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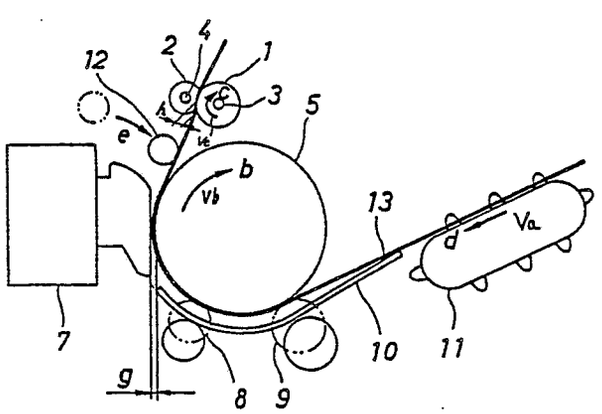
(54) Paper feeding apparatus for printers.

(57) For achieving a high positional accuracy of the paper with respect to a printing head (7) and a stable paper feeding over a long period in a printer, a paper feeding apparatus for a printer comprises a platen (5), a paper feeding tractor (11) for feeding fan-fold paper (13), arranged at the upstream side of said platen (5) with respect to the paper feeding direction (d), a power mechanism (6, 14 - 18) for driving said platen (5) and said paper feeding tractor (11), a roller (1) located at the downstream side of said palten and coupled to said power mechanism to rotate with the same or a higher circumferential speed than that of the platen (5), and a pressing member (2, 20) for pressing the paper (13) which is fed out from the upper side of the platen (5) after printing, against said roller (1).



(b)

FIG.1

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PAPER FEEDING APPARATUS FOR PRINTERS

The present invention relates to a paper feeding apparatus for a printer.

According to a conventional method for paper positioning in a printer utilizing a platen, a roller having a diameter smaller than the platen provided at the upper portion of a printing head and located at the feeding-out side with respect to the printing head is pressed against the platen with said paper therebetween to generate frictional force, whereby the fed-out portion of paper after printing is drawn.

In this method, the paper feeding speed of the supplying side and that of the feeding-out side are both determined by the platen so that no difference is caused between both speeds. There is no trouble in feeding normal paper, however, when a continuous roll of paper having a line of feeding holes with regular intervals therebetween along both edges is fed, the main power is not provided by a platen but by a sprocket or a belt having pins to be inserted into the feeding holes. Therefore, a fine difference of speed between the platen and the sprocket is caused due to changes of the ambient temperature, and paper sagging, tearing of feeding holes and other troubles are caused by repeating paper feeding for a long distance. High positional accuracy of the paper with respect to a printing head and stable pa per feeding over a long period of time cannot be achieved in the above method.

Further, a paper bail pressing paper against the cylindrical platen is switched by a solenoid between a position in which the bail is in touch with the platen and a position in which the bail is released from the platen, and the paper bail, in the condition that the kinetic energy thereof is not absorbed, comes in touch with the paper on the platen or in touch with a stopper at the release position causing mechanical shocks.

The impact noice caused by abrasion or impingement at a junction portion of a paper bail shaft with a paper bail lever or at a junction portion of a paper bail lever with a loading lever is rasping, and further, a trace of the paper bail is left on pressure sensitive paper due to the impact when the paper bail is returned to the pressing position after releasing. Furthermore, if a mechanical dumper is attached in order to lighten the impact, the device becomes complicated and large-sized.

A positioning operation to set the printing start position after setting paper onto a platen is described herein below.

Fig. 15 is a cross sectional view for explaining a conventional controlling method. Fig. 14 shows a flow chart of a loading sequence in a printer having a conventional autoloading function. When printing paper is manually inserted, the end of paper 13 is stopped at the position where paper-feeding roller 58 is pressed against platen 55 and is adjusted to position S.

Next, when a switch for autoloading provided on an operation panel or the like is pressed, platen 55 rotates in the direction of arrow U by a predetermined amount to feed the paper out in the direction of arrow P. The loading sequence is completed when the paper end from position S is fed to a predetermined start position R. Then the apparatus is in the condition of waiting for printing data.

When cut sheets are used as a printing paper, printing sometimes starts at a position which is not predetermined, such as within a predetermined frame or at the very upper end portion of the paper. Up to now, in those case, the user turns a knob or the like attached to the platen manually each time to adjust the start position on the paper after setting the paper by autoloading.

However, fine adjustment of the start position in accordance with the above method is difficult while turning the platen, and since the knob should be turned for a printing of each paper, the adjustment operation is quite troublesome and the printing position is varied among papers.

It is an object of the invention to provide a paper feeding apparatus avoiding the drawbacks of the conventional apparatus. This object is achieved with a paper feeding apparatus as claimed.

According to the construction of the present invention, a roller made of rubber or similar material is provided at the upper portion of the platen, which corresponds to the slip stream side in the paper-feeding direction with respect to the printing head, and the roller is rotated at the same or a higher peripheral speed as the peripheral speed of the platen, whereby printed paper is fed out to contact the periphery of the roller and is drawn by frictional force thereof. Therefore, paper is fed accurately and steadily in any ambient condition or with any kind of paper, without tear of paper, jamming, inferiority of the paper feeding accuracy caused by a deflection of paper.

Further, during automatic opening and closing movement of a paper pressure lever, a driving means is energized before the paper pressure lever returns to the paper pressing position by the returning force of a pressure member just after the holding power of the driving means is released at the moment of the returning movement of the paper pressure lever. Thus, the impact between the paper pressure lever and the platen and the impact noise thereof can be reduced, and the abrasion of the paper pressure lever and the paper pressure roller shaft can be reduced, whereby not only is the

durability improved but the problem that a trace of the paper pressure roller is left on pressure sensitive paper can be solved.

Further, during the opening movement of the pressure lever, the impact in each portion can be reduced similar to the closing movement by a plurality of energizations of a loading solenoid, and the same effect thus can be obtained.

Furthermore, unstable movements, such as rebounding of the paper pressure lever by an impact at the opening movement of the paper pressure lever due to a high voltage, and earlier returning to the pressing position before reaching the released position due to a low voltage, can be eliminated.

Since the parts can be assembled within a small space without mechanical dumpers, a compact paper pressure apparatus for a printer with a loading solenoid performing automatic opening and closing movement steadily, stably and quietly can be obtained.

In accordance with the present invention, after positioning the paper automatically by a preset amount stored in a ROM by autoloading, the length from the leading edge of the paper to the initial printing position can be controlled precisely by the user with a button operation to rotate the motor for driving the platen forward or backward by minute steps. Therefore, dispersion of such length due to an inaccuracy of parts can be corrected and the paper can be loaded precisely to an initial printing position more correctly and easily than by a manual adjustment by turning the platen knob. Further, since the amount of motor rotation required for fine adjustment is stored in memory, in the next autoloading the paper is loaded by an amount of motor rotation including the initial amount set in the ROM and the amount of fine adjustment stored in the memory, which results in the autoloading of paper precisely to a desired position. Therefore, in the case of repeated printing on a specific position of cut sheets, the user does not have to repeat the paper positioning operation for each cut sheet and dispersion of printing position thus can be prevented.

Ways of carrying out the invention will be described in detail below with reference to the drawings which illustrate only specific embodiments and in which:

Fig. 1(a) is a schematic partial plan view of an apparatus constructed in accordance with an embodiment of the present invention utilizing paper bail 12;

Fig. 1(b) is a schematic cross sectional view of Fig. 1(a);

Fig. 2(a) is a schematic partial plan view of an apparatus constructed in accordance with an embodiment of the present invention utilizing paper guide 20;

Fig. 2(b) is a schematic cross sectional view of Fig. 2(a)

Fig. 3(a) is a schematic partial plan view of an apparatus constructed in accordance with an embodiment of the present invention wherein an auxiliary paper feeding roller is pressed directly against paper feed roller 1;

Fig. 3(b) is a schematic cross sectional view of Fig. 3(a)

Fig. 4 is a block diagram showing an embodiment of the present invention;

Fig. 5 is a circuit diagram showing an example of a driving circuit of solenoid 46;

Fig. 6 is a timing chart showing a method for energizing the solenoid;

Fig. 7 is a front elevational view showing a paper pressure mechanism schematically;

Fig. 8 is a side elevational view schematically showing an arrangement for operating the paper bail;

Fig. 9 is a side elevational view similar to Fig. 8 showing the released condition of the paper bail;

Fig. 10 is a timing chart showing a conventional method for energizing the solenoid;

Fig. 11 is a flow chart corresponding to an embodiment of the present invention;

Fig. 12 is a schematic cross sectional view of a printer constructed in accordance with an embodiment of the present invention;

Fig. 13 is a schematic cross sectional view of a printer constructed in accordance with another embodiment of the present invention;

Fig. 14 is a flow chart operation showing an autoloading by a conventional method; and

Fig. 15 is a schematic cross sectional view for explaining a conventional paper feeding apparatus.

