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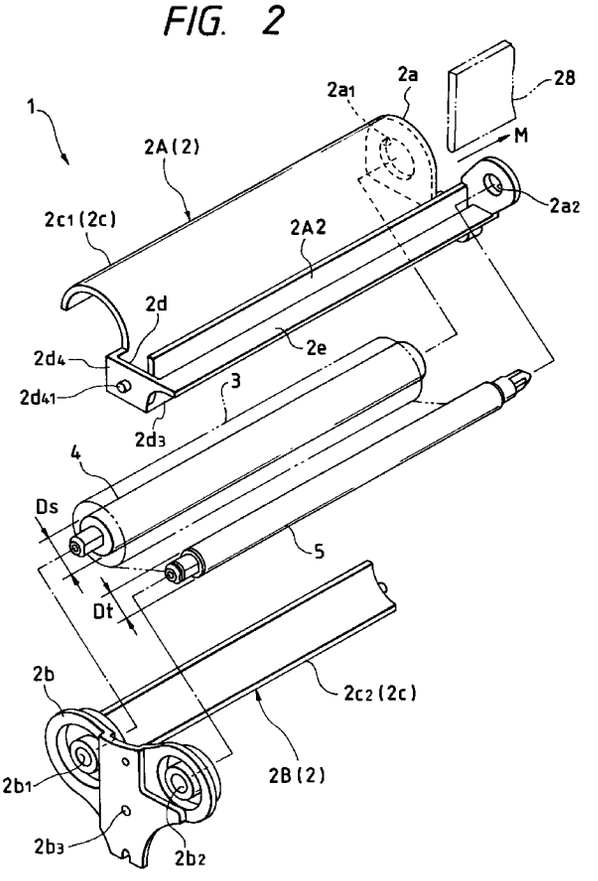
(54) Improved structure of inked ribbon cartridge and thermal transfer color printer

(57) An inked ribbon cartridge and a portable color printer are provided which are compact in size and capable of printing color images with high quality. The inked ribbon cartridge includes an inked ribbon wound between a supply bobbin and a take-up bobbin. The take-up bobbin is smaller in diameter than the supply bobbin for preventing a maximum diameter of the inked ribbon all wound on the take-up bobbin from exceeding that of the inked ribbon wound about the supply bobbin before use, which is caused by formation of air layers between adjacent turns of the inked ribbon wound on the take-up bobbin. The supply bobbin is covered by a cartridge casing, while the take-up bobbin is exposed outside the cartridge casing, thereby achieving a compact and light weight construction of the inked ribbon cartridge.

FIG. 2



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Description

BACKGROUND OF THE INVENTION

The present invention relates generally to improved compact structures of a thermal transfer color printer and an inked ribbon cartridge used therein.

Fig. 21 shows a conventional inked ribbon cartridge 100 for use in thermal transfer color printers.

The inked ribbon cartridge 100 includes a cartridge casing 101 in which inked ribbon 102 is wound between a supply bobbin (spool) 103 and a take-up bobbin (spool) 104. The inked ribbon 102 consists of a plurality of full color image strip segments each including three ink color blocks coated with yellow (Y), magenta (M), and cyan (C) inks or four ink color blocks coated with yellow (Y), magenta (M), cyan (C), and black (BK) inks. Usually, the dye or ink of inked ribbon is a hot-melt ink or a thermal sublimation ink. The type of record (print) paper depends upon the type of the inked ribbon.

The cartridge casing 101 consists of separate upper and lower casings 101A and 101B made of resin material. In assembling, both the supply and take-up bobbins 103 and 104 are first disposed in either of the upper and lower casings 101A and 101B. Next, the upper and lower casings 101A and 101B are attached to each other to complete the cartridge casing 101. The supply and take-up bobbins 103 and 104 are rotatably supported in bearing holes formed in side walls 101a and 101b of the cartridge casing 101. The supply and take-up bobbins 103 and 104 have the same structure, thus allowing the same parts to be used.

The cartridge casing 101 has formed between upper walls 101c and 101d a rectangular head opening 101e through which the inked ribbon 102 faces a thermal head 105 held horizontally within a thermal transfer printer (not shown). The thermal head 105 includes a ceramic plate and a projecting glazed layer 105a. The glazed layer 105a is formed on the ceramic plate in a widthwise direction of the inked ribbon 102 and has disposed thereon an array of heating elements. The distance between longitudinal center lines of the supply and take-up bobbins 103 and 104 is determined so that the thermal head 105 can be disposed within the head opening 101e completely.

In an printing operation, image signals are inputted to the thermal head 105. The thermal head 105 releases different colors required by the respective image signals from the inked ribbon 102 and transfer them, in sequence, onto the record paper in an overlapped fashion to form a full color image. The transfer of the required colors onto the record paper is achieved by passing the inked ribbon 102 through the thermal head 105 as many times as the number of the colors while drawing the inked ribbon 102 from the supply bobbin 103.

A color block leader sensor which detects a leader of each color block of the inked ribbon 102 is installed on a feed path of the inked ribbon 102. A record paper edge sensor which detects leading and trailing edges of the record paper is also installed on the feed path of the inked ribbon 102.

The above inked ribbon cartridge 100, however, encounters the following drawbacks.

The supply and take-up bobbins 103 and 104 are, as described above, made of the same parts, so that they have the same diameter. After the inked ribbon 102 is all used, however, the diameter of the inked ribbon 102 wound up by the take-up bobbin 104 becomes greater than the diameter of the inked ribbon 102 wound about the supply bobbin 103 before used. This is because the inked ribbon 102 is subjected to head radiated from the thermal head 105 during printing, so that they are deformed or waved undesirably, thereby causing air layers to be formed between adjacent turns of the inked ribbon 102 when wound on the take-up bobbin 104. The resistance to winding of the inked ribbon 102 on the take-up bobbin 104 is, thus, increased, requiring increase in power of an electric motor for the take-up bobbin 104.

The relatively large head opening 101e is, as described above, formed between the supply and take-up bobbins 103 and 104, thus resulting in an increased size of the inked ribbon cartridge 100.

In recent years, compact printers appear on the market which are capable of printing out image information with color immediately after captured by a portable video camera in a digital form. It is difficult for this type of printer to provide the space available to installation of the color block leader sensor and the record paper edge sensor for compactness of the printer.

SUMMARY OF THE INVENTION

It is therefore a principal object of the present invention to avoid the disadvantages of the prior art.

It is another object of the present invention to provide compact structures of a thermal transfer printer and an inked ribbon cartridge capable of printing images with high quality.

According to one aspect of the present invention, there is provided an inked ribbon cartridge for a printer which comprises: (a) a cartridge casing; (b) a supply bobbin disposed within the cartridge casing; (c) a take-up bobbin disposed within the cartridge casing, the take-up bobbin having a diameter smaller than that of the supply bobbin; and (d) an inked ribbon wound between the supply and take-up bobbins.

In the preferred mode of the invention, the diameter of the take-up bobbin is so determined that a maximum diameter of the used inked ribbon wound about the take-up bobbin is substantially equal to a maximum diameter of the unused inked ribbon wound about the supply bobbin.

According to the second aspect of the invention, there is provided an inked ribbon cartridge for a printer

which comprises:

(a) a supply bobbin; (b) a take-up bobbin; (c) an inked ribbon wound between the supply and take-up bobbins; and (d) a cartridge casing defining therein an enclosed chamber within which the supply bobbin is disposed rotatably. The cartridge casing includes a supporting member which supports the take-up bobbin rotatably outside the cartridge casing.

According to the third aspect of the invention, there is provided an inked ribbon cartridge for a printer which comprises:

(a) a supply bobbin; (b) a take-up bobbin; (c) an inked ribbon wound between the supply and take-up bobbins; and (d) a cartridge casing supporting the supply and take-up bobbins rotatably. The cartridge casing has a first and a second outer wall which extend between lengths of the supply and take-up bobbins to define a groove between the first and second outer walls in which a printing head is disposed when the inked ribbon cartridge is loaded into the printer. The first and second outer walls also define an opening across which a portion of the inked ribbon is stretched and through which the thermal head disposed within the groove faces the portion of the inked ribbon stretched across the opening.

In the preferred mode of the invention, the first and second outer walls have flat surfaces, respectively, which extend in parallel to each other to define the groove therebetween. The groove has an end opening oriented in a lengthwise direction of the supply and take-up bobbins for entry of the thermal head.

The first and second outer walls have first and second edges which define the opening across which the inked ribbon is stretched between the first and second edges.

A protrusion may be formed on one of the first and second edges of the first and second outer walls closer to the take-up bobbin. The protrusion is brought into engagement with the thermal head when the inked ribbon cartridge is loaded into the printer.

An elastic plate may be attached to one of the first and second outer walls closer to the take-up bobbin. The elastic plate projects from an edge of the one of the first and second outer walls to define along with the edge of the other of the first and second outer walls the opening across which the inked ribbon is stretched.

The elastic plate is deformed inwardly of the groove by tension of the stretched inked ribbon.

According to the fourth aspect of the invention, there is provided a thermal transfer color printer which comprises: (a) an inked ribbon including a series of different color blocks; (b) an inked ribbon winding mechanism that withdraws the inked ribbon from a supply bobbin and winds the inked ribbon to a take-up bobbin; (c) a first sensor that detects a leader of each of the different color blocks of the inked ribbon moved by the inked ribbon winding mechanism and provides a signal indicative thereof; (d) a record paper transport mechanism including a drive roller and a driven roller, the driven roller being urged against the drive roller to form a nip through which a sheet of record paper is transported to a printing station at a constant speed; (e) a second sensor that detects an end of the sheet of record paper being transported and provides a signal indicative thereof; and (f) a printing mechanism including a thermal head and a platen roller, the platen roller being urged against the thermal head through the inked ribbon and the sheet of record paper at the printing station to print a desired color image based on the signals from the first and second sensors. The driven roller extends parallel to the drive roller and is smaller in length than the drive roller so as to produce a mount space adjacent one end of the driven roller. At least one of the first and second sensors is disposed in the mount space.

In the preferred mode of the invention, the first and second sensors may be disposed in the mount space.

According to the fifth aspect of the invention, there is provided a thermal transfer color printer which comprises: (a) a printer casing; (b) a inked ribbon cartridge storage chamber defined in the printer casing for storing therein an inked ribbon cartridge in which an inked ribbon including a series of different color blocks is wound between a supply bobbin and a take-up bobbin; (c) a record paper storage chamber defined in the printer casing for storing therein a record paper cassette in which sheets of record paper are stacked; (d) a record paper transport mechanism including a drive roller and a driven roller, the driven roller being urged against the drive roller to form a nip through which one of the sheets of record paper is transported to a printing station; (e) a paper feeding roller that feeds the sheets of record paper stacked in the record paper cassette to the record paper transport mechanism; and (f) a printing mechanism disposed at the printing station, including a thermal head and a platen roller, the platen roller being urged against the thermal head through the inked ribbon and the sheet of record paper transported by the record paper transport mechanism to print a desired color image. The record paper cassette has formed in an end surface thereof a slit which allows only one of the sheets of record paper to pass therethrough toward the record paper transport mechanism.

According to the sixth aspect of the invention, there is provided a thermal transfer color printer which comprises: (a) a printer casing; (b) a inked ribbon cartridge storage chamber defined in the printer casing for storing therein an inked ribbon cartridge in which an inked ribbon including a series of different color blocks is wound between a supply bobbin and a take-up bobbin; (c) a

record paper storage chamber defined in the printer casing for storing therein sheets of record paper; (d) a record paper transport mechanism including a drive roller and a driven roller, the driven roller being urged against the drive roller to form a nip through which one of the sheets of record paper is transported to a printing station; (e) a paper feeding roller that feeds the sheets of record paper stored in the record paper storage chamber to the record paper transport mechanism along a paper feed path; (f) a printing mechanism disposed at the printing station, including a thermal head and a platen roller, the platen roller being urged against the thermal head through the inked ribbon and the sheet of record paper transported by the record paper transport mechanism to print a desired color image; (g) a record paper loading opening formed in the printer casing communicating with the record paper storage chamber; (h) a record paper loading door closing the record paper loading opening; (i) an urging member that is installed on an inner surface of the record paper loading opening door to urge the sheets of record paper against the paper feeding roller; and (j) a slit member provided on the paper feed path downstream of the paper feeding roller, defining a slit between itself and a portion of the inner wall of the record paper loading door, the slit allowing only one of the sheets of record paper to pass therethrough toward the record paper transport mechanism.

In the preferred mode of the invention, the paper feeding roller is exposed to the inside of the record paper storage chamber at a location shifted from a center of the record paper storage chamber in a widthwise direction of the sheets of record paper. The slit member is disposed adjacent the paper feeding roller.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood more fully from the detailed description given hereinbelow and from the accompanying drawings of the preferred embodiment of the invention, which, however, should not be taken to limit the invention to the specific embodiment but are for explanation and understanding only.

In the drawings:

Fig. 1 is a perspective view which shows an inked ribbon cartridge according to the first embodiment of the invention;

Fig. 2 is an exploded view which shows an internal structure of the inked ribbon cartridge of Fig. 1;

Fig. 3(a) is a cross sectional view taken along the line X-X in Fig. 1;

Fig. 3(b) is a side view which shows an end wall of the inked ribbon cartridge in Fig. 1;

Fig. 3(c) is a top view which shows the inked ribbon cartridge in Fig. 1;

Figs. 4(a) to 4(f) show several arrangements of color blocks in a full color image strip segment of an inked ribbon which may be employed in the inked ribbon cartridge in Fig. 1;

Fig. 5 is a perspective view which shows a record paper cassette;

Fig. 6 is a perspective view which shows a thermal transfer color printer used in the first embodiment;

Fig. 7 is a longitudinal cross sectional view which shows the thermal transfer color printer in Fig. 6;

Fig. 8 is a perspective view which shows sensor installation on a record paper transport mechanism;

Fig. 9(a) is a right side view of Fig. 8;

Fig. 9(b) is a front view of Fig. 8;

Fig. 9(c) is a top view of Fig. 8;

Fig. 9(d) is a left side view of Fig. 8;

Fig. 10(a) is a top view which shows a thermal head;

Fig. 10(b) is an enlarged view which shows a thermistor;

Fig. 10(c) is an enlarged cross sectional view which shows a heater mounted on the thermal head in Fig. 10(a);

Fig. 10(d) is a side view of Fig. 10(a);

Fig. 11 is a perspective view which shows an inked ribbon cartridge according to the second embodiment of the invention;

Fig. 12(a) is a cross sectional view taken along the line P-P in Fig. 11;

Fig. 12(b) is a cross sectional view taken along the line Q-Q in Fig. 11;

Fig. 12(c) is a top view which shows the inked ribbon cartridge in Fig. 11;

Fig. 13(a) shows an inked ribbon cartridge which does not have a protrusion serving to avoid elastic deformation of a cartridge casing wall;

Fig. 13(b) is a side view of Fig. 13(a);

Fig. 13(c) shows an inked ribbon cartridge with a protrusion mounted on a cartridge casing wall in engagement with a thermal head;

Fig. 13(d) is a side view of Fig. 13(c);

Fig. 14(a) is a cross sectional view taken along the line P-P in Fig. 14(c) which shows a modification of the inked ribbon cartridge in Fig. 11;

Fig. 14(b) is a cross sectional view taken along the line Q-Q in Fig. 14(c);

Fig. 14(c) is a top view;

Fig. 15 is a cross sectional view which shows the inked ribbon cartridge in Fig. 14(c) when subjected to tension of an inked ribbon wound between a supply and a take-up bobbin;

Fig. 16 is a perspective view which shows a thermal transfer color printer used in the second embodiment;

Fig. 17(a) is a perspective view which shows the bottom of the thermal transfer color printer in Fig. 16;

Fig. 17(b) is a perspective view which shows the thermal transfer color printer in Fig. 17(a) when a paper loading door is opened;

Fig. 18(a) is a cross sectional bottom view which shows the thermal transfer color printer in Fig. 16 when a paper loading door is opened;

Fig. 18(b) is a sectioned side view which shows the thermal transfer color printer in Fig. 18(a);

Fig. 19 is a perspective view which shows sensor installation on a record paper transport mechanism in the thermal transfer color printer in Fig. 16;

Fig. 20(a) is a front view of Fig. 19;

Fig. 20(b) is a top view of Fig. 19;

Fig. 20(c) is a left side view of Fig. 19; and

Fig. 21 is a perspective view which shows a conventional inked ribbon cartridge.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, particularly to Fig. 1, there is shown an inked ribbon cartridge 1 according to the present invention which includes a cartridge casing 2, an inked ribbon 3, a supply bobbin 4, and a take-up bobbin 5.

The inked ribbon cartridge 1 is designed to have a small size matched with card-sized record paper 8, as shown in Figs. 5 and 7, and is loaded into and unloaded from a cartridge loading opening 11e1, as shown in Fig. 6, formed in a left side wall 11e of a printer casing 11.

The inked ribbon 3 consists of a base film such as a polyester film on which a plurality of full color image strip segments is formed. Each full color image strip segment includes ink color blocks, as shown in Figs. 4(a) to 4(f). In Fig. 4(a), each full color image strip segment consists of three ink color blocks coated with yellow (Y), magenta (M), and cyan (C) inks. In Fig. 4(b), an undercoating ink block (U.C) for undercoating the record paper 8 pre-printing is further provided preceding the yellow ink color block (Y). In Fig. 4(c), an overcoating ink block for overcoating the record paper 8 after printed with an image is provided following the cyan ink color block (C). In Fig. 4(d), a black ink color block (BK) is provided following the cyan ink color block (C). Figs. 4(e) and 4(f) show the full color image strip segments in a combination of Figs. 4(b) and 4(d) and a combination of Figs. 4(c) and 4(d), respectively.

Each ink color block has, as shown in Fig. 4(a), printed on a corner of a front edge (i.e., a leading edge) thereof an ink color mark (M1, M2, or M3) which represents the color of the ink color block and which is also used to locate the leading edge of the ink color block. Figs. 4(b) to 4(f) omit this mark for the brevity of illustration.

The inked ribbon 3 is, as shown in Fig. 2, wound about the cylindrical supply and take-up bobbins 4 and 5 prior to installation in the cartridge casing 2.

The take-up bobbin 5 is designed to have a diameter Dt which is smaller than a diameter Ds of the supply bobbin 4. The diameter Dt of the take-up bobbin 5 is experimentally determined so that a maximum diameter of the inked ribbon 3 when wound up by the take-up bobbin 5 may substantially agree with a maximum diameter of the inked ribbon 3 wound about the supply bobbin 4 before use. The reason for determining the diameter Dt experimentally is that the presence of air layers between adjacent turns of the inked ribbon 3 wound about the take-up bobbin 5 makes it difficult to determine the diameter Dt mathematically in a simple manner.

Conversely, the supply bobbin 4 is greater in diameter than the take-up bobbin 5, so that a change in diameter of the inked ribbon 3 wound on the supply bobbin 4 by withdrawal in each printing operation will be small, thereby resulting in a decreased change in back-tension of the inked ribbon 3 to avoid transfer of a stripped pattern from the inked ribbon 3 to the record paper 8.

The maximum diameter of the inked ribbon 3 after wound on the take-up bobbin 5 does not exceed the maximum diameter of the inked ribbon 3 wound about the supply bobbin 4 before use, thereby eliminating the need for increasing the power of a take-up bobbin motor 27, as shown in Fig. 7. This also improves the ability of winding the inked ribbon 3 and allows the cartridge casing 2 to be decreased in size.

The cartridge casing 2, as clearly shown in Fig. 2, consists of an upper casing 2A and a lower casing 2B which are asymmetric in shape and made of resin material. The upper casing 2A has a right side wall 2a which is V-shaped to have two circular sections having formed therein bearing holes 2a1 and 2a2 for rotatably bearing support shafts of the supply and take-up bobbins 4 and 5, respectively. The loading of the inked ribbon cartridge 1 into the thermal transfer printer 10, as shown in Figs. 6 and 7, is accomplished by inserting the right side wall 2a of the upper casing 2A from the arrow M into the cartridge loading opening 11e1 and securing the cartridge casing 2 at a printing station where the thermal head 28, as clearly shown in Fig. 3(a), is disposed between the supply and take-up bobbins 4 and 5. The right side wall 2a of the upper casing 2A is, as described above, of V-shape, thus enabling horizontal entry of the thermal head 28 between the supply and take-up bobbins 4 and 5.

The lower casing 2B has, as shown in Figs. 2 and 3(b), a left side wall 2b having formed thereon bosses in which bearing holes 2b1 and 2b2 are formed for rotatably bearing the support shafts of the supply and take-up bobbins 4 and 5.

The thermal head 28 is, as can be seen in Fig. 3(a), disposed between the supply and take-up bobbins 4 and 5 substantially perpendicular to a plane including both the lengths of the supply and take-up bobbins 4 and 5. This allows the interval between the lengths of the supply and take-up bobbins 4 and 5 to be decreased as compared with the conventional cartridge in Fig. 21, which results in a reduced size of the inked ribbon cartridge 1.

The cartridge casing 2 includes, as shown in Fig. 3(a), an outer cylindrical wall 2c for covering the supply bobbin 4. The outer cylindrical wall 2c consists of an upper wall 2c1 and a lower wall 2c2. The upper wall 2c1 is substantially of a half-pipe shape. The lower wall 2c2 occupies an angular range of the outer cylindrical wall 2c smaller than that occupied by the upper wall 2c1. The upper wall 2c1 is, as shown in Fig. 2, connected to the upper casing 2A and enclosed at one end by the right side wall 2a. The lower wall 2c2 is connected at one end thereof to the lower casing 2B so as to define a lower opening along a lower edge thereof from which the inked ribbon 3 is withdrawn by the take-up bobbin 5.

The upper casing 2A defines a substantially U-shaped groove 2d, as shown in Figs. 2 and 3(a), between a vertically extending surface 2A1 of the upper wall 2c1 of the outer cylindrical wall 2c and a vertically extending outer wall 2A2. The surface 2A1 and the outer wall 2A2 extend substantially parallel to each other. The groove 2d has the length along the width of the inked ribbon 3 wound between the supply and take-up bobbins 4 and 5 and extends vertically below a plane including the longitudinal center lines of the supply and take-up bobbins 4 and 5. The groove 2d has a rectangular lower opening 2d1 through which the thermal head 28 faces the inked ribbon 3 stretched between lower edges 2d2 and 2d3 of the surface 2A1 of the upper wall 2c1 and the outer wall 2A2. The lower edges 2d2 and 2d3 also serve to guide transport of the inked ribbon 3 from the supply bobbin 4 to the take-up bobbin 5. The thermal head 28 is, as shown in Fig. 7, mounted vertically within the groove 2d and pressed by a platen roller 24 through the inked ribbon 3 and the record paper 8.

The upper casing 2A also has, as shown in Figs. 2 and 3(a), a rectangular guide flange 2e which extends from an upper edge of a left side wall 2d4 of the groove 2d to a lower portion of the right side wall 2a with a given gap 31 between itself and a side surface of the outer wall 2A2 through which the inked ribbon 3 is wound on the take-up bobbin 5.

Specifically, the inked ribbon 3 is transported from the supply bobbin 4 to the take-up bobbin 5 through the lower opening 2d1 of the groove 2d and the gap 31 formed between the outer wall 2A2 and an inner wall of the guide flange 2e.

The assembly of the cartridge casing 2 is achieved by mounting the supply and take-up bobbins 4 and 5 rotatably between the right side wall 2a of the upper casing 2A and the left side wall 2b of the lower casing 2B and fitting a boss 2d41 formed on an outer surface of the left side wall 2d4 of the upper casing 2A into a mount hole 2b3 formed in the left side wall 2b of the lower casing 2B.

Fig. 5 shows a record paper cassette 6 which consists of a box-shaped casing 6A and a mouth piece 6B. The mouth piece 6B is mounted on a front portion of the casing 6A and has formed in a front surface 6c thereof a paper feed opening 6c2 from which sheets of record paper 8 stacked within the casing 6A are withdrawn one by one. The paper feed opening 6c2 has formed in both ends thereof slits 6c1 for separating a leading edge 8a of the uppermost one of the sheets of record paper 8 from the remainder.

The thermal transfer printer 10 of the first embodiment will be discussed below with reference to Figs. 6 to 10.

The thermal transfer printer 10 is compact in size for portability and measures 130 × 94 × 40 mm high. The thermal transfer printer 10 has, as shown in Fig. 6, disposed therein a power supply or storage battery BAT.

The printer casing 11 has formed in a front surface 11a a cassette loading opening 11a1 for loading the record paper cassette 6 and in a rear surface 11d a record paper ejecting opening 11d1 for ejecting printed sheets of the record paper 8. The printer casing 11, as already described, also has formed in a left side surface 11e the cartridge loading opening 11e1 for loading the inked ribbon cartridge 1

Internally, the thermal transfer printer 10, as shown in Fig. 7, defines a record paper cassettes storage chamber between a bottom plate 11b and a middle plate 11c for storing therein the record paper cassette 6. A flat plate spring (i.e. a single leaf spring) 12 is installed on the bottom plate 11b. A fan-shaped paper feed roller 13 is mounted above the longitudinal center line of the record paper cassette 6 so as to be rotatable clockwise.

When the record paper cassette 6 is loaded into the printer casing 11, the plate spring 12 enters an opening 6a1 formed in the bottom 6a of the record paper cassette 6 to urge the sheets of record paper 8 upward, thereby keeping uppermost one of the sheets of record paper 8 stacked in the record paper cassette 6 at a constant level. Thus, when the paper feed roller 13 is turned, a curved surface thereof engages the uppermost sheet of record paper 8 and feeds it to the printing station.

A record paper sheet transport mechanism is disposed in front of the record paper cassette 6 which includes a drive roller 15, a driven roller 16, and a roller arm 19. The drive roller 15 is turned by an electric motor 14 in normal and reverse directions. The roller arm 19 is pivotably supported by a shaft 17 and urged upward at one end by a coil spring 18 to bring at the other end the driven roller 16 into constant engagement with the drive roller 15 to form a nip through which one of the sheets of record paper 8 extracted from the record paper cassette 6 is transported back and forth at constant speed along a paper feed path according to the rotation of the drive roller 15.

A color block leader sensor 20 and a record paper edge sensor 22, to be described hereafter in detail, are arranged near both ends of the drive roller 15. The color block leader sensor 20 is mounted on a first printed board 21, as shown in Figs. 8, 9(b), and 9(c), and detects a leader of each ink color block of the inked ribbon 3. The record paper edge sensor 22 is mounted on

a second printed board 23 and detects leading and trailing edges of each sheet of record paper 8 during transportation.

The platen roller 24 is disposed downstream of the drive roller 15 and rotatably supported by one end of a platen roller arm 25. The platen roller arm 25 is pivotably supported by a support shaft 26 so that it may bring the platen roller 24 into engagement with and disengagement from the thermal head 28 through a lifting mechanism (not shown).

Defined above the platen roller 24 is an inked ribbon cartridge storage chamber into and from which the inked ribbon cartridge 1 is loaded and unloaded through the cartridge loading opening 11e1, as shown in Fig. 6, formed in the left side surface 11e of the printer casing 11. When the inked ribbon cartridge 1 is loaded into the printer casing, the take-up bobbin 5 of the inked ribbon cartridge 1 is connected to an output shaft of the take-up bobbin motor 27. Simultaneously, the thermal head 28 is disposed vertically between the supply and take-up bobbins 4 and 5 and engages through heaters a reverse surface of the inked ribbon 3 on the platen roller 24.

The thermal head 28 includes, as shown in Fig. 10(a), a base 28a, a glass bar 28b, a heater 28c, a glass base 28d, a protector 28e, a first thermistor 28g, drive ICs 28h, and a second thermistor 28j.

The base 28a is made of an epoxy resin rectangular plate and has disposed on a longitudinal edge thereof the glass bar 28b. The heater 28c is, as shown in Fig. 10(c), formed on an outer surface of the glass bar 28b and consists of an array of heating elements 28c1 made of a high-resistance material such as NiCr or TaN. Each of the heating elements 28c1 is connected at one end to an individual electrode 28c2 and at the other end to a common electrode 28c3. The electrodes 28c2 and 28c3 are made from, for example, aluminum, gold, or copper. The glass base 28d is attached to a back surface of the base 28a and connects the electrodes 28c2 and the drive ICs 28h. The protector 28e made of a metal such as iron or aluminum is bonded to the surface of the glass base 28d for protecting the electrodes 28c2. The first thermistor 28g is mounted on the base 28a in the vicinity of the heater 28c and connected at one end to the common electrode 28c3 of the heater 28c and at the other end to a connector (not shown). The drive ICs 28h are installed on the base 28a in parallel to the glass bar 28b and serve to output image printing signals to the heating elements 28c1 through the electrodes 28c2 selectively. The drive ICs 28h are covered with a protector 28i. The second thermistor 28j is installed on a corner of the base 28a far from the heater 28c and connected at both ends to connectors (not shown).

Referring back to Fig. 7, the printer casing 11, as described above, has formed in the rear surface 11d the record paper ejecting opening 11d1. Between the record paper ejecting opening 11d1 and the front surface 6c of the record paper cassette 6, the paper feed path extends straight.

The installation of the color block leader sensor 20 and the record paper edge sensor 22 will be discussed below with reference to Figs. 8 to Figs. 9(a) to 9(d).

The drive roller 15 is rotatably supported at right and left shaft ends 15a and 15b by inner side walls (not shown) of the printer casing 11. The length L1 of the drive roller 15 is equal to or slightly greater than the width W of the record paper 8.

The driven roller 16 has the length L2 shorter than the length L1 of the drive roller 15 and is rotatably supported at right and left shaft ends 16a and 16b by the inner side walls of the printer casing 11 through supporters (not shown). The distance L3 between the right and left shaft ends 16a and 16b is shorter than the length L1 of the drive roller 15 to produce spaces for mounting the color block leader sensor 20 and the record paper edge sensor 22 between the right and left shaft ends 16a and 16b and the inner side walls of the printer casing 11.

Specifically, the color block leader sensor 20 is mounted on the first printed board 21 arranged near the printing station between the right shaft end 16a of the driven roller 16 and the inner side wall of the printer casing 11. The color block leader sensor 20 includes a reflection photosensor designed to detect the presence of the ink color marks M1, M2, and M3, as shown in Fig. 4(a), printed on the front edges of the ink color blocks (Y), (M), and (C).

