July 15, 1947. W. A. AYRES 2,424,073

RECORD FEEDING DEVICE

Original Filed Dec. 15, 1939 4 Sheets-Sheet 1

FIG.1.

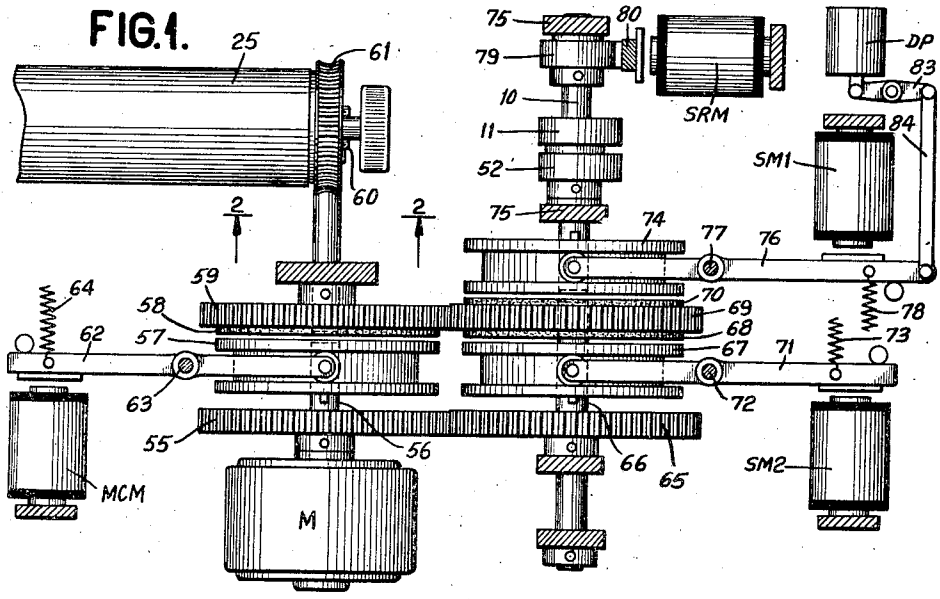


FIG.2.

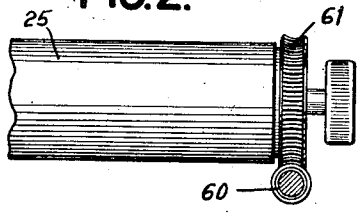
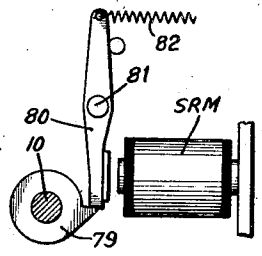


FIG.3.



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July 15, 1947. W. A. AYRES 2,424,073

RECORD FEEDING DEVICE

Original Filed Dec. 15, 1939 4 Sheets-Sheet 2

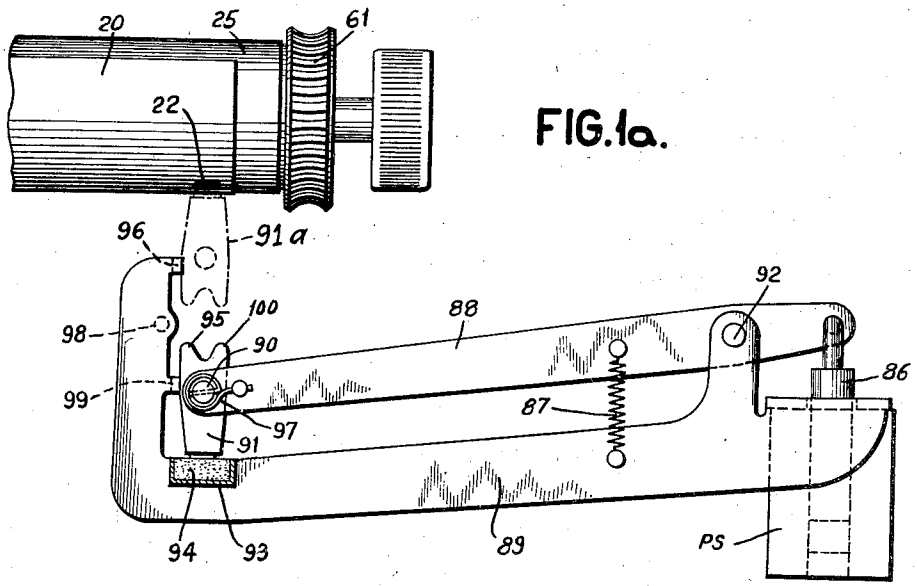
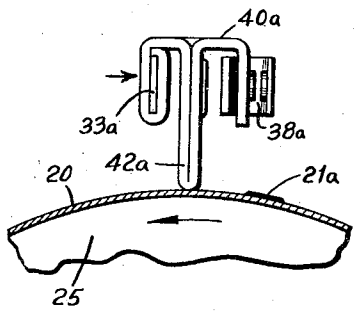


FIG. 1a.

FIG. 8a.



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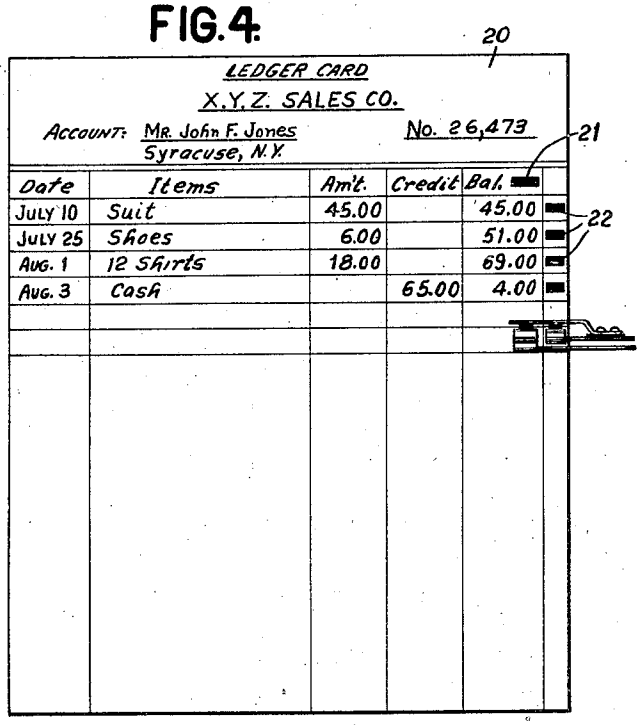
July 15, 1947. W. A. AYRES 2,424,073

RECORD FEEDING DEVICE

Original Filed Dec. 15, 1939 4 Sheets-Sheet 3

FIG. 4.



LEDGER CARD

X.Y.Z. SALES CO.

ACCOUNT: Mr. John F. Jones, Syracuse, N.Y. No. 26,473

Date	Items	Am't.	Credit	Bal.
JULY 10	Suit	45.00		45.00
JULY 25	Shoes	6.00		51.00
AUG. 1	12 Shirts	18.00		69.00
AUG. 3	Cash		65.00	4.00

FIG. 5.

