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(54) Ink ribbon cassette for a printer.

(57) A thermal transfer printer including a platen, (1,2) a carriage (5) supported for movement lengthwise of the platen, a ribbon cassette (7) removably mounted on to the carriage (5), an inked ribbon (16) held in the ribbon cassette (7) and wound at opposite end portions thereof on two ribbon cores (26, 40), and a thermal head (15) supported by the carriage (5) to force the inked ribbon (16) against a sheet of paper on the platen (14). The inked ribbon has an upper printing zone and a lower printing zone disposed in superposed relation one above the other in a direction perpendicular to the direction in which the inked ribbon is moved. The ribbon cassette (7) is turned over after one of the upper and lower printing zones has been used to perform printing of characters, symbols, etc., and mounted to the carriage again to continue the printing by using the other printing zone. The ribbon cassette is provided with a back tension imparting mechanism (33) located between the thermal head (16) and the ribbon core toward which the inked ribbon moves, to apply the predetermined brake to the inked ribbon during its travel.

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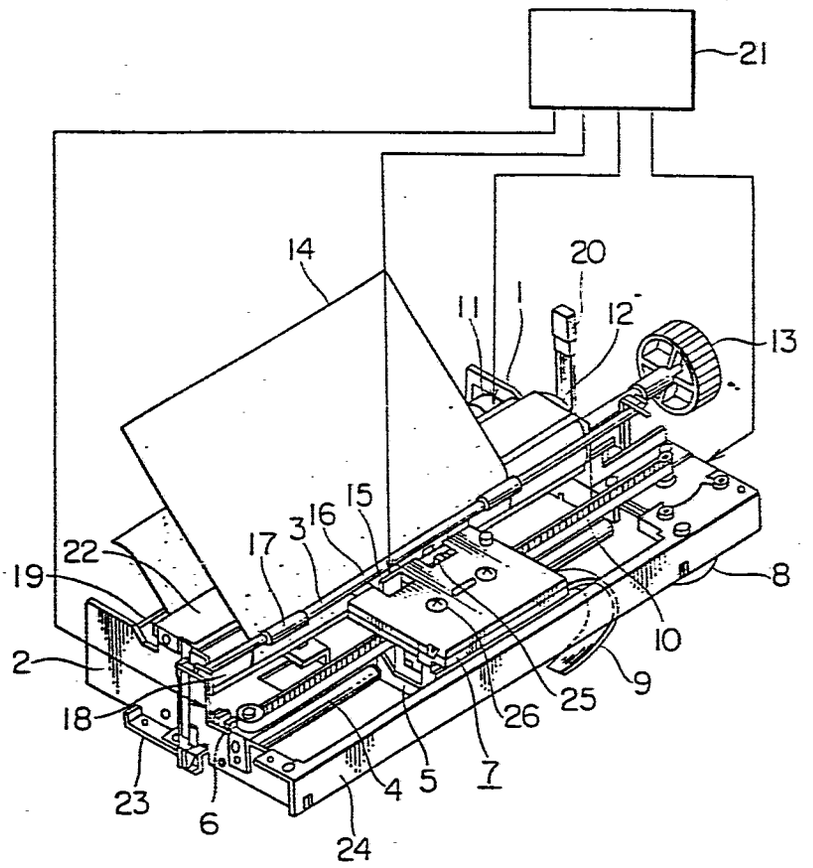
FIG. 1



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PRINTER

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

This invention relates to thermal transfer printers, and more particularly it is concerned with a thermal transfer printer equipped with an improved ribbon cassette that holds an inked ribbon suitable for use with a thermal transfer printer.

DESCRIPTION OF THE PRIOR ART

It has hitherto been usual practice to use with thermal transfer printers inked ribbons of the type that can be used only once, because the ink of the inked ribbon is transferred to a sheet of paper to form characters, symbols, etc., thereon by thermal transfer printing. The inked ribbon once used is not fit for reuse. Thus, the use of conventional inked ribbons has made the thermal transfer printer uneconomical to use because of its high running cost.

SUMMARY OF THE INVENTION

OBJECT OF THE INVENTION

This invention has as its object the privision of a thermal transfer printer equipped with an improved ribbon cassette that holds an inked ribbon of low running cost and high stability in movement during operations.

SUMMARY OF THE INVENTION

The outstanding characteristics of the invention enabling the aforesaid object to be accomplished are that the ribbon cassette holds therein an inked ribbon having two printing zones or an upper printing zone and a lower printing zone disposed in superposed relation one above the other in a direction perpendicular to the direction in which printing is performed and each having a width large enough to accommodate one line of printed characters, symbols, etc., and that the ribbon cassette is provided with back tension imparting means for imparting a predetermined back tension to the inked ribbon to apply the brake thereto during its movement.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of the thermal transfer printer comprising one embodiment of the invention;

Fig. 2 is an exploded perspective view, on an enlarged scale, of one constructional form of the ribbon cassette of the thermal transfer printer shown in Fig. 1;

Fig. 3 is a top plan view of the ribbon cassette shown in Fig. 2, showing its interior;

Fig. 4 is an exploded perspective view, on an enlarged scale, of another constructional form of the ribbon cassette shown in Fig. 2;

Fig. 5 is a top plan view of the ribbon cassette shown in Fig. 4, showing its interior;

Fig. 6 is an exploded perspective view, on an enlarged scale, of still another constructional form of the ribbon cassette shown in Fig. 2; and

Fig. 7 is a top plan view of the ribbon cassette shown in Fig. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Various constructional forms of the ribbon cassette of the thermal transfer printer comprising a preferred embodiment of the invention will now be described by referring to the accompanying drawings.

Fig. 1 shows in a perspective view the preferred embodiment of the thermal transfer printer in conformity with the invention, and Figs. 2 and 3 show one constructional form of the ribbon cassette of the thermal transfer printer shown in Fig. 1, Fig. 2 being an exploded perspective view, on an enlarged scale, of the ribbon cassette and Fig. 3 being a top plan view of the ribbon cassette, showing its interior.

Referring to Fig. 1, the thermal transfer printer comprises a pair of side plates 1 and 2, a plurality of shafts 3 and 4, a carriage 5, a home position sensor 6, a ribbon cassette 7, a carriage motor 8, a flat cable 9, a timing belt 10, a line feed motor 11, a gear 12, a platen knob 13, a thermal head 15, an inked ribbon 16, a plurality of sheet keep rollers 17, a platen 18 on which a sheet of paper 14 is wound, a sheet guide 19, a release lever 20, a controller 21, a cover 22, a rear stay 23, a front stay

24, a ribbon sensor 25 and a take-up shaft 26.

More specifically, the shaft 4 is secured at opposite ends thereof to the side plates 1 and 2 for supporting thereon the carriage 5 for sliding movement. Mounted on the carriage 5 are the ribbon cassette 7 holding the inked ribbon 16 therein, and the thermal head 15.

The carriage 5 is driven by the carriage motor 8 through the timing belt 10 to move rightwardly and leftwardly in the figure.

The line feed motor 11 is operative to transmit a motive force to the gear 12 which is secured to a shaft of the platen 18 to feed the sheet of paper 14. The sheet of paper 14 can also be fed manually as the platen knob 13 is turned by hand. The sheet of paper 14 is guided by the sheet guide 19 as it is fed mechanically or manually.

As the release lever 20 is moved forwardly and backwardly, the sheet keep rollers 17 supported by the shaft 3 for sliding movement can be brought into and out of pressing contact with the surface of the sheet of paper 14.

The flat cable 9 performs the function of passing an electric current therethrough to the thermal head 15 and the other electric components.

The printer of the aforesaid construction is of a one-way printing type. More specifically, it performs printing only when the carriage 5 moves rightwardly, so that the inked ribbon 16 is taken up only when it moves rightwardly and not taken up when it moves leftwardly.

The carriage motor 8, line feed motor 11, home position sensor 6 and thermal head 15 and so forth are controlled by the controller 21.

The ribbon cassette 7 will now be described by referring to Fig. 2. As shown, the ribbon cassette 7 comprises an upper cassette case 31 and a lower cassette case 34 secured together by screws 30 and 32 to provide a hollow case in which are mounted the inked ribbon 16 and a constant tension imparting means or mechanism 33 for imparting a predetermined back tension to the inked ribbon 16. The upper cassette case 31 and lower cassette case 34 are each formed with cutouts 37A and 37B for alternately receiving the thermal head 15 supported by the carriage 5. Two ribbon cores 39 and 40 having opposite ends of the inked ribbon 16 connected thereto support the latter in the cassette case 7.

The constant tension imparting means 33 comprises friction members 35 and 36 formed of felt or like material, and a plate spring 38 for imparting a predetermined back tension to the inked ribbon 16. The details of the constant tension imparting means 33 is subsequently to be described.

Fig. 3 shows the interior of the ribbon cassette 7 as viewed from above by removing the upper cassette case 31.

The operation of taking up the inked ribbon 16 will be described by referring to Figs. 2 and 3.

In the thermal transfer printer having the

ribbon cassette 7 of the construction described hereinabove, the thermal head 15 is positioned such that a heat generating element section, not shown, thereof is operative to use only the upper printing zone of the inked ribbon 16 for performing thermal transfer printing, and the ribbon cassette 7 is mounted on the carriage 5 such that the lower cassette case 34 is brought into contact with a top surface of the carriage 5. This causes the thermal head 15 inserted in the cutout 37A of the ribbon cassette 7 to force the inked ribbon 16 against the sheet of paper 14, and the inked ribbon 16 is moved toward the ribbon core 39 as the carriage 5 is driven by the carriage motor 8.

That is, as the ribbon cassette 7 moves with the carriage 5 as a unit, the inked ribbon 16 wound on the ribbon core 40 which is not used yet is threaded through the constant tension imparting means 33 after being payed out the ribbon core 40 and moved to the thermal head 15 through the constant tension imparting means 33.

After characters, symbols, etc., are printed by the thermal head 15 on the sheet of paper 14 through the agency of the inked ribbon 16, the inked ribbon 16 is wound on the ribbon core 39 which is connected to a take-up shaft 26 mounted on the carriage 5 and driven by the timing belt 10 for rotation.

The characters, symbols, etc., which are printed as described hereinabove by thermal transfer printing

leave traces in an upper printing zone of the inked ribbon 16 as indicated by hatching in Fig. 2.

The inked ribbon 16 having the traces of printed characters, symbols, etc., left only in the upper printing zone is moved from the ribbon core 40 toward the ribbon core 39 until an end portion of the inked ribbon 16 wound on the ribbon core 40 is reached.

When the inked ribbon 16 has been payed out and the end portion thereof wound on the ribbon core 40 is reached, the ribbon cassette 7 is removed from the carriage 5 and mounted thereon again upside down after being turned over.

More specifically, the ribbon cassette 7 is mounted on the carriage 5 in an upside down position so that the upper cassette case 31 is brought into contact with the top surface of the carriage 5, and the thermal head 15 is inserted in the cutout 37B of the ribbon cassette 7. As a result, the heat generating element section of the thermal head 15 is positioned against the lower printing zone of the inked ribbon 16 which has not been used in the preceding printing operation, and the ribbon core 40 supporting the inked ribbon at one end thereof is connected to the take-up shaft 26.