The record paper edge sensor 22 is mounted on the second printed board 22 arranged near the printing station between the left shaft end 16b of the driven roller 16 and the inner side wall of the printer casing 11. The record paper edge sensor 22 includes, similar to the color block leader sensor 20, a reflection photosensor designed to detect leading and trailing edges 8a and 8b, as clearly shown in Fig. 8, of each sheet of record paper 8.

The color block leader sensor 20 and the record paper edge sensor 22 are, as described above, installed in spaces occupying between the ends of the driven roller 16 and the inner side walls of the printer casing 11, thereby allowing the thermal transfer printer 10 to be reduced in size. Further, the location of the color block leader sensor 20 near the printing station serve to improve the reliability in detecting the leader of each ink color block of the inked ribbon 3. The location of the record paper edge sensor 22 near the printing station allow a blank portion of the record paper 8 between the edge 8b and a printing start position to be shortened. The thermal transfer printer 10 of this embodiment does not always require both the color block leader sensor 20 and the record paper edge sensor 22 and may include at least one of them.

The operation of the thermal transfer printer 10 will be described below with reference to Fig. 7. Note that the thermal transfer printer 10 has, as described above, the compact structure and is operable in any attitude.

First, the paper feed roller 13 is turned clockwise, as viewed in the drawing, to feed uppermost one of the sheets of record paper 8 stacked in the record paper cassette 6 toward the paper feed opening 6c2 formed in the mouth piece 6B. The leading edge 8a of only the uppermost sheet of record paper 8 is allowed to pass through the slits 6c1 of the paper feed opening 6c2 so that the uppermost sheet of record paper 8 is separated from the remainder and withdrawn from the record paper cassette 6. The sheet of record paper 8 withdrawn from the record paper cassette 6 is transported through the nip between the drive roller 15 and the driven roller 16 until the trailing edge or printing start edge 8b of the record paper 8 is detected by the record paper edge sensor 22. When the printing start edge 8b of the record paper 8 reaches the record paper edge sensor 22, it projects from the record paper ejecting opening 11d1. When the paper feed roller 13 leaves the uppermost sheet of record paper 8, the transportation thereof terminates. During the transportation of the sheet of record paper 8, the platen roller 24 is held in disengagement from the thermal head 28.

When the record paper edge sensor 22 detects the printing start edge 8b of the record paper 8, the drive roller 15 is reversed (i.e., in a clockwise direction as viewed in Fig. 7) to move the record paper 8 back into a chamber defined between the middle plate 11c of the printer casing 11 and the upper surface 6b of the record paper cartridge 6. The platen roller 24 is lifted upward to urge the record paper 8 into engagement with the thermal head 28 through the inked ribbon 3. The take-up bobbin motor 27 is turned on to wind the inked paper 3 on the take-up bobbin 5 and locates the leader of the ink color block (Y) at the printing station when the record paper edge sensor detects the ink color mark M1. When the leader of the ink color block (Y) reaches the printing station, a first printing operation is initiated to supply yellow color image signals to the thermal head 28 to print a yellow color image on the record paper 8.

When the record paper edge sensor 22 detects the printing end edge 8a of the record paper 8 after completion of the first printing operation, the platen roller 24 is moved downward out of engagement with the thermal head 28. The second and third printing operations are performed in the same manner to print magenta and cyan color images on the record paper 8 to produce a desired full color image. After completion of the first to third printing operations, the image-printed record paper 8 is ejected from the record paper ejecting opening 11d1.

Fig. 11 shows an inked ribbon cartridge 51 according to the second embodiment of the invention which is a modification of the first embodiment. The same reference numbers as employed in the first embodiment refer to the same parts, and explanation thereof in detail will be omitted here.

The inked ribbon cartridge 51 includes a cartridge casing 52 in which the inked ribbon 3 is wound between the supply and take-up bobbins 4 and 5. The cartridge casing 52 is designed to be loaded into the thermal transfer printer 60, as shown in Fig. 16, from a direction N through a cartridge loading opening 61f1 formed in a right side wall 61f of a printer casing 61.

The cartridge casing 52, as shown in Figs. 12(a) to 12(c), consists of an upper casing 52A and a lower casing 52B which are asymmetric in shape and made of resin material. The upper casing 52A has a left side wall 52a which is V-shaped to have two circular sections which rotatably bear ends of support shafts of the supply and take-up bobbins 4 and 5, respectively. The loading of the inked ribbon cartridge 51 into the thermal transfer printer 60 is accomplished by inserting the left side wall 52a of the upper casing 52A from the arrow N into the cartridge loading opening 61f1 and securing the cartridge casing 52 at a printing station where the thermal head 28, as clearly shown in Figs. 12(a) and 12(b), is disposed between the supply and take-up bobbins 4 and 5.

The lower casing 52B has, as shown in Fig. 12(b), a right side wall 52b on which the other ends of the support shafts of the supply and take-up bobbins 4 and 5 are rotatably mounted.

The cartridge casing 52 includes, as shown in Fig. 12(a), an outer cylindrical wall 52c for covering the supply bobbin 4. The outer cylindrical wall 52c consists of an upper wall 52c1 and a lower wall 52c2. The upper wall 52c1 is substantially of a half-pipe shape. The lower wall 52c2 occupies an angular range of the outer cylindrical wall 52c smaller than that occupied by the upper wall 52c1. The upper wall 52c1 is connected to the upper casing 52A and enclosed at one end by the left side wall 52a. The lower wall 52c2 is connected at one end thereof to the lower casing 52B so as to define a lower opening along a lower edge thereof from which the inked ribbon 3 is withdrawn by the take-up bobbin 5.

The upper casing 52A defines a substantially U-shaped groove 52d between a vertically extending surface 52A1 of the upper wall 52c1 of the outer cylindrical wall 52c and a vertically extending outer wall 52A2. The groove 52d has the length along the width of the inked ribbon 3 between the supply and take-up bobbins 4 and 5 and extends vertically below a plane including the longitudinal center lines of the supply and take-up bobbins 4 and 5. The groove 52d has a rectangular lower opening 52d1 through which the thermal head 28 faces the inked ribbon 3 stretched between lower edges 52d2 and 52d3 of the surface 52A1 of the upper wall 52c1 and the outer wall 52A2. The lower edges 52d2 and 52d3 also serve to guide transport of the inked ribbon 3 from the supply bobbin 4 to the take-up bobbin 5. The thermal head 28 is, as shown in Fig. 18(b), mounted vertically between the supply and take-up bobbins 4 and 5 and pressed downward by the platen roller 24 through the inked ribbon 3 and the record paper 8.

Unlike the first embodiment, the upper casing 52A does not have the rectangular guide flange 2e shown in

Fig. 2. The winding of the inked ribbon 3 on the take-up bobbin 5 is, as can be seen in Figs. 12(a) and 12(b), achieved by rotating the take-up bobbin 5 clockwise, as viewed in the drawings.

The outer wall 52A2 of the upper casing 52A has formed on a central portion of the lower edge 52d1 a half-moon protrusion 52d31, as shown in Figs. 12(b) and 12(c), which extends inward and is brought into constant engagement with the thermal head 28 when the inked ribbon cartridge 51 is loaded into the thermal transfer printer 60. Specifically, the outer wall 52A2 is, as shown in Figs. 13(c) and 13(d), held rigidly by the thermal head 28, thus avoiding inward deformation of the outer wall 52A2, as shown in Figs. 13(a) and 13(b), due to tension of the inked ribbon 3 being wound on the take-up bobbin 5, which may cause wrinkles to be produced in an image printed on the record paper 8.

The take-up bobbin 5 is, as apparent from the above discussion, exposed to the atmosphere, thereby resulting in a great decrease in amount of resin material used to form the cartridge casing 52 and in a compact and light weight construction of the inked ribbon cartridge 51.

Figs. 14(a) to 14(c) and 15 show a modification of the inked ribbon cartridge 51 of the second embodiment.

The outer wall 52A2 of the upper casing 52A is smaller in width than that in the first embodiment and has an upper portion curved outward. The outer wall 52A2 has disposed on the overall width of an inner surface thereof an elastic film 53 which projects downward from the lower edge 52d3 so that a lower edge thereof is flush with the lower edge 52d2 of the surface 52A1 of the upper casing 52A. The elastic film 53 has the rigidity higher than that of the base film of the inked ribbon 3, but is deformed inward when subjected to tension of the inked ribbon 3 being wound on the take-up bobbin 5.

When the inked ribbon cartridge 51 is loaded into the thermal transfer printer 60, the thermal head 28 presses, as shown in Fig. 15, the inked ribbon 3 downward, thus producing the tension which causes the film 53 to be elastically urged into constant engagement with the thermal head 28. This causes the inked ribbon 3 to be transported from a nip between the thermal head 28 and the platen roller 24 directly to the take-up bobbin 5. Specifically, the inked ribbon 3 leaves the record paper 8 quickly after passing through the nip between the thermal head 28 and the platen roller 24, thereby ensuring a desired angle which a portion of the inked ribbon 3 leaving the platen roller 24 makes with the record paper 8, which improves the quality of printed images.

The thermal transfer printer 60 will be described blow with reference to Figs. 16 to 20(b).

The thermal transfer printer 60 of this embodiment, like the one in the first embodiment, has a compact structure measuring 130 × 94 × 40 mm high. The thermal transfer printer 60 has, as shown in Fig. 16, disposed therein a power supply or storage battery BAT for portability.

The thermal transfer printer 60, unlike the first embodiment, does not use a record paper cassette. The printer casing 61 has formed in the bottom 61b the record paper loading opening 61b1 through which the sheets of record paper 8 are loaded into the printer casing 61. The record paper loading opening 61b1 is closed by a paper loading door 62 pivotably installed on one edge of the record paper loading opening 61b1 using a hinge 63. The printer casing 61 has also formed in the read surface 61d the record paper ejecting opening 61d1 for ejecting printed sheets of the record paper 8 and installed on the right side surface 61f a cartridge loading door 64 for closing the cartridge loading opening 61f1.

Internally, the printer casing 61, as shown in Figs. 17(b) and 18(b), defines a record paper storage chamber 61c1 between an inner plate 70 attached to an inner wall of the paper loading door 62 and a middle plate 61c1. The loading of the sheets of record paper 8 into the thermal transfer printer 60 is, as shown in Figs. 17(a) and 17(b), accomplished by turning the printer casing 61 upside down, moving a locking pawl 65 to unlock the paper loading door 62, opening the paper loading door 62, and putting the sheets of paper 8 in the record paper storage chamber 61c1.

A slit member 67 is, as shown in Figs. 17(b), 18(a), and 18(b), installed outside a front corner of the record paper storage chamber 61c1 which defines a slit between itself and a front end of the middle plate 61c for separating lowermost one of the sheets of record paper 8, as viewed in Fig. 18(b), from the remainder thereof. A fan-shaped paper feed roller 66 is installed pivotably in the printer casing 61 so that it may partially be exposed to the record paper storage chamber 61c1. The paper feed roller 66 is, as can be seen in Fig. 18(a), located adjacent the slit member 67 so that it may hold a front edge of one of the sheets of record paper 8 and pass it through the slit 67 immediately, thus achieving reliable feeding of the record paper 8 sheet by sheet.

A compression coil spring 68 with a cap 69 is disposed within a recess formed in the inner plate 70 of the paper loading door 62. When the paper loading door 62 is closed, the cap 69 urges the sheets of record paper 8 stacked within record paper storage chamber 61c1 against the paper feed roller 66 for increasing friction between the paper feed roller 66 and the record paper 8 to facilitate the feeding of the record paper 8 to the printing station.

A record paper sheet transport mechanism is disposed in front of the record paper storage chamber 61c1 which includes a drive roller 15 and a driven roller 16. The drive roller 15 is turned by an electric motor (no shown) in normal and reverse directions. The driven roller 16 engages, as shown in Fig. 19, at large-diameter end portions with the drive roller 15 to form a nip through which one of the sheets of record paper 8

extracted from the record paper storage chamber 61c1 is transported back and forth along a paper feed path according to the rotation of the drive roller 15.

The platen roller 24 is disposed adjacent the drive roller so that it may be lifted up and down by a lifting mechanism (not shown) into engagement with and disengagement from the thermal head 28 through the record paper 8 and the inked ribbon 3.

A color block leader sensor 20 and a record paper edge sensor 22 are, as shown in Figs. 19 to 20(c), disposed adjacent one end of the driven roller 16. The record paper edge sensor 22 is installed on a bottom surface of an L-shaped mount plate 71 facing the drive roller 15 (i.e., the record paper 8 being transported). The color block leader sensor 20 is installed on a vertically extending surface of the L-shaped mount plate 71 facing the inked ribbon 3.

The length L1 of the drive roller 15 is, like the first embodiment, equal to or slightly greater than the width W of the record paper 8. The driven roller 16 has the length L2 shorter than the length L1 of the drive roller 15. The distance L3 between right and left shaft ends 16a and 16b of the driven roller 16 is shorter than the length L1 of the drive roller 15. This structure allows the L-shaped mount plate 71 to be disposed adjacent the left shaft end 16b of the driven roller 16.

The operation and other arrangements of the thermal transfer printer 60 are identical with those of the thermal transfer printer 10 of the first embodiment, and explanation thereof in detail will be omitted here.

While the present invention has been disclosed in terms of the preferred embodiment in order to facilitate a better understanding thereof, it should be appreciated that the invention can be embodied in various ways without departing from the principle of the invention. Therefore, the invention should be understood to include all possible embodiments and modification to the shown embodiments which can be embodied without departing from the principle of the invention as set forth in the appended claims.

An inked ribbon cartridge and a portable color printer are provided which are compact in size and capable of printing color images with high quality. The inked ribbon cartridge includes an inked ribbon wound between a supply bobbin and a take-up bobbin. The take-up bobbin is smaller in diameter than the supply bobbin for preventing a maximum diameter of the inked ribbon all wound on the take-up bobbin from exceeding that of the inked ribbon wound about the supply bobbin before use, which is caused by formation of air layers between adjacent turns of the inked ribbon wound on the take-up bobbin. The supply bobbin is covered by a cartridge casing, while the take-up bobbin is exposed outside the cartridge casing, thereby achieving a compact and light weight construction of the inked ribbon cartridge.

Claims

1. An inked ribbon cartridge for a printer comprising:

   a cartridge casing;
   a supply bobbin disposed within said cartridge casing;
   a take-up bobbin disposed within said cartridge casing, said take-up bobbin having a diameter smaller than that of said supply bobbin; and
   an inked ribbon wound between said supply and take-up bobbins.

2. An inked ribbon cartridge according to claim 1, wherein the diameter of said take-up bobbin is so determined that a maximum diameter of the used inked ribbon wound about said take-up bobbin is substantially equal to a maximum diameter of the unused inked ribbon wound about said supply bobbin.

3. An inked ribbon cartridge for a printer comprising:

   a supply bobbin;
   a take-up bobbin;
   an inked ribbon wound between said supply and take-up bobbins; and
   a cartridge casing defining therein an enclosed chamber within which said supply bobbin is disposed rotatably, said cartridge casing including a supporting member which supports said take-up bobbin rotatably outside said cartridge casing.