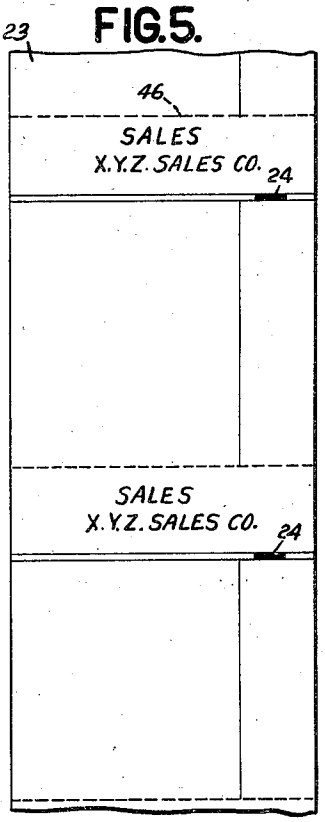


FIG. 8.

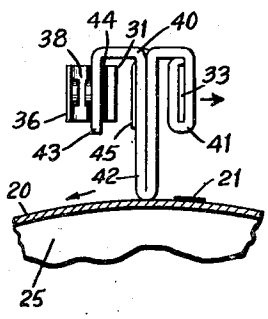


FIG. 6.

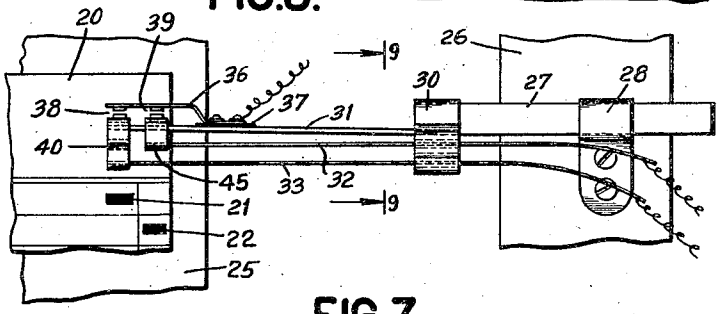


FIG. 9.

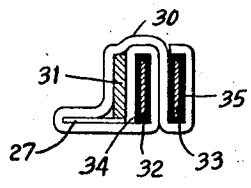
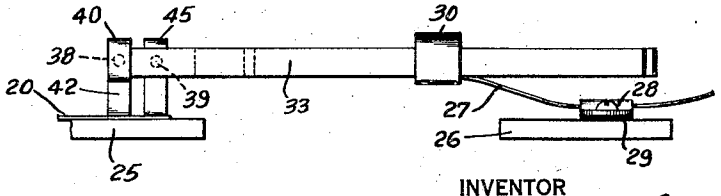


FIG. 7.



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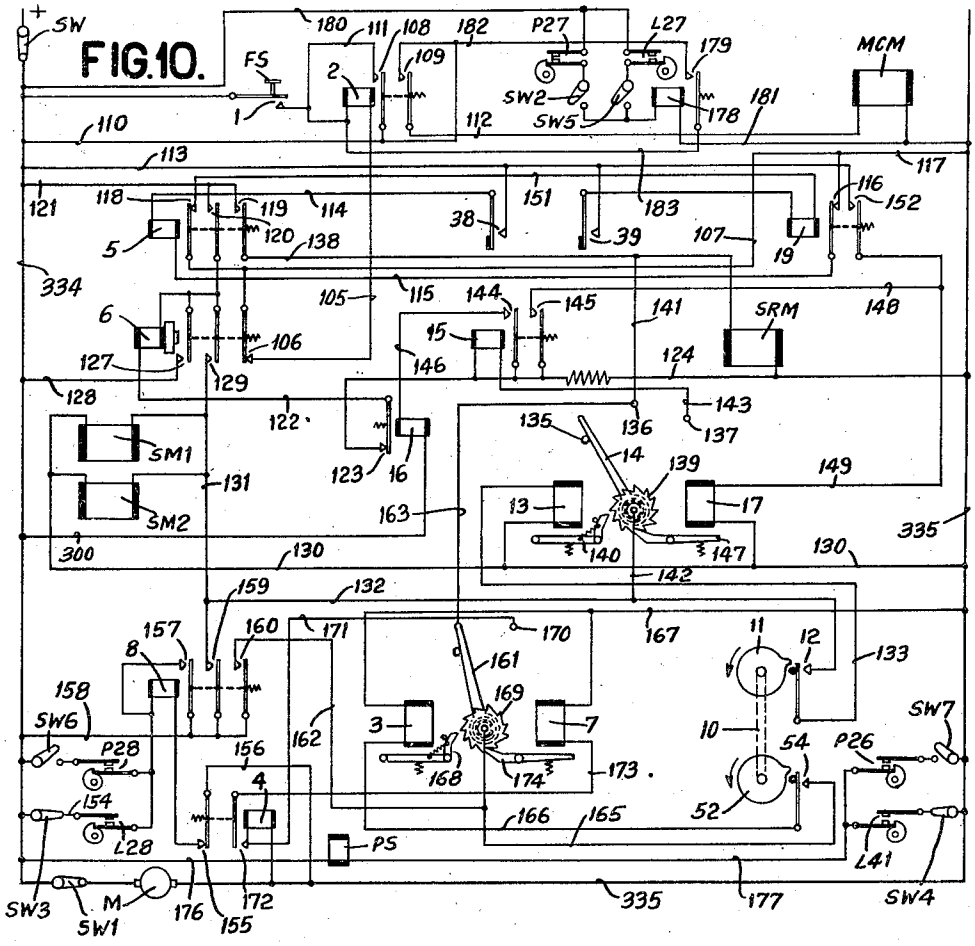
July 15, 1947. W. A. AYRES 2,424,073

RECORD FEEDING DEVICE

Original Filed Dec. 15, 1939 4 Sheets-Sheet 4

FIG.10.



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Patented July 15, 1947 2,424,073

UNITED STATES PATENT OFFICE

2,424,073

RECORD FEEDING DEVICE

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Original application December 15, 1939, Serial No. 309,445, now Patent No. 2,366,827, dated January 9, 1945. Divided and this application March 4, 1944, Serial No. 525,112

7 Claims. (Cl. 197—127)

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This is a division of my application Serial No. 309,445, filed December 15, 1939, and issued as Patent No. 2,366,827, on January 9, 1945, said application being further divided into three applications, Serial No. 525,111, filed on March 4, 1944; Serial No. 737,771, filed on March 28, 1947; and Serial No. 737,772, filed on March 28, 1947. The parent case, Patent 2,366,827, presents claims to the sensing devices cooperating with records having frictional indicia; the present case, Serial No. 525,112, contains claims for devices for controlling sheet feeding by frictional indicia thereon; the third case, Serial No. 525,111, asserts claims for a control element bearing index points of friction material; the fourth case, Serial No. 737,771, sets forth claims for a control element bearing index points which are mechanically treated to make them frictional; and the fifth case, Serial No. 737,772, presents claims for a control element bearing index points of lubricating material.

