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Paper feeding mechanism for a printer

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FIG. 1

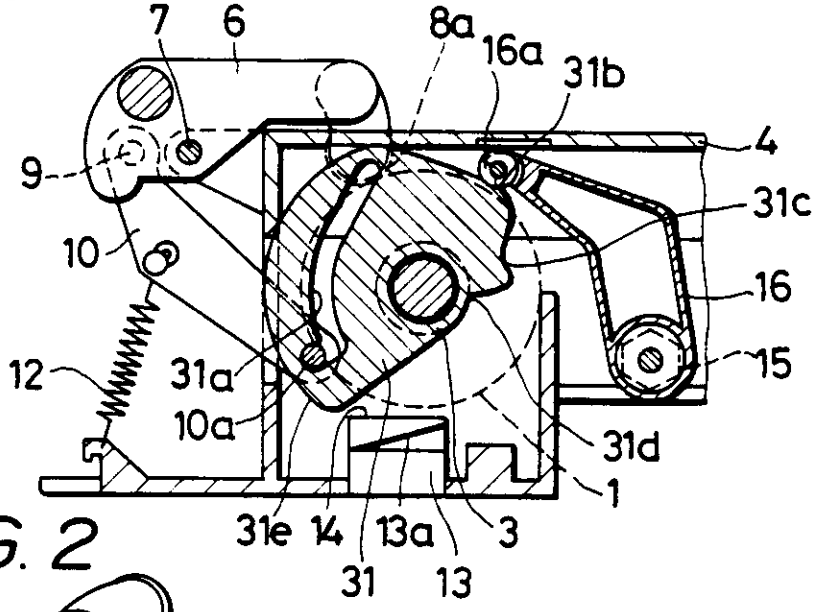


FIG. 2

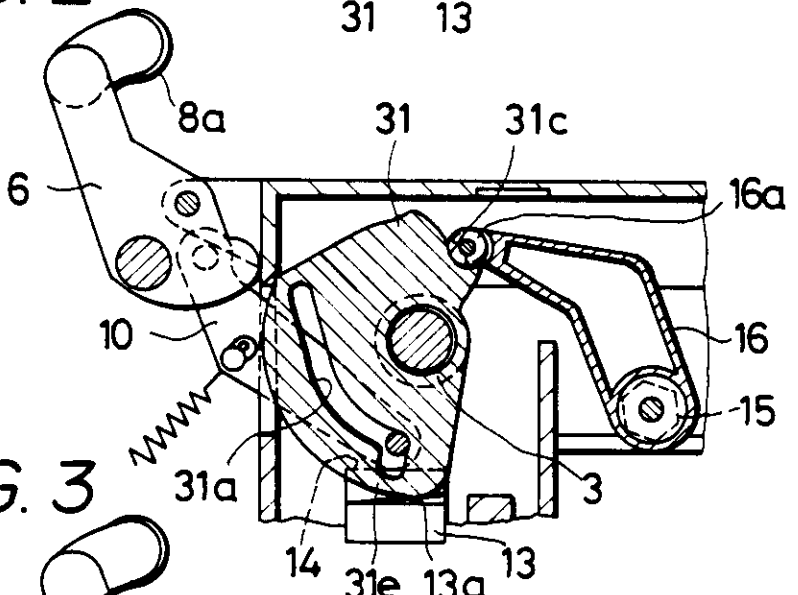


FIG. 3

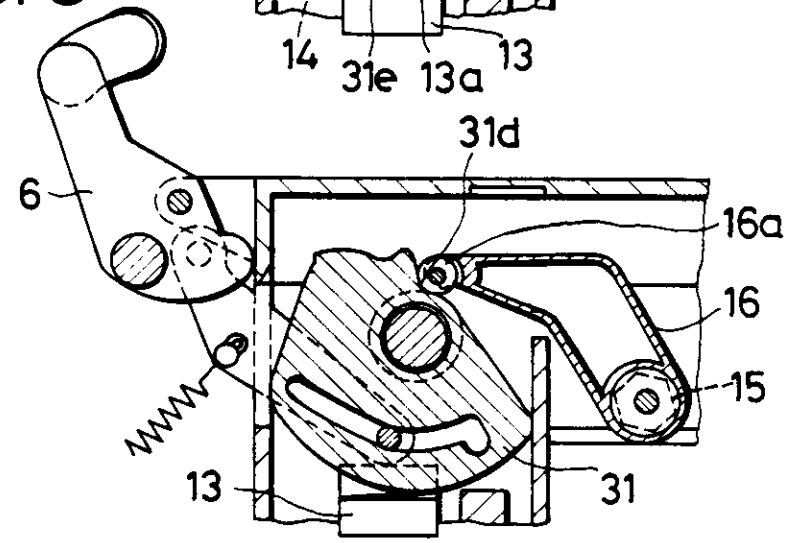


FIG. 4

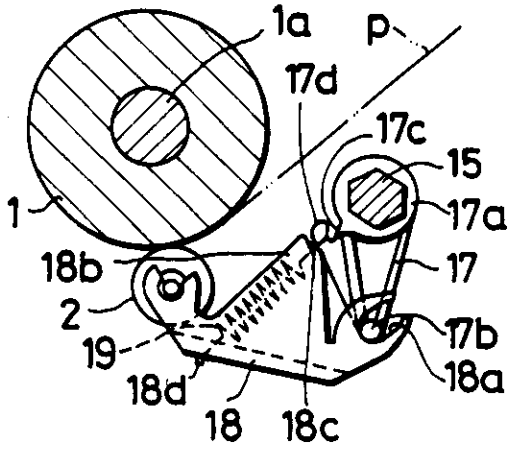


