, and switch **53** to the positive side of the line. Accordingly, if switch **251** is still held closed at the completion of the single line space movement, the holding circuit will prevent relay **210** from being deenergized. Contact **212** will accordingly remain open preventing a second operation of relay **170**.

While there has been shown a preferred embodiment of the invention, it will be understood that various changes may be made in the form, detail, arrangement, and proportions of the parts without departing from the spirit and scope of the invention. Thus, although the instant disclosure shows the invention as embodied in the device of the Oberholzer et al. patent application, the broader principles of the invention are equally applicable to many different types of work sheet handling mechanisms for printing machines. Accordingly, it is intended that the foregoing disclosure be illustrative only and not limitative of the following claims.

I claim:

1. In a work sheet feeding device for a printing machine, sheet feeding means operable to feed a work sheet in one direction to one of a plurality of line positions and alternatively operable thereafter to feed said sheet in the opposite direction for ejection thereof, first control means for controlling operation of said feeding means to feed said sheet to said one line position, and ejection control means operated immediately upon feeding of said sheet in said one direction to a predetermined line position for controlling operation of said feeding means to feed said sheet in the opposite direction for ejection thereof.

2. The invention according to claim 1, said first control means including means operable to terminate the feeding of said sheet in said one direction at said one line position, and normally ineffective operating means effective immediately upon termination of said feeding movement at said predetermined line position for operating said ejection control means.

3. The invention according to claim 2, said predetermined line position being the position in which the last line of the sheet is positioned to receive printing impressions from said printing machine.

4. The invention according to claim 2, said operating means comprising two normally disabled operating components both of which must be enabled to render said operating means effective, means for enabling one of said operating components upon operation of said terminating means, and means for enabling the other operating component upon movement of said sheet in said one direction into said predetermined line position.

5. In a work sheet feeding device for a printing machine, sheet feeding means operable to feed a work sheet in one direction to one of a plurality of line positions and alternatively operable thereafter to feed said sheet in the opposite direction for ejection thereof, control means for controlling operation of said feeding means to feed said sheet to said one line position, a normally ineffective ejection control relay operable to control operation of said feeding means to feed said sheet in said opposite direction for ejection thereof, and normally ineffective electric circuit means for operating said relay immedi-

ately upon termination of feeding movement of said sheet in said one direction at a predetermined line position.

6. The invention according to claim 5, including means for rendering said electric circuit means effective in response to termination of feeding movement of said sheet in said one direction at said predetermined line position.

7. The invention according to claim 5, said electric circuit means including two normally disabled circuit portions both of which must be enabled to render said electric circuit means effective, means for enabling one of said circuit portions in response to termination of feeding movement in said one direction, and means for enabling the other circuit portion in response to movement of said sheet into said predetermined line position.

8. In a work sheet feeding device for a printing machine, sheet feeding means operable to feed a work sheet in one direction to one of a plurality of line positions and alternatively operable thereafter to feed said sheet in the opposite direction for ejection thereof, control means for controlling operation of said feeding means to feed said sheet to said one line postion, a normally ineffective ejection control relay operable to control operation of the feeding means to feed the sheet in said opposite direction for ejection thereof, normally disabled circuit means for operating said relay, said circuit means comprising: a normally discharged capacitor in series with said relay for operating said relay by charging therethrough, and a normally open charging circuit for said capacitor, said charging circuit including said relay: and means for enabling said circuit means, said enabling means comprising means for closing said charging circuit upon termination of feeding movement of the sheet in said one direction at a predetermined line position.

9. The invention according to claim 8, said control means including means for terminating feeding movement of said sheet in said one direction, said charging circuit including a normally open circuit portion, said means for closing said charging circuit including means for closing said circuit portion upon operation of said terminating means.

10. The invention according to claim 8, said control means including means for terminating feeding movement of said sheet in said one direction, said charging circuit including a normally open circuit portion, said means for closing said charging circuit including means operable to close said circuit portion upon movement of said sheet in said one direction into said predetermined line position.

11. The invention according to claim 8, said control means including means for terminating feeding movement of said sheet in said one direction, said charging circuit including two normally open circuit portions, said means for closing said charging circuit including: means for closing one of said circuit portions upon operation of said terminating means, and means for closing the other of said circuit portions upon movement of said sheet into said predetermined line position.

12. In a front feed work sheet handling device for a printing machine, front feed guide means for said sheet, means for feeding said sheet to a postion wherein a blank line thereof below the lowermost previously printed line is positioned to receive printing from said machine, means for determining whether said previously printed line is a predetermined line, and means controlled by said determining means for preventing any printing thereafter on said blank line when said previously printed line is said predetermined line.

13. The invention according to claim 12, said means for preventing printing comprising means for ejecting said sheet.

14. The invention according to claim 13, said predetermined line being the lowermost line upon which said sheet is to receive printing.

References Cited in the file of this patent

UNITED STATES PATENTS

2,244,252 Keen ---------- June 3, 1941

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,916,129 December 8, 1959

Charles A. Parker

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 52, for "lines" read -- line --; column 5, line 38, after "338," insert -- relay --.

This certificate supersedes Certificate of Correction issued July 12, 1960.

Signed and sealed this 8th day of November 1960.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents