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PRINTER

BACKGROUND OF THE INVENTION

The present invention relates to a printer for printing on recording paper, which comprises a platen and a thermal head. More particularly, the present invention relates to a structure of a thermal head and a structure for guiding recording paper.

A general structure of a conventional printer is now described briefly in the following with reference to Fig. 2. As shown in Fig. 2A, a printer includes a platen 101 and a thermal head 102. The platen 101 is rotatably supported about an axis 101a along the width direction of recording paper. More specifically, a stepping motor 104 is connected with the axis 101a via a train of gears 103. The rotational motion of the stepping motor 104 is decelerated by the train of gears 103, and is transmitted to a rear axis 101a, and the platen 101 is appropriately intermittently rotated for feeding paper in the direction shown by an arrow in the figure. The thermal head 102 is disposed so as to face the platen 101 via recording paper. The thermal head 102 is swingably supported about an axis 105. In printing operation, a heater of the thermal head 102 is pressed against the recording paper. With this state maintained, the heater is electrically energized to print a line of letters on the recording paper. After the printing of the line, the platen 101 is rotated in the direction shown by the arrow to feed the recording paper.

Fig. 2B shows a schematic cross-sectional structure of the printer shown in Fig. 2A. The thermal head 102 is disposed so as

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☒	Claim(s) : paged ...11... to paged ...13...	
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to face the platen 101 via a recording paper 106 as shown in the figure. It should be noted that the direction of appearance of a printed face of the recording paper 106 is considered to be the front. When the thermal head 102 is swung counterclockwise about the axis 105 that is in parallel with but different from the axis 101a of the platen 101, the heater above the axis 105 is pressed against the platen 101. In order to provide the pressing force, a spring member 107 intervenes between the thermal head 102 and a frame 108 of the printer. On the contrary, when the thermal head 102 is swung clockwise against the urging force by the spring member 107, the heater of the thermal head 102 is retracted from the platen 101. This operation is carried out when, for example, the recording paper 106 is fed between the platen 101 and the thermal head 102.

Fig. 3 is a sectional view of a specific structure of the conventional printer shown in Fig. 2, wherein like reference characters designate corresponding parts shown in Fig. 2 to promote understanding. A frame 108 is in the shape of a box having six faces, i.e., front, rear, left, right, top, and bottom faces. In the present specification, the front face, the rear face, the left face, the right face, the top face, and the bottom face are represented as F, B, L, R, U, and D, respectively. As mentioned in the above, the front face F is on the side of the printed face of recording paper. The platen 101 is rotatably, axially supported between the left and right faces of the frame 108. Similarly, the thermal head 102 is swingably supported between the left and right faces of the frame 108 about an axis different from that of the platen, and opens and closes with respect to the platen 101. With such a structure,



printing is carried out on recording paper (not shown) fed between the platen 101 and the thermal head 102 from the bottom face D or the rear face B of the frame 108 and then the recording paper is discharged to the top face U of the frame 108. In the figure, a first supply path from an arrow SIN to an arrow OUT is referred to as a straight path, while a second supply path from an arrow CIN to the arrow OUT is referred to as a curled path. A sheet 110 intervenes between the straight path and the curled path so as to separate them. The thermal head 102 comprises a ceramic substrate 111 and a support body 112 for fixing the ceramic substrate 111. A heater 113 contacting with the platen 101, a semiconductor device 114 for driving the heater 113, and sealing resin 115 for protecting the semiconductor device 114 are formed on the ceramic substrate 111 on the side facing the platen 101. The sealing resin 115 is a relatively soft resin and is provided for the purpose of protecting against breakage extra fine gold wire or the like connected with the semiconductor device 114 such as an IC chip. Further, a cover 116 for mechanically protecting the semiconductor device 114 and the sealing resin 115 are attached to the support body 112 of the thermal head 102.

The cover 116 is made of metal or resin and is provided for the purpose of mechanical protection of the semiconductor device 114 and preventing the sealing resin 115 from wearing out. If it were not for the cover 116, the sealing resin 115 would wear out due to repeated contact with recording paper. In addition, the cover 116 prevents recording paper from catching on the sealing resin 115. In this way, in a conventional printer, the cover 116 is an



essential composing element. However, provision of the cover 116 inevitably narrows the paper feed path. Therefore, the heater 113 and the semiconductor device 114 can not be disposed so as to be adjacent to each other on the ceramic substrate 111, and thus, it is difficult to miniaturize the ceramic substrate 111. Since the number of ceramic substrates gotten from a wafer can not be large without miniaturization of the ceramic substrate, the cost can not be lowered. Even if the ceramic substrate 111 is miniaturized to dispose the semiconductor device 114 closer to the heater 113, the cover 116 comes closer to the side of the heater 113 accordingly. Since the cover 116 oppresses the paper feed path, recording paper can not be fed smoothly.

SUMMARY OF THE INVENTION

Accordingly, in order to solve the above-mentioned problems of a conventional printer, an object of the present invention is to miniaturize a ceramic substrate with protection of a semiconductor device and of sealing resin being materialized, and the following measures are taken. A printer according to the present invention comprises a frame, a platen, and a thermal head as a basic structure. The frame is in the shape of a box having six faces, i.e., front, rear, left, right, top, and bottom faces. The platen is rotatably axially supported between the left and right faces of the frame. Similarly, the thermal head is swingably supported between the left and right faces of the frame, and opens and closes with respect to the platen. With such a structure, printing is carried out on recording paper fed between the platen and the thermal head from the bottom face or the rear face of the



frame and then the recording paper is discharged to the top face of the frame. The thermal head comprises a ceramic substrate and a support body for fixing the ceramic substrate. A heater contacting with the platen, a semiconductor device for driving the heater, and sealing resin for protecting the semiconductor device are formed on the ceramic substrate on the side facing the platen. First and second paper feed paths to be alternatively adopted are made inside the frame. In case that the first paper feed path is adopted, recording paper is fed between the platen and the thermal head from the bottom face of the frame, and a sheet member for preventing recording paper from contacting with the exposed sealing resin is attached along the first paper feed path. Adversely, in case that the second paper feed path is adopted, recording paper is fed between the platen and the thermal head from the rear face of the frame, and another sheet member for preventing recording paper from contacting with the exposed sealing resin is attached at another place along the second paper feed path.

According to the present invention, a printer with a small line thermal head mounted thereon comprises a thermal head incorporating a ceramic substrate provided with a heater and a semiconductor device for driving the heater (driver IC). Further, relatively hard sealing resin is used for protecting the semiconductor device. By making the sealing resin hard different from the conventional soft sealing resin, the cover is eliminated. The printer according to the present invention has two paper feed paths. Sheet members (polyimide films, for example) for guiding recording paper are stuck at appropriate places for the respective



paper feed paths to prevent the sealing resin from wearing out due to friction with recording paper. With this structure, the semiconductor device is protected sufficiently even if the cover is eliminated, and further, recording paper is inserted and fed in an improved manner.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is a sectional view illustrating a curled path of a printer as an embodiment of the present invention;

Fig. 1B is a sectional view illustrating a straight path of the printer as an embodiment of the present invention;

Fig. 2A is a schematic view illustrating a conventional printer;

Fig. 2B is a schematic sectional view illustrating the conventional printer; and

Fig. 3 is a sectional view illustrating a specific structure of the conventional printer.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The best mode of the present invention is now described in detail in the following with reference to the drawings. Fig. 1 is a sectional view of a printer according to the present invention. Fig. 1A illustrates a structure of the printer in case one paper feed path (curled path) is adopted, while Fig. 1B illustrates a structure of the printer in case the other paper feed path (straight path) is adopted. As shown in the figures, the printer comprises a frame 1, a platen 2, and a thermal head 3. The frame 1 is molded



out of resin, and is in the shape of a box having six faces, i.e., front, rear, left, right, top, and bottom faces F, B, L, R, U, and D. The platen 2 is rotatably, axially supported between the left and right faces L and R of the frame 1. Similarly, the thermal head 3 is swingably supported between the left and right faces L and R of the frame 1, and opens and closes with respect to the platen 2. It is to be noted that a pressure spring 4 and a pressure cam 5 are used to press the thermal head 3 against the platen 2. Further, the thermal head 3 is swingably supported by bearings 6 integrally formed with the left and right faces L and R of the frame 1. More specifically, rotation shafts 7 protruding at both ends of the lower end portion of the thermal head 3 are fit in the bearings 6. With such a structure, the printer carries out printing on recording paper (not shown) fed between the platen 2 and the thermal head 3 from the rear face B of the frame 1 and then the recording paper is discharged to the top face U of the frame 1. This paper feed path is referred to as a curled path and is shown as from an arrow CIN to an arrow OUT. It is to be noted that, in order to carry out paper feed in this way, a paper feed motor 8 for driving the platen 2 to rotate via a decelerating train of gears (not shown) is housed in the frame 1.

The thermal head 3 comprises a ceramic substrate 11 and a support body 12 for fixing the ceramic substrate 11. A heater contacting with the platen 2, a semiconductor device 13 for driving the heater, and sealing resin 14 for protecting the semiconductor device 13 are formed on the ceramic substrate 11 on the side facing the platen 2. The sealing resin 14 is hard, thereby eliminating



a conventionally essential cover. Two paper feed paths (a curled path and a straight path) to be alternatively adopted are made in advance inside the frame 1. In Fig. 1A, the curled path as one of the paper feed paths is adopted. In this case, recording paper (not shown) is fed between the platen 2 and the thermal head 3 from the rear face B of the frame 1 as shown by an arrow CIN, and a sheet 15 for preventing recording paper from contacting with the exposed sealing resin 14 is attached with adhesive or the like along this paper feed path.

On the other hand, as shown in Fig. 1B, in case the other paper feed path (straight path) is adopted, recording paper is fed between the platen 2 and the thermal head 3 from the bottom face D of the frame 1 as shown by an arrow SIN, and the recording paper is discharged from the top face U of the frame 1 as shown by an arrow OUT. In this case, another sheet 16 for preventing recording paper from contacting with the exposed sealing resin 14 is attached along the straight path. As is clear from comparison between Fig. 1A and Fig. 1B, the sheet 15 used in the curled path and the sheet 16 used in the straight path are different in shape and are attached with adhesive or the like at different places. It is to be noted that the frame 1 has a built-in paper sensor 20 for detecting recording paper fed through the curled path or the straight path. As shown in Fig. 1A, in case the curled path is adopted, the paper sensor 20 is attached upward, while, as shown in Fig. 1B, in case the straight path is adopted, the paper sensor 20 is attached toward the front.



As is clear from the description in the above, according to the present invention, a printer has the small line thermal head 3, for example, mounted thereon. The heater and the semiconductor device 13 for driving the heater are formed on the ceramic substrate 11 incorporated in the thermal head 3. The hard sealing resin 14 is provided so as to cover the semiconductor device 13. By providing the hard sealing resin 14, a cover is eliminated. The printer has two paper feed paths for recording paper, i. e., a curled path and a straight path. Two kinds of sheets 15 and 16 for guiding recording paper are provided accordingly. It is to be noted that both of the sheets 15 and 16 are made of a polyimide film or the like. The sheets 15 and 16 are stuck at appropriate places for the respective paper feed paths to prevent the sealing resin 14 from wearing out due to friction with recording paper. Further, by attaching the sheets 15 and 16 at appropriate places, recording paper is inserted and fed in an improved manner. By making the sealing resin hard, the semiconductor device (driver IC) is directly protected from shocks from the external and the like. Further, since the sheets stuck to the side of the frame intervenes between the recording paper and the sealing resin, the sealing resin is prevented from wearing out. By this, a cover conventionally attached can be eliminated. Elimination of the cover makes it possible to secure the paper feed path even the sealing resin and the heater are disposed close to each other. This makes it possible to miniaturize the ceramic substrate attached to the thermal head. Since the number of ceramic substrates gotten from a large wafer is increased, the cost can be lowered.