FIG. 5

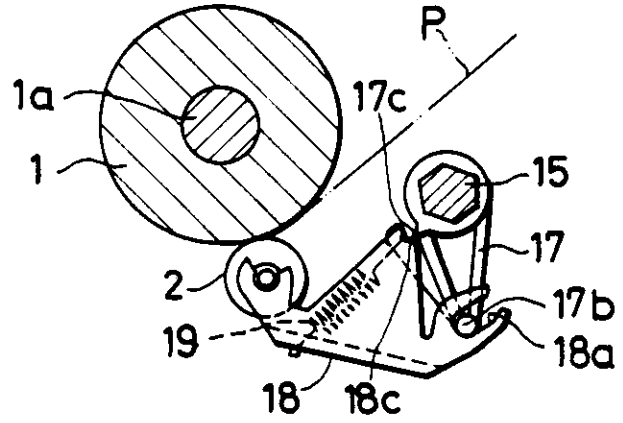


FIG. 6

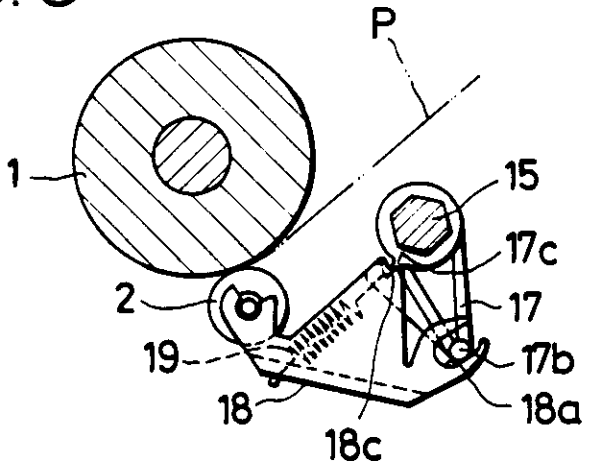
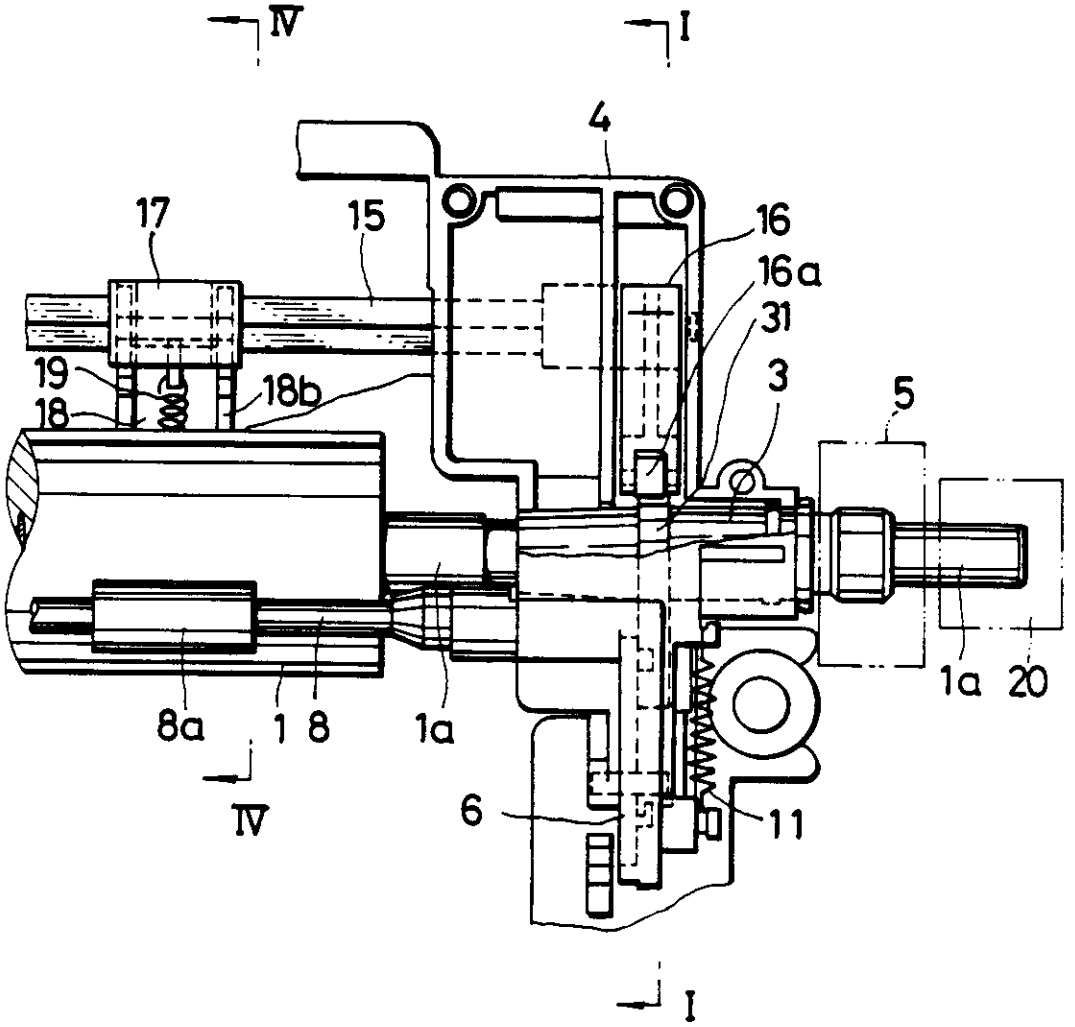


FIG. 7



PAPER FEEDING MECHANISM FOR A PRINTER

This invention relates to paper feeding mechanisms for printers.

Conventionally, large size printers provided with automatic paper loading mechanism have been used as output devices of word processors, etc. In such an automatic paper loading mechanism, a paper pressing roller is separated from a platen by a manually operable lever projecting outwards, and then a push-button is depressed to start a paper feeding motor so that recording paper is automatically drawn in.