4. An inked ribbon cartridge for a printer comprising:

   a supply bobbin;
   a take-up bobbin;
   an inked ribbon wound between said supply and take-up bobbins; and
   a cartridge casing supporting said supply and take-up bobbins rotatably, said cartridge casing having a first and a second outer wall which extend between lengths of said supply and take-up bobbins to define a groove between the first and second outer walls in which a printing head is disposed when the inked ribbon cartridge is loaded into the printer, the first and second outer walls also defining an opening across which a portion of the inked ribbon is stretched and through which the thermal head disposed within the groove faces the portion of the inked ribbon stretched across the opening.

5. An inked ribbon cartridge according to claim 4, wherein the first and second outer walls have flat surfaces, respectively, which extend in parallel to each other to define the groove therebetween, and

wherein the groove has an end opening oriented in a lengthwise direction of said supply and take-up bobbins for entry of the thermal head.

6. An inked ribbon cartridge according to claim 4, wherein the first and second outer walls have first and second edges which define the opening across which the inked ribbon is stretched between the first and second edges.

7. An inked ribbon cartridge according to claim 6, further comprising a protrusion formed on one of the first and second edges of the first and second outer walls closer to said take-up bobbin, said protrusion being brought into engagement with the thermal head when the inked ribbon cartridge is loaded into the printer.

8. An inked ribbon cartridge according to claim 4, further comprising an elastic plate attached to one of the first and second outer walls closer to said take-up bobbin, said elastic plate projecting from an edge of the one of the first and second outer walls to define along with an edge of the other of the first and second outer walls the opening across which the inked ribbon is stretched.

9. An inked ribbon cartridge according to claim 8, wherein said elastic plate is deformed inwardly of the groove by tension of the stretched inked ribbon.

10. A thermal transfer color printer comprising:

an inked ribbon including a series of different color blocks;
an inked ribbon winding mechanism that withdraws said inked ribbon from a supply bobbin and winds said inked ribbon to a take-up bobbin;
a first sensor that detects a leader of each of the different color blocks of said inked ribbon moved by said inked ribbon winding mechanism and provides a signal indicative thereof;
a record paper transport mechanism including a drive roller and a driven roller, the driven roller being urged against the drive roller to form a nip through which a sheet of record paper is transported to a printing station at a constant speed;
a second sensor that detects an end of the sheet of record paper being transported and provides a signal indicative thereof; and
a printing mechanism including a thermal head and a platen roller, the platen roller being urged against the thermal head through said inked ribbon and the sheet of record paper at the printing station to print a desired color image based on the signals from said first and second sensors;

wherein the driven roller extends parallel to the drive roller and is smaller in length than the drive roller so as to produce a mount space adjacent one end of the driven roller, and wherein at least one of the first and second sensors is disposed in the mount space.

11. A thermal transfer printer according to claim 10, wherein said first and second sensors are both disposed in the mount space.

12. A thermal transfer color printer comprising:

a printer casing;
a inked ribbon cartridge storage chamber defined in said printer casing for storing therein an inked ribbon cartridge in which an inked ribbon including a series of different color blocks is wound between a supply bobbin and a take-up bobbin;
a record paper storage chamber defined in said printer casing for storing therein a record paper cassette in which sheets of record paper are stacked;
a record paper transport mechanism including a drive roller and a driven roller, the driven roller being urged against the drive roller to form a nip through which one of the sheets of record paper is transported to a printing station;
a paper feeding roller that feeds the sheets of record paper stacked in the record paper cassette to said record paper transport mechanism; and
a printing mechanism disposed at the printing station, including a thermal head and a platen roller, the platen roller being urged against the thermal head through the inked ribbon and the sheet of record paper transported by said record paper transport mechanism to print a desired color image;

wherein the record paper cassette has formed in an end surface thereof a slit which allows only one of the sheets of record paper to pass therethrough toward said record paper transport mechanism.

13. A thermal transfer color printer comprising:

a printer casing;
a inked ribbon cartridge storage chamber defined in said printer casing for storing therein an inked ribbon cartridge in which an inked ribbon including a series of different color blocks is wound between a supply bobbin and a take-up bobbin;
a record paper storage chamber defined in said

printer casing for storing therein sheets of record paper;

a record paper transport mechanism including a drive roller and a driven roller, the driven roller being urged against the drive roller to form a nip through which one of the sheets of record paper is transported to a printing station;

a paper feeding roller that feeds the sheets of record paper stored in said record paper storage chamber to said record paper transport mechanism along a paper feed path;

a printing mechanism disposed at the printing station, including a thermal head and a platen roller, the platen roller being urged against the thermal head through the inked ribbon and the sheet of record paper transported by said record paper transport mechanism to print a desired color image;

a record paper loading opening formed in said printer casing communicating with said record paper storage chamber;

a record paper loading door closing said record paper loading opening;

an urging member that is installed on an inner surface of said record paper loading opening door to urge the sheets of record paper against said paper feeding roller; and

a slit member provided on the paper feed path downstream of said paper feeding roller, defining a slit between itself and a portion of the inner wall of said record paper loading door, the slit allowing only one of the sheets of record paper to pass therethrough toward said record paper transport mechanism.

14. A thermal transfer printer according to claim 13, wherein said paper feeding roller is exposed to the inside of said record paper storage chamber at a location shifted from a center of said record paper storage chamber in a widthwise direction of the sheets of record paper, and wherein said slit member is disposed adjacent said paper feeding roller.

FIG. 1

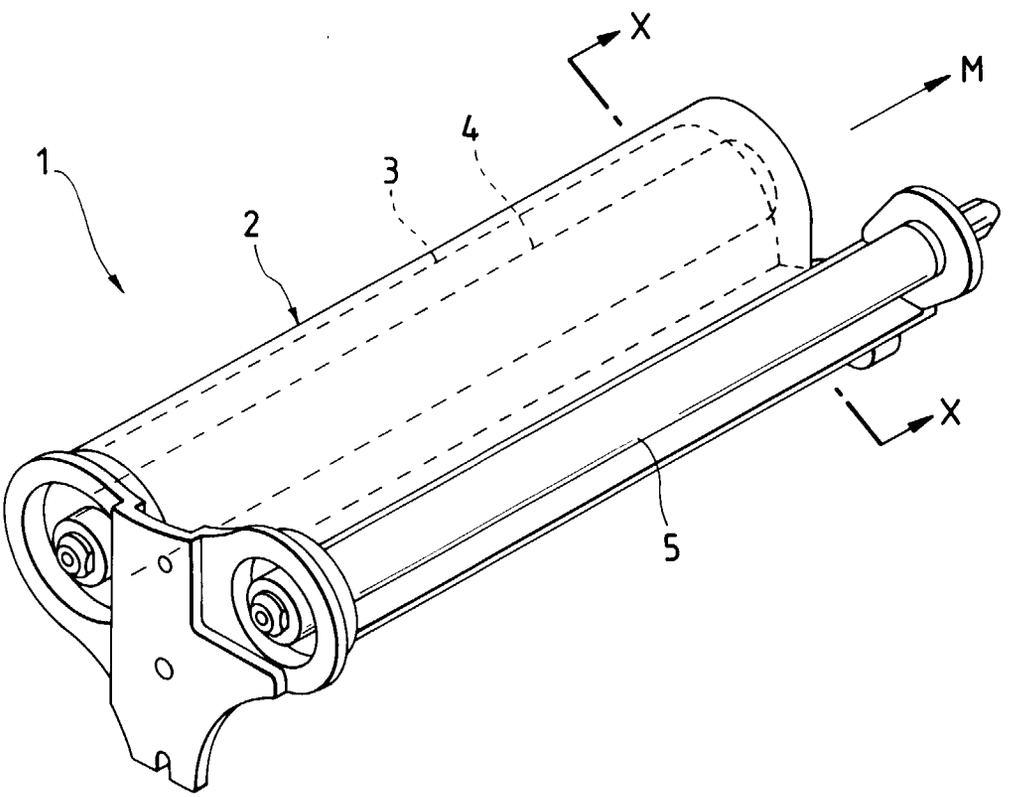
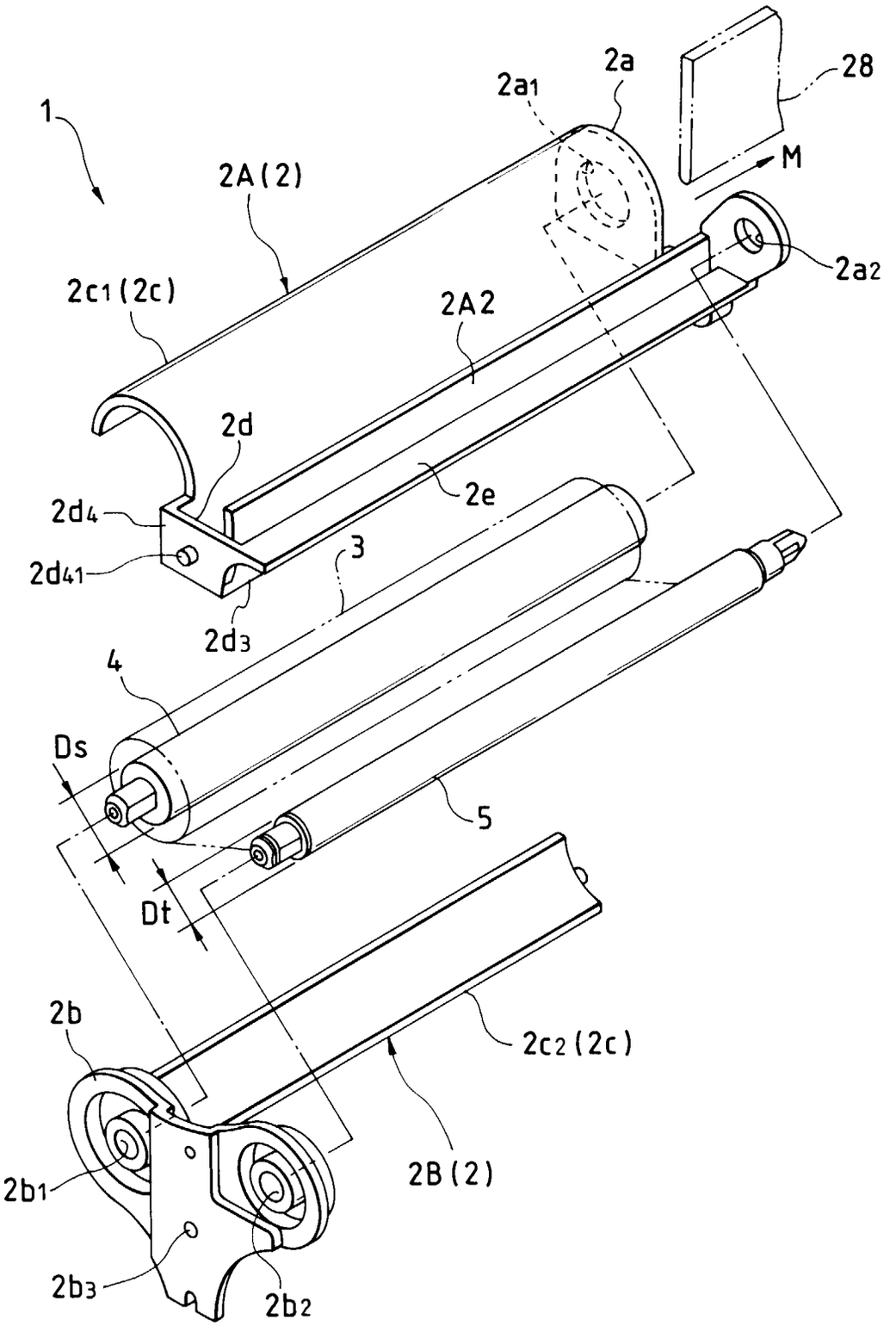


FIG. 2


1
2A(2)
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2a
28
M
2a2
2c1(2c)
2A2
2d
2d4
2d41
2d3
2e
3
4
Ds
5
Dt
2b
2c2(2c)
2B(2)
2b1
2b3
2b2

FIG. 3(a)

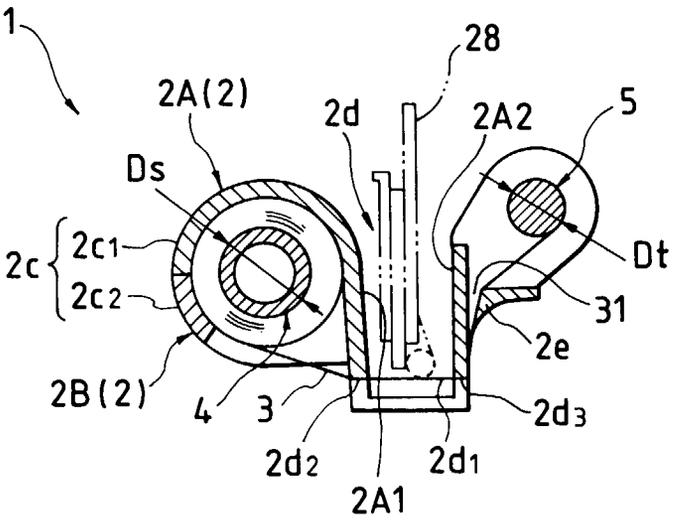


FIG. 3(b)

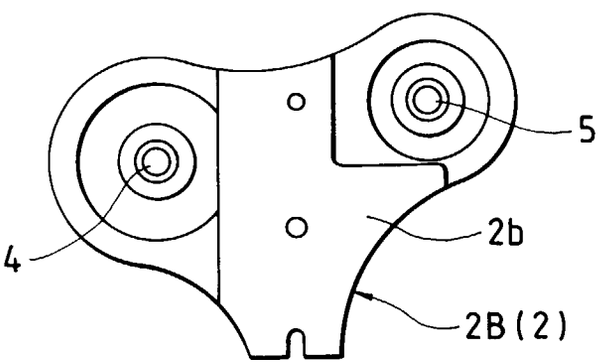


FIG. 3(c)

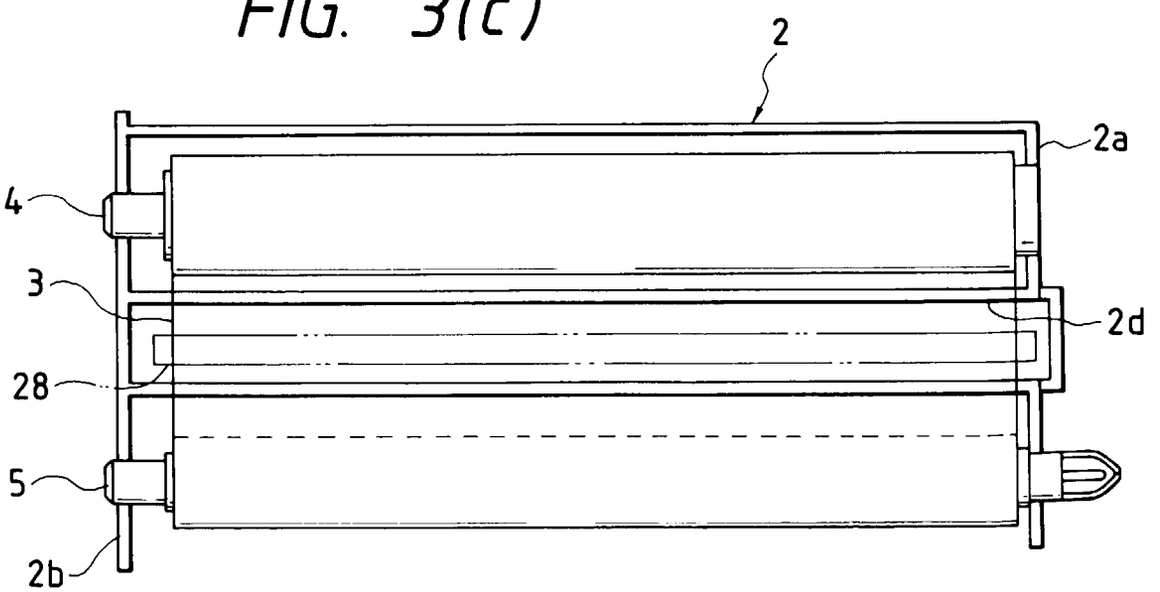


FIG. 4(a)