Upon receipt of a command to start a printing operation, the thermal transfer printer is actuated and characters, symbols, etc., are printed on the sheet of paper 14 through the agency of the inked ribbon 16 by using a lower printing zone of the inked ribbon 16 in the

same manner as described by referring to the printing of characters, symbols, etc., by using the upper printing zone of the inked ribbon 16, and the inked ribbon payed out of the ribbon core 39 is wound on the ribbon core 40.

The constant tension imparting means 33 for imparting a predetermined back tension to the inked ribbon 16 will now be described by referring to Fig. 2.

As described hereinabove, the constant tension imparting means 33 comprises the friction members 35 and 36 and the plate spring 38. The friction member 35 is attached to a wall surface having a certain curvature located substantially in a central portion of the front of the lower cassette case 34. The friction member 36 is attached to a central portion of the plate spring 38. In operation, the inked ribbon 16 is sandwiched between the two friction members 35 and 36 so that a predetermined tension is imparted to the inked ribbon 16 by the resilience of the plate spring 38.

The friction members 35 and 36 each have a width which is greater than the width or edge-to-edge dimension of the inked ribbon 16. The inked ribbon 16 and friction members 35 and 36 are constructed and arranged such that the center of the width of the friction members 35 and 36 and the center of the edge-to-edge dimension of the inked ribbon 16 coincide with each other.

Thus, upper and lower edges of the inked ribbon 16 are completely covered with the friction members 35 and 36 so that the inked ribbon 16 is prevented from being

displaced in a vertical direction during its travel. This is conductive to a stabilized movement of the inked ribbon 16 during its travel.

As can be seen in Fig. 2, the plate spring 38 is in the form of a letter H so that it produces at its central portion a biasing force distributed substantially equally in magnitude to the left and right sides of the plate spring 38. This enables a predetermined back tension to be imparted to the inked ribbon 16 irrespective of the direction of its movement as the ribbon cassette 7 is mounted in the regular position and in the upside down position on the carriage 5.

In the thermal transfer printer according to the invention, the upper printing zone of the inked ribbon 16 is used in a first printing operation in which the inked ribbon 16 is moved from the ribbon core 40 toward the ribbon core 39 and the lower printing zone thereof is used in a second printing operation in which the inked ribbon 16 is moved from the ribbon core 39 toward the ribbon core 40. However, this is not restrictive, and the lower printing zone may be used in the first printing operation and the upper printing zone may be used in the second printing operation.

Figs. 4 and 5 show another constructional form of the ribbon cassette suitable for use with the thermal transfer printer according to the invention, Fig. 4 being an exploded perspective view, on an enlarged scale, of the ribbon cassette and Fig. 5 being a top plan view of

the ribbon cassette, showing its interior.

The ribbon cassette of the constructional form shown in Figs. 4 and 5 is designated by the reference numeral 7a, and the carriage of the thermal transfer printer for supporting the ribbon cassette 7a is designated by the reference numeral 5a. Parts shown in Figs. 4 and 5 which are similar to or identical with those shown in Figs. 2 and 3 are designated by like reference characters.

In the constructional form shown in Figs. 4 and 5, the ribbon cassette 7a is provided with a pair of constant tension imparting mechanisms or means 33a and 33b each comprising griction members 35a and 36a formed of felt or like material, and a plate spring 38a. The two constant tension imparting means 33a and 33b located in the front of the ribbon cassette 7a on opposite sides of a cutout 37c formed in upper and lower cassette cases 31a and 34b for receiving the thermal head 15 are symmetrically arranged.

Each friction member 35a which is constructed to have the same width as the friction member 35 shown in Figs. 2 and 3 is attached to the curved surface of each partition rib 42 formed integrally with the lower cassette case 34a. Each friction member 36a of the same construction as the friction member 35a is attached to each plate spring 38a in the form of a letter T in a lying position. In operation, the inked ribbon 16 is sandwiched between the friction members 35a and 36a during its travel so that

a constant tension is imparted to the inked ribbon 16 by the resilience of the plate spring 38a.

The constant tension imparting means 33a and 33b of the construction shown in Figs. 4 and 5 and described hereinabove can achieve the same effects as those achieved by the constant tension imparting means 33 shown in Figs. 2 and 3. That is, they are capable of preventing the vertical displacement of the inked ribbon 16 and stabilizing its movement during its travel.

The carriage 5a is distinct from the carriage 5 shown in Fig. 5 in that two pins 41 are secured thereto and project therefrom. The pins 41 perform the function of facilitating the positioning of the upper and lower cassette cases 31a and 34a when they are assembled.

Of the two pins 41, the pin 41 located on an upper left portion of the lower cassette case 34a as shown in Fig. 5 is maintained in contact with the plate spring 38a of the constant tension imparting means 33a interposed between the thermal head 15 received in the cutout 37c and the take-up shaft 26 to provide a gap between the two friction members 35a and 36a. By this arrangement, the inked ribbon 16 is free from tension in its run between the thermal head 15 and takeup shaft 26. That is, a constant back tension is imparted to a run of the inked ribbon 16 between the ribbon core 40 and thermal head 15 received in the cutout 37c only by the constant tension imparting means 33b.

When the ribbon cassette 7 is turned over and

mounted in an upside down position on the carriage 5a, the constant back tension can be imparted to the inked ribbon 16 by the constant tension imparting means 33a.

In the constructional form of the ribbon cassette 7a shown in Figs. 4 and 5, the upper printing zone of the inked ribbon 16 is used in a first operation for printing characters, symbols, etc., as the inked ribbon 16 is moved from the ribbon core 40 toward the ribbon core 39, and the lower printing zone is used in a second operation for printing purposes as the inked ribbon 16 is moved from the ribbon core 39 toward the ribbon core 40. However, this is not restrictive, and the lower printing zone may be used in the first operation and the upper printing zone may be used in the second operation.

Figs. 6 and 7 show still another constructional form of the ribbon cassette suitable for use with the thermal transfer printer according to the invention, Fig. 6 being an exploded perspective view, on an enlarged scale, of the ribbon cassette and Fig, 7 being a top plan view of the ribbon cassette, showing its interior.

The ribbon cassette shown in Figs. 6 and 7 are designated by the reference numeral 7b which is mounted on the carriage 5a shown in Fig. 4. In Figs. 6 and 7, parts similar to or identical with those shown in Figs. 2 to 5 are designated by like reference characters.

The ribbon cassette 7b comprises an upper cassette case 31b formed with cutouts 37A and 37B similar to those shown in Fig. 2, and a lower cassette case 34b

formed with cutouts 37A and 37B similar to those shown in Fig. 4. The ribbon cassette 7b which is provided with a pair of constant tension imparting mechanisms or means 33c and 33d is supported on the carriage 5a. The constant tension imparting means 33c and 33d are operative to impart a predetermined back tension to the inked ribbon 16 irrespective of the direction of its movement as the ribbon cassette 7b is mounted in the regular position and in the upside down position on the carriage 5a.

More specifically, the constant tension imparting means 33c and 33d each comprise friction members 35b and 36b formed of felt or like material, and a plate spring 38b. The constant tension imparting means 33c and 33d of substantially U-shaped are located symmetrically on the lower cassette case 34b outwardly of the cutouts 37A and 37B for alternately receiving the thermal head 15.

The friction member 35b which is constructed to have the same width as the friction member 35 shown in Figs. 2 and 3 is attached to the curved surface of each partition rib 42 formed integrally with the lower cassette case 34b. Each friction member 36b of the same construction as the friction member 35b is attached to each plate spring 38b. The inked ribbon 16 is sandwiched between the friction members 35b and 36b, and a constant tension is imparted to the sandwiched inked ribbon 16 by the plate spring 48b. By this arrangement, it is possible to achieve the same effects as those described hereinabove.

The pins 41 projecting from the carriage 5a

perform the same function as that described hereinabove in connection with the cassette shown in Figs. 4 and 5.

All the constructional forms of the ribbon cassette shown in Figs. 2 through 7 have been described as being moved in opposite directions and turned over when one of the two printing zones disposed one above the other has been used. However, the invention is not limited to the type of ribbon cassette which is turned over. The invention can have application in a thermal transfer printer of the type which enables printing to be performed by using the upper and lower printing zones of the inked ribbon while moving the ribbon cassette vertically in place of turning it over.

When the invention is applied to this type of thermal transfer printer, printing of characters, symbols, etc., would be performed by using the upper printing zone of the inked ribbon as the carriage supporting the ribbon cassette moves rightwardly. As soon as one end portion of the inked ribbon is detected, the inked ribbon would be moved upwardly and the carriage would be moved leftwardly to print characters, symbols, etc., by using the lower printing zone of the inked ribbon.

Even if the invention is applied to the aforesaid type of thermal transfer printer, the constructional forms of the ribbon cassettes 7, 7a and 7b shown and described hereinabove can be used. However, when the thermal transfer printer is of the type in which the ribbon cassette is moved vertically in place of being

turned over, those ribbon cassettes which are not constructed to be turned over may also be used, to perform printing by using the two printing zones disposed one above the other of the inked ribbon.

When ribbon cassettes having no mechanism for turning it over are used, the upper printing zone of the inked ribbon would be used when the carriage moves rightwardly and the lower printing zone would be used when the carriage moves leftwardly. The same result can be achieved by using the upper printing zone when the carriage moves leftwardly and by using the lower printing zone when the carriage moves rightwardly.

The thermal transfer printer according to the invention is capable of not only printing characters, symbols, etc., but also drawing graphs, charts, diagrams, etc.

From the foregoing description, it will be appreciated that the use of the ribbon cassette according to the invention enables a predetermined back tension to be imparted to the inked ribbon when the latter is moved in opposite directions, thereby allowing the travel of the inked ribbon to be stabilized. This is conductive to a great reduction in running cost.

WHAT IS CLAIMED IS:

1. A printer comprising:

an inked ribbon (16);

a ribbon cassette (7) for holding said inked ribbon;

a thermal head (15);

a carriage (5) for supporting and moving said ribbon cassette and thermal head;

thermal head pressing means provided to said carriage; and

a controller (21) for controlling a printing operation; wherein the improvement resides in that:

the inked ribbon hold in the ribbon cassette (7) has an upper printing zone and a lower printing zone disposed in superposed relation one above the other in a direction perpendicular to the direction in which the inked ribbon is moved to perform printing and, the ribbon cassette is provided with back tension imparting means (33) for imparting a predetermined back tension to the inked ribbon as it moves in opposite directions.

2. A printer as claimed in claim 1, wherein said back tension imparting means comprises a constant tension imparting mechanism (33) which includes a pair of friction members (35, 36) and a plate spring (38) located substantially at a central portion of the front of the ribbon cassette (7), said pair of friction members being adapted to sandwich the inked ribbon (16) therebetween and said plate spring being secured to the back of one of the friction members, said plate spring being shaped such that it produces at its

central portion at which it presses against the inked ribbon a biasing force which is distributed substantially equally in magnitude to the left and right sides of the plate spring.

3. A printer as claimed in claim 1, wherein said back tension imparting means (33) comprises two sets of constant tension imparting mechanisms (33a, 33b) each including a plate spring (38a), said constant tension imparting mechanisms being positioned on opposite sides of the thermal head such that the two plate springs are located along the path of travel of the inked ribbon in such a manner that one of them is disposed anterior to the latter with respect to the direction of movement of the inked ribbon.