This invention relates generally to improvements in devices for making and sensing index points on accounting records and more specifically to means for marking or treating a record to change its frictional characteristics at differential points which are later sensed to control the accumulation and recording of the data represented. The frictional marks may also control the feeding of a sheet bearing them.

An object of the present invention is to provide a control element or card with index points in the form of frictional surface marks which do not weaken the element and do not interfere with printed matter on the element. The friction material may be colorless to avoid confusion with the printed matter over which it may be placed.

Another object of the invention is to provide a record element made of fine paper which is smooth to the touch but has a high coefficient of friction, said element having index points marked thereon with graphite, wax or powder to cause certain index areas to have a lower coefficient of friction than the body of the element. As an alternative form of record, there may be used a paper stock which appears rough to the touch but which has a low coefficient of friction and is receptive to marks made with frictional matter such as rubber, gum, ink, pitch or wax which are comparatively higher in frictional characteristics.

Another object of the invention is to treat accounting records with frictional marking materials of either a water or oil base to fix data representing index points thereon. For example, the

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marking material may be composed of latex plus water soluble glue and added coloring material if desired. Another composition may include rubber dissolved in benzol or any other rubber solvent plus resin dissolved in turpentine plus coloring material if desired.

It is also an object of the invention to provide record sensing devices sensitive to all types of data representation.

The sensing devices when adapted to distinguish between areas of differing frictional nature are also suited to sense incised or embossed points as well as the usual perforated index positions, thus making the sensing controls of a kind universal to all forms of records.

Another object of the invention is to provide ledger sheet posting control devices which cooperate with friction marks on ledger sheets to space said sheets automatically into a first line position beyond the heading area and also for feeding past previously printed items to position a re-inserted sheet to receive item impressions directly under other impressions. A mark of friction material is recorded or deposited as each line of data is printed so that the marks may later control re-insertion to the proper point to resume item printing.

Another feature of the invention is the use of friction marks and sensing devices cooperating therewith to control the feeding of connected forms on a continuous sheet. The lengths of such sheets vary with changes in atmospheric conditions and the lengths of the different forms often differ enough to disturb printing alignment. Therefore it is desirable to have friction marks related to the first line printing positions on succeeding forms to control the spacing of the sheet from form to form.

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 modes, which have been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a plan view of the clutch and gear mechanism for controlling sheet feeding. The magnets for operating under control of the friction mark sensing devices are also shown.

Fig. 1a is a plan view of the marking devices for placing feed control friction marks on ledger sheets.

Fig. 2 is a detail view of the worm drive associated with the platen.

Fig. 3 is a detail view showing the relay and

armature controls associated with a single revolution clutch release shaft.

Fig. 4 shows a sample ledger sheet marked with marginal friction marks for controlling sheet feeding.

Fig. 5 shows a portion of continuous strip divided into forms, each form having frictional feed control marks.

Fig. 6 is a plan view of dual mark sensing devices adapted to cooperate with the record sheets such as those shown in Figs. 4 and 5.

Fig. 7 is a side elevation view of the sensing devices shown in Fig. 6.

Fig. 8 is an end view of one of the sensing fingers shown in Fig. 6 cooperating with a sheet having spots of friction on a surface of less friction.

Fig. 8*a* is an end view of a sensing finger arranged in the reverse manner to that of Fig. 8 to bear on a sheet with a high coefficient of friction containing index points of less friction.

Fig. 9 is a sectional view taken along line 9—9 in Fig. 6 and looking on the sensing members in the direction of the arrows.

Fig. 10 is a wiring diagram of the electrical controls for governing the feeding of record sheets under control of friction marks and the dual mark sensing devices.

The feeding devices of the present invention are adapted to control the positioning of various kinds of record forms. They are arranged to control the initial positioning and the successive reinsertion of ledger sheets, such as the one shown in Fig. 4, and also to control the spacing of forms in a continuous strip, such as that shown in Fig. 5.

The ledger sheet **20** is printed with the usual heading data and in addition thereto has a mark **21** which is of friction material. This mark is placed on the sheet before it is threaded into the accounting machine to receive impressions of the various items. As item entering takes place and lines of print are recorded on the ledger sheet, accompanying each item printing operation is a mark printing operation which serves to place friction marks **22** along the margin in the sheet in line with each related item. Mark **21** is sensed to determine the initial printing position of the sheet and the other marks **22** determine the position of the sheet when it is reinserted for additional item entry operations, after having received one or more items on previous operations. When a sheet such as that shown in Fig. 4 is inserted in the machine, it is apparent, since it already contains four lines of item print, that it must be controlled to move automatically into position to receive an item impression on the fifth line.

Turning to the other kind of record media shown in Fig. 5, it is seen that the continuous strip **23** is divided into forms, such as sales slips, which may be of uniform or varying length but will always be shifted into position for recording the first item directly under a heading under control of friction marks **24**. These marks bear the same relationship with respect to the heading areas of all forms so that, when sensed, they may govern stopping the feed to locate a form in position to receive the first line of print. After a series of items are recorded, the strip is automatically shifted upon the taking of a total after the recording of the total, and then the sensing devices come into play to stop the strip when the succeeding form arrives at the printing position. The marks **24** are placed on strip **23** at the time the heading is printed thereon or when lines of tearing perforations **46** are cut between

the forms. The nature of the material used in making friction marks **24** need not be of a durable kind, because these marks are sensed only once by the sensing finger resting on the continuous strip. However, marks such as designations **21** and **22** on the sheet **20** of Fig. 4 must retain their frictional characteristics through repeated operation.

Illustrated in Figs. 6–9 is a dual form of friction sensing devices adapted to sense the presence of marks, such as the marks **21** and **22**. Upon a fixed portion of a frame **26** there is assembled a leaf spring **27** adjustably held on the frame by a clamp **28** which is insulated by a strip **29**. Fixed on the end of spring **27** is a contact blade holder **30** carrying a stiff contact stop member **31** and two flexible contact making blades **32** and **33**. Referring to the sectional view shown in Fig. 9, it is seen that holder **30** is formed of a single piece of strip stock which is bent to engage the spring **27** in a fixed manner, while also providing an opening in which member **31** is held and sockets wherein insulating bushings **34** and **35** are assembled to provide holders for the adjustable blades **32** and **33**.

Attached to member **31**, but insulated therefrom is a contact holder **36** bearing two points of the pairs of contacts **38** and **39**. Strip **37** is an insulator for the holder **36**.

Assembled on the left end of the outer blade **33** is a mark sensing finger **40** which is shaped as shown in Fig. 8. There it is seen that the finger is made up of a continuous length of strip material bent in a form designed to carry out all the sensing functions. One side **41** of the finger **40** is clamped around the blade **33** to hold it thereon. The center part of the finger is bent downward and then upward in an elongated U form, the bottom of which is rounded to contact the surface of the record material and there encounter and detect various frictional differences such as presented by the mark **21** of a higher coefficient of friction than the record **20** upon which it appears. Extending over from the U-shaped portion of the finger **40** is an L-shaped extension **43** which passes beyond the stiff member **31** and carries one point of a pair of contacts **38**. An insulation piece **44** is attached to stop member **31** and, although the tension in blade **33** tends to move extension **43** against member **31**, insulator **44** keeps them separated as shown until they are separated further when mark **21** causes movement of the finger to the left, at which time blade **33** is momentarily flexed while contacts **38** are closed.