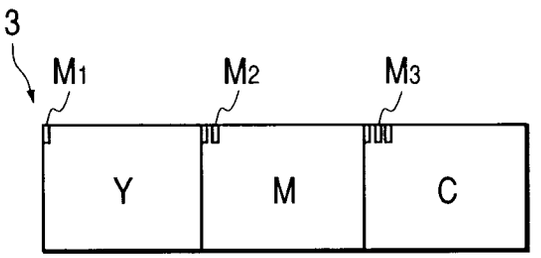


FIG. 4(b)

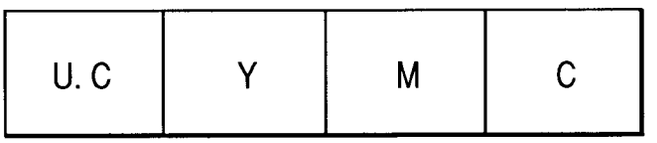


FIG. 4(c)

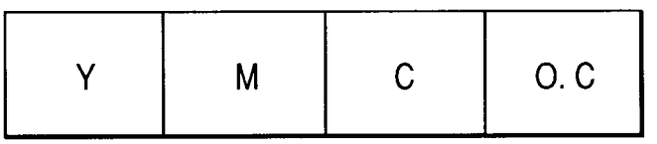


FIG. 4(d)

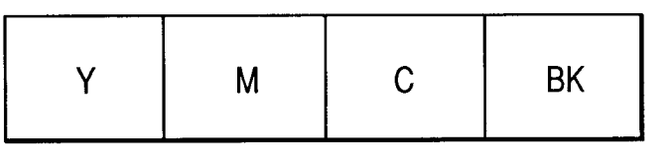


FIG. 4(e)

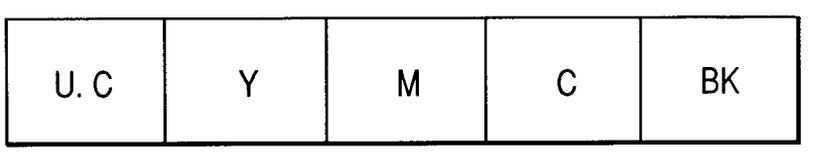


FIG. 4(f)

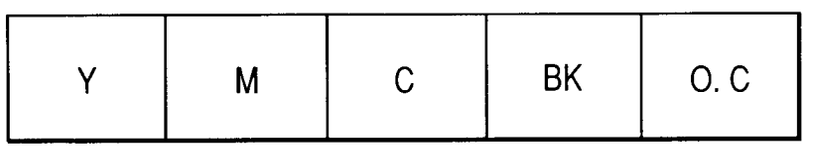


FIG. 5

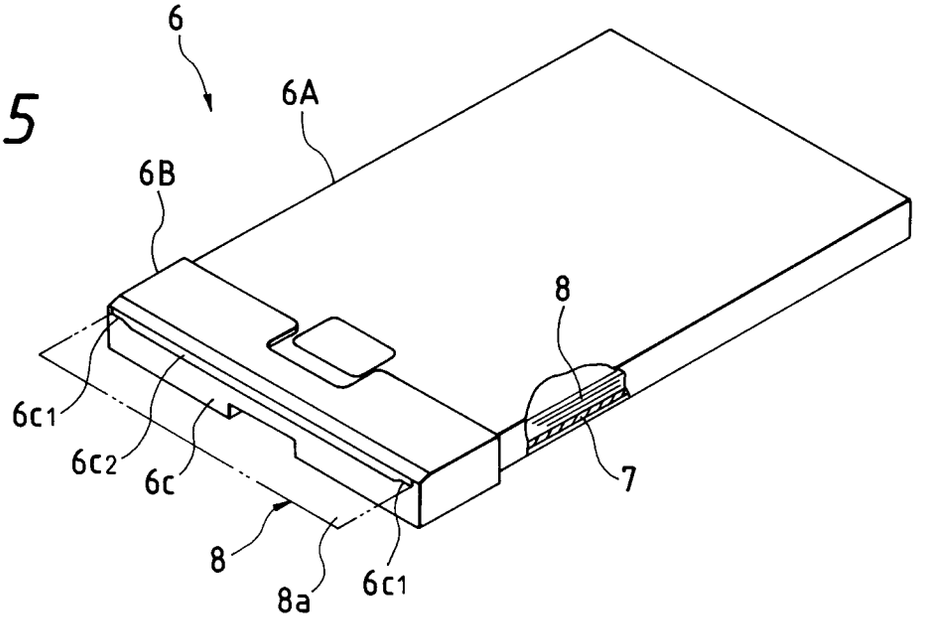

6
6A
6B
8
6c1
6c2
6c
7
8
8a
6c1

FIG. 6

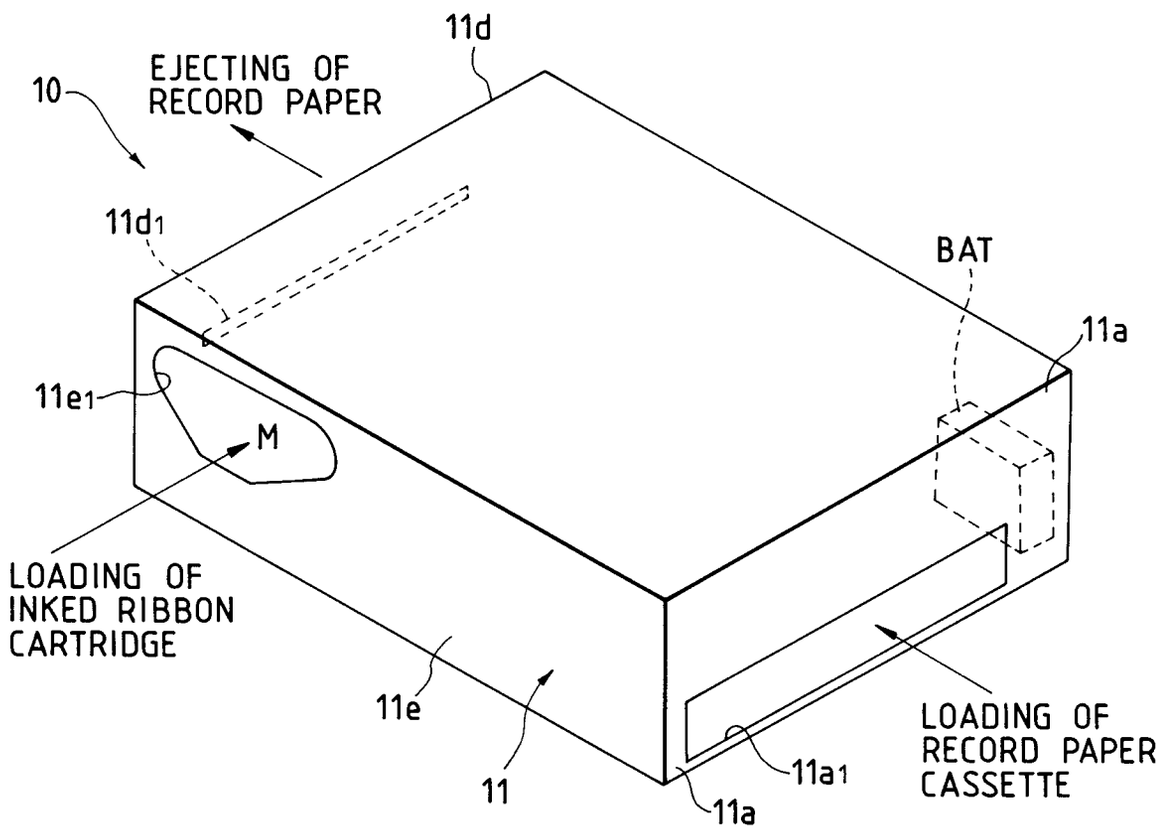

11d
EJECTING OF
RECORD PAPER
10
11d1
BAT
11a
11e1
M
LOADING OF
INKED RIBBON
CARTRIDGE
11e
11
11a1
11a
LOADING OF
RECORD PAPER
CASSETTE

FIG. 7

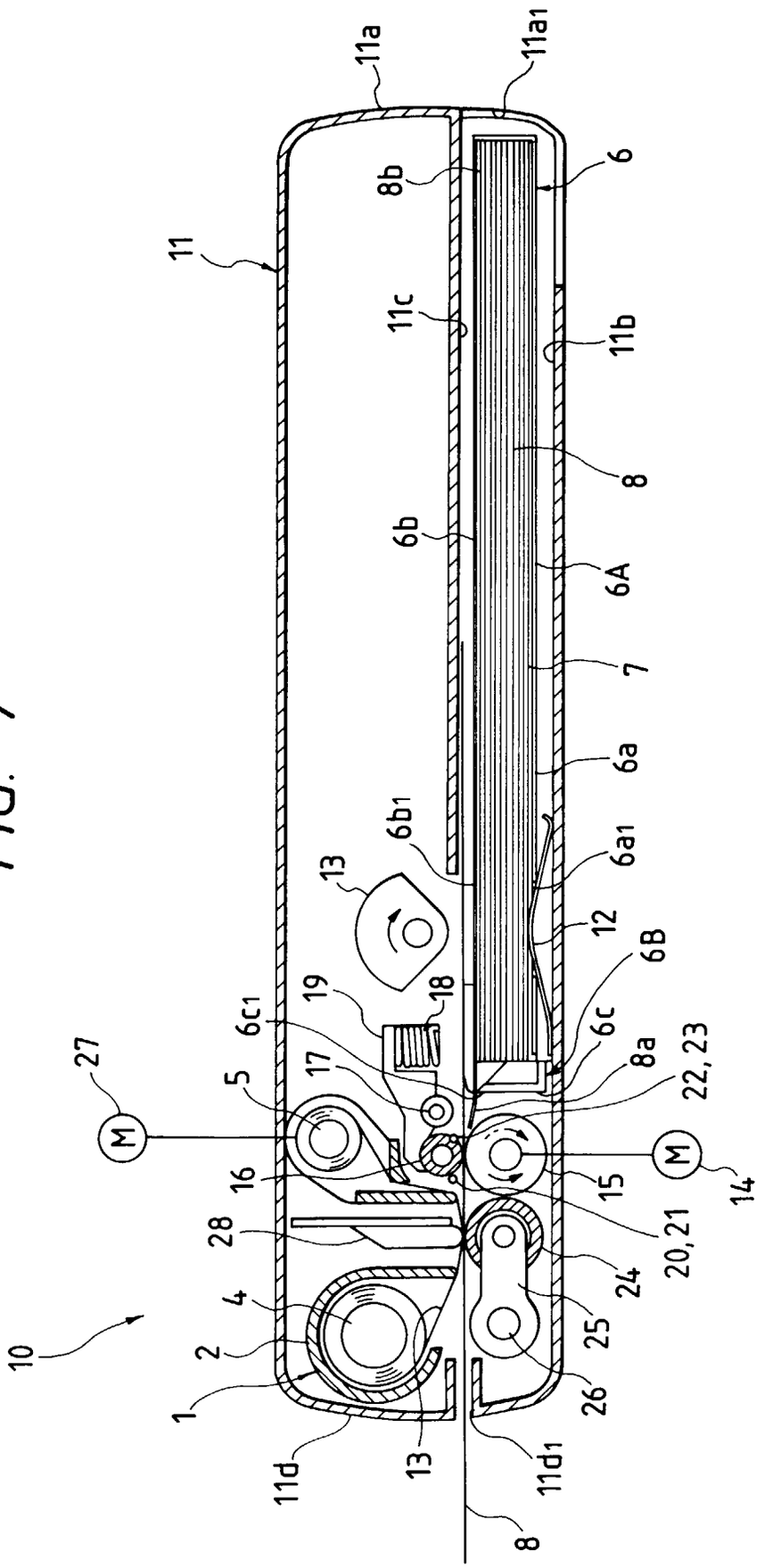
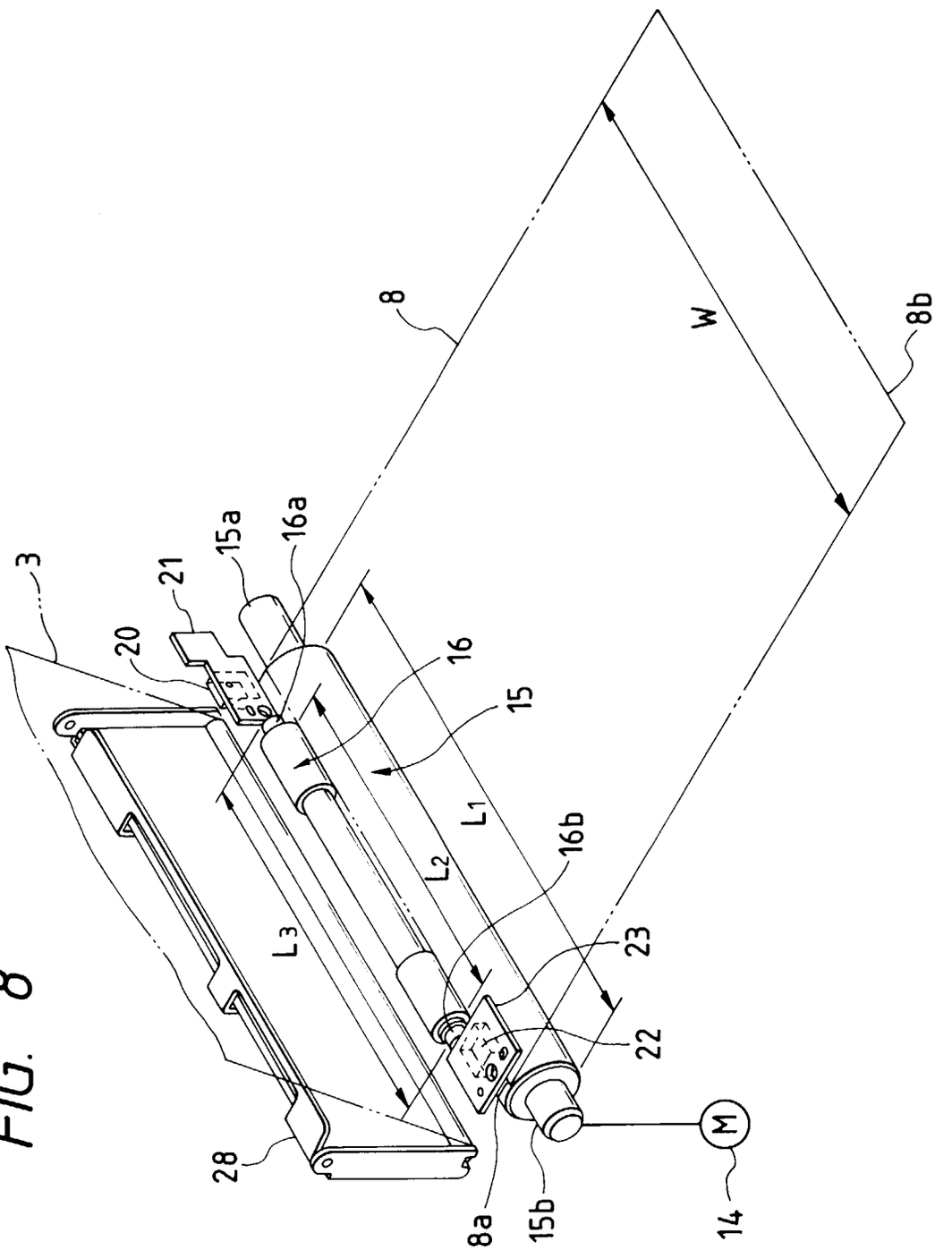