One known frictional paper feeding mechanism is such that a spring fixed to a frame of a printer holds a pinch roller. Alternatively a pinch roller is pressed by a spring attached to a bottom plate of a printer.

In such automatic paper loading mechanisms, operation is complicated because both the operation of the manually operable lever and the push-button are required. Further, in the above paper feeding mechanisms, when recording paper is inserted as well as fed, the resilient force by which the pinch roller is urged against the platen is always so strong that the recording paper is not easily inserted between the platen and the pinch roller even when the leading edge of the recording paper has come into contact with the pinch roller. Further, when the recording paper is fed by, for example, a pin tractor, it is necessary to provide a separate mechanism for causing the pinch

roller to move away from the platen against the spring force resulting in a complicated structure.

The present invention seeks to provide a paper feeding mechanism for a printer in which (a) recording paper can be automatically drawn in by a simple operation, (b) recording paper can be surely inserted between a platen and a pinch roller, (c) mis-insertion of recording paper can be easily corrected, for example, in the case where the recording paper is drawn in at an angle, and (d) an appropriate tensile force can be applied to the recording paper even in the case of tractor feeding.

According to the present invention there is provided a paper feeding mechanism for a printer comprising: a platen for feeding recording paper; a pinch roller resiliently urged into contact with said platen; a platen bearing for rotatably supporting said platen, said platen bearing being arranged to be rotatable by a knob fixed to an outward projecting end of said platen bearing; a cam portion on the platen bearing; a rotatable paper pressing lever supporting a paper pressing roller; a connecting lever for pivoting said paper pressing lever in response to rotation of said cam portion; a cam follower lever fixed on a rotatable support shaft and provided at one end with a cam follower

engageable with a cam surface of said cam portion; a support arm fixed on said support shaft so as to be pivotally displaced in response to rotation of said support shaft; a roller receiver carrying said pinch roller at one end thereof; connecting means for rotatably and movably connecting one end of said support arm and the other end of said roller receiver; a spring extending between said support arm and said roller receiver; and a protrusion and a protrusion receiver provided on one and the other of said support arm and said roller receiver, said protrusion and said protrusion receiver being disposed at a position separated from a line of action of a spring force of said spring, said cam surface of said cam portion including a first, a second and a third positioning cam surface portions of different radii, said first, second and third positioning cam surface portions being, in operation, selectively followed by said cam follower for displacing said cam follower lever into a selected one of three rotational positions, said cam surface further including a switch pressing cam surface portion for operating a switch controlling a paper feeding motor.

In the preferred embodiment said protrusion is provided on the support arm and the protrusion receiver is provided on the roller receiver.

Preferably the spring extending between said support arm and said roller receiver is a tension spring.

Accordingly, on insertion of recording paper, merely by operation of the knob, the cam portion is rotated to cause the paper pressing roller to separate from the platen, and at

the same time the cam follower moves from the first positioning cam surface portion to the second positioning cam surface portion thereby to actuate the switch controlling the paper feeding motor. If the knob is turned further, the cam follower moves from the second positioning cam surface portion to the third positioning cam surface portion, so that the support arm is pivoted and the fulcrum defined by the protrusion and the protrusion receiver is changed so that the force biasing the pinch roller against the platen is changed. That is, when the cam follower follows the first positioning cam surface portion, the paper pressing roller is resiliently biased against the platen, at the same time the switch controlling the paper feeding motor is deactuated, and the pinch roller is biased against the platen with a relatively strong biasing force. When the cam follower follows the second positioning cam surface, the switch is actuated and the pinch roller is resiliently biased against the platen with a somewhat lesser biasing force. When the cam follower follows the third positioning cam surface portion, the switch is maintained actuated and the pinch roller is resiliently urged against the platen with a relatively weak biasing force.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:-

Figures 1 to 3 are cross-sectional views taken along a line I-I in Figure 7 to explain the operation of an embodiment of a paper feeding mechanism according to the present invention for a printer;

Figures 4 to 6 are cross-sectional views taken along a line IV-IV in Figure 7 of the paper feeding mechanism of Figure 7; and

Figure 7 is a partially broken-away plan view of a paper feeding mechanism according to the present invention for a printer.