Another somewhat similar sensing finger **45** is attached to the other blade **32**. This sensing finger also has a formation such as the elongated portion **42** and the angular stop **43**. However, the elongated portion also acts as a clamp in its upper section to attach the finger to the blade **32**. This sensing finger **45** also carries one contact point of a pair of contacts **39** and cooperates with a strip of insulation on member **31** which holds it in a position wherein the contacts are normally opened.

In Fig. 6 it is seen that the two sensing fingers **40** and **45** are situated to cooperate with different portions of the margin of sheets, such as record **20**. Finger **40** is positioned to detect the appearance of mark **21** located in relation with the initial printing position of the ledger sheet. It is also arranged to sense the presence of form spacing marks **24**, Fig. 5. The other sensing finger **45** is

located to detect the appearance of line spacing marks 22.

The pressure with which said fingers bear down on records may be varied by adjusting spring 27 to lengthen or shorten it, and the positions of the fingers may be varied by shifting blades 32 and 33 back or forth in the holder 30 and sliding member 31 along therewith. Of course, when adjustments of a substantial extent are made, the contact holder 36 must be replaced with another bracket having contact points spaced to coincide with the new position of the sensing fingers. The relative tension between blades 32 and 33 and holding spring 27 may be varied by shifting the holder 30 along so that the effective working part of the blades 32 and 33 is shortened at the same time that the effective part of spring 27 is lengthened, or these adjustments may be reversed when found necessary by the frictional nature of the record material or the marks thereon. When a high degree of sensitivity is required, spring 27 must be adjusted to press lightly on the records and blades 32 and 33 must be of such length as to allow free movement of the sensing portions at the ends of the blades.

The arrangement of the sensing device in Fig. 8 is designed to detect the appearance of a friction mark on a surface of less friction. A reverse arrangement such as that shown in Fig. 8*a* can be used when it is desired to detect marks 21*a* of a low frictional coefficient on a surface of highly frictional nature. The contacts 38*a* are normally closed and blade 33*a* tends to keep them that way, but upon engagement of end 42*a* with the friction surface of sheet 20, the contacts 38*a* are opened and held open until the mark 21*a* of wax, graphite, powder, or the like, is engaged. Then the end 42*a* skids over the mark and towards the right to close contacts 38*a* momentarily, and again open them as the sheet surface engages the end 42*a* and moves it towards the left. In this modification it may be noted that a depression or perforation in the record causes the same contact closing action as a mark 21*a*.

It is understood that circuit breaker devices are used to render ineffective the normal closure of the contacts in the device of Fig. 8*a*, and a similar precaution is taken to make ineffective all impulses initiated when the sensing device of Fig. 8 strikes the edges of sheets.

The electrical circuits established through contacts 38 and 39, Fig. 6, are used to energize relays which control clutch magnets and driving connections of a gear train (Fig. 1) which is used to control movement of a platen 25. The platen is moved for sheet feeding by means of a motor M which carries a gear 55 attached to the motor shaft 56. Sliding on a splined portion of motor shaft 56 is a clutch disc 57 adapted to engage with a clutch friction surface 58 on a gear 59 attached to a worm shaft 60 cooperating with a worm wheel 61 attached to the platen 25. The shaft 56 is in axial alignment with the worm 60 so that, when a driving connection is established, the worm and worm wheel cooperate so that each revolution of the shaft 56 causes a line space movement of platen 25.

Disc 57 is formed with a groove in which there extends the operating end of armature lever 62 pivoted at 63 alongside the driving gears. A spring 64 attached to lever 62 normally holds the disc 57 in a position wherein it is separated from the clutch surface 58, thus holding the platen out of operation. However, whenever a main clutch magnet MCM is energized, lever 62 is rocked in a counterclockwise direction and disc 57 is forced against the clutch face 58 and a driving connection is established between the motor M and the platen 25. These connections are controlled to persist over more than one line space to be used for long feeding operations wherein a strip is spaced between forms or a sheet is reinserted.

Other clutch connections are provided to control the platen for line spacing operation and for feeding ledger sheets beyond the last mark sensing position so that the sheet is moved above the sensing devices into a position wherein it receives not only other lines of print but also other marks to control subsequent feeding operations. In mesh with gear 55 is a gear 65 on a shaft 66 which is splined to carry a clutch disc 67 adapted to cooperate with a frictional clutch surface 68 on a gear 69 having another clutch surface 70. This gear 69 is loosely mounted on the end of shaft 66 but meshes with gear 59 attached to the worm drive shaft 60. Disc 67 is formed with a groove in which there extends one end of an armature lever 71 pivoted at 72. A spring 73 attached to lever 71 tends to keep the clutch open but whenever a related magnet SM2 is energized, the lever is rocked in a clockwise direction and the clutch is closed to establish a driving connection from the motor M, through gears 55 and 65, through clutch 67 and 68 and thence through gears 69 and 59 to shaft 60 which drives the platen.

Cooperating with the other clutch surface 70 is another clutch disc 74 splined on a shaft 10 mounted in bearing blocks 75. This clutch disc 74 is normally held out of engagement by an armature lever 76 pivoted at 77 and having a spring 78 urging it towards a disengaged position. Cooperating with the lever 76 is a magnet SM1 which is energized to engage the clutch 74 whenever it is desired to measure or limit the line spacing movement of platen 25.

Auxiliary devices are provided in association with clutch 74 so that it may function as a single revolution clutch. For this purpose there is attached to shaft 10 a single toothed disc 79 (Figs. 1 and 3), the tooth of which cooperates with the end of an armature lever 80 pivoted at 81 and provided with a spring 82 which tends to hold the lever in position to engage the disc 79 as it rotates in a counterclockwise direction. A magnet SRM is provided to govern the single revolution control by attracting lever 80 to rock it and free the disc 79 and shaft 10 for operation, so that the connected clutch disc 74 may turn as operated by the clutch surface 70 and gear 69. A pair of contact operating cams 11 and 52 are mounted on shaft 10 and used to govern the feeding operation as explained hereinafter with reference to the wiring diagram.

A dash pot DP is provided with lever and link connections 83 and 84 attached to the end of armature lever 76 for delaying engagement of clutch 70—74, so that magnet SRM may effect release of the single revolution stop lever 80 before a clutch connection is established, when both magnets SRM and SM1 are energized at the same time.

The devices for marking a series of marginal friction feed control designations on a ledger sheet are shown in Fig. 1*a*. There it is seen that a solenoid PS contains a core piece 86 which is normally drawn upward by a lever 88 pivoted at 92 on a bracket 89. A spring 87 is drawn between the lever and the bracket to hold the lever normally positioned as shown.

Pivoted on the left end of lever 88 is an impression arm 91 attached to a stud 90. Lever 88 fits loosely over the stud 90 and under a washer which is confined thereon by the end of a spiral spring 97 one end of which is attached near the top of stud 90 and the other end fixed to a pin on the lever. This spring 97 tends to move arm 91 parallel with the end of the lever but the arm is operated positively to oscillate between the position shown, wherein it rests on a pad 94 containing friction material, and the dotted line position 91*a* wherein it effects an impression to deposit the friction material as a mark 22 on sheet 20.

The oscillating movement of arm 91 is governed by portions of bracket 89 in the form of extending lugs 96 and 99 and pin 98 which cooperate with teeth 95 and 100 on the arm. When the solenoid PS is energized, core piece 86 is attracted and the connected lever 88 is rocked clockwise. Then, as center 90 moves upward, spring 97 rocks arm 91 counterclockwise, inserting tooth 95 between lug 99 and pin 98. After the arm 91 has rocked through an angle of 90 degrees, the spring 97 is no longer tensioned, but then the pin 98 is in positive engagement between teeth 95 and 100 and as the lever 88 rocks further the pin turns the arm through the greater part of another 90 degrees the final portion of which movement is directed at right angles to platen 25 with the side of arm 91 sliding along the side of lug 96. The impression arm 91 then strikes against the record sheet in a direct perpendicular blow to impress the friction material thereon. If a solid crayon, wax, or the like, are to be marked thereon, the arm may be made longer and tipped with the solid material which is then marked on with the arcuate penciling movement.

During the second 90 degrees of the printing movement of arm 91, spring 97 is tensioned and tends to turn the arm clockwise but is prevented by the contact of the arm against lug 96. However, when the solenoid PS is deenergized, spring 87 becomes effective to pull lever 88 down, and then arm 91 turns 180 degrees in a clockwise direction. The final portion of the arm movement is brought about by the engagement of pin 98 with tooth 100 and the turning of tooth 95 around lug 99. As lever 88 nears the end of the return stroke, the side of arm 91 slides along the side of lug 99 and the point of the impression arm is directed perpendicularly into the pad 94 which is held on the bracket 89 by a cup 93.

The marginal mark printing unit is situated one line space above the position of the sensing devices (Fig. 4) so that when the ledger sheets 20 are fed two spaces beyond the position in which the last recorded friction mark 22 is sensed, the sheet will be in the proper print receiving position ready for the reception of another mark which accompanies the printing of the first item of the new group of items.

Before pointing out the various combinations of substances from which the records and index points may be constituted, it may be explained that the variations are as numerous as the kinds of matter to be found with different frictional characteristics. As a general rule, materials with rough, hard surfaces were found to have a low coefficient of friction and the cooperating sensing finger slid over such surfaces but was retarded when a spot of rubber, gum, wax or pitch engaged the finger.

The materials found satisfactory for establishing areas of friction on record members of a low

friction surface such as sheet metal, card stock, newsprint, typewriter paper, or the like are as follows:

Rubber	Wax
rubber cement and pitch	beeswax
Lotol	paraffin
Lotol and machine oil	crayon
latex and glue	china marking pencil or any of the above dissolved in alcohol, acetone, turpentine, carbon disulphide or benzol
Neoprene cement, resin and turpentine	

Gum	Pitch
resin	fluid pitch
resin, turpentine, rubber cement and machine oil	pitch dissolved in benzine, gasoline or carbon tetrachloride

The materials which performed satisfactorily in creating areas of a low coefficient of friction on record members of a higher frictional value such as sheet aluminum, weighted papers, and other materials smooth to the touch, were found to be, graphite, wax, china marking pencil, or the foregoing dissolved in alcohol, acetone, turpentine, carbon-disulphide, or benzol. In record members of this kind, perforations and depressions are as effective as the low friction material in influencing movement of the sensing fingers.

From the foregoing, it is apparent that some marking materials are effective on either kind of record. This is so when the frictional index of the material is midway between the friction values of the surfaces of record members having extremely high or low coefficients of friction.

The friction material when in the form of a solid may be marked or deposited on the records in the differential positions. When liquified it may be carried on ribbons or pads and transferred therefrom to the record material in any well known manner of printing. Coloring pigment may be added to the friction deposit material when distinctive character or index point outlines are to be made, otherwise a clear colorless deposit will serve for most purposes. The friction materials may also be either the same color as the background or contrasted therewith according to the purpose of hiding or revealing the marks.

Instead of using material to form a frictional area a certain portion or area of the surface of a record may be treated mechanically to create a surface having a coefficient of friction differing from the surrounding areas. The printing impression arm 91, described hereinbefore, can be formed with a striking face that acts mechanically to indent, emboss, roughen or smooth a record surface, rather than deposit material thereon.

Turning now to the controls for governing the feeding of ledger sheets and continuous strips, reference may be made to the electrical wiring diagram shown in Fig. 10. It is understood that these controls are connected and coordinated with the electrical controls of an accounting machine, such as that shown in Patent 1,976,617, or the one disclosed in Patent 1,762,145. The feed devices are controlled and coordinated with the accounting machine by means of listing cam contacts which are operated during item entering cycles and other total cam contacts which become effectively only on total taking cycles. The usual line spacing mechanism of the machine is

disabled while the disclosed feed controls are selected for operation. Closure of the switches SW and SW1 connect the main lines 334 and 335 of the accounting machine to the feed control devices and also energize motor M for turning gears 55 and 65 (Fig. 1) and clutch discs 57 and 67.

When ledger sheets are to be handled, the switch SW2, Fig. 10, is open to prevent automatic starting of the sheet feed through closure of cam contacts P27; and instead, the feeding operation is initiated by operation of the feed starting key FS to close contacts 1 and set up a circuit through a relay 2 comprising line 334, contact 1, relay 2, wire 105, contacts 106, and wires 107 and 117 to line 335. Relay 2 then closes associated contacts 108 and 109 to set up a holding circuit and also condition the main clutch magnet MCM for operation. The holding circuit includes line 334, wire 110, contacts 108, wire 111, relay 2, wire 105, contacts 106 and wires 107, 117 to line 335. Magnet MCM is energized by a circuit through line 334, wire 110, contacts 109, wire 112, magnet MCM and line 335.

Referring to Fig. 1, it is seen that actuation of magnet MCM causes clutch 57 to engage and drive the platen to feed the sheet as long as it is sustained in operation. Feeding continues until the friction control mark 21 (Fig. 6) strikes finger 40 and causes contacts 38 to close, energizing relays 5 and 6 (Fig. 10) to deenergize magnet MCM. Relay 5 is energized by a circuit which may be traced through line 334, wire 113, contacts 33, wire 114, relay 5, wire 115, contacts 116, and wire 117 to line 335. Relay 5 then operates to open associated contacts 118 and close other contacts 119 and 120. Finger 40 is operated by both friction marks and severing lines; however, the marks are of substantial width or vertical depth when compared with the severing lines. Therefore, when a mark 21 is encountered, contacts 38 are closed and circuit connections are maintained for a larger period of time than when a severing line is sensed.

Closure of contacts 120 serves to energize relay 6 through a circuit including line 334, wire 121, contacts 120, relay 6, wire 122, contacts 123, wire 124 and line 335. Closure of contacts 119 makes magnet SRM effective by means of a circuit including line 334, wire 121, contacts 119, wire 138, magnet SRM and wire 124 to line 335. When energized, relay 6 sets up a holding circuit through the closure of contacts 127. Then a circuit is established through line 334, wire 128, contacts 127, relay 6, wire 122, contacts 123, and wire 124 to line 335. Relay 6 also operates other contacts 129 to energize magnets SM1 and SM2 at the same time that associated contacts 106 are opened to deenergize relay 2, open contacts 109, and make clutch magnet MCM ineffective, so that the long feeding operation is terminated. Line space control magnets SM1 and SM2 are energized by means of a circuit including line 334, wire 128, contacts 127 and 129, magnets SM1 and SM2 arranged in parallel and wire 130 to line 335.

With all three magnets SRM, SM1 and SM2 (Fig. 1) energized, it is apparent that the clutch connections are established for initiating the first of a series of line spacing operations. The number of line spacing movements that follow are limited to two operations unless a mark is encountered and then the operations depend upon the number of times that the contacts 39 (Fig. 6) are closed by marginal marks 22. In the sequence of operations about to be pointed out, it is assumed that the sheet has no marks 22. As the first line spacing operation takes place, shaft 10 (Fig. 1) is rotated carrying the cam 11 thereon around in a counterclockwise direction (Fig. 10) so that cooperating contacts 12 are closed near the end of the cycle. The closure of these contacts energizes a magnet 13 through a circuit including line 334, wire 128, contact 127, contact 129, wire 131, 132, contacts 12, wire 133, magnet 13 and wire 130 to line 335. This magnet then operates a pawl mechanism 140 and ratchet 139 to shift a switch arm 14 from the normal stop 135 to an intermediate terminal point 136. Through the closed contact 136, magnet SRM is again energized to release the clutch shaft for a second line spacing operation. The circuit comprises line 334, wire 128, contacts 127 and 129, wires 131, 132 and 142, arm 14, terminal 136, wire 141, magnet SRM and wire 124 to line 335. Thus, operation of magnet SRM releases shaft 10 for a second operation during which contacts 12 are closed near the end of the operation, again energizing magnet 13. Energization of magnet 13 causes operation of the ratchet and pawl mechanism to advance arm 14 another step to cooperate with contact point 137. Through circuits established by contact with point 137, relays 15, 16 and magnet 17 are energized to cause cessation of line spacing and resetting of the electrical controls in readiness for other feeding operations. The circuit through relay 15 may be followed from line 334, through wire 128, contacts 127 and 129, wire 131, wire 132, wire 142, arm 14, contact point 137, wire 143, relay 15, and wire 124 to line 335. Relay 15 closes associated contacts 144 and 145. Closure of contacts 144 serves to activate relay 16 through a circuit which may be traced from line 334, through wire 300, relay 16, wire 146, contacts 144, wire 124, to line 335. Then relay 16 operates to open contacts 123 thereby disabling the holding circuit connections through relay 6. Since operation of magnet 13 causes movement of arm 14 away from terminal 136, it deenergizes magnet SRM to allow the armature lever 80 (Fig. 3) to swing back into position obstructing the single toothed member 79 on shaft 10. The other contact 145 when closed serves to set up a circuit through the magnet 17 cooperating with a detent lever 147 normally holding the ratchet wheel 139 so that the arm 14 is held in the adjusted positions. When magnet 17 is energized, the detent 147 is operated and the ratchet is released so that it may be rocked in a counterclockwise direction by a spiral spring to throw arm 14 back against the fixed stop 135. A circuit through magnet 17 may be traced from line 334, through wire 300, relay 16, wire 146, contacts 144 and 145, wire 148, wire 149, magnet 17, and wire 130 to line 335.

When relay 6 is deenergized by the opening of contacts 123, the associated contacts 129 are opened and magnets SM1 and SM2 are deenergized because the circuit through these magnets was established through contacts 129. Since these two magnets then release associated clutches, the line spacing feed of the ledger sheet is interrupted after it has been spaced two line spaces beyond the position in which the mark 21 was detected by finger 40 and contact 38. The foregoing sequence of operations holds true whenever a new ledger sheet is presented to receive the initial printing impressions representing items associated with a related account.

As lines of item impressions are made on a

sheet, related frictional feed control marks 22 are impressed along the margin of the sheet. These marks control other portions of the inserting mechanism when the sheet is later reinserted to continue the printing operations which have been interrupted by ejection of the sheet. When a sheet is inserted bearing marks 22 and previously printed items, such as that shown in Fig. 4, it apparent that not only will finger 40 cooperate with mark 21 as already explained, but the other finger 45 will also cooperate with marks 22 to determine the differential displacement of the sheet. The first mark 22 is encountered upon the first step of line space movement after mark 21 is encountered. The purpose of the finger 45 and connected controls is to reset the feeding control mechanism each time a mark 22 is sensed, so that the line spacing operations started by mark 21 will continue until (when the last mark is sensed) two line spacing operations will follow to move the highest unprinted line of the sheet above the sensing devices and stop it in position to receive impressions from the type. In other words, the marks 22 and the controls operated thereby serve to forestall feed stoppage because they keep arm 14 from moving to point 137; therefore, relay 15 is not operated until after the last mark 22 is passed. The contacts 39, when operated and closed by one or more marks 22, cause energization of relay 19 and magnet 17 (Fig. 10) to restore the ratchet and pawl mechanism and also deenergize relay 5. The initiating circuit through contacts 39 may be traced through line 334, wire 113, contacts 39, relay 19, wire 151, contacts 118, wires 107 and 117 to line 335. Relay 19 then opens the contacts 116 previously mentioned, and closes contacts 152 to establish a circuit through magnet 17 which may be followed through line 334, wire 113, contacts 152, wire 149, magnet 17 and wire 130 to line 335. Through these connections magnet 17 will serve to restore arm 14 each time a marginal feed control mark 22 is sensed on the ledger sheet. Arm 14 touches terminal 136 each time magnet 13 is energized by the closure of contacts 12, but the arm is restored immediately and prevented from touching terminal 137. Since magnets SM1 and SM2 continue to be energized, and since magnet SRM is energized each time arm 14 touches terminal 136, there will be initiated a continuous series of spacing operations with magnet SRM recurrently effecting a feed cycle, during which contacts 12 are closed to call in magnet 13 which operates arm 14 to again touch terminal 136. During such operations, marks 22 and magnet 17 operated thereby serve merely to restore arm 14 successively. After the last mark is sensed, the contacts 39 open, magnet 17 becomes ineffective and then arm 14 can be shifted under control of magnet 13 on two successive operations to cause the double line spacing movement and termination of the feed as outlined hereinbefore. Of course, each operation of magnet 13 is accompanied by a line spacing operation, because not only is magnet SRM operated for clutch release, but magnets SM1 and SM2 are effective for clutch operation since relay 6 is maintained effective.

During the succession of line spacing operations caused by the detection of the first and following marks 22, relay 5 is deenergized to insure closure of contacts 118 for the effectiveness of relay 19. Relay 5 is not needed for operation of magnet SRM at the time, because then magnet SRM is energized through terminal 136 every time magnet 13 is energized by cam 11. Relay 5 is not needed to energize relay 6 because this relay is held energized through contacts 123 since terminal 137 is not reached to call in relay 16 to break the holding circuit until after the last mark 22 is sensed. Therefore, it is evident that upon sensing the first mark 22 and each of a succession of such marks, there is a sequence of operation involving cam 11, magnet 13, terminal 136, magnet SRM, contacts 39, relay 19 and magnet 17 in the order mentioned. Such operations are recurrent until contacts 39 fail to close, and then arm 14 is rocked to touch terminal 137 for terminating spacing as already explained.

When feeding continuous strips such as strip 23, it is well to distinguish between the line of severing perforations 46 and the frictional mark 24 thereon because both of these portions of the strip act to influence the sensing fingers and effect closure of contacts 38 and 39. The leading edge of a ledger sheet also strikes both fingers simultaneously and tends to close the contacts. Either the sensing devices must be made nonresponsive to these interruptions or other provisions made to counteract their effect. Therefore control circuits are provided to nullify the effect of the contacts when they are closed together. On the continuous strip a distinction is made between the two kinds of frictional surfaces by restricting the width of the mark 24 so that it will influence only one of the contact closing fingers while the line of perforations cooperates with both contact closing members. When both contacts are closed simultaneously, it is desired that there should be no change in the long feeding operation taking place at the time. For this reason the closing of contacts 38 (Fig. 10) energizes the relay 5 through contacts 116 which will be opened by relay 19 when it is energized by the closing of contacts 39. Similarly, the return circuit for relay 19 is opened by contacts 118 of relay 5 when this relay is energized by the closure of contacts 38. Relay 6 is a retarded action relay and although picked up momentarily by relay 5, its contacts are not fully operated when relay 5 again deenergizes. The contact blades of relay 6 could also be attached to a dash pot for further delay if it is needed. In this way, when both contacts 38 and 39 are closed simultaneously, no variation in sheet feeding control is effected, but the closing of contacts 38 alone does cause the termination of long feeding and the closing of contacts 39 causes initiation of successive line spacing operations as already pointed out.

After each line of item or total print is recorded on a sheet or strip, it is desired that a line spacing operation take place to advance the record. For this purpose either switch SW3 or SW5 is closed to make either cam contacts L28 or P28 effective, depending upon whether control is wished to accompany item listing or total tabulating. These cam contacts are arranged to close late in the printing cycles after an impression has been made. The feeding operation is initiated by the closure of contacts L28 near the end of each item printing operation. The impulse through contacts L28 energizes relay 8 through a circuit which may be followed from line 334, through switch SW3, wire 154, contacts L28, relay 8, contacts 155, and wire 156 to line 335. Relay 8 then establishes a holding circuit for itself through closed contacts 157 and wire 158. The energization of this relay also controls closing of contacts 159 to establish a circuit through the single revolution clutch magnets

SM1 and SM2. The circuit follows a course through line 334, wire 158, contacts 159, wire 131, magnets SM1, SM2, and wire 130 to line 335. Another contact 160 is closed by relay 8 to send current through a contact arm 161 to energize the single revolution release magnet SRM. The circuit through the magnet follows a path through line 334, wire 158, contacts 160, wire 162, contact arm 161, wire 163, wire 141, magnet SRM and wire 124 to line 335. The activity of the three magnets SRM, SM1 and SM2 causes release and operation of the clutch devices for connecting the platen to the driving motor so that the record media may be shifted one step. As the feed connections are operated, shaft 10 turns a cam 52 mounted thereon to cooperate with contacts 54 to close them just before the completion of one revolution. Closure of contacts 54 serves to set up a circuit for energizing a magnet 3 for shifting arm 161. The circuit for magnet 3 may be followed from line 334, through wire 158, contacts 160, wires 162 and 165, contacts 54, wire 166, magnet 3, and wire 167 to line 335.

Energization of magnet 3 causes operation of pawl 168 to rotate ratchet 169 and move arm 161 in contact with terminal point 170. The circuit thus closed by arm 161, includes a relay 4 which is energized by the connections from line 334, through wire 158, contacts 160, wire 162, arm 161, terminal 170, wire 171, relay 4 and line 335. Relay 4 then operates to close contacts 172, to operate magnet 7 and restore arm 161, and it also opens contacts 155 to disable relay 8. There is sufficient lag between the operation of relay 4 to close contacts 172, and the release of relay 8 to open contacts 160, so that both contacts are closed momentarily for an impulse through magnets 7 at the end of the feed cycle.

The circuit through magnet 7 may be followed from line 334, through wire 158, contacts 160, wire 162, arm 161, terminal 170, wire 171, contacts 172, wire 173, magnet 7, and wire 167 to line 335. Magnet 7 operates the detent lever 174 to release ratchet 169 so that the arm 161 thereon may be moved back to the normal position by a clock spring attached to the ratchet wheel.

When arm 161 touches terminal 170 and relay 4 is energized, contacts 155 are opened and the holding circuit through relay 8 is interrupted. It is this relay 8 and its related contacts 159 and 160 which caused the energization of feed control magnets SM1, SM2 and SRM for the one cycle of operation that is terminated when the relay becomes inactive. From the foregoing it is apparent that the record sheet or strip is advanced one line space after each listing or tabulating cycle.

Whenever items are being printed on a ledger sheet 20, Fig. 4, it is desired that a friction mark 22 be placed opposite each line of print. It is for this reason that a switch SW4, Fig. 10, is closed to energize print solenoid PS, Fig. 1*a*, while posting. The circuit through the solenoid, Fig. 10, may be traced from line 334, through wire 176, solenoid PS, wire 177, cam contacts L41 closed at the usual printing time, switch SW4 and line 335.

Since the forms of the continuous strip 23 (Fig. 5) are to be printed in a single continuous cycle of printing operation, there is no need for the impression thereon of marks such as marks 22 which appear on a ledger sheet. Instead, the forms are merely advanced a line space after each printing cycle and then, finally, on the occurrence of a total printing cycle, connections are established to start a long feeding operation, whereupon the strip is shifted until a mark 24 is encountered and then a new form is in the initial print receiving position. For form feeding, control switch SW2 is closed to place a relay 178 in circuit with cam contacts P27 closed near the end of each total printing operation. Then a circuit passes through relay 178 in the following manner: from line 334, through wire 180, contacts P27, switch SW2, relay 178, wire 181, to line 335. The relay 178 then closes contacts 179 to initiate operation of the relay 2 previously mentioned. The circuit through relay 2 may be followed from line 334, through wire 110, wire 182, contacts 179, wire 183, relay 2, wire 105, contacts 106, wires 107 and 117 to line 335. Relay 2, when effective, operates in the same manner as when activated by the start key FS, and calls into operation the main clutch magnet MCM as previously described. The sheet continues to move until the friction mark 24 thereon encounters the feeler finger 40 (Fig. 6) whereupon the contacts 38 (Fig. 10) are closed and the connected relays 5 and 6 are energized. The operation of relay 6 serves to open contacts 106 which are in series with the start relay 2 and the clutch magnet MCM. Therefore, when this connection is opened, both controls are made ineffective, the sheet feeding clutch connection is disengaged and the strip is stopped in a position related to the sensed mark.