11a
11a1
8b
6
11
11c
11b
8
6b
6A
7
6a
6b1
6a1
13
12
6B
19
18
6c1
6c
8a
22, 23
27
M
5
17
16
15
M
14
28
20, 21
4
24
25
10
2
26
1
11d
13
11d1
8

FIG. 8



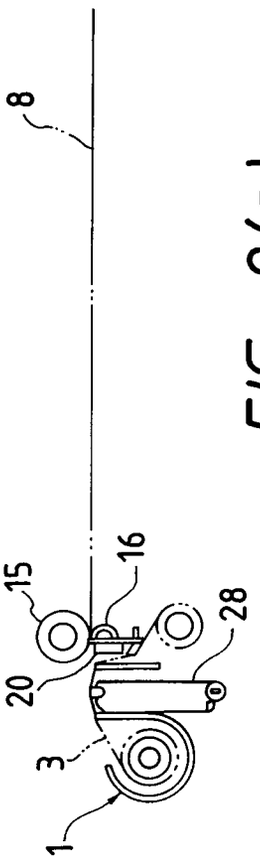


FIG. 9(a)

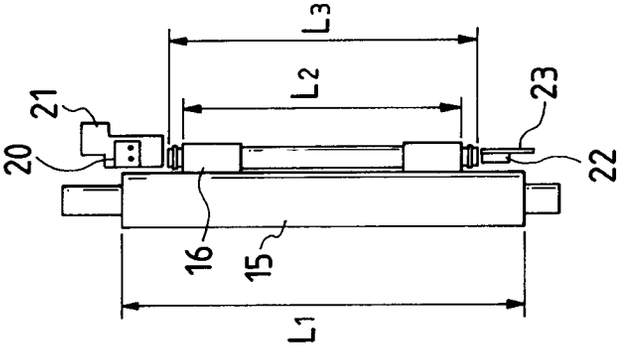


FIG. 9(b)

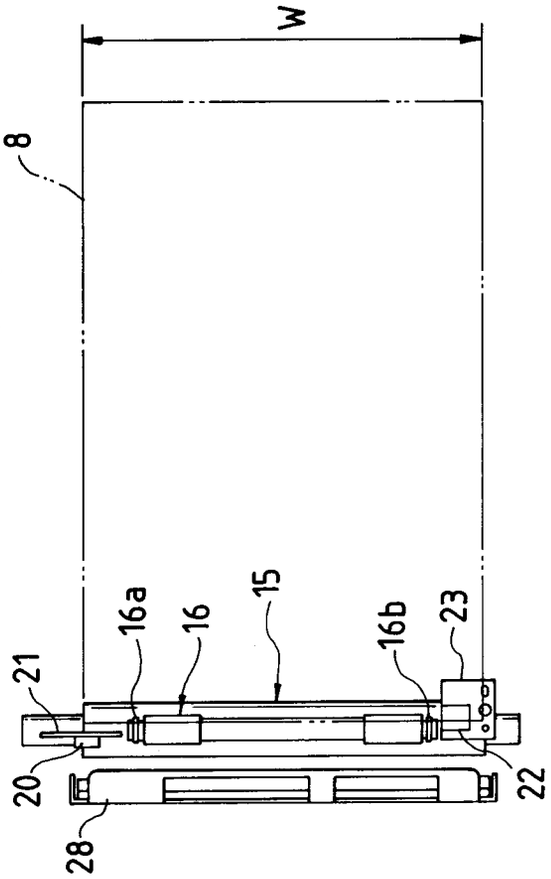


FIG. 9(c)

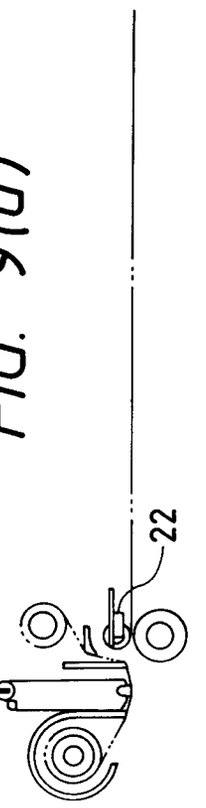


FIG. 9(d)

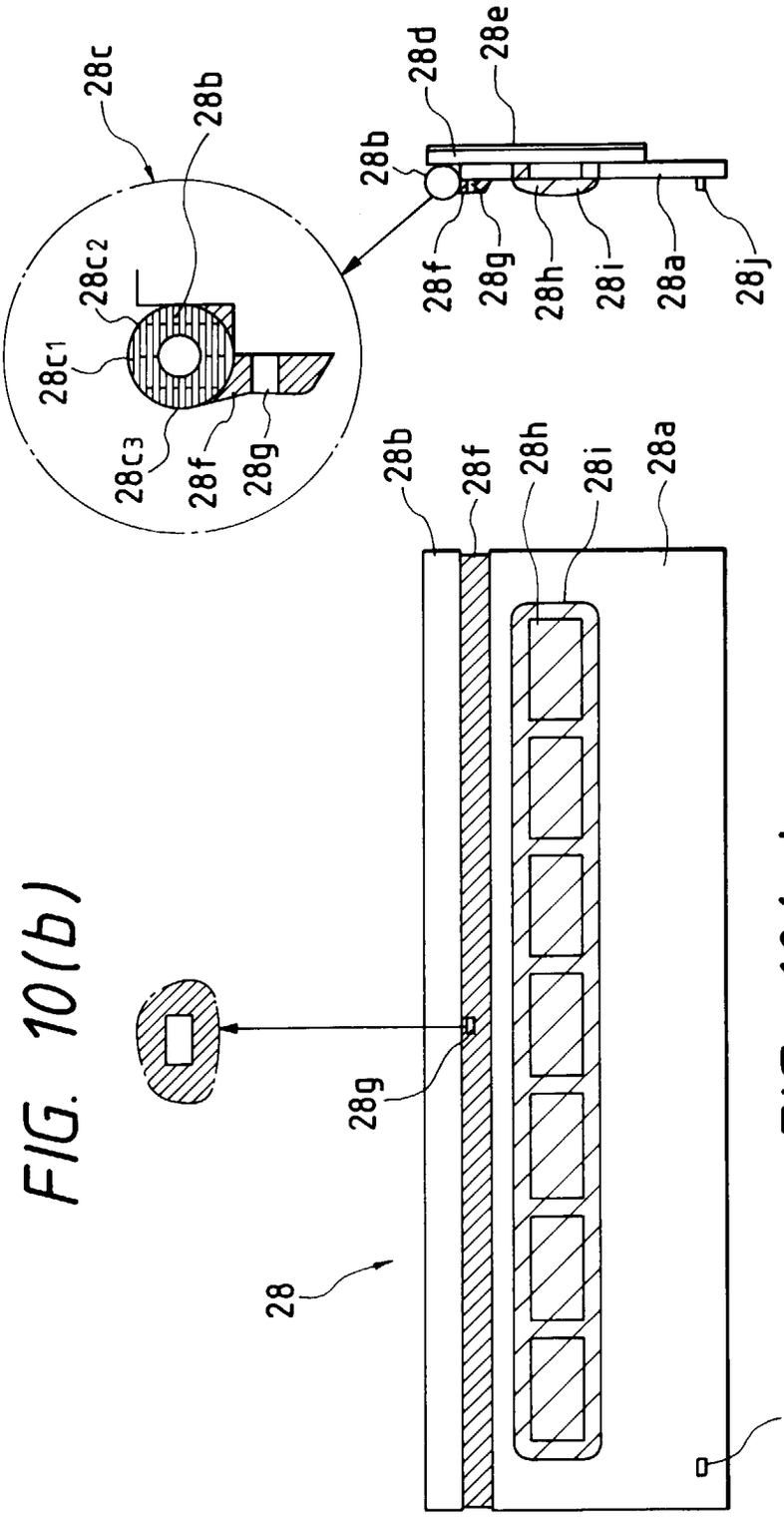


FIG. 10(c)

FIG. 10(d)

FIG. 10(b)

FIG. 10(a)

FIG. 11

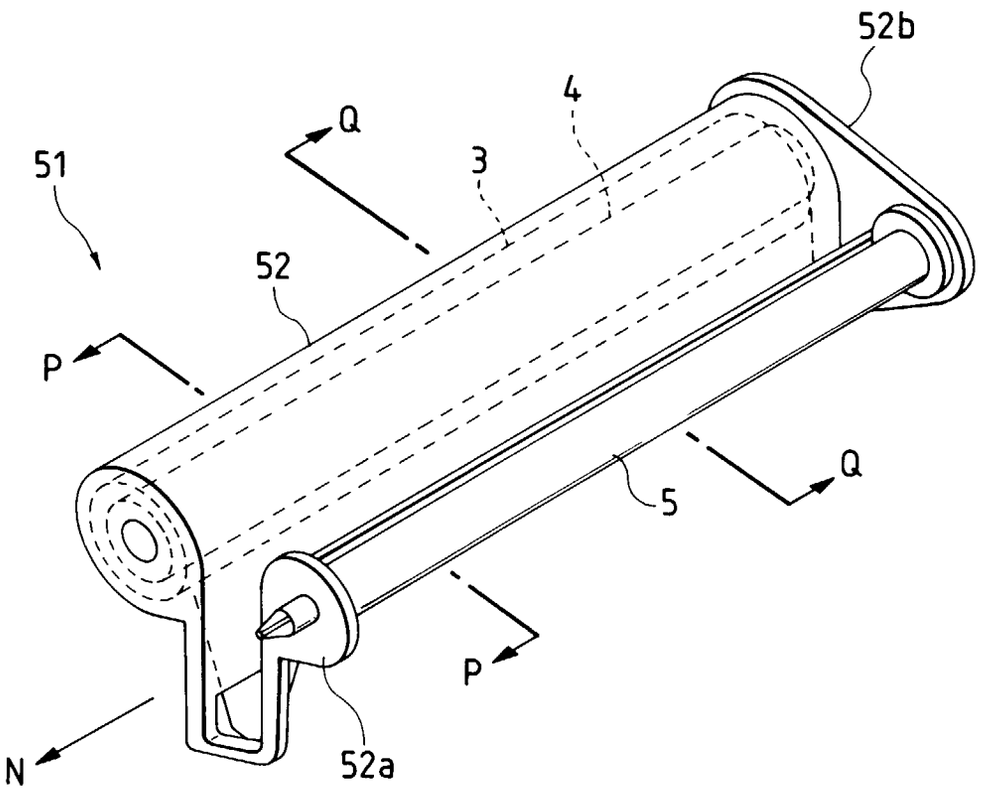


FIG. 12(a)

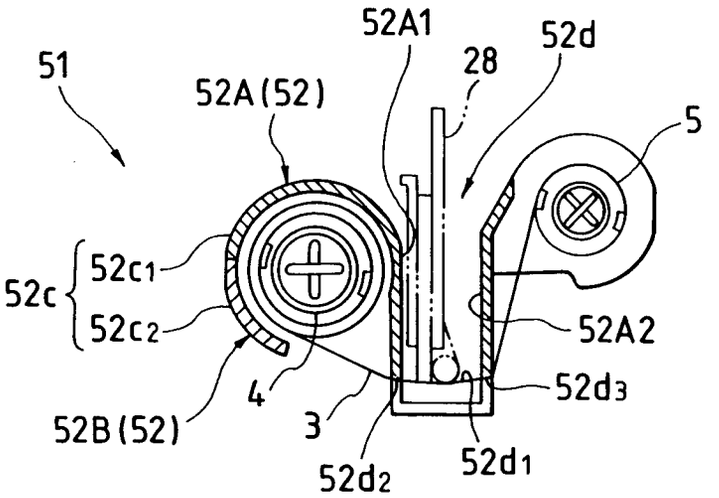


FIG. 12(b)

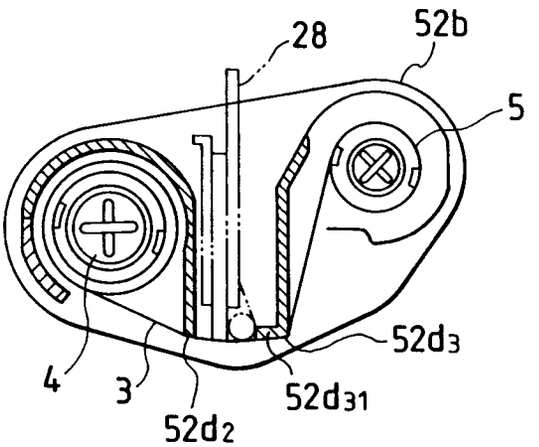


FIG. 12(c)

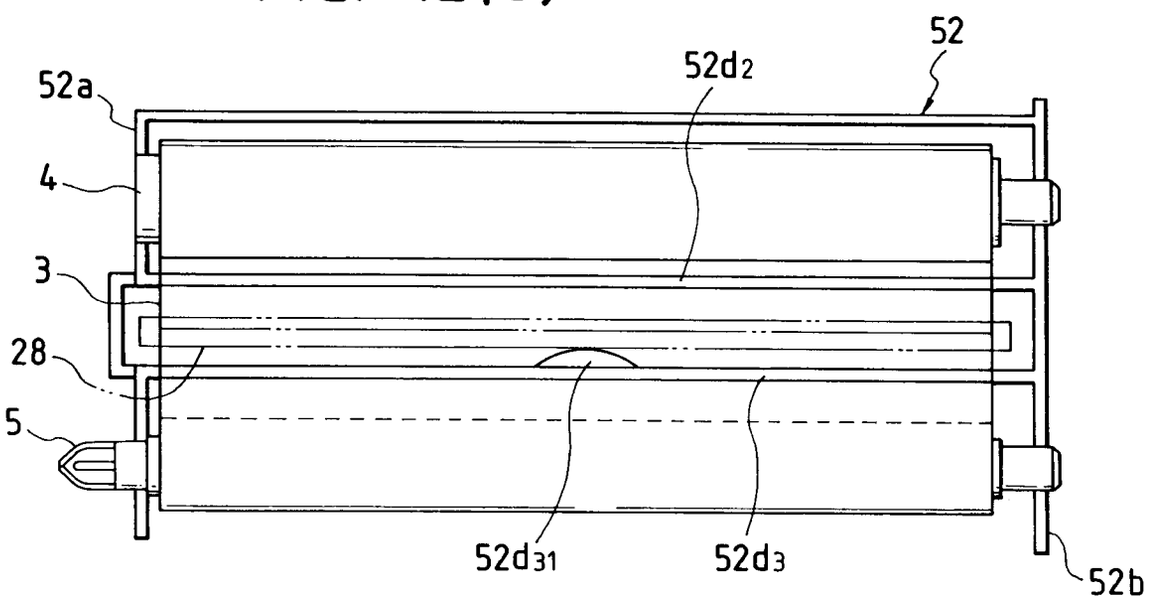


FIG. 13(a)