Referring specifically to Figures 1, 4 and 7 of the drawings, an embodiment of a paper feeding mechanism according to the present invention for a printer has a platen 1 arranged to be rotated to feed recording paper P. A pinch roller 2 (Figure 4) is resiliently urged against the platen 1. The recording paper P is fed between the platen 1 and a pinch roller 2. A shaft 1a of the platen 1 is rotatably supported in a platen bearing 3 (Figures 1 and 7) which is rotatably supported by a frame 4 of the printer. The platen bearing 3 is provided at its outward projecting end with a knob 5 fixed thereto and at its intermediate portion with a cam portion 31. A slot 31a is formed in a side surface of the cam portion 31. The cam portion 31 has a cam surface including a first positioning cam surface portion 31b, a second positioning cam surface portion 31c and a third positioning cam surface portion 31d, these having different radii. The cam surface further includes a switch operating cam surface portion 31e. A paper pressing lever 6 is rotatably attached to a shaft 7 provided on the frame 4. A paper pressing roller 8a for applying friction to the recording paper P is rotatably mounted on a shaft 8 (Figure 7) which is supported at one end of the paper pressing lever 6. A connecting bar 10 is rotatably

attached at one end to the other end of the paper pressing lever 6 through a connecting pin 9. A pin 10a projects from the other end of the connecting bar 10 and is inserted into the slot 31a to follow rotation of the cam portion 31. A tension spring 11 (Figure 7) extends between the paper pressing lever 6 and the frame 4 and a tension spring 12 extends between the connecting bar 10 and the frame 4. A switch 13 for a paper feeding motor (not shown) is disposed under the cam portion 31 and is arranged to be turned on when an actuator member 13a of the switch 13 is depressed by the switch pressing cam surface portion 31e. A stage portion 14 is arranged in the path of travel of the pin 10a to lift an end portion of the connection bar 10. A support shaft 15 is disposed in parallel with the platen 1 and rotatably supported by the frame 4. A lever 16 is fixed at one end to an end of the support shaft 15, so that the lever 16 can be pivoted about said one end. A rotatable cam follower 16a is provided on the other end of the lever 16 to follow the rotation of the cam portion 31 thereby to cause the lever 16 and the support shaft 15 to pivot and rotate respectively.

A support arm 17 is fixed to the support shaft 15 (Figure 7). The support arm 17 is integral with a boss portion 17a fitted on the support shaft 15, and is integrally provided at its tip with a connecting shaft 17b. A protrusion 17c is formed on the boss portion 17a (Figure 4). A spring hanger 17d is integrally formed on the support arm 17 at a position adjacent

to the platen 1 and spaced by a slight distance from the protrusion 17c. A roller receiver 18 is connected with the support arm 17. The pinch roller 2 is rotatably supported at one end of the roller receiver 18, so as to be resiliently biased into contact with the platen 1. A connecting notch 18a is formed in the other end of the roller receiver 18 so that the connecting shaft 17b is rotatably and movably engaged with the connecting notch 18a. An upright bent portion 18b is respectively formed at each of the opposite sides of the roller receiver 18 and a concave protrusion receiver 18c is formed in the upright bent portion 18b so as to be engageable with the protrusion 17c. A spring hanger 18d is formed on the roller receiver 18 and a tension spring 19 is stretched between the spring hanger 18d and the spring hanger 17d of the support arm 17.

As shown in Figure 6, the support arm 17 pivots only within a predetermined angular range from a retracted position where the support arm is pivoted in a direction opposite to the roller receiver 18 to an advanced position (see Figure 4) where the support arm is pivoted toward the roller receiver 18 in response to rotation of the support shaft 15 as a result of the lever 16 moving over the cam portion 31. A knob 20 for turning the shaft 1a of the platen 1 is fixed on an end of the shaft as seen in Figure 7.