4. A printer as claimed in claim 3, wherein the carriage (5) for supporting and moving the ribbon cassette has a plurality of pins (41) projecting therefrom, one of said plurality of pins being adapted to be positioned against the plate spring of the constant tension imparting mechanism interposed between the thermal head and an inked ribbon take-up shaft when the ribbon cassette is mounted to the carriage.

5. A thermal transfer printer comprising:

a platen;

a carriage supported for movement lengthwise of said platen;

a ribbon cassette removable mounted to said carriage;

an inked ribbon held in said ribbon cassette and

wound at opposite ends thereof on two ribbon cores; and

a thermal head supported by said carriage to force the inked ribbon against a sheet of support material on said platen; wherein the improvement resides in that:

said inked ribbon has an upper printing zone and a lower printing zone disposed in superposed relation one above the other in a direction which is perpendicular to the direction in which the inked ribbon is moved, said ribbon cassette is adapted to be turned over after one of the upper and lower printing zones has been used to print characters, symbols, etc., and mounted to the carriage so as to continue the printing of characters, symbols, etc., by using the other printing zone, and said ribbon cassette is provided with back tension importing means located between the thermal head and the ribbon core toward which the inked ribbon moves, to apply the predetermined brake to the inked ribbon during its travel.

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FIG. 1