The embodiments described below are used in a serial type impact dot printer as an example. The embodiment of Fig. 1 is a printer wherein paper is guided to the feeding-out roller in use of a paper bail provided with a movable shaft. In the embodiment of Fig. 2 a fixed paper-path for guiding the paper is provided. The embodiment of Fig. 3 has a paper bail such as in Fig. 1 and a roller to press the feeding-out roller with the paper therebetween.

Fig. 1(a) is a plan view and Fig. 1(b) is a sectional view of a first embodiment. For wrapping printing paper 13 around platen 5 made of rubber or a similar material, and positioning and feeding it toward printing head 7, platen 5 is arranged such that a space is defined between platen 5 and printing head 7 during reciprocating movement of the latter in the direction of arrow a. At an upstream position of printing head 7 with respect to the paper feeding direction d (Fig. 1(b)), paper feeding rollers 8 and 9 are arranged below the platen, and

a paper guide plate 10 for guiding the leading edge of paper 13 toward the front of printing head 7 is arranged so as to partly wrap around the peripheral surface of platen 5 with a space therebetween from the vicinity of a tractor 11 (described later) to the vicinity of the lower portion of printing head 7. Further, at the upstream side of paper guide plate 10, tractor 11 utilizing a belt with pins having the same diameter and pitch as those of feeding holes of fanfold paper is arranged. At the paper feeding-out side after printing, a rod movable in the direction of arrow e as a paper bail 12 for guiding the leading edge of printing paper 13 toward the gap between a paper feeding-out roller 1 and an auxiliary paper feeding-out roller 2 is disposed above printing head 7. Above paper bail 12, at the downstream side in the paper feeding direction, paper feeding-out rollers 1 having the same friction coefficient as rubber or the like and being driven in the direction of arrow c to draw printing paper 13, and auxiliary paper feeding-out rollers 2 are disposed. As shown in the cross sectional view of Fig. 1(b), the outer circumference of auxiliary rollers 2 overlaps by h with that of feeding-out rollers 1, and there is a space in between each side of a feeding-out roller 1 and the adjacent auxiliary roller 2. Feeding-out rollers are fixed to feeding-out roller shaft 3 by press fitting or the like for preventing idle running, so that it rotates with the feeding-out roller shaft. Auxiliary feeding-out rollers 2 are rotatably supported on auxiliary feeding-out roller shaft 4, so that friction load with respect to the movement of paper is not caused at the contact portion of feeding-out roller 2 with the printing paper and paper feeding-out rollers 2 can perform idle running. Auxiliary feeding-out roller shaft 4 is fixed at frame 19 in order not to allow an idle running. Feeding-out roller shaft 3 and platen 5 pass through and engage with frame 19 and are positioned so as to be smoothly rotatable. The portion of shaft 3 and that of the shaft of the platen 5, projecting from frame 19 are fixed to gears 16 and 18, respectively so as not to cause idle running. Paper feeding motor 6, platen 5 and paper feeding-out roller shaft 3 are mechanically coupled by a gear train consisting of gears 14 to 18.

Next, the operation of the above embodiment will be described.

For a cut sheet printing, tractor 11 is not utilized and printing paper is directly inserted between paper guide plate 10 and platen 5. A cut sheet is pressed against platen 5 with high load by paper feeding rollers 8 and 9 (shown by imaginary lines in Fig. 1(b)) and the cut sheet is positioned and moved in accordance with the rotation of platen 5 by frictional force. Accordingly, since printing paper is fed by the peripheral surface of platen 5 which is the area where printing is actually effected, the positional accuracy with respect to printing is high.

On the other hand, for a fanfold paper printing, paper feeding rollers 8 and 9 are separated from platen 5 as shown in Fig. 1(b), and printing paper 13 is hooked by pins of tractor 11 and is inserted into an opening between paper guide plate 1 and the periphery of platen 5. At the upper portion of platen 5 corresponding to the downstream side in the direction of paper feeding with respect to printing head 7, both cut sheet and fanfold paper are fed toward paper bail 12, wrapping around the periphery of platen 5 through the front of printing head 7. Paper bail 12 is located at the position apart from platen 5 shown by a broken line in Fig. 1(b) till the leading edge of the paper is fed to approximately the intermediate point between paper bail 12 and feeding-out roller 1, so that when the leading edge of the paper is fed to a position above printing head 7, it does not contact with paper bail and jamming is avoided. Then, when the leading edge of the paper reaches the intermediate point, paper bail 12 moves to the position indicated by a solid line in the direction of arrow e and guides the leading edge so that it is drawn automatically into the opening between feeding-out roller 1 and auxiliary feeding-out roller 2. The power for the series of paper feeding operations is obtained by the rotational force of paper feed motor 6. Pinion gear 14 fixed to the tip portion of the motor axis is rotated by the rotation of motor 6, and the rotational power is transmitted to platen gear 16 which is fixed to the shaft of platen 5 to rotate platen 5 through reduction gear 15. Further, platen gear 16 rotates several feeding-out rollers 1 fixed to feeding-out roller shaft 3 in the column direction by rotating feeding-out roller gear 18 fixed to shaft 3 through transmission gear 17. Since the outer diameter of platen 5 is approximately the same as the diameter of the pitch circle of platen gear 16 and the outer diameter of the feeding-out rollers 1 is the same as or a little geater than the diameter of the pitch circle of feeding-out roller gear 18, the peripheral speed Vb of platen 5 is the same as or higher than the peripheral speed Vc of feeding-out rollers 1 by several percents ($Vc > Vb$). Likewise, tractor 11 is so arranged that the peripheral speed Va of the tractor and the peripheral speed Vb of the platen have the relation $Vb \geq Va$. By setting the downstream feeding speed higher than or the same as the upstream feeding speed, the paper is not sagged between these paper feeding portions.

In accordance with the construction for paper feeding at the feeding-out portion, feeding-out rollers 1 and auxiliary feeding-out rollers 2 are so arranged that they overlap each other by an amount h (as shown in the cross sectional view of Fig. 1(b)) and are arranged with a gap i there-

between (as shown in the plan view of Fig. 1(a)). Therefore, the paper inserted between these rollers is sagged and is pressed against each roller by the restoring force of the paper, and the paper is fed out in accordance with the rotation of these rollers by the frictional force generated between the paper and the rollers. The restoring force of the paper due to the sagging differs depending on the kind of paper, so that thicker paper has a stronger restoring force. Accordingly, for thick paper being apt to generate sagging by its weight on the way from tractor 11 to feeding-out rollers 1, such sagging is prevented by strong feeding-out force. On the contrary, for thin paper having small restoring force and being easily broken when strong stress is concentrated on the pins of tractor 11 with too large a tensile force, the tensile force is reduced to prevent tearing of the feeding holes. In such a manner, the feeding-out force is self-controlled automatically in accordance with the thickness of the paper.

The feeding force generated by platen 5 located at an intermediate position in the paper feeding mechanism is not utilized since paper bail 12 is not pressed directly against platen 5 with the paper therebetween but is used only for guiding the paper being apart from platen 5, so that it depends on the contact angle of paper with respect to platen 5 and the feeding-out force generated by feeding-out roller 1. Therefore, the feeding force has the same relation as that of the feeding-out force and is self-controlled in accordance with the thickness of paper. Further, if the amount of sagging, tear, friction coefficient of feeding-out rollers 1 and that of platen 5 are changed due to a change in the ambient temperature or the ambient humidity, a change in rigidity of the paper itself is caused, whereby the feeding-out force from feeding-out rollers 1 and the feeding force from platen 5 are changed. For instance, even if the friction coefficient is decreased at low ambient temperatures and paper is made to sag more easily, the feeding-out force is increased with a rise of paper rigidity to prevent sagging. Further, if the friction coefficient is increased at high ambient temperatures and paper is made to sag less easily, the feeding-out force is decreased with a lowering of paper rigidity to prevent tear of the paper.

Reference is next made to Fig. 2 showing a second embodiment of the invention wherein a guide cover 20 which is integrally formed from transparent resin is utilized in place of a paper bail and auxiliary feeding-out rollers. In paper guide cover 20, a rib portion 20a is integrally formed with a plate portion 20b extending in the column direction. Paper is guided by the ridgeline portion of rib portion 20a. Both ends of paper guide cover 20 are fixed to frame 19 by screws 21. Further, being different from the above embodiment, a sprocket wheel 22 and sprocket cover 23 for preventing the paper from rising up are arranged in place of a tractor utilizing a belt when fanfold paper with holes for feeding is utilized. The operation and the effect are almost the same as that of the above embodiment. The leading edge of the paper is guided from the front of printing head 7 to feeding-out rollers 1 along rib portions 20a of paper guide cover 20, in place of utilizing the opening/closing movement of paper bail 12. In this embodiment, in place of auxiliary feeding-out rollers, rib portions 20a of paper guide cover 20 are arranged on both sides of a feeding-out roller 1 at a distance i from the roller and overlapping by amount h, so that the control of the feeding-out force in accordance with the paper sagging is the same as in the above embodiment. In place of sprocket wheel 22 of this embodiment, tractor 11 utilized in the above embodiment can be also utilized.