When the knob 5 is turned counterclockwise after the recording paper P is inserted between the platen 1 and the pinch roller 2, the platen bearing 3 rotates counterclockwise, and the cam portion 31 rotates counterclockwise to cause the pin 10a located

in the engaging portion of the slot 31a as shown in Figure 1 to follow the cam portion 31 to reach the position shown in Figure 2. As the cam portion 31 rotates, the connecting bar 10 is moved by the pin 10a, the paper pressing lever 6 is swung counterclockwise to raise the paper pressing roller shaft 8, and the paper pressing roller 8a is separated from the platen 1. In the position shown in Figure 2, an end portion of the connecting bar 10, where the pin 10a is formed, is lifted by the stage portion 14 so as to cause the pin 10a to separate from an engaging portion of the slot 31a and enter a sliding portion. The pin 10a therefore does not follow subsequent rotation of the cam portion 31. Further, in the position of Figure 2, the switch pressing cam surface portion 31e of the cam portion 31 presses down the actuator member 13a of the switch 13 to close it so that the paper feeding motor is started and the recording paper P is drawn in. After a predetermined period of time, after the leading edge of the recording paper P has passed in front of a reflection-type sensor (not shown), the paper feeding motor is stopped and the recording paper P is set at a predetermined position.

As shown in Figure 1, when the cam follower 16a is in contact with the first positioning cam surface portion 31b of the cam portion 31, the support shaft 15 is in the position shown in Figure 4. At that time, the support arm 17 is in its advance position and the roller receiver 18 is pushed forward to its advanced position by the support arm 17 to the connecting shaft 17b thereof, so that the protrusion 17c and the protrusion receiver 18c are separated from each other to extend the tension

spring 19. Accordingly, the connecting shaft 17b and the connecting notch 18a forms a fulcrum for the movement of the pinch roller 2 and this fulcrum is separated from the line of action of the spring force of the spring 19 (that is, a line connecting the spring hangers 17d and 18d), so that the pinch roller 2 is resiliently urged against the platen 1 with a relatively strong biasing force.

As shown in Figure 2, when the cam follower 16a is resiliently urged against the second positioning cam surface portion 31c, the support shaft 15 rotates a little counterclockwise from the position shown in Figure 4 to the position shown in Figure 5. At that time, the connecting shaft 17b and the connecting notch 18a are retracted a little from the position shown in Figure 4 and the pinch roller 2 is also retracted a little. However, the protrusion 17c and the protrusion receiver 18c are separated a little from each other, so that the spring force of the spring 19 is exerted onto the platen 1 through the pinch roller 2 through the above-mentioned fulcrum thereby resiliently to urge the pinch roller 2 against the platen 1 with a sufficiently large biasing force which is slightly less than that in the position shown in Figure 4.

As described above, the recording paper P is inserted between the platen 1 and the pinch roller 2 in the position as shown in Figures 2 and 5. In the case where the recording paper is drawn in misaligned, for example, at an angle, the knob 5 is further turned counterclockwise so as to correct the

alignment of the recorcding paper. When the cam portion 31 comes to the position shown in Figure 3, the connecting bar 10 does not move together with the cam portion 31 because the pin 10a slides in the sliding portion of the slot 31a, so that the position of the paper pressing lever 6 is not altered. Because the cam follower 16a is resiliently urged against the third positioning cam surface portion 31d however, the support shaft 15 rotates further counterclockwise to the position shown in Figure 6. At that time, the support arm 17 is in the retracted position and the protrusion receiver 18c is engaged with the protrusion 17c under the action of the spring force of the spring 19 and the roller receiver 18 is maintained with the engaging position as a fulcrum. Because the fulcrum at that time is extremely near to the line of action of the spring force of the spring 19, the pinch roller 2 is resiliently urged against the platen 1 with a relatively weak biasing force. In that position, the pinch roller 2 is more retracted than in the position shown in Figure 5. Accordingly, if the knob 5 is turned, the state shown in Figure 5 is changed to that shown in Figure 6 and then misalignment of the recording paper P can be corrected so that the recording paper having a correct alignment can be sandwiched between the platen 1 and the pinch roller 2. Even in the state shown in Figures 3 and 6, the switch 13 is closed, and therefore if the state is turned back to the state shown in Figures 2 and 5 to increase the biasing force acting on the pinch roller, the recording paper P in