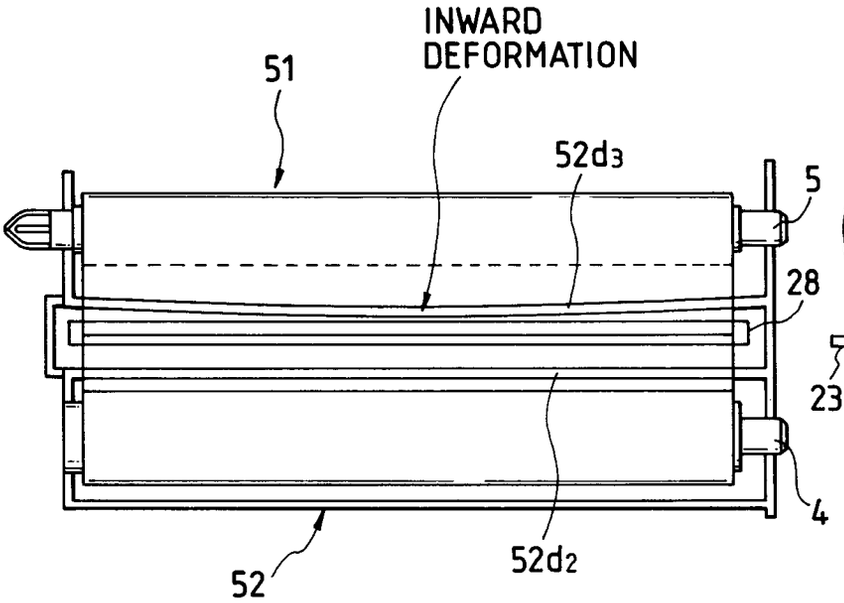


FIG. 13(b)

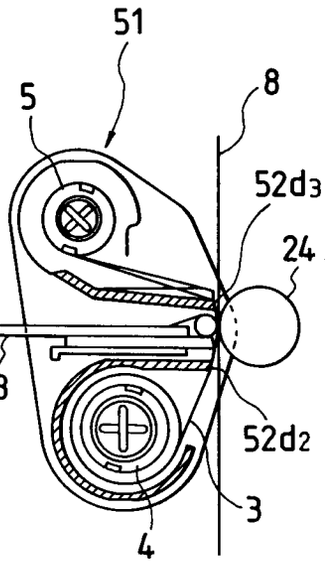


FIG. 13(c)

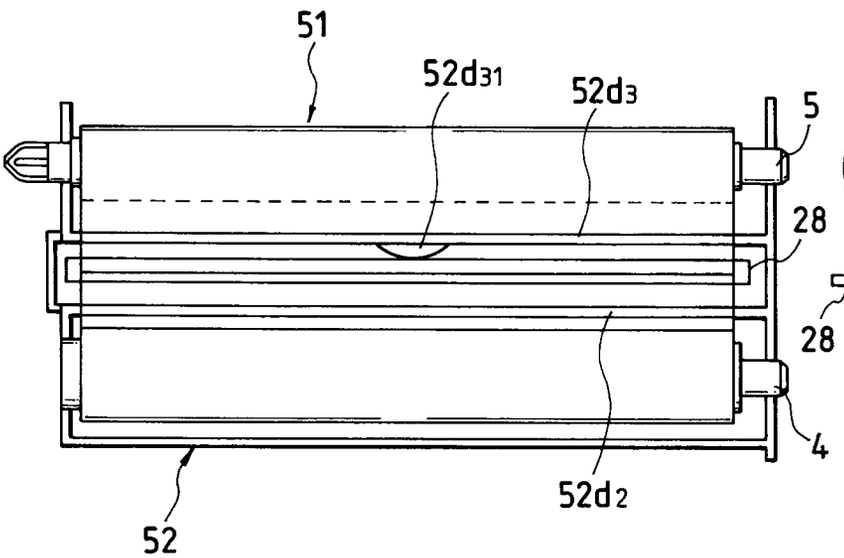


FIG. 13(d)

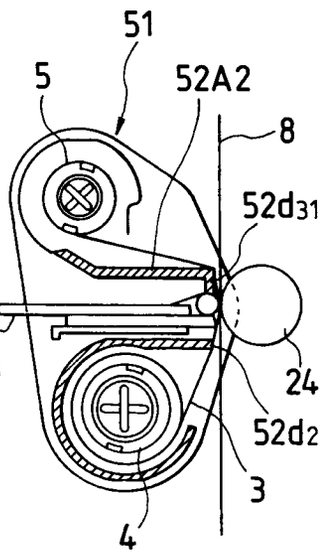


FIG. 14(a)

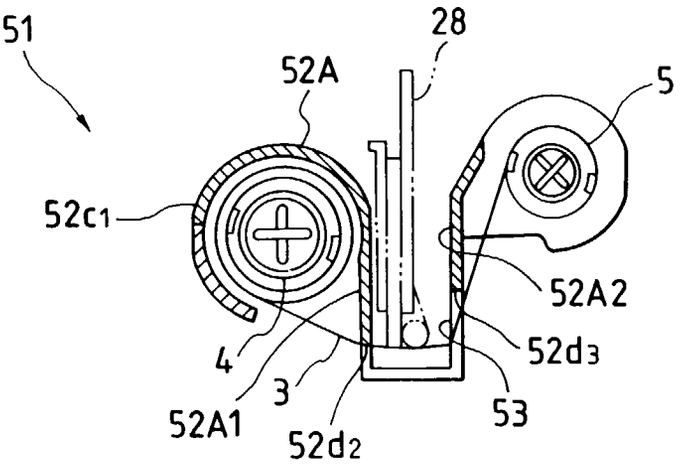


FIG. 14(b)

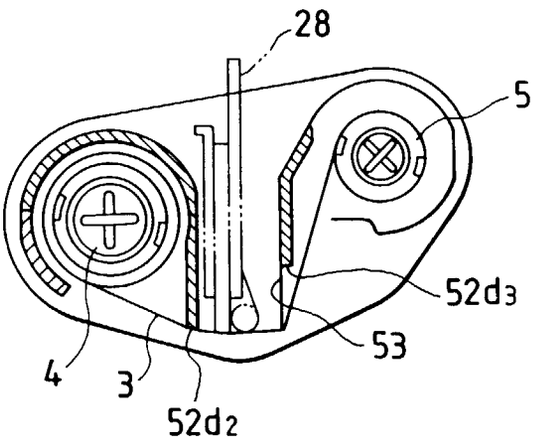


FIG. 14(c)

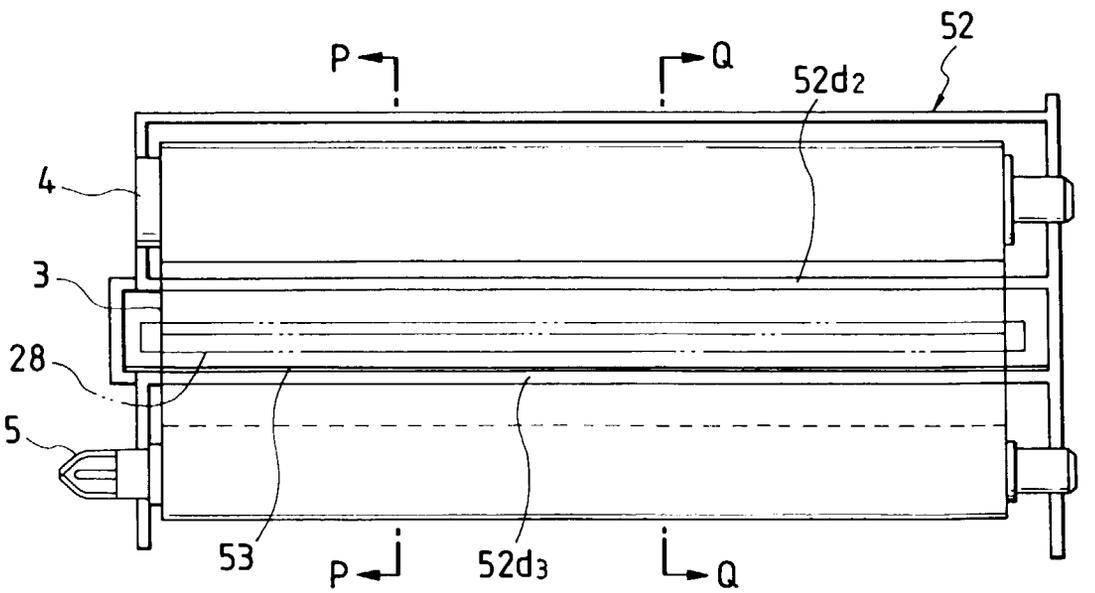


FIG. 15

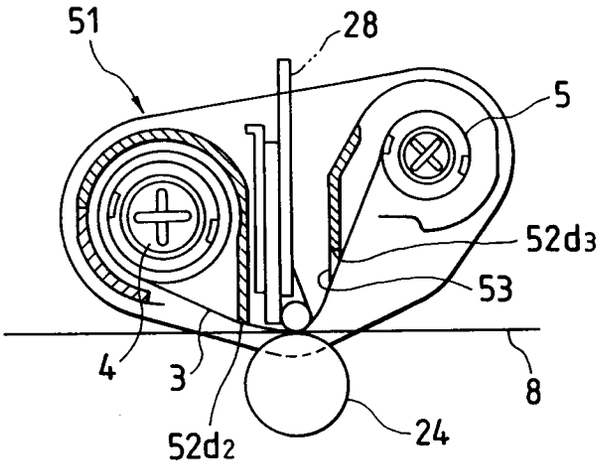

51
28
5
52d3
53
4
3
8
52d2
24

FIG. 16

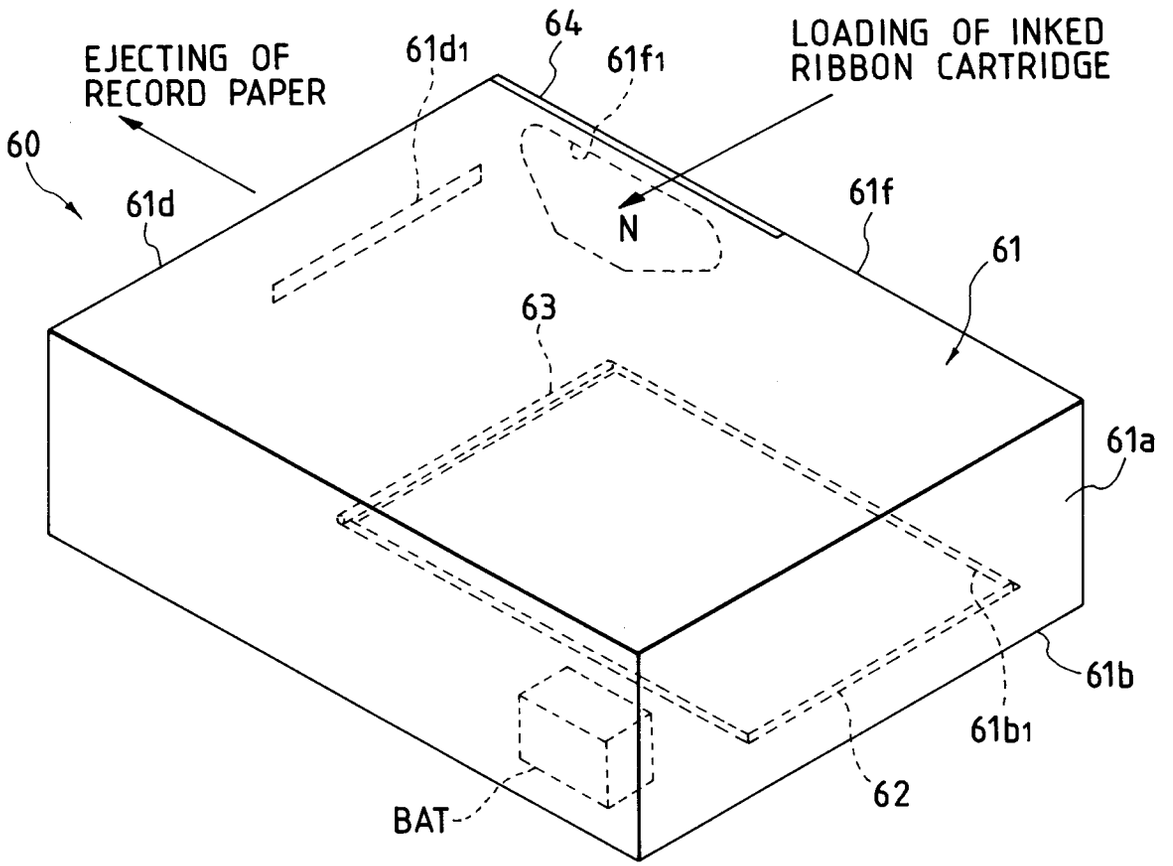

EJECTING OF
RECORD PAPER
61d1
64
61f1
LOADING OF INKED
RIBBON CARTRIDGE
60
61d
N
61f
61
63
61a
61b
61b1
62
BAT

FIG. 17(a)

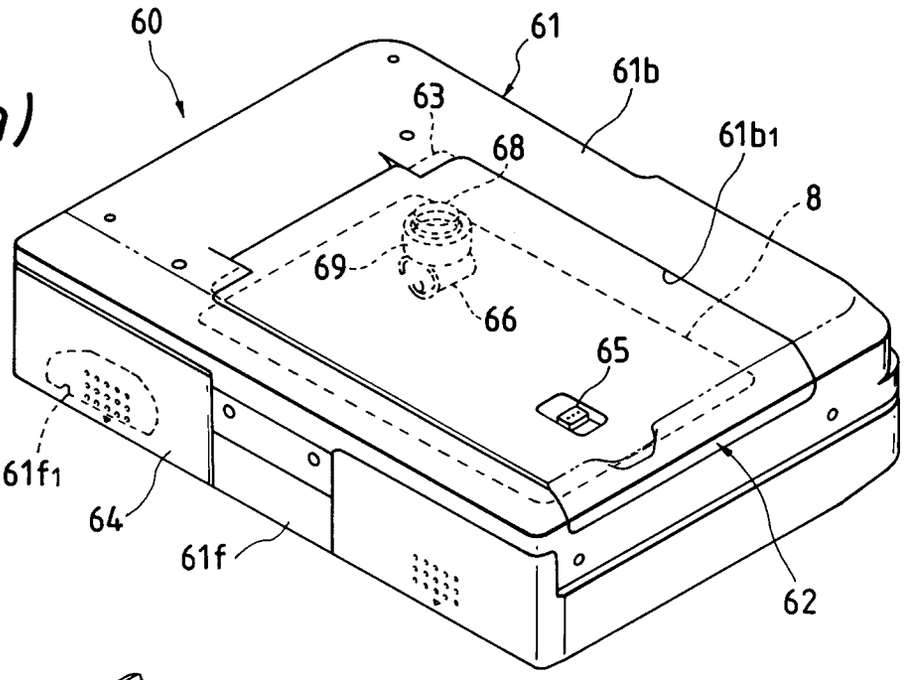


FIG. 17(b)