Reference is next made to Fig. 3 showing a third embodiment wherein auxiliary feeding-out rollers 2a are arranged so as to be directly pressed against feeding-out rollers 1, instead of being arranged at both ends of feeding-out rollers 1. The pressing load is produced by a tension spring 31 attached between the end portion of auxiliary feeding-out roller shaft 4 and a spring peg 25 projecting through feeding-out roller frame 30. Feeding-out roller shaft 3, feeding-out roller gear 18 and transmission gear 17 are fixed to a feeding-out roller frame 30 and form a removable unit which is separate from frame 19. Paper bail 12 is fixed to a paper bail lever 24 pivoting on a shaft 28 projecting through frame 19 and is rotatable in the direction of arrow e. Printing paper 13 is pressed by a pressure force produced by a tension spring 32 connecting shaft 29 projecting through frame 19, and shaft 27 projecting through paper bail lever 24. Further, when the above unit is mounted, paper bail lever 24 is adjusted by stopper pin 26 projecting through feeding-out roller frame 30, whereby paper bail 12 is kept away from platen 5 as shown in Fig. 3. On the other hand, when the unit is not mounted, paper bail 12 is utilized as in a conventional printer, i.e. paper bail 12 is pressed against the periphery of platen 5 by tension spring 31, and another unit such as a cut sheet feeder can be mounted. The other arrangement is the same as with the first embodiment shown in Fig. 1. In this third embodiment, in place of contacting printing paper with feeding-out roller 1 by the restoring force produced by paper sagging due to an overlapping of feeding-out roller 1 with auxiliary feeding-out roller 2a, an auxiliary feeding-out roller is pressed by tension spring 31 against feeding-out roller 1 with printing paper 13 therebetween, so that the feeding-out force for printing paper 13 is deter-

mined by the load of tension spring 31 and the surface friction coefficient of feeding-out roller 1.

Next the construction, circuit and the like for operating paper bail 12 will be described.

Fig. 4 is a block diagram showing an embodiment. Voltage detector circuit 130 is coupled to the input of analog-to-digital conversion circuit 131 (hereinafter referred to as A/D conversion circuit). The output line of A/D conversion circuit 131 is coupled to the input port of input/output interface 132 (hereinafter referred to as IOP), and the output of IOP 132 is coupled to the bases of transistors Q_1 and Q_2 of a solenoid driving circuit shown in Fig. 5. IOP 132 is coupled to microprocessor 133 (hereinafter referred to as CPU) and to ROM/RAM 134.

A change in voltage from the value of 35V is detected by voltage detector circuit 130 and is converted into a digital signal by A/D conversion circuit 131. Then the digital signal is inputted into IOP 132. CPU 133 detects the condition of IOP 132, changes attraction time width of loading solenoid 46 in accordance with the output of CPU 133 corresponding to that condition, and turns on transistor Q_1. In such a manner, the driving time of transistors Q_1 and Q_2 is set in accordance with the combination of the level of the output line of A/D conversion circuit 131, and a counted value corresponding to the time is stored in ROM/RAM 134 and is read out by CPU 33, whereby transistors Q_1 and Q_2 are properly controlled.

Fig. 5 is a driving circuit for exciting the solenoid. The collector of transistor Q_1 and that of transistor Q_2 are connected to loading solenoid 46 and a nominal voltage of 35V is applied to loading solenoid 46 by turning on transistors Q_1 and Q_2. Further, a nominal voltage of 5V is applied to loading solenoid 46 by turning-off transistor Q_1 and turning-on transistor Q_2.

The operation will next be described referring to the timing diagram of Fig. 6 and Fig. 8 and 9 showing the operation. Platen 5 is rotatably supported and produces a feeding force for printing paper 13. Paper bail 12 is rotatably supported by shaft 12S which is mounted in parallel with platen 5, and both ends of shaft 12S are supported on both sides of the printer by paper bail levers 12L with point 12a as the fulcrum. Paper bail 12 is kept in contact with platen 5 through paper bail levers 12L by paper bail pressure springs 48 provided on both sides of the printer. When printing paper 13 is to be automatically loaded, after loading the leading edge of paper to the pressure contact point between paper feeding roller 8 and platen 5, loading solenoid 46 is energized by tuning on transistors Q_1 and Q_2 of Fig. 5 simultaneously and paper bail lever 12L is opened through loading lever 47. At an intermediate position C before paper bail lever 12L reaches release position B, i.e. after a period of time t_1 (Fig. 6), transistor Q_1 is turned off, and after a further period of time t_2, transistor Q_1 is turned on again. As described above, an unstable movement of paper bail lever 12L due to a change in the driving voltage can be corrected by properly setting the energizing period t_1, in accordance with the change in driving voltage, and, thus, the impact when paper bail lever 12L reaches release position B can be reduced. Further after paper bail lever 12L reached release position B, transistor Q_1 of Fig. 5 is turned off while paper bail lever 12L is kept at the release position B. Due to the above controlling, the attraction force of loading solenoid 46 is released halfway, and the energy is absorbed by the tensile force of paper bail pressure lever spring 48 in the opposite direction to the inertia force around fulcrum 12a. Thus, the speed of the movement of paper bail 12 reaching release position B can be reduced.

In the next step, when platen 5 is rotated to feed the leading edge of printing paper 13 to position 13B, the rotation of platen 5 is stopped, transistor Q_2 of Fig. 5 is turned off and paper bail lever 12L is returned to its pressed position (condition of Fig. 8) by the restoring force of paper bail pressure spring 48. After a period of t_4 from the moment the transistor Q_2 is turned off, when paper bail lever 12L reaches the intermediate position C, transistors Q_1 and Q_2 of Fig. 5, both are turned on and loading solenoid 46 is energized for a minute moment. Then after a further period of time t_5, transistors Q_1 and Q_2 are turned off, and paper bail lever 12L is returned to its pressed position, whereby paper 13 is completely set.

When loading solenoid 46 is energized before paper bail lever 12L has returned to its pressed position, the attraction force of loading solenoid 46 acts in the direction opposite to the restoring force of paper bail pressure spring 48 by which paper bail lever 12L is returned. Thus, the speed at which paper bail 12 strikes upon platen 5 can be reduced and rebounding due to such striking can be prevented.

Further, loading solenoid is energized only one time in this embodiment, however, the same effect can be achieved by two or more times of ON-OFF controlling. Furthermore, t_1 is varied in accordance with the variation of the driving voltage in this embodiment. However, if t_2 is varied so as to, for instance, shorten the period when the driving voltage is low and prolong the period when the driving voltage is high, the same effect can be obtained.

Referring to Fig. 11 to 13, autoloading of printing paper will be described. Fig. 12 is a schematic cross sectional view of an apparatus according to the present invention using a cut sheet and Fig. 11 is an example of a flow chart of the loading se-

quence thereof.

When printing paper 13 is manually inserted, the end of printing paper 13 is stopped at the position where paper feeding roller 8 is pressed against platen 5, and then is adjusted to and located at position E. Then, when a switch (not shown) for autoloading provided on the operation panel or the like is turned on, paper feeding motor 6 (Fig. 1) is driven by a rotational amount stored in a ROM and an amount stored in a memory (RAM) and the driving force of the paper feeding motor is transmitted to platen 5 through the transmission means to rotate platen 5 in the direction of arrow U. Thereby the end of paper 13 is fed from position E to position G to complete paper positioning for the start of printing. After that, the apparatus is in the condition of waiting for printing data.

Since the memory is cleared immediately after the power is applied during the first loading, initially the motor is driven merely by a rotational amount stored in the ROM.

If a positional change of the end of paper 13 is required, the paper feeding motor is rotated forward or backward by minute steps. For this, a switch for fine adjustment provided on the operation panel or the like is used while the apparatus is in the condition of waiting for printing data, in order to rotate platen 5 through a gear train in the direction of arrow U or in the direction opposite thereto. Since the paper located at position G is fed by a very small amount in the direction of arrow P or in the direction opposite thereto, a user can position the paper at the desired position (for instance, at position F) easily and correctly without manual operation to rotate the platen knob. This fine adjustment operation can be continued until the input of the next printing data. The rotational amount required for the fine adjustment is added to or subtracted from a value in the memory and is stored therein (as mentioned above the initial value is 0).