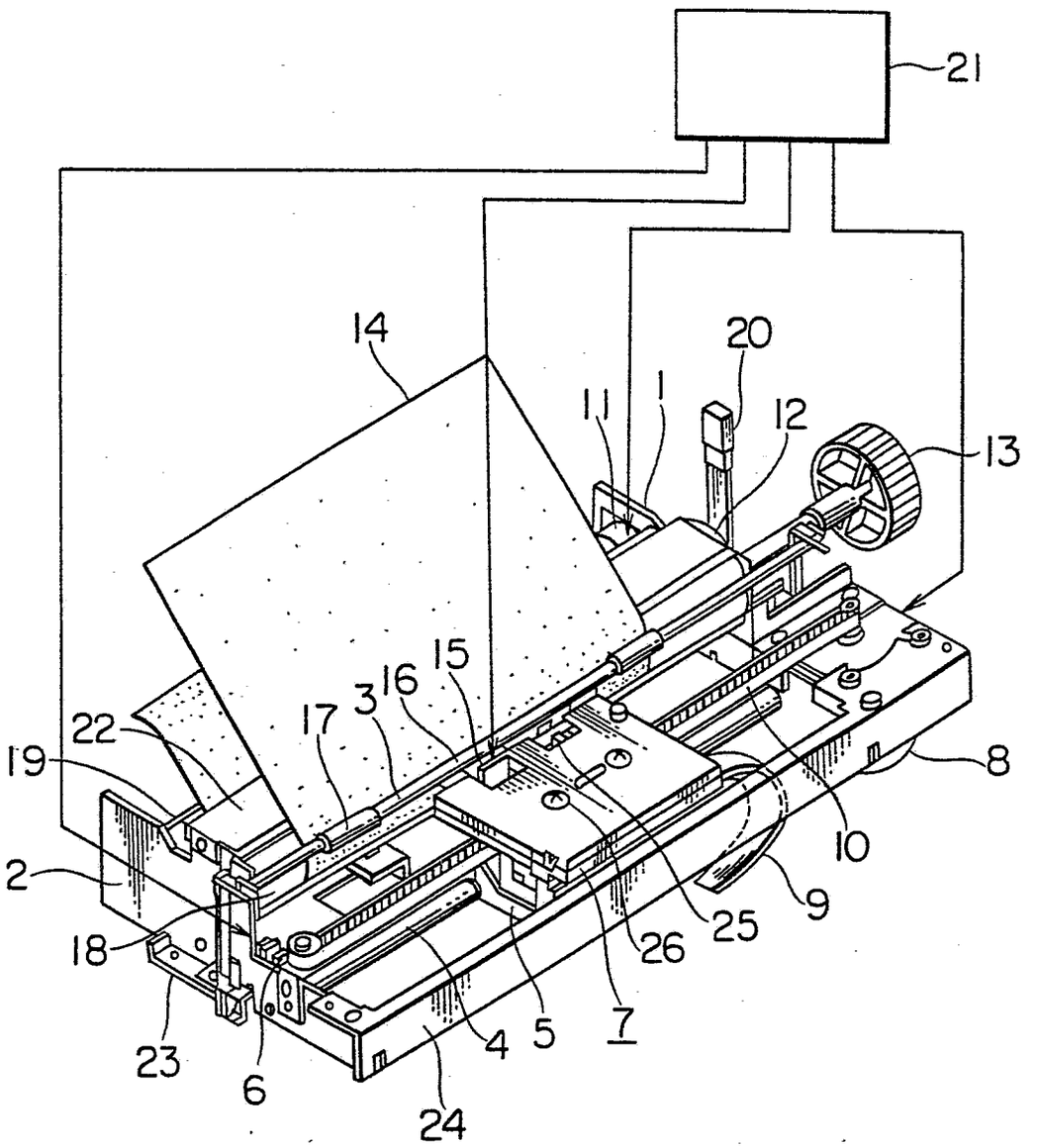

FIG. 2

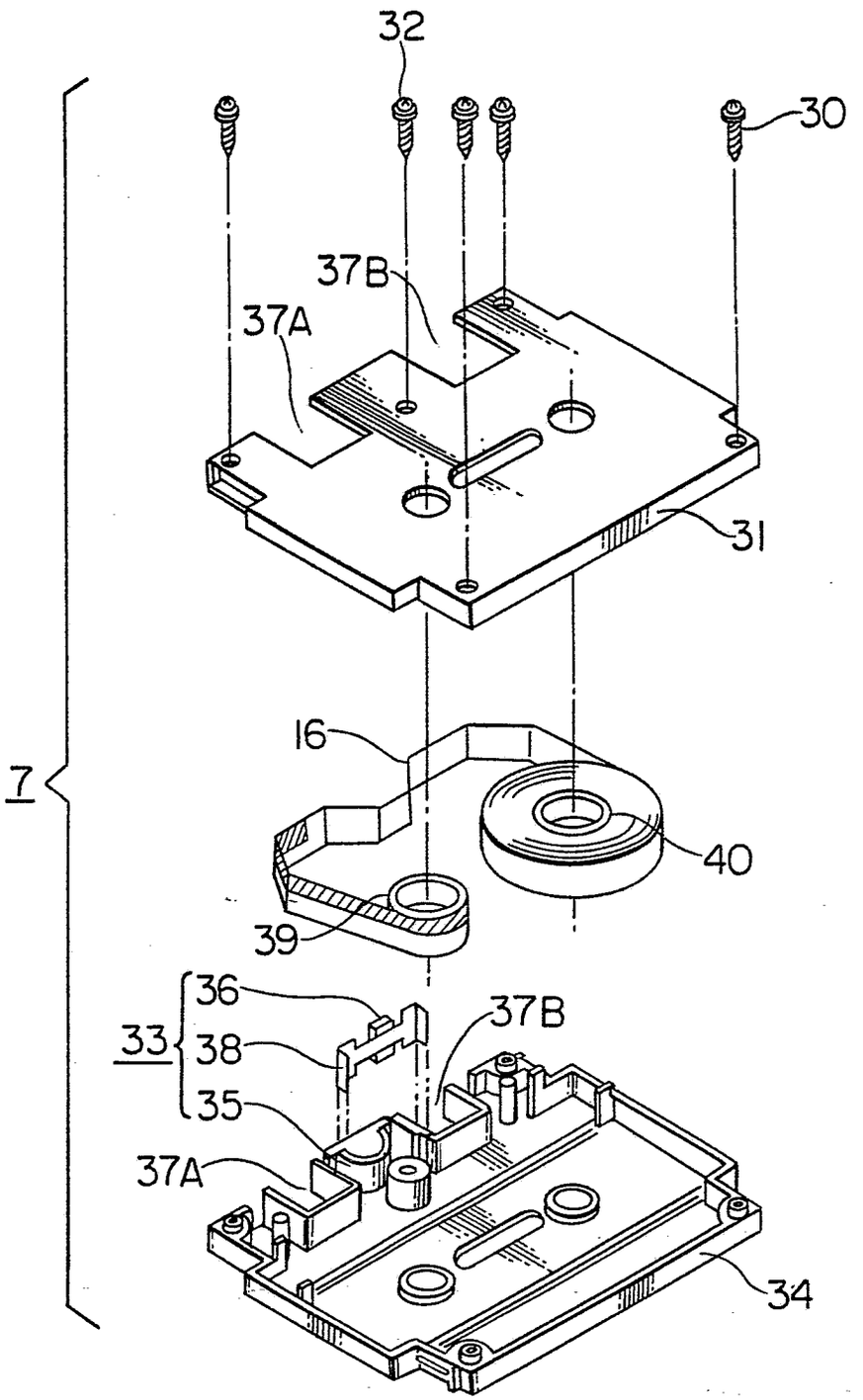

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FIG. 3

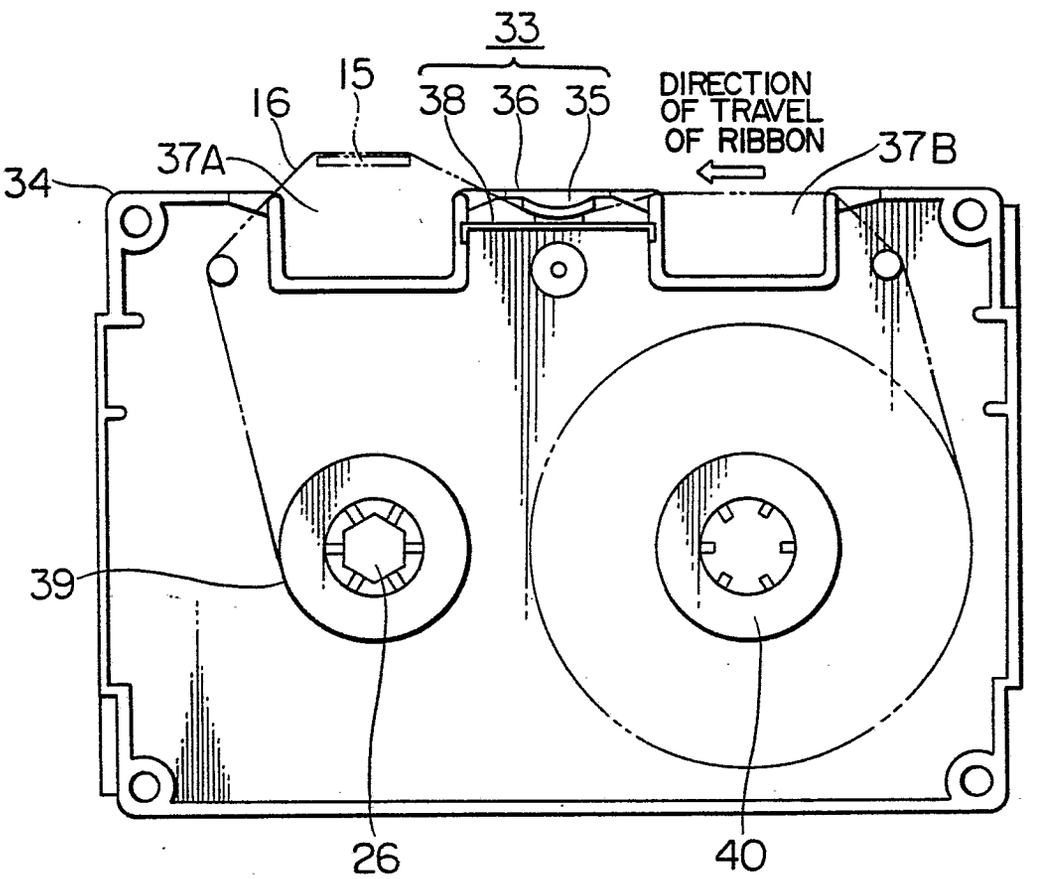

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FIG. 4

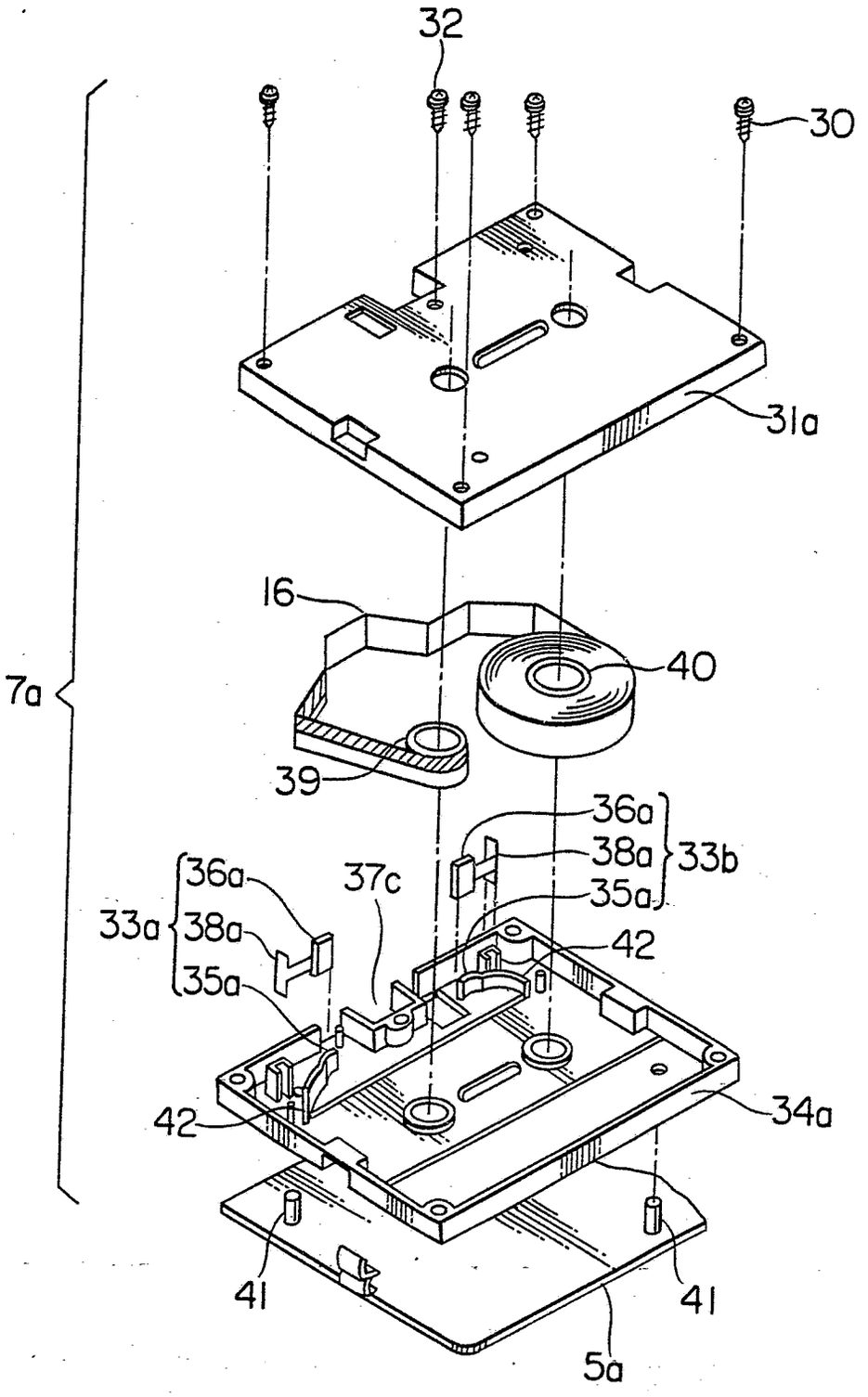

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FIG. 5

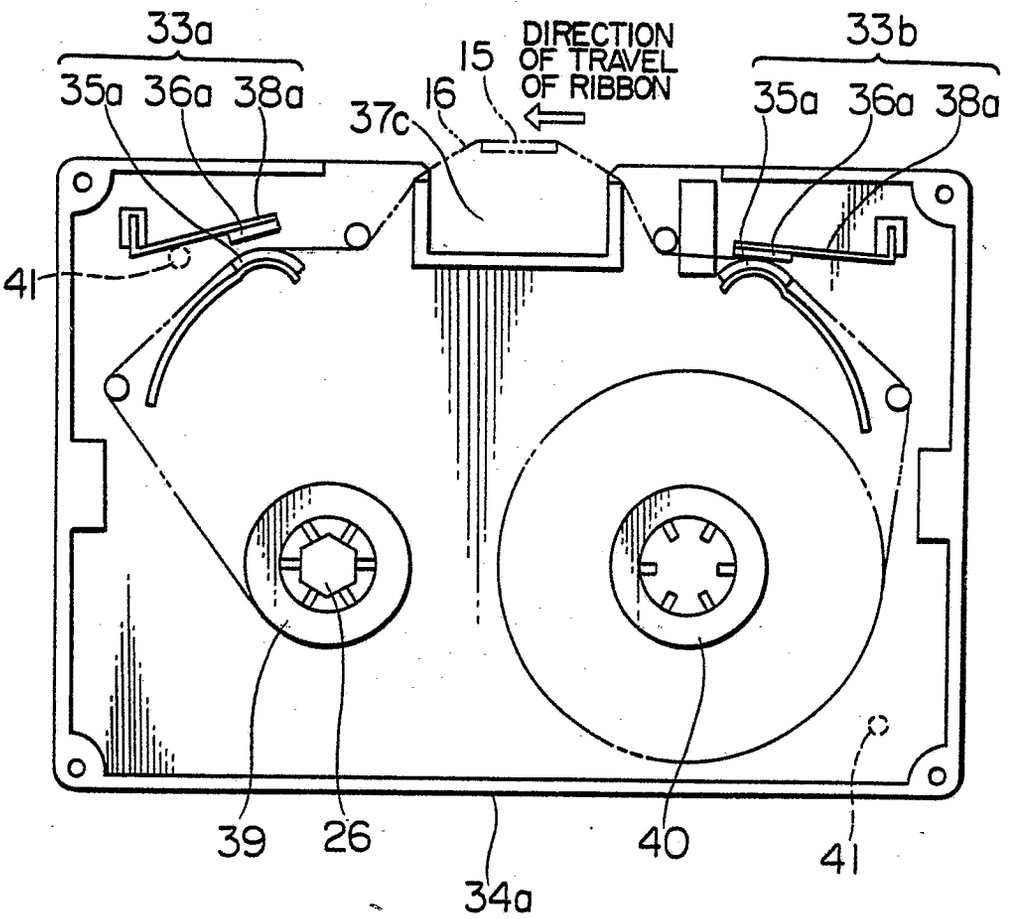

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FIG. 6

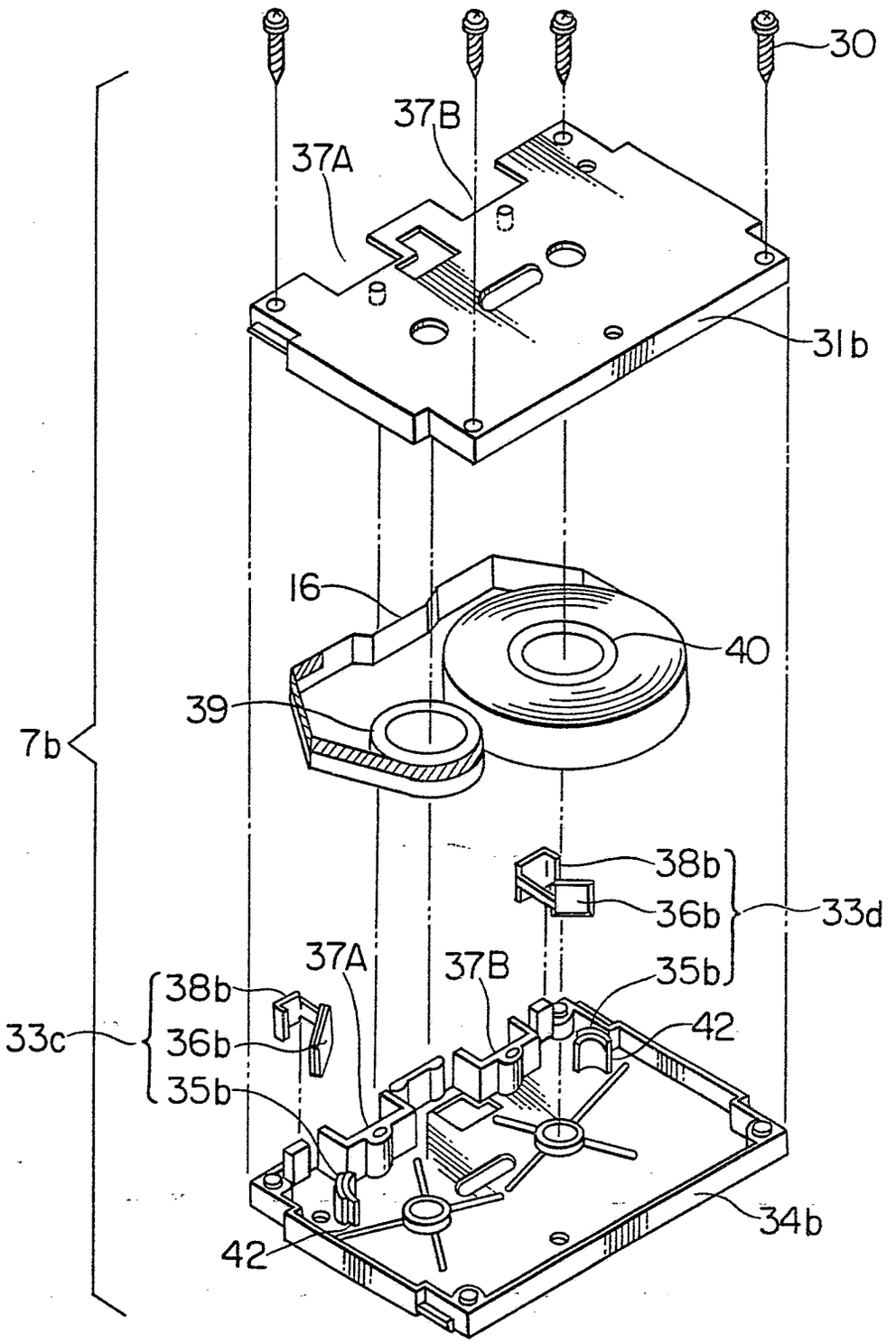

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FIG. 7