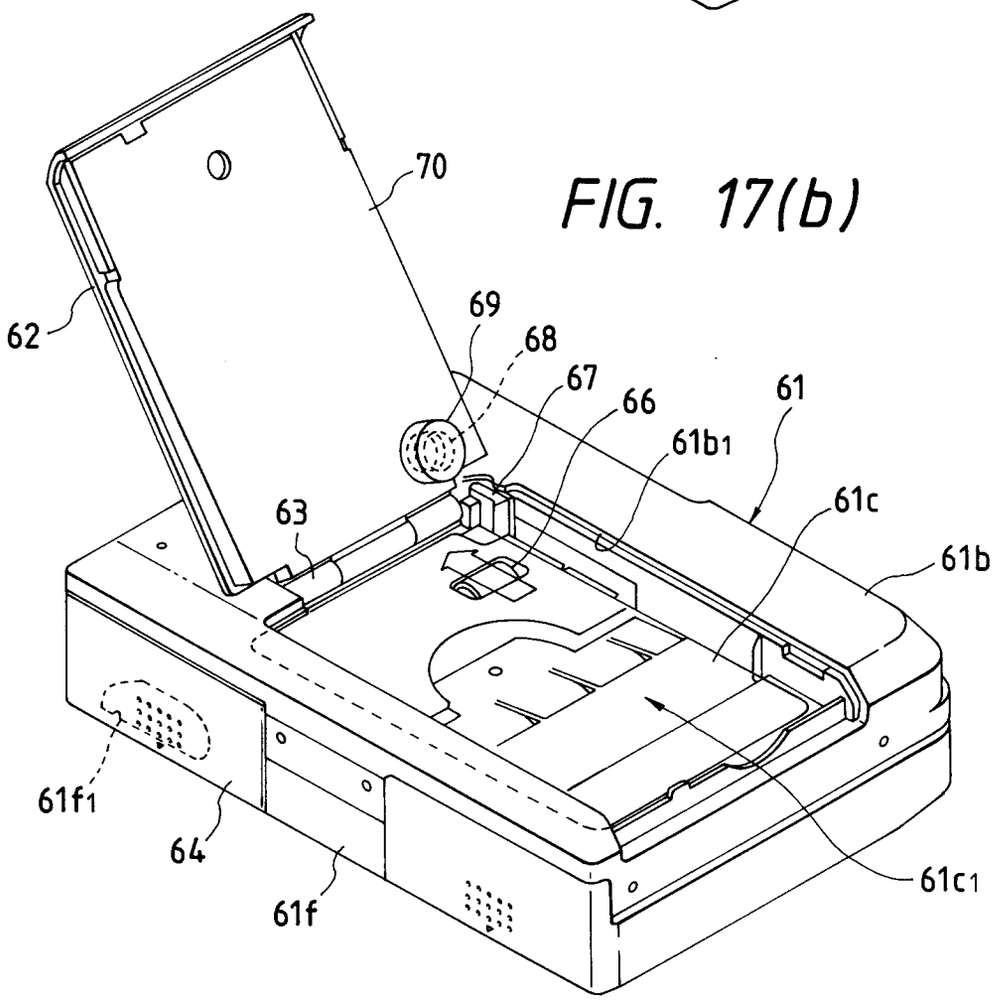


FIG. 18(a)

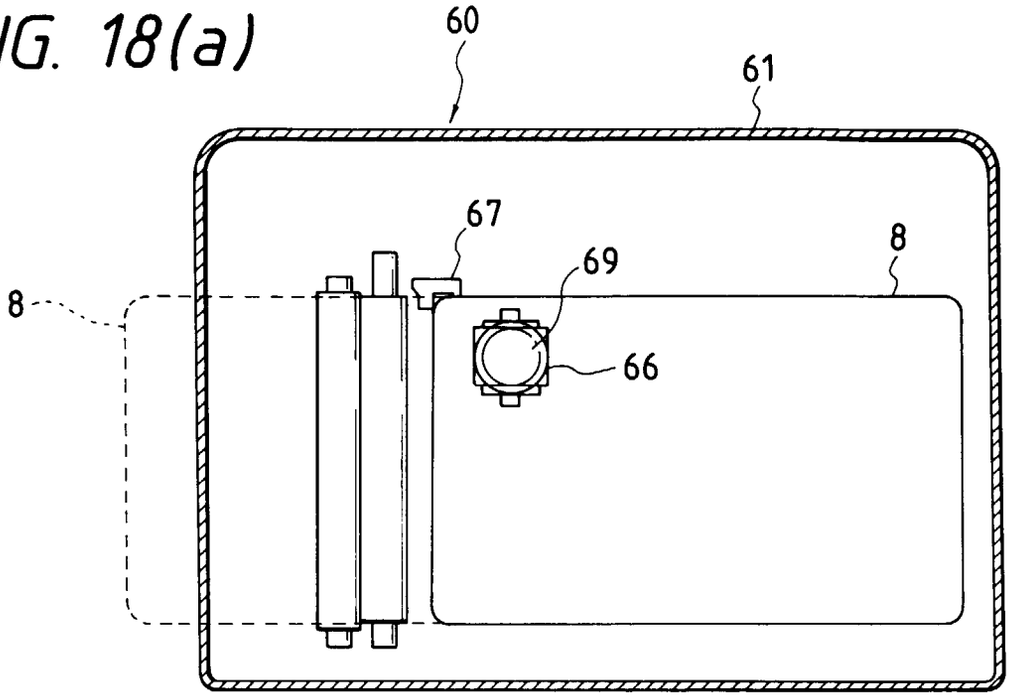


FIG. 18(b)

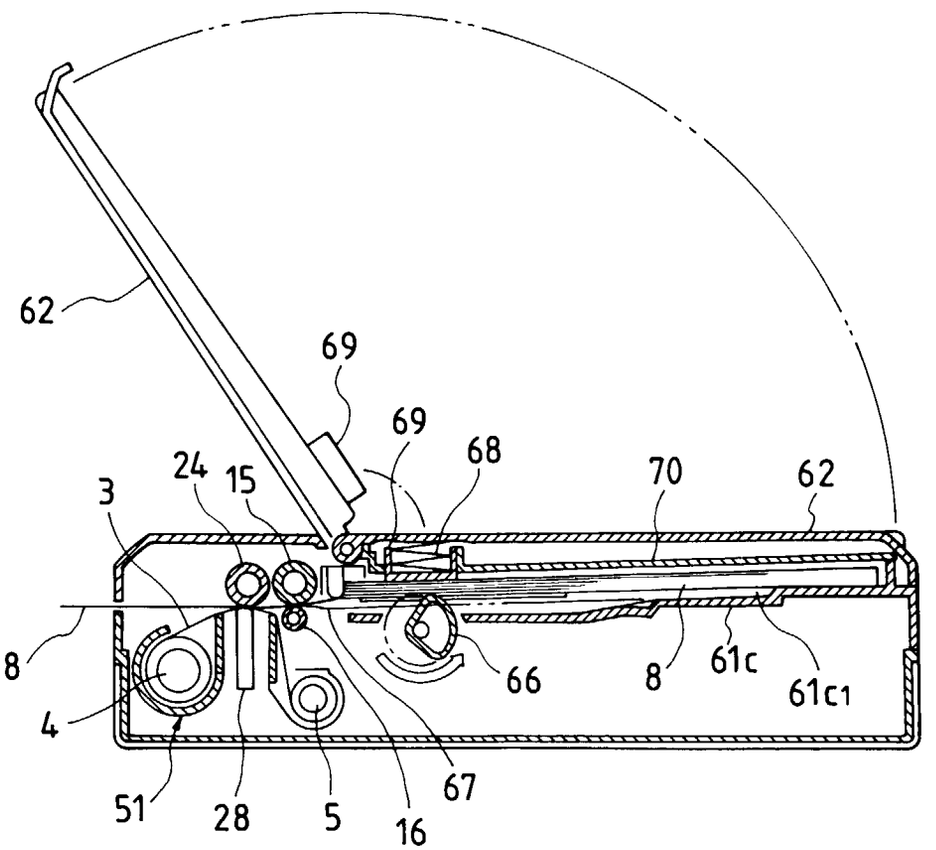


FIG. 19

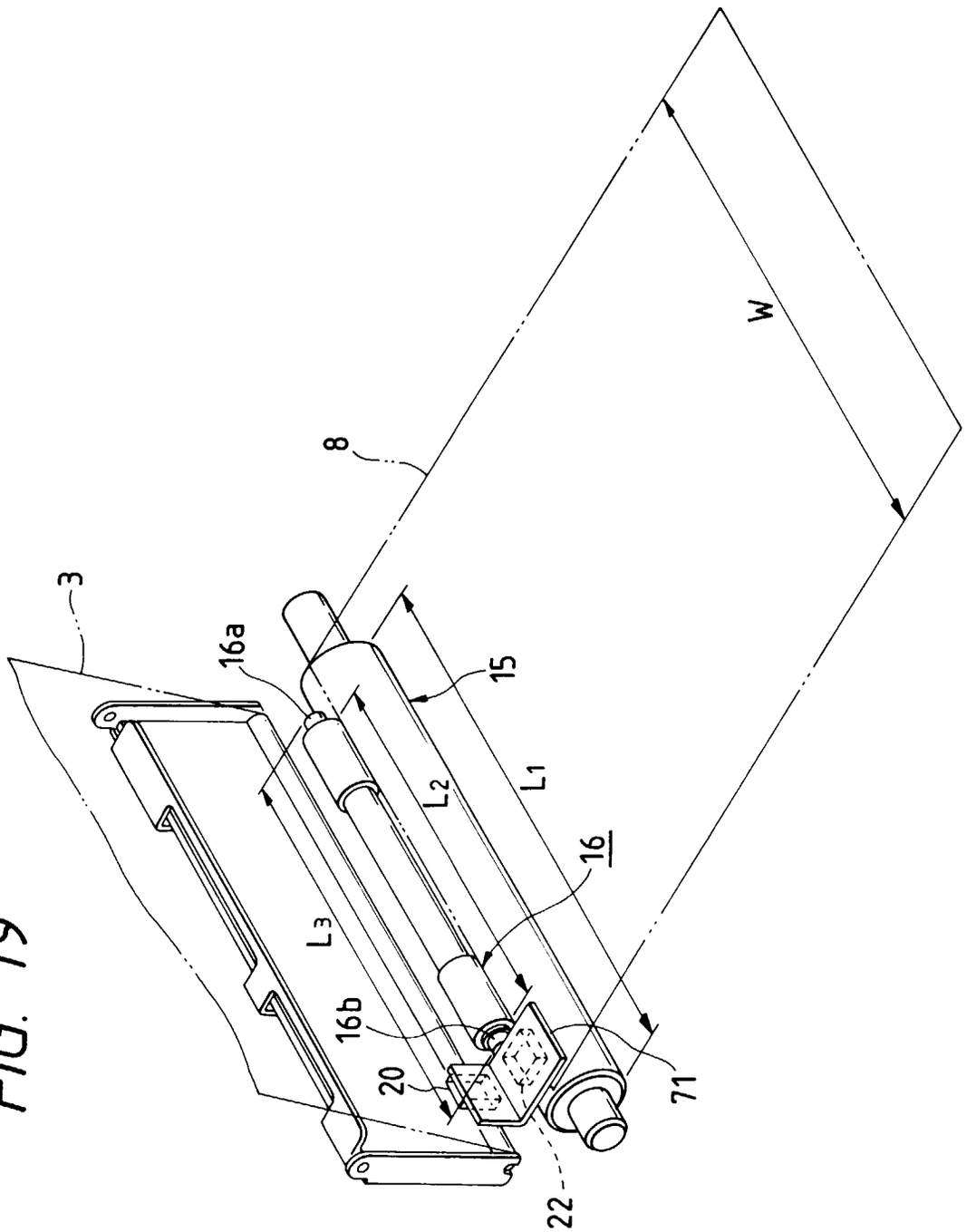


FIG. 20(b)

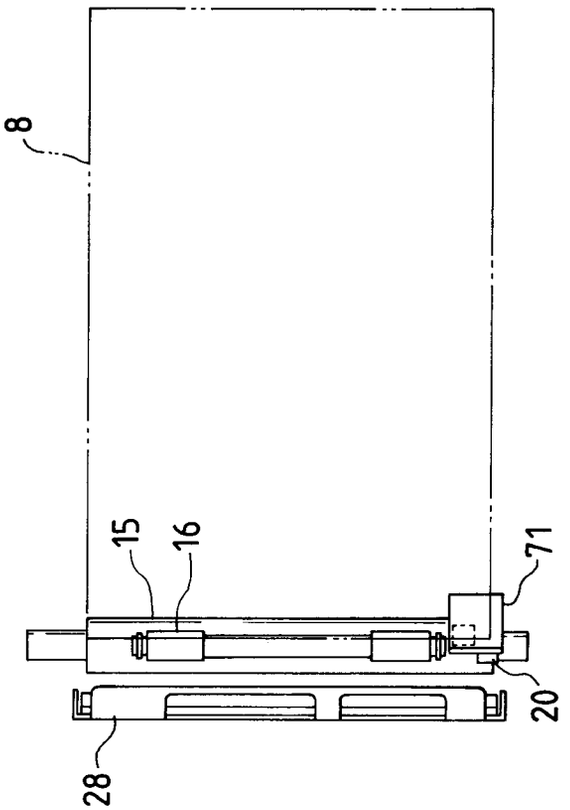


FIG. 20(c)

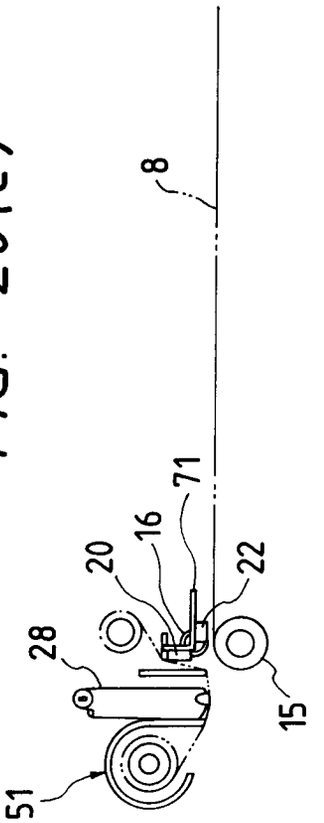


FIG. 20(a)

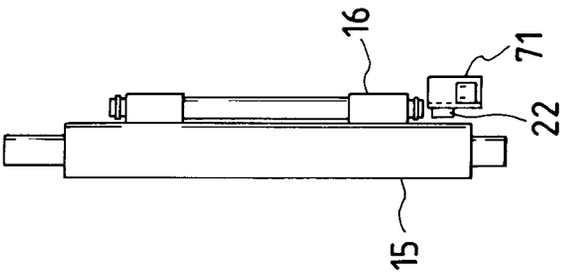


FIG. 21
PRIOR ART