According to this embodiment, if the paper at position G is required to be advanced to position F a rotational amount of motor 6 corresponding to length A is stored in the memory. The above sequence is completed when printing data is inputted, and it returns to (1) in the flow chart of Fig. 11 after printing.

During the next autoloading sequence, when the switch for autoloading is turned on after inserting paper, the paper feeding motor is driven by a rotational amount stored in the ROM (feeding the paper to position G) and a further amount stored in the memory (length A) so that the paper is immediately fed to position F. Therefore, it is unnecessary to position each paper individually for the printing start, which improves remarkably the facility of the apparatus. Further, if many papers are printed, each paper is set at the correct position without variation of the printing position.

In this embodiment, the memory is cleared when the power of the printer is turned off. However, if the memory is backed up, the starting position of the last printing is stored and maintained in the memory by the time that the user repositions the printing start position after once turning-off the power source. Thus, it is very convenient for printing on many sheets of papers in a specific format.

Fig. 13 is a cross sectional view of an other embodiment of the present invention utilizing a fanfold paper.

Tractor 11 on which fanfold paper is set and platen 5 are driven by a motor through a gear train. When a switch for autoloading is turned on, tractor 11 and platen 5 are driven in the direction of arrow j and k, respectively, and printing paper 13 is fed in the direction of arrow m. The end of paper 13 gradually presses a paper detecting sensor 44 downward from position 45a , and sensor 44 detects the paper at position 45b. At this moment, the end of printing paper 13 is at a position 13t, which corresponds to position E in Fig. 12, and serves as the reference position for leading the paper to a desired start position.

After a detection of paper 13 by paper detector sensor 44, the motor is driven by a rotational amount stored in the ROM and an amount stored in the memory for the start of printing. The fine adjustment operation is carried out in the same manner as in the above embodiments.

In addition, as reference position 13t varies due to an inaccuracy of parts of the paper detector sensor 44 and of its mounting, to the quality of printing paper 13 and to the ambient temperature in the conventional method, the printing start position is unstable. However, according to the present invention, the user can re-position the printing start position by fine adjustment so that printing can always be started from a desired position, not influenced by such variations.

Claims

1. A paper feeding apparatus for a printer, comprising:

a platen (5),

a paper feeding tractor (11) for feeding fan-fold paper (13), arranged at the upstream side of said platen (5) with respect to the paper feeding direction (d),

a power mechanism (6, 14 - 18) for driving said platen (5) and said paper feeding tractor (11),

a roller (1) located at the downstream side of said palten and coupled to said power mechanism

to rotate with the same or a higher circumferential speed than that of the platen (5), and

a pressing member (2, 20) for pressing the paper (13) which is fed out from the upper side of the platen (5) after printing, against said roller (1).

2. An apparatus according to claim 1, wherein said pressing member (2) comprises two pressing member portions arranged at both sides of said roller (1) in the axial direction thereof, overlapping said roller (1) in a direction perpendicular to the axis of the roller (1).

3. An apparaus according to claim 2, wherein each pressing member portion (2) comprises an auxiliary roller.

4. An apparatus according to claim 2, wherein said pressing member comprises a paper guide cover (20) having rib portions (20b) forming said pressing member portions.

5. A paper feeding apparatus for a printer, comprising:

a platen (5) supported rotatably to feed paper (13),

a paper presser means (12),

a paper presser lever (24) for supporting the paper presser means (12), which is rotatable between a position in which the paper presser means (12) presses the paper (13) against the platen (5) and a position in which the paper (13) is released from the paper presser means (12),

a pressing member (32) for supplying pressing force to the paper presser lever in said paper-pressing position, and

a driving means (46) for supplying a driving force to rotate said paper presser lever (24),

wherein a control apparatus for controlling energization of said driving means (46) is provided, said control apparatus performing one energization or a plurality of successive energizations of said driving means (46) for moving said paper presser lever (24) from said released position to said pressing position and/or for moving said paper presser lever (24) from said pressing position to said released position.

6. A control apparatus for loading paper into a printer having an autoloading mechanism, wherein the paper is automatically drawn in to be set at a predetermined start position for printing, the apparatus comprising:

a first storage means for storing data corresponding to said predetermined start position,

a switch operable for moving said paper forward or backward in order to achieve a fine adjustment of said start position, and

a second storage means for storing data corresponding to a fine adjustment effected by said switch.

7. An apparatus according to claim 6, wherein said first storage means is a read-only memory and said second storage means a random access memory.