As described in the above, according to the present invention, by making the sealing resin hard, the semiconductor device is protected against shocks. The sheets are stuck at different places according to the two paper feed paths such that one of the sheets always intervenes between recording paper and the sealing resin. By this, the sealing resin can be prevented from wearing out, and thus, a cover conventionally attached can be eliminated from the thermal head. Elimination of the cover makes it possible to dispose the sealing resin and the heater close to each other. As a result, miniaturization of the ceramic substrate can be attained, and the cost can be lowered.

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What is claimed is:



1. A printer comprising: a frame having front, rear, left, right, top, and bottom faces; a platen rotatably axially supported between the left and right faces of the frame; and a thermal head similarly swingably supported between the left and right faces of the frame for opening and closing with respect to the platen, for printing on recording paper fed between the platen and the thermal head from the bottom face or the rear face of the frame and discharging the recording paper to the top face of the frame, wherein the thermal head comprises a ceramic substrate and a support body for fixing the ceramic substrate; and

a heater contacting with the platen, a semiconductor device for driving the heater, and sealing resin for protecting the semiconductor device are formed on the ceramic substrate on the side facing the platen, wherein first and second paper feed paths to be alternatively adopted are made inside the frame, and when the first paper feed path is adopted, recording paper is fed between the platen and the thermal head from the bottom face of the frame and a sheet member for preventing recording paper from contacting with the exposed sealing resin is attached along the first paper feed path, and when the second paper feed path is adopted, recording paper is fed between the platen and the thermal head from the rear face of the frame and another sheet member for preventing recording paper from contacting with the exposed sealing resin is attached along the second paper feed path.

2. A printer comprising: a frame having front, rear, left, right, top, and bottom faces; a platen rotatably axially supported



between the left and right faces of the frame; and a thermal head swingably supported between the left and right faces of the frame for operating so as to get away from or come in contact with the platen and having a ceramic substrate and a support body for fixing the ceramic substrate, for printing on recording paper fed between the platen and the thermal head, wherein the thermal head comprises:

a heater provided on the ceramic substrate so as to contact the platen;

a semiconductor device for driving the heater; and

sealing resin for protecting the semiconductor device, wherein:

a first paper feed path for feeding recording paper between the platen and the thermal head from the bottom face of the frame and a second paper feed path for feeding recording paper between the platen and the thermal head from the rear face of the frame are provided in the frame; and

the thermal head comprises at least one of a first sheet member provided along the first paper feed path and a second sheet member provided along the second paper feed path at a different place where the first sheet member is provided, both for preventing recording paper from contacting with the sealing resin.

3. A printer comprising: a frame having front, rear, left, right, top, and bottom faces; a platen rotatably axially supported between the left and right faces of the frame; and a thermal head swingably supported between the left and right faces of the frame for operating so as to get away from or come in contact with the



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platen and having a ceramic substrate and a support body for fixing the ceramic substrate, for printing on recording paper fed between the platen and the thermal head, wherein:

the thermal head comprises:

a heater provided on the ceramic substrate so as to contact the platen;

a semiconductor device for driving the heater;

sealing resin for protecting the semiconductor device;

a paper feed path provided in the frame for feeding recording paper between the platen and the thermal head; and

a sheet member provided along the paper feed path for preventing recording paper from contacting with the sealing resin.

4. The printer as claimed in claim 3, wherein the paper path comprises a plurality of paths consisting of a first paper feed path for feeding recording paper between the platen and the thermal head from the bottom face of the frame and a second paper feed path for feeding recording paper between the platen and the thermal head from the rear face of the frame; and

the sheet member is at least one of a first sheet member provided along the first paper feed path and a second sheet member provided along the second paper feed path at a different place where the first sheet member is provided.



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