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[Title of the invention]

Printer and control method therefor ✓

[Detailed description of the invention]**[Field of the invention]**

The invention relates to a printer requiring recording paper replenishment, and relates particularly to a printer comprising a release lever for opening the recording paper path and to a control method for said printer.

[Prior art]

In printers in which the gap between the print head and platen is narrow, the recording paper can easily be caught between the print head and platen when loading the recording paper. A release lever is typically provided to prevent this by increasing the distance between the print head and platen when the recording paper is loaded, thereby making it easier to insert the recording paper.

In line thermal printers in particular the print head touches the platen, thus effectively closing the recording paper path in this area and making it difficult to feed the recording paper between the print head and platen. It is therefore necessary to separate the print head from the platen, thereby opening the recording paper path, before inserting the recording paper.

FIG. 6 shows the mechanism of a line thermal printer. In the mechanism shown in FIG. 6 the release lever 2 operates in conjunction with the print head 6. During printing print head 6 is pressed against platen 4 with the recording paper disposed therebetween by means of a coil spring or other energized means. This assures tight contact between the recording paper and print head 6, and enables the effective transfer of heat from the print elements in print head 6 to the recording paper.

When recording paper must be loaded, release lever 2 is operated to lift print head 6 from platen 4, thereby forming a gap through which the recording paper can be passed. Note that this operation is referred to below as "opening" the release lever. The recording paper is then inserted to the gap between platen 4 and paper feed roller 5, which is embedded in paper guide 9, and paper feed knob 3 linked to platen 4 is manually turned to advance the recording paper caught between platen 4 and paper feed roller 5. To thus load the recording paper it is necessary for the operator to hold and insert the paper

with one hand while turning paper feed knob 3 with the other hand. After advancing the recording paper the required distance, release lever 2 is again operated to close the gap between print head 6 and platen 4 and complete the recording paper loading process. Note that this last operation of release lever 2 to close the gap is also referred to below as "closing" the release lever.

[Problem to be resolved by the invention]

Printers such as described above have become a widely used peripheral device connected to personal computers (PC) and other information processing devices, and people that have never before operated such printers are increasingly exposed to the need and opportunity to use such printers. This widespread use of printers has increased demand for greater ease of use, particularly in the frequently performed, trouble-prone procedure used to load recording paper. Recording paper is one of the most common printer consumables, and the roll paper used in printers used in POS and ECR stations must be replaced right at the checkout counter. Because the recording paper must often be replenished, i.e., installed, while customers are waiting, it is necessary to complete the installation quickly and reliably in order to minimize the customer waiting time.

The conventional method of installing recording paper as described above is, however, both complicated and time-consuming. That paper feed knob 3 shown in FIG. 6 must also be turned with the fingers is also not intuitively understood, and it is therefore necessary to educate and train workers in how to properly install the recording paper.

It can also be difficult to hold and insert the recording paper with one hand, making sure the paper stays straight, while turning the paper feed knob with the other hand to advance the paper.

[Means of resolving the problem]

The object of the present invention is therefore to resolve the aforementioned problems by providing a printer and method for easily inserting and loading the recording paper to the printer.

To achieve the above object, a printer according to the invention has a printing means, a recording paper path for transporting the recording paper passed the printing means, a path closing means situated in the recording paper path for holding and releasing the recording paper, a recording paper

transportation means capable of transporting the recording paper along the recording paper path, and an open path detection means for detecting whether the path closing means is open or closed. When the printing means is driven to print to the recording paper, the path closing means is closed, and when recording paper is to be loaded, the path closing means is opened. Therefore, when the recording paper path is detected to be open by the open path detection means, the recording paper transportation means is activated to advance the recording paper.

More specifically, a printer having at least a printing means, a platen disposed opposite the printing means, a path closing means for opening and closing a recording paper path comprising the printing means and the platen, and a recording paper transportation means capable of transporting the recording paper along the recording paper path, comprises according to the invention an open path detection means for detecting whether the recording paper path that is opened and closed by the path closing means is open or closed, and starts the recording paper transportation means when the open path detection means detects that the path closing means and recording paper path are open.

Each of the preceding configurations may further comprise a recording paper detection means for detecting the presence of recording paper in the recording paper path, and a transport amount detection means for detecting the amount of recording paper transportation means operation. When thus configured, the paper transport control means stops the recording paper transportation means as required based on the output from the recording paper detection means and the transport amount detection means. It is further preferable for the paper transport control means to stop operation of the recording paper transportation means based on the detection of a first known recording paper transport amount when there is no recording paper and/or a second known recording paper transport amount when recording paper is present.

It is further advantageous for the above printer to comprise a stop state indication means for indicating that the recording paper transportation means has stopped when the recording paper transportation means stops due to detection of the first known recording paper transport amount in the no-paper state.

It is yet further advantageous to comprise a restart command means for commanding the recording paper transportation means to restart when a stop state is indicated by the stop state indication means.

It is also preferable for the above printer to comprise an automatic paper cutter for cutting off the end of the recording paper when the recording paper transportation means stops based on detection of the second known recording paper transport amount when paper is present and the path closing means is detected to be closed by the open path detection means.

The invention can also be expressed as a printer control method.

The operation of the invention thus comprised is described below.

A release lever is operated when loading the recording paper. Opening or closing of this release lever is detected to automatically execute a recording paper feed operation. More specifically, when a detector detecting the open or closed state of the release lever detects that the release lever is open, a recording paper feed operation is initiated. It is therefore not necessary to manually turn the paper feed knob to advance the recording paper when recording paper is loaded because the recording paper feed operation is automatically executed whenever recording paper is loaded because the release lever must be operated to insert and load the recording paper. This also frees both hands to hold and insert the recording paper to the insertion opening, and thus makes inserting the recording paper simple and reliable.

A paper detector can also be provided to detect whether the recording paper has been inserted during the recording paper feed operation, and to determine how far the recording paper has been advanced. This also makes it possible to automatically advance the recording paper a known required distance, thereby eliminating problems caused by insufficiently advancing the recording paper.

Furthermore, if the recording paper is not inserted during the recording paper feed operation executed for a predetermined time or to advance a predetermined length of recording paper, the recording paper feed operation can also be automatically stopped. Thus automatically stopping the recording paper feed operation avoids continued needless operation of the recording paper transportation means, the incumbent wasteful consumption of electricity, and needless heating and wear of mechanical parts.

The operator can also be notified that the recording paper has not been inserted by providing a means of flashing an LED or activating some other

notification means. Considering cases in which the operator notices the flashing LED or other notification means and thus realizes that the recording paper is not inserted, it is also possible to provide the user with the opportunity to re-insert the recording paper. This can be accomplished by preferably providing a paper feed switch, for example.

The operator can then press the paper feed switch, for example, to effect the same operation executed when the release lever is opened. If such means is not provided, it is simply necessary to close the release lever once and then open the release lever again to automatically restart the paper loading process.

If the printer comprises an automatic paper cutter, it is also possible to automatically cut off any excess paper after the recording paper is loaded by operating the automatic cutter when closing of the release lever is detected.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a simplified view of a printer mechanism according to the preferred embodiment of the invention.

FIG. 2 is a simplified side cross sectional view of an alternative embodiment of the invention.

FIG. 3 is a flow chart of the recording paper loading operation executed by the printer according to the first embodiment shown in FIG. 1.

FIG. 4 is a flow chart of the recording paper loading operation executed by the printer according to the second embodiment shown in FIG. 2.

FIG. 5 is an external view of a printer according to the present invention.

FIG. 6 is a simplified view of a printer mechanism according to the prior art.

Description of preferred embodiments

The preferred embodiments of the present invention are described below with reference to the accompanying figures.

FIG. 1 is a simplified view of mechanism 1 of printer 18 according to a first embodiment of the invention.

FIG. 2 is a simplified side cross sectional view of mechanism 1 of printer 18 in a second embodiment of the invention. Note that mechanism 1 of printer 18 in FIG. 2 is the same as that shown in FIG. 1 with the addition of photosensor (paper detector) 11 used to detect the recording paper, and automatic paper cutter 12.

FIG. 3 is a flow chart of the recording paper loading operation accomplished with the printer of the first embodiment shown in FIG. 1, and FIG. 4 is a flow chart of the process executed in the printer of the second embodiment shown in FIG. 2.

FIG. 5 is an external view of printer 18 integrating printer mechanism 1 according to the present invention.

Printer 18 of the invention is built using mechanism 1 shown in FIG. 1. Print head 6 and release lever 2 are a linked assembly and open and close together. More specifically, when release lever 2 is moved in the direction of arrow A to open the gap between print head 6 and platen 4, print head 6 is lifted off platen 4. This operation is also called "opening" release lever 2 below. When release lever 2 is moved in the direction opposite arrow A to close the gap, print head 6 is pressed against platen 4 once again. This operation is also called "closing" release lever 2 below. This closed position is shown in FIG. 2.

Loading the recording paper is accomplished by opening release lever 2 and lifting print head 6 off platen 4. To print, release lever 2 is closed again to press print head 6 against platen 4. When release lever 2 is closed, lever open sensor 10 is ON, and when release lever 2 is open, lever open sensor 10 is OFF. It is therefore possible to determine whether release lever 2 is open or closed by reading the detection state of lever open sensor 10.

It should be noted that while a microswitch is used for lever open sensor 10 detecting the open/closed state of release lever 2 in this embodiment, the invention shall not be so limited and a variety of other sensors, including a photointerrupter, can be alternatively used.

The recording paper feed operation is accomplished by driving stepping motor 7, and transferring the rotational drive power of stepping motor 7 through transfer gear set 8 to platen 4.

A mechanism further comprising automatic paper cutter 12, paper feed roller 5, and paper detector 11 is shown in FIG. 2. Paper feed roller 5 and paper detector 11 are provided in paper guide 9 facing the recording paper path. Recording paper 14 pulled off paper roll 13 is held between platen 4 and paper feed roller 5, and is advanced when platen 4 rotates in the direction of arrow B.

Paper detector 11 is a common photoreflector that detects the passage of recording paper 14 near paper detector 11 from the difference in the reflectance of recording paper 14 and platen 4.

How far the recording paper has been advanced, i.e., the paper transportation amount, can be calculated from the number of steps stepping motor 7 is driven.

Automatic paper cutter 12 is mounted above print head 6, and cuts the excess end of recording paper 15 fed out from the printer by the recording paper feed operation.

The process whereby the recording paper is loaded into the above printer is described below with reference to the flow chart in FIG. 3.

This process starts (S1) when the power is turned on, and it is then immediately determined whether release lever 2 is open by checking the on/off state of lever open sensor 10 (S2). If release lever 2 is not open, the procedure continues to loop through this step (S2). Other necessary printer control processes can be executed during this standby period.

When the operator opens release lever 2, release lever opening is detected by lever open sensor 10 (S2), and control passes to start the recording paper feed operation (S3). Note that the recording paper feed operation is accomplished by driving stepping motor 7 to rotate print head 6. Once the recording paper feed operation starts it is determined whether release lever 2 is closed again by checking the on/off state of lever open sensor 10 (S4). The recording paper feed operation (S3) continues until release lever 2 is closed again.

If the operator inserts recording paper between paper feed roller 5 and platen 4 during this time, the recording paper is automatically fed into the printer by the recording paper feed operation (S3) because platen 4 rotates in the same direction as the recording paper insertion direction. Note that it is not necessary to manually rotate a paper feed knob to insert the recording paper, and the operator can therefore hold the recording paper with both hands to assure that the recording paper is inserted in the correct orientation.

After the recording paper is inserted and advanced a sufficient distance, the operator closes release lever 2. The printer thus detects by means of lever open sensor 10 that release lever 2 is closed (S4), stops driving stepping motor 7, stops the recording paper feed operation (S5), and terminates the process (S6).

It is therefore possible by means of the printer according to the present embodiment of the invention to quickly and reliably load recording paper by simply operating a release lever 2 and inserting the recording paper, and it is

not necessary to manually turn a paper feed knob. The recording paper can also be simply and reliably inserted because it can be held with both hands.

The operation of a printer according to the second embodiment shown in FIG. 2 is described next with reference to the flow chart in FIG. 4.

This embodiment comprises paper detector 11 as shown in FIG. 2, and the condition for initiating the process shown in FIG. 4 is that recording paper 14 is not detected by paper detector 11. This method is used to distinguish the recording paper replenishing or loading process from the normal printing process. More specifically, it is often necessary to operate release lever 2 to open the print head during normal printing processes in order to clean the print head or remove foreign matter or paper jams. There should also be no recording paper in the printer when the recording paper loading operation is performed. As a result, the process shown in FIG. 4 is only executed when paper detector 11 detects that there is no recording paper in the printer.

When the process starts (S11) it is determined whether release lever 2 is open by checking the on/off state of lever open sensor 10 (S12). If release lever 2 is not open, the procedure continues to loop through this step (S12). The recording paper feed operation starts when paper detector 11 detects that release lever 2 has been opened (S13). Paper detector 11 continues to detect recording paper presence (S14) during the recording paper feed operation.

If recording paper is detected, the recording paper has been transported from the insertion opening, i.e., from paper feed roller 5 and platen 4, to paper detector 11. The distance the recording paper is advanced thereafter, i.e., the paper transportation amount, is therefore counted (S15). This is accomplished by counting the number of steps stepping motor 7 is driven from when the recording paper is detected.

It is next determined whether the paper transport amount in the paper-present state has reached a predetermined value (S16), and the recording paper feed operation (S13) is continued until this predetermined value is reached. More specifically, the recording paper is automatically advanced through the printer when the operator inserts the recording paper, and the recording paper feed operation is continued until the paper transportation amount in the paper-present state reaches a predetermined value. The recording paper feed operation is then stopped automatically (S17).

It is then determined whether release lever 2 has been closed by checking the on/off state of lever open sensor 10 (S18), and this step repeats

until release lever 2 is closed. Once release lever 2 is closed, automatic paper cutter 12 is operated (S19) to cut off the excess recording paper 15 fed out from the printer, and the process S2 terminates.

While this automatic paper cutting operation is preferably executed with the recording paper held firmly between print head 6 and platen 4, the invention shall not be so limited. Specifically, the recording paper can be cut by automatic paper cutter 12 before release lever 2 is closed.

Note that because the paper feed operation is stopped automatically it is not necessary for the operator to manually confirm that the recording paper has been advanced an appropriate distance and then close release lever 2 to stop the feed operation.

Furthermore, the need for the operator to manually cut off any excess paper with scissors or other means can be eliminated by automatically operating automatic paper cutter 12. In this case the operator only needs to remove the cut paper end.

If it is determined that no paper is present (S14), the no-paper state paper transport amount is counted (S21). It is then determined whether the no-paper state paper transportation amount has reached a predetermined value (S22). If it has not, the recording paper feed operation (S13) continues while waiting for recording paper insertion.

However, if the operator does not insert the recording paper and the no-paper state paper transportation amount reaches a predetermined value (S22), the feed operation is automatically stopped (S23). This prevents the feed operation from continuing endlessly until the recording paper is inserted, prevents unnecessary shortening of the printer life, and reduces power consumption.

As shown in FIG. 5 printer 18 also comprises LED 16 and paper feed switch 17. When the recording paper feed operation is stopped automatically (S23), LED 16 flashes to notify the operator (S24) that the recording paper could not be loaded because the operator has not inserted the recording paper. It should be noted that the invention shall not be limited to an LED for this notification means, and that the user can be notified by sounding a buzzer or using other means. It will also be obvious that if the printer is connected to a host device, other commonly used means such as sending a status signal to the host device to notify the user can be used. In the present example the LED

notification means 16 continues flashing (S24) until paper feed switch 17 is pressed (S25).

If the operator notices that the recording paper was not loaded and wishes to reload the recording paper, the operator can simply press paper feed switch 17. This causes LED 16 to turn off (S26), returns control to the main routine, i.e., the recording paper feed operation (S13), and restarts the paper loading process.

With the control process described above the same process executed when release lever 2 is opened is executed when the printer could not load the recording paper and the operator presses paper feed switch 17, and the recording paper feed operation can therefore be repeated. Note that LED flashing can also be stopped after the paper loading process is completed. This paper feed switch function also enables the paper loading process to be repeated without the need to close and then re-open release lever 2.

Note, further, that if paper feed switch 17 is not used it is possible to detect whether release lever 2 has been closed by checking lever open sensor 10 after the paper feed operation is stopped (S23), and then loop back to the start of the process (S11) once release lever 2 is closed. With this operation the recording paper feed operation can be repeated by simply closing and then re-opening release lever 2.

It should be further noted that while the invention has been described with reference to a line thermal printer, the invention shall not be so limited. From the content of the above disclosure it will be obvious to those skilled in the art that the invention can be applied with all printers in which part of the recording paper path is opened and closed when loading the recording paper.

The invention shall furthermore not be limited to using recording paper supplied in roll form, and the invention can also be used with printers using cut sheet forms and fan-fold paper.

Effect of the invention

As described above, a printer and control method therefor according to the invention can detect release lever opening and closing to automatically execute a recording paper feed operation, thereby enabling the operator to reliably load recording paper with a simple operation.