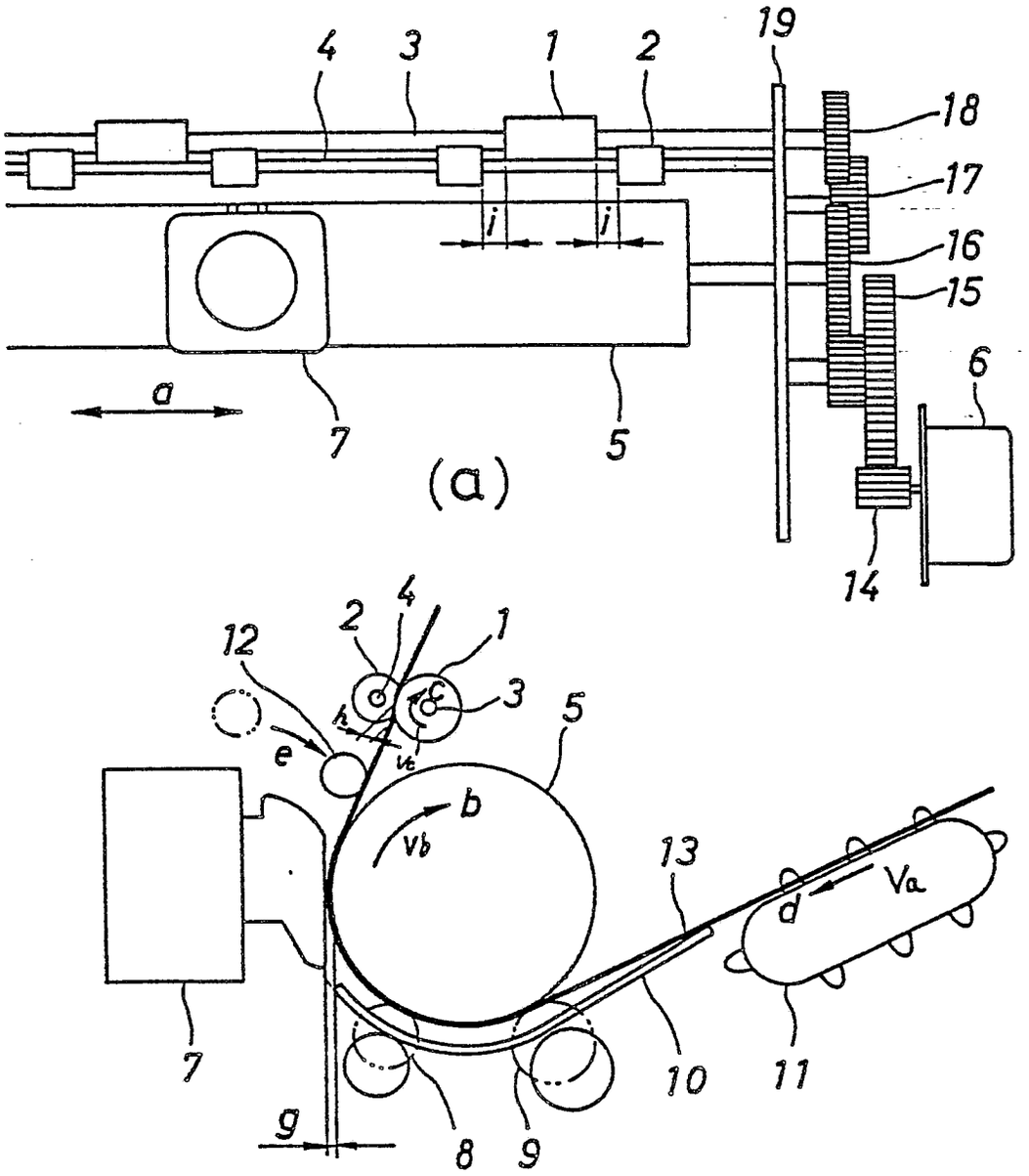

FIG.1

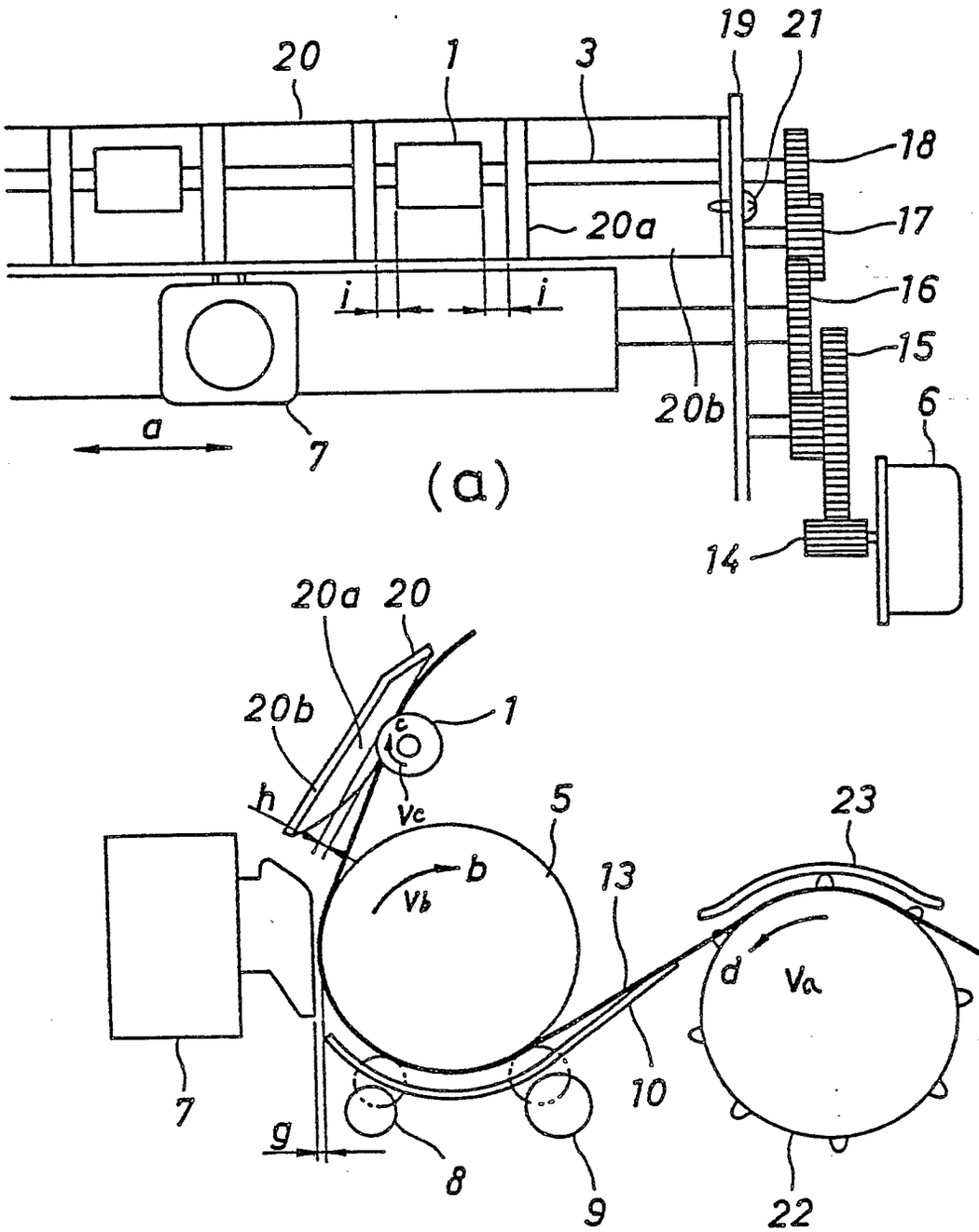
20
1
3
19
21
18
17
16
15
6
20a
i
i
20b
a
7
14
(a)
20a
20
20b
1
c
h
Vc
5
23
b
Vb
13
d
Va
7
10
g
8
9
22
(b)

FIG. 2

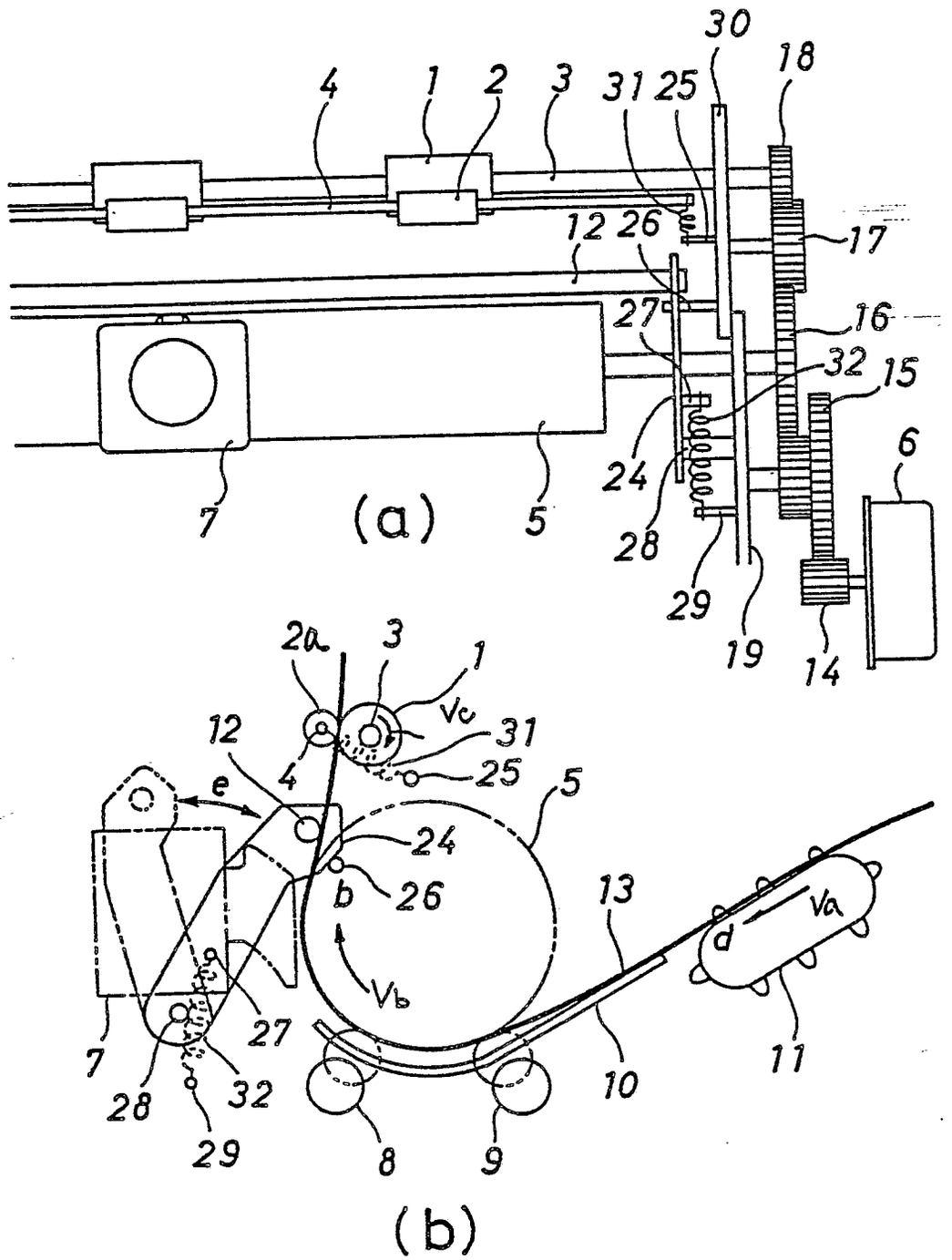
30
18
4
1
2
3
31
25
12
26
17
27
16
32
15
24
6
28
29
19
14
7
(a)
5
2a
3
1
Vc
12
31
4
25
e
5
24
b
26
13
d
Va
Vb
27
7
28
32
29
8
9
10
11
(b)