There are conditions under which it is advisable to record totals rather than items on the record sheets. Under such tabulating conditions, the strip or sheets are to be fed a single line space after the printing of each total and to remain stationary while items are being added. In order to select such control, a switch SW6 may be closed to place cam contacts P28 in line with the space initiating relay 8 while the usual operating control through listing contacts L28 is disabled by the opening of switch SW3. When such tabulating feed control is in effect, the printing of the special marks along with total printing is selected by the closure of switch SW7 to direct impulses through cam contacts P26 and print solenoid PS late in each total printing operation.

When ledger sheets are being handled, the cam contacts L27 and P27 do not have any effect in inserting the sheets. Instead, the operator inserts each ledger sheet manually and then presses the start key FS to direct an impulse through relay 2 to initiate the operation for automatically positioning the sheet. However, the ledger sheets may be ejected after the entry of a single item, or upon the taking of a total, by selective closure of switches SW5 or SW2. The total is to be "non-printed" when the sheet is ejected after receiving a series of items.

The circuit may be traced from line 335, through card lever contacts 59*a*, circuit breaker contacts CBC, along channel 210, finger 212, contact 215, member 209, plug socket 225, plug wire 226, magnet AM, magnet PM and line 334. The energizing magnets serve to stop a related type bar in a differential printing position and also clutch the related adding wheel to start entering the amount represented by the mark sensed.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, 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 feeding record material with horizontal severing lines of friction and a horizontal edge, said material bearing an area of friction distinguished from the surface of the material, means for feeding said material, a pair of sensing means cooperating with the surface of said material, one of said sensing means being positioned to detect the appearance of said frictional area thereunder as said material is fed and also detect said edge and lines of friction, the other of said sensing means being aligned with the first mentioned sensing means and positioned to avoid detection of said area but to detect said horizontal edge and lines of friction, means for stopping said feeding means, means under control of said one sensing means for operating said stopping means when an area of friction is detected, and means under control of said other sensing means for preventing operation of said stop operating means when both sensing means detect the edge or severing line of friction of the material.

2. In a device for controlling the feeding of record material bearing areas of frictional characteristics differing from the surface of the material, means for feeding said material, a sensing means comprising a flexible element bearing upon the surface of said material and tensioned to resist movement in the direction of movement of material, said flexible element carrying one contact of a pair of contacts, a stiff member carrying another contact opposite the first mentioned contact and located in a direction along the line of travel of said material so that when the element encounters a frictional area and is carried along thereby, said contacts will be closed, and electric control means connected to said contacts for controlling operation of said feeding means.

3. In a machine for feeding a record bearing deposits of friction material to influence the positioning of said record, means for feeding said record, means for influencing the extent of operation of said feeding means comprising a sensing means cooperating with said record to detect the appearance of said frictional deposits, said sensing means including a sensing finger mounted on an adjustable flexible blade, said blade being mounted in a holder on an adjustable spring member causing said finger to bear down on the surface of said record, said first mentioned blade being tensioned to resist the movement of said finger along with said record in the direction of movement of the record, a contact on said finger, another contact opposite the first mentioned contact and mounted on a stiff immovable member held in said holder, said contacts being closed when said finger is shifted by encountering a frictional deposit on the record moved by the feeding means.

4. In a machine for printing items and totals on ledger sheets, said sheets bearing a frictional deposit related to the first item printing line of the sheet and other marginal friction marks related to lines of print on said sheet, friction sensitive means for sensing the appearance of said deposit on a moving sheet, friction sensitive means for sensing said marks on a moving sheet, a main operating means, a feeding means for said sheets, a clutch between said feeding means and the operating means, a magnet for operating said clutch, relay controls for energizing and deenergizing said magnet, a start key, contacts in series with said relay controls and operated by said key to initiate feeding operation, other contacts in series with said relay controls and operated after printing to initiate feeding, means under control of the first-mentioned sensing means for operating said relay controls to terminate feeding, line spacing clutch devices between said main operating means and sheet feeding means, magnets for operating said line spacing clutches, control relays for energizing and deenergizing said magnets, a single revolution clutch control, a magnet for operating said control, means under control of said second-mentioned sensing means for operating the line space control relays to feed the sheet according to the number of marginal marks thereon, means cooperating with said line space relays to initiate two line spacing operations after the sensing of the last marginal mark, a mark printing means, a solenoid for operating said means, and means for energizing said solenoid to print an additional mark under said other marginal friction marks after said sheet is inserted and as an incident to printing a line of data on said sheet.

5. In a machine for printing and feeding a ledger sheet bearing an area of a frictional coefficient differing from that of the surface of said sheet, said area being positioned relative to the first item print receiving line on said sheet, a member resting on said sheet in the path of said area and sensitive to the frictional nature of the surface of said sheet, said member being shifted relative to a normal position by said frictional area when the sheet is moved relative thereto to a predetermined extent, means for moving said sheet and member relative to each other, and means under control of said member for stopping operation of said shifting means when the sheet is in position to receive a first line of print.

6. In a machine for printing, feeding and reinserting a ledger sheet bearing a series of colorless marginal deposits of friction material differing in coefficient of friction from the surface of the sheet, said deposits being positioned relative to lines of print on said sheet and marking the progress of printing on said sheet, means for feeding said sheet to insert and eject it, means for controlling operation of said feeding means, means cooperating with said feeding means for line spacing said sheet, a member resting on said sheet in the path of said deposits and sensitive to the frictional nature of the surface of said sheet, said member being shifted relative to normal position upon encountering each deposit on a sheet while feeding, means under control of said member for operating said line spacing means successively to feed said sheet to a print receiving position directly beyond the last printed line, and means for placing an additional deposit of friction material on said sheet after insertion and as an incident to the printing of each line.

7. In a machine for printing and feeding a continuous strip divided into forms with headings, each form bearing an area of a frictional characteristic differing from the frictional nature of the surface of the strip, said area being positioned relative to the first print line of the form, a member resting on said strip in the path of said area and sensitive to the frictional nature of the surface of said sheet, said member being shifted relative to a normal position under control of said area on a moving sheet, means for feeding the strip, means under control of said member for stopping said feeding means to position said strip

to receive the first line of print below the heading on a succeeding form, and means for initiating operation of said feeding means after printing is completed.

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