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(54) **RIBBON SPOOL, RIBBON CASSETTE, AND PRINTING APPARATUS**

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(57) **ABSTRACT**

A ribbon spool is detachably attached to a printing apparatus for forming an image on a recording medium by using an ink ribbon. The printing apparatus has an engaging member including an engaging convex portion for engaging the ribbon spool. The ribbon spool includes a ribbon retaining portion for retaining the ink ribbon, and an engaging portion provided at one lateral side end of the ribbon spool for engaging the engaging convex portion and having a plurality of inclined grooves. The grooves have a different inclination angle from that of a lateral side face of the engaging convex portion. At least one of the grooves of the engaging portion has a point contact with the engaging convex portion at two points to engage the engaging convex portion.

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