the correct alignment can be fed to a predetermined position by operation of the paper feeding motor.

When printing is performed after the recording paper P has been set, the state is returned back to the state shown in Figures 1 and 4, where the paper pressing lever 6 is returned into its original position, the paper pressing roller 8a is resiliently urged against the platen 1 with the recording paper P sandwiched therebetween, and the pinch roller 2 is also resiliently urged against the platen 1 by a large biasing force with the recording paper P sandwiched therebetween, so that the recording paper P is frictionally fed by the paper feeding motor during printing.

When the recording paper P is printed using tractor feeding, if the state is brought into that shown in Figures 3 and 6, the pinch roller 2 is resiliently urged against the platen 1 with a relatively weak biasing force with the recording paper P sandwiched therebetween, so that appropriate tensile force is applied to the recording paper so that clear printing is possible.

In the above described paper feeding mechanism according to the present invention, only by turning the knob connected with the platen bearing is the paper pressing roller separated from the platen and at the same time the switch of the paper feeding motor for feeding the recording paper is turned on, so that the recording paper can be automatically drawn in with a simplified structure as well as an improved reliability of operation. When the recording paper is drawn in a misaligned

manner, merely by further turning the knob, the biasing force acting on the pinch roller is reduced and the recording paper can be surely inserted in correct alignment between the platen and the pinch roller, thereby ensuring correct automatic insertion of the recording paper. Further, when the recording paper is tractor fed, an appropriate and relatively weak biasing force is applied to the pinch roller for urging the pinch roller against the platen, so that an appropriate tensile force can be maintained on the recording paper to effect clear printing.

C L A I M S

1. A paper feeding mechanism for a printer comprising: a platen for feeding recording paper; a pinch roller resiliently urged into contact with said platen; a platen bearing for rotatably supporting said platen, said platen bearing being arranged to be rotatable by a knob fixed to an outward projecting end of said platen bearing; a cam portion on the platen bearing; a rotatable paper pressing lever supporting a paper pressing roller; a connecting lever for pivoting said paper pressing lever in response to rotation of said cam portion; a cam follower lever fixed on a rotatable support shaft and provided at one end with a cam follower engageable with a cam surface of said cam portion; a support arm fixed on said support shaft so as to be pivotally displaced in response to rotation of said support shaft; a roller receiver carrying said pinch roller at one end thereof; connecting means for rotatably and movably connecting one end of said support arm and the other end of said roller receiver; a spring extending between said support arm and said roller receiver; and a protrusion and a protrusion receiver provided on one and the other of said support arm and said roller receiver, said protrusion and said protrusion receiver being disposed at a position separated from a line of action of a spring force of said spring, said cam surface of said cam portion including a first, a second and a third positioning cam surface portions of different radii, said first, second and third positioning cam surface portions being in

operation, selectively followed by said cam follower for displacing said cam follower lever into a selected one of three rotational positions, said cam surface further including a switch pressing cam surface portion for operating a switch controlling a paper feeding motor.

2. A paper feeding mechanism as claimed in claim 1 in which said protrusion is provided on the support arm and the protrusion receiver is provided on the roller receiver.

3. A paper feeding mechanism as claimed in claim 1 or 2 in which the spring extending between said support arm and said roller receiver is a tension spring.

4. A paper feeding mechanism for a printer substantially as herein described with reference to and as shown in the accompanying drawings.

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