FIG. 3

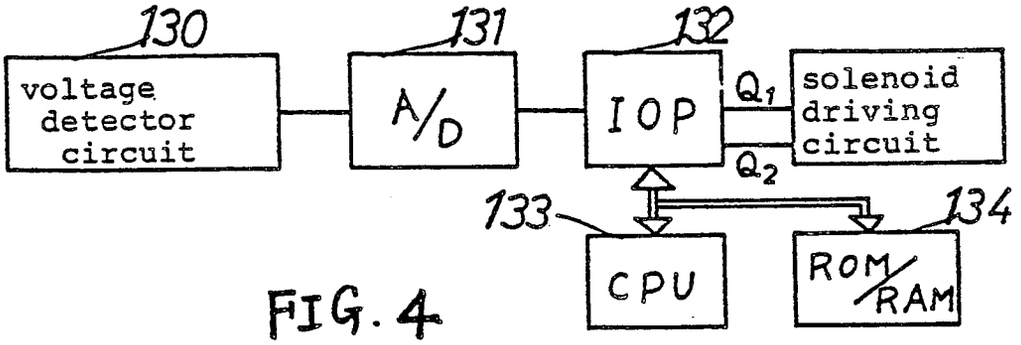

FIG. 4

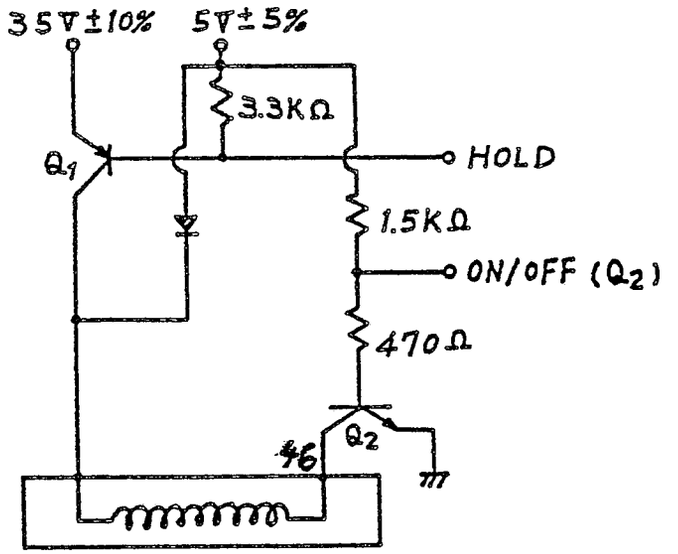

FIG. 5

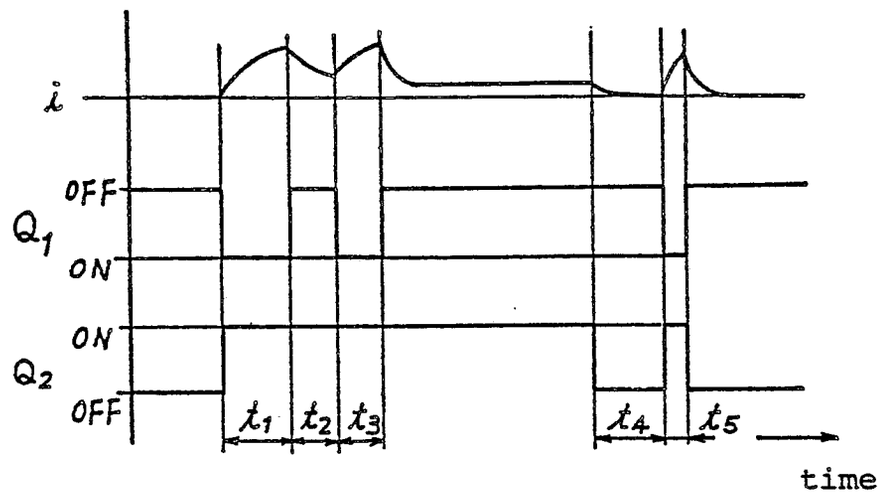

FIG. 6

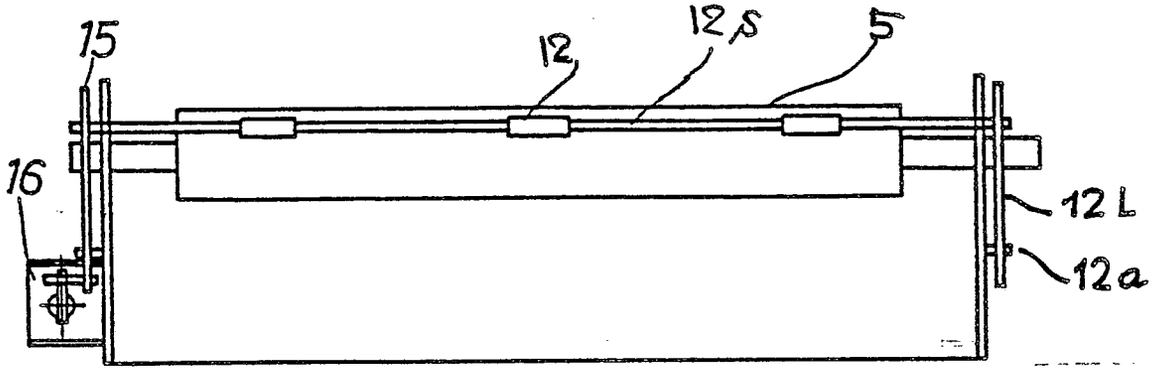

FIG. 7

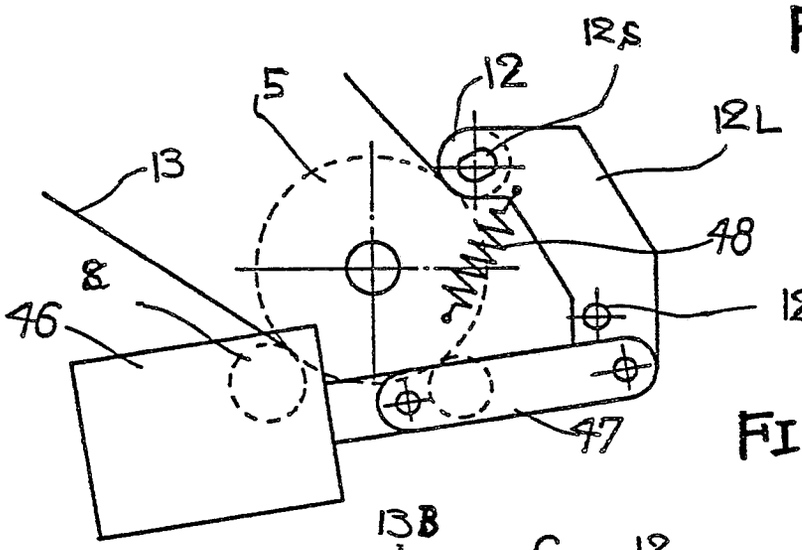

FIG. 8

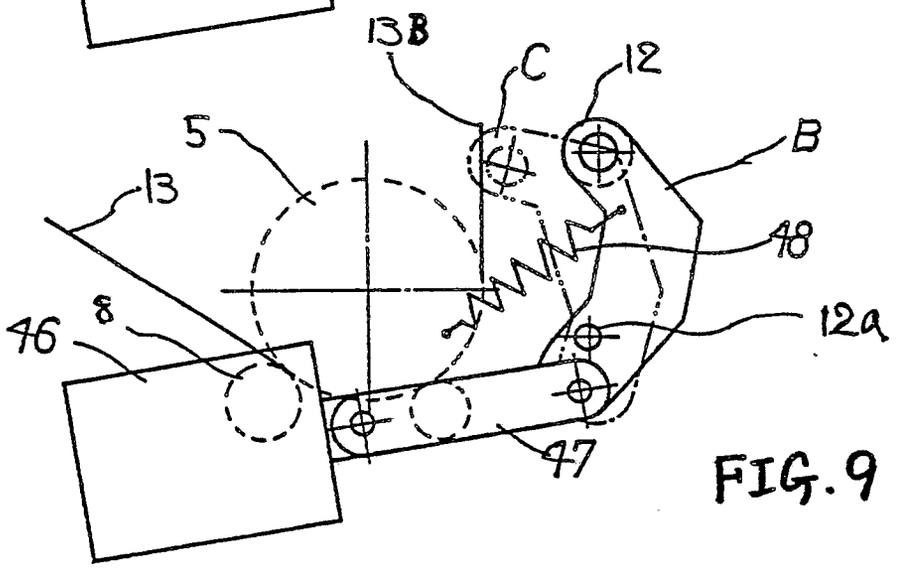

FIG. 9

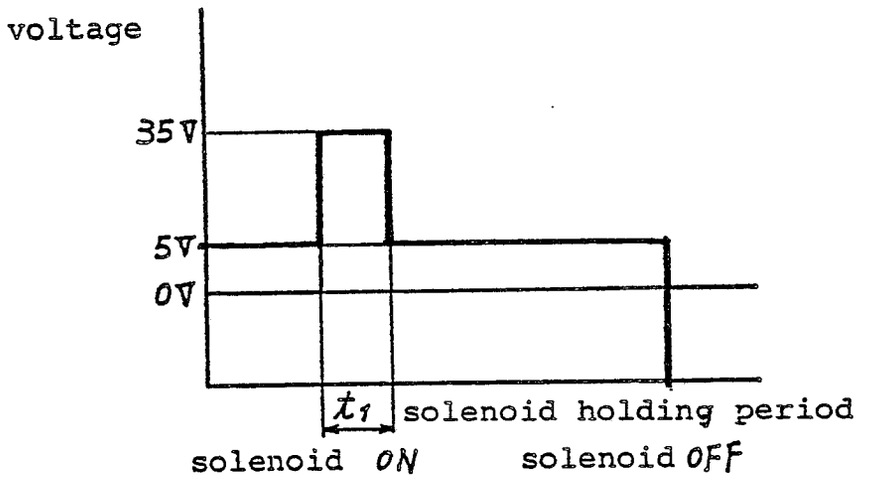
voltage
35V
5V
0V
t_1
solenoid holding period
solenoid ON
solenoid OFF

FIG. 10

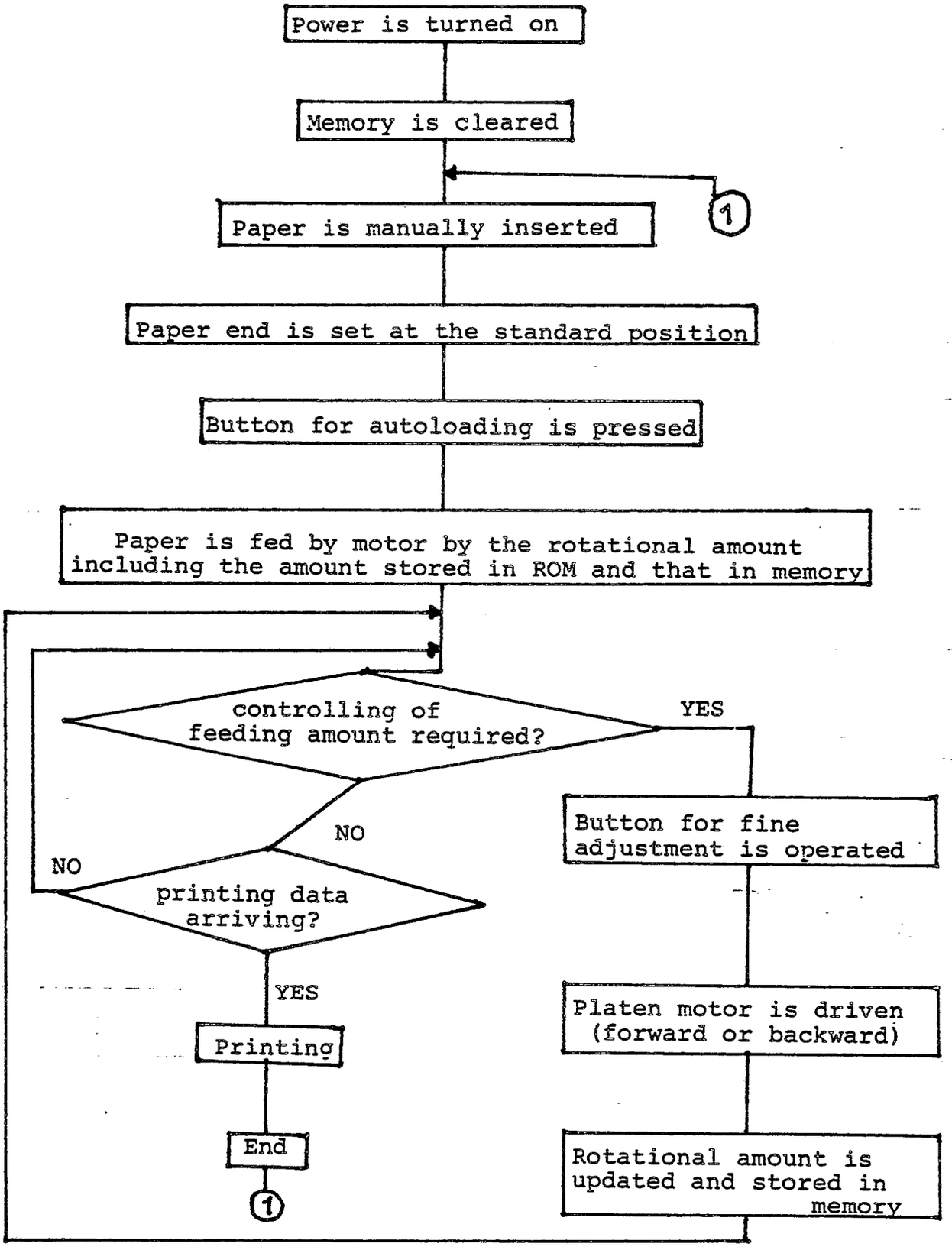
Power is turned on
Memory is cleared
Paper is manually inserted
1
Paper end is set at the standard position
Button for autoloading is pressed
Paper is fed by motor by the rotational amount including the amount stored in ROM and that in memory
controlling of feeding amount required?
YES
NO
Button for fine adjustment is operated
NO
printing data arriving?
YES
Platen motor is driven (forward or backward)
Printing
End
Rotational amount is updated and stored in memory
1