[Key to the figures]

1 mechanism

- 2 release lever
- 3 paper feed knob
- 4 platen
- 5 recording paper presser (feed) roller
- 6 print head
- 7 stepping motor
- 8 transfer gear set
- 9 paper guide
- 10 lever open sensor
- 11 paper detector
- 12 automatic paper cutter
- 13 paper roll
- 14 recording paper
- 15 excess recording paper
- 16 LED
- 17 paper feed switch
- 18 printer

TEXT IN THE FIGURES

FIG. 3

- S1 Start
- S2 Release lever opened?
- S3 Recording paper feed operation
- S4 Release lever closed?
- S5 Stop recording paper feed operation.
- S6 End

FIG. 4

- S11 Start
- S12 Release lever opened?
- S13 Recording paper feed operation
- S14 Paper present?
- S15 Count paper transport amount when paper present.
- S16 Paper advanced predetermined amount?
- S17 Stop recording paper feed operation.
- S18 Release lever closed?

- S19 Operate automatic paper cutter.
- S20 End
- S21 Count paper transport amount when paper not present.
- S22 Paper advanced predetermined amount?
- S23 Stop recording paper feed operation.
- S24 Flash LED.
- S25 Paper feed switch pressed?
- S26 LED off



[What is claimed]

1. A printer having a printing means, a recording paper path for transporting the recording paper passed the printing means, a path closing means situated in the recording paper path for holding and releasing the recording paper, and a recording paper transportation means capable of transporting the recording paper along the recording paper path, comprises

an open path detection means for detecting whether the path closing means is open or closed, and

a paper transport control means for starting the recording paper transportation means when the open path detection means detects that the path closing means is open.

2. A printer having at least a printing means, a platen disposed opposite the printing means, a path closing means for opening and closing a recording paper path comprising the printing means and the platen, and a recording paper transportation means capable of transporting the recording paper along the recording paper path, comprises

an open path detection means for detecting whether the recording paper path that is opened and closed by the path closing means is open or closed, and

a paper transport control means for starting the recording paper transportation means when the open path detection means detects that the path closing means is open.

3. The printer according to claim 1 or claim 2 wherein the paper transport control means stops operation of the recording paper transportation means when the open path detection means detects that the recording paper path is closed.

4. The printer according to claim 1 further comprising

a recording paper detection means for detecting the presence of recording paper in the recording paper path, and

a transport amount detection means for detecting the operating amount of the recording paper transportation means,

wherein the paper transport control means stops the recording paper transportation means based on the output from the recording paper detection means and the transport amount detection means.



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5. The printer according to claim 1 wherein
the paper transport control means stops operation of the recording paper transportation means based on the detection of a first known recording paper transport amount when there is no recording paper and/or a second known recording paper transport amount when there is recording paper.
6. The printer according to claim 5 further comprising a stop state indication means for indicating that the recording paper transportation means has stopped when the recording paper transportation means stops due to detection of the first known recording paper transport amount in the no-paper state.
7. The printer according to claim 6 further comprising a restart command means for commanding the recording paper transportation means to restart when a stop state is indicated by the stop state indication means,
wherein the paper transport control means starts the recording paper transportation means as instructed by the restart command means.
8. The printer according to claim 5 further comprising a recording paper cutting means for cutting the recording paper, and
a cutting control means for driving the recording paper cutting means to cut the recording paper after the recording paper transportation means stops based on detection of the second known recording paper transport amount when paper is present.
9. The printer according to claim 8 wherein the recording paper cutting means drives the recording paper cutting means to cut the recording paper after the path closing means is detected to be closed by the open path detection means.
10. A control method for a printer having a recording paper path through which the recording paper is transported passed the printing means, having a step of closing the paper path to hold the recording paper in the recording paper path, and a step of opening the paper path to release the paper held in the closing step, and comprising the steps of;



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a. detecting whether the recording paper path is open or closed, and
b. starting the recording paper transportation operation based on detection of an open path detected in step a.

11. The control method according to claim 10 further comprising the steps of;
c. detecting the presence of recording paper in the recording paper path,
d. detecting the amount of the recording paper transportation operation,
and

e. stopping the recording paper transportation operation based on a no-paper detection in step c, and detection of a first predetermined amount in step d.

12. The control method according to claim 11 further comprising the steps of;
f. stopping the recording paper transportation operation based on a paper-present detection in step c, and detection of a second predetermined amount in step d.

13. The control method according to claim 11 further comprising the steps of;
g. notifying that paper transportation has stopped when transportation is stopped in step e, and

h. commanding the start of paper transportation in accordance with step g.

14. The control method according to claim 10 further comprising the steps of;
c. detecting the presence of recording paper in the recording paper path,
d. detecting the amount of the recording paper transportation operation,
and

j. stopping the recording paper transportation operation based on a paper-present detection in step c, and detection of a second predetermined amount in step d.

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