FIG. 11

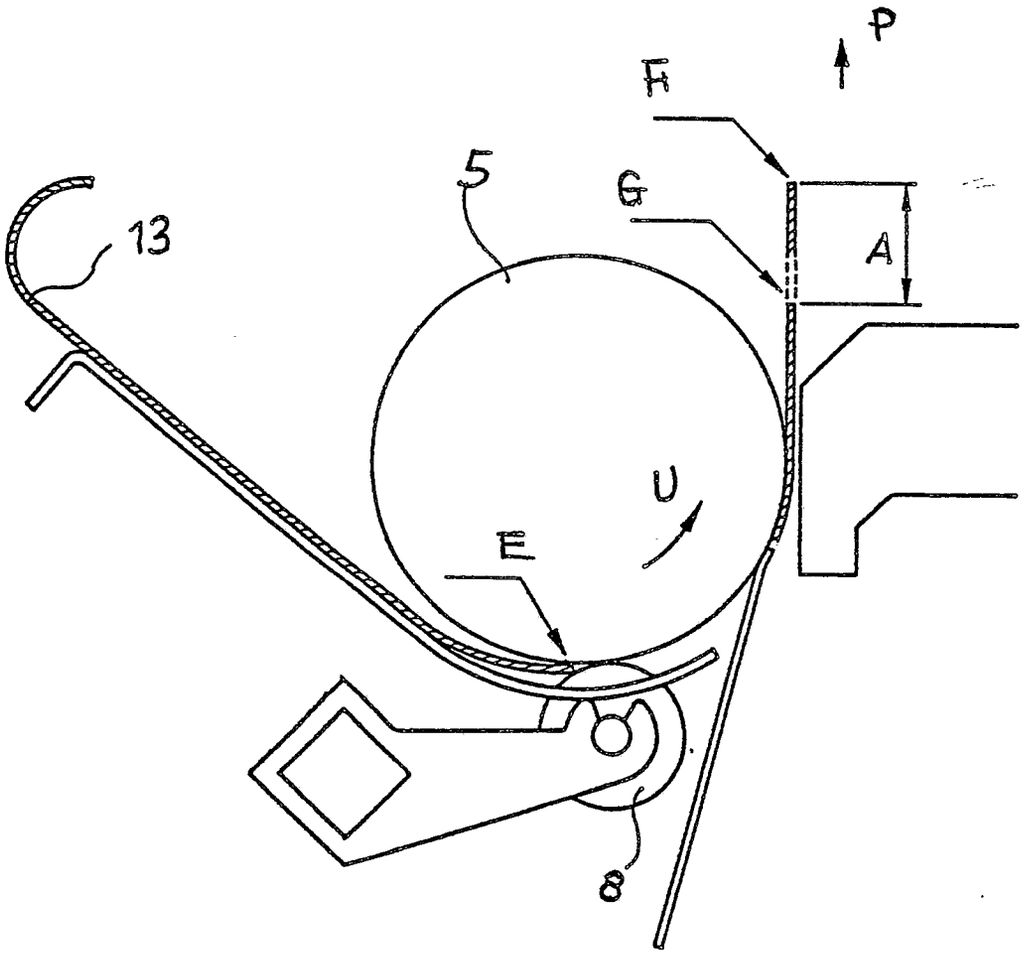

FIG. 12

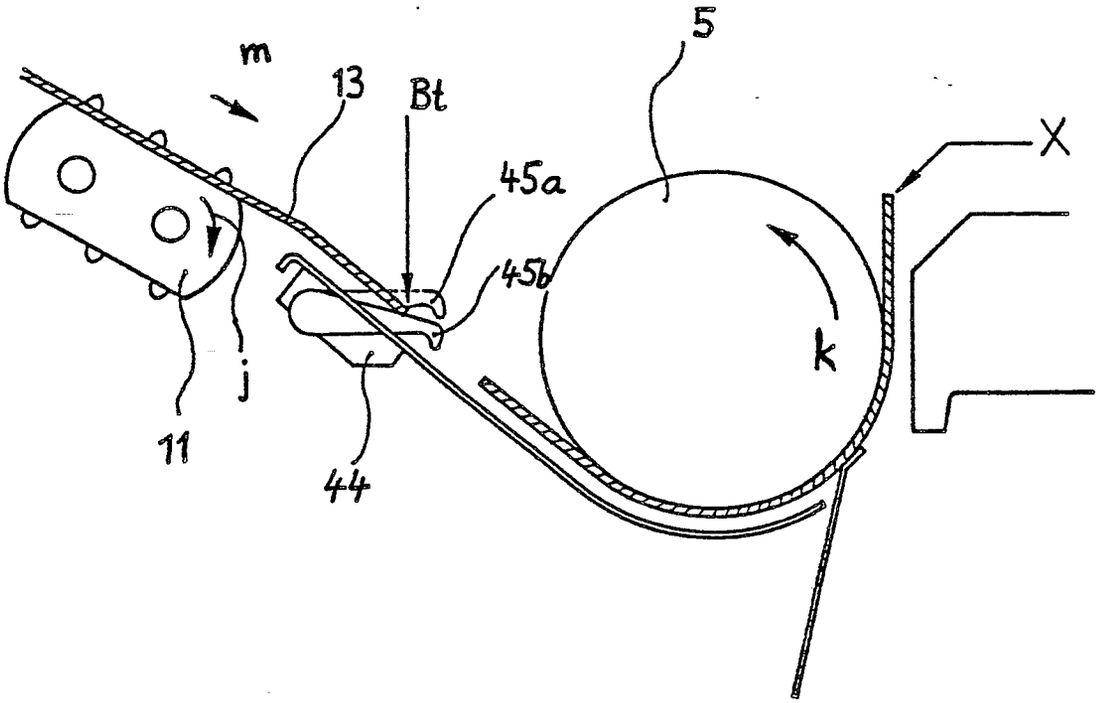

FIG. 13

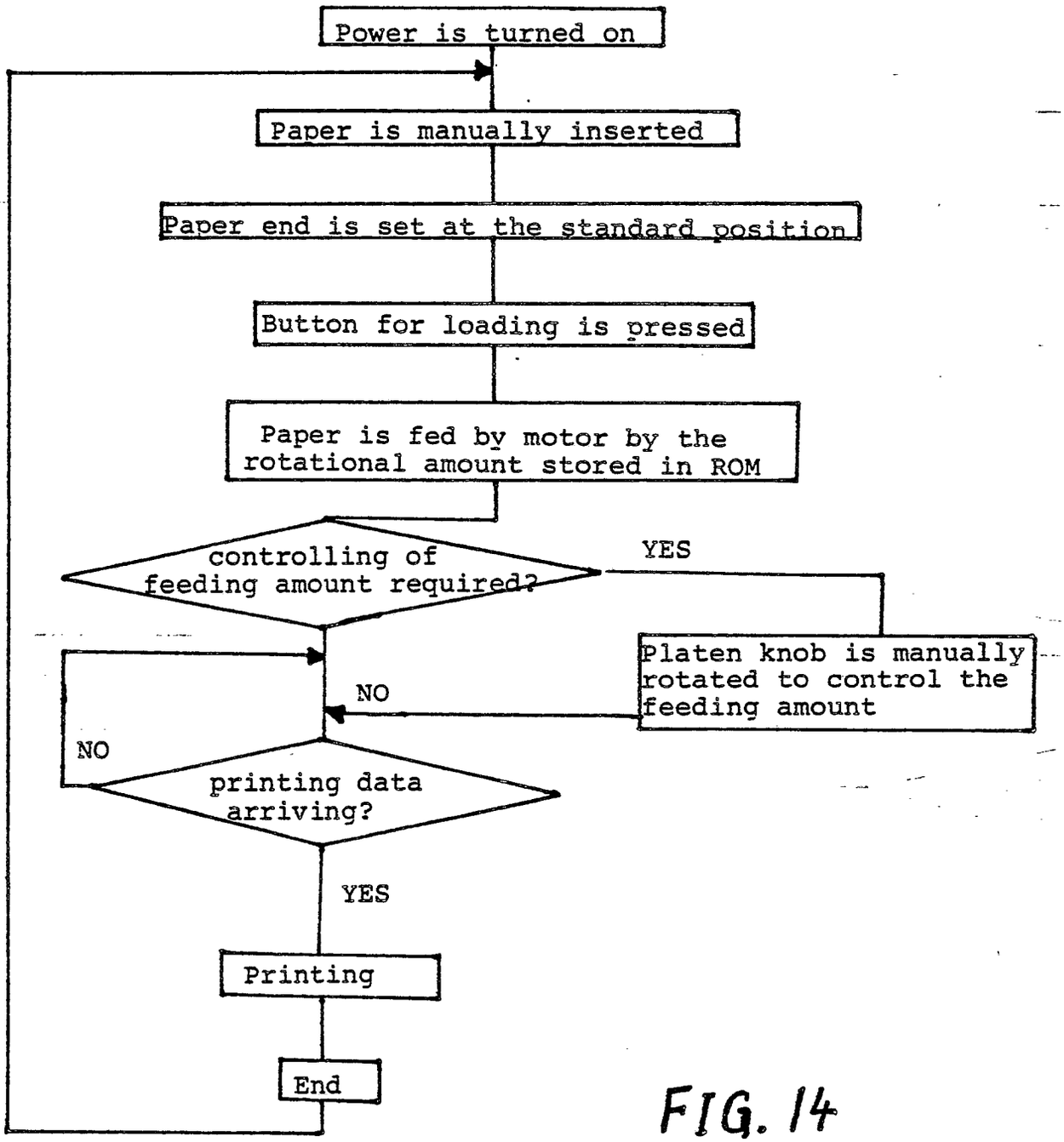
Power is turned on
Paper is manually inserted
Paper end is set at the standard position
Button for loading is pressed
Paper is fed by motor by the rotational amount stored in ROM
controlling of feeding amount required?
YES
Platen knob is manually rotated to control the feeding amount
NO
NO
printing data arriving?
YES
Printing
End

FIG. 14

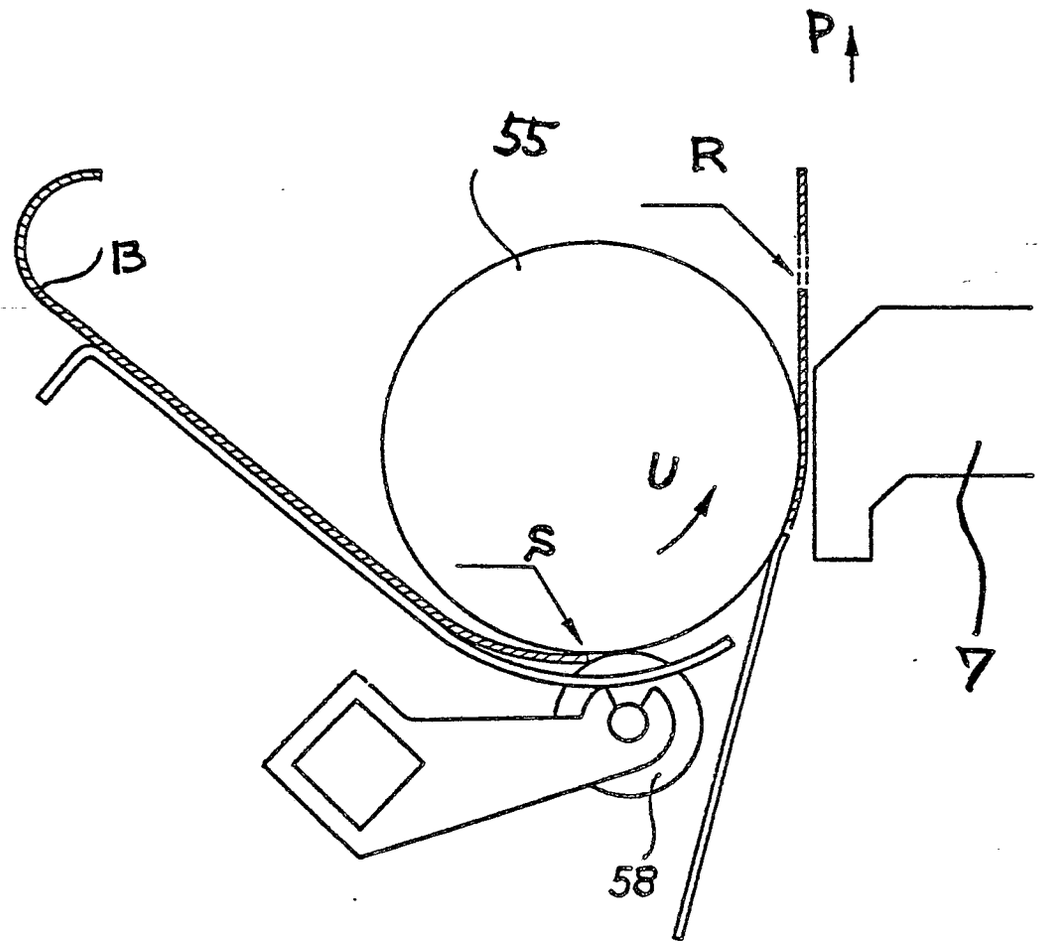

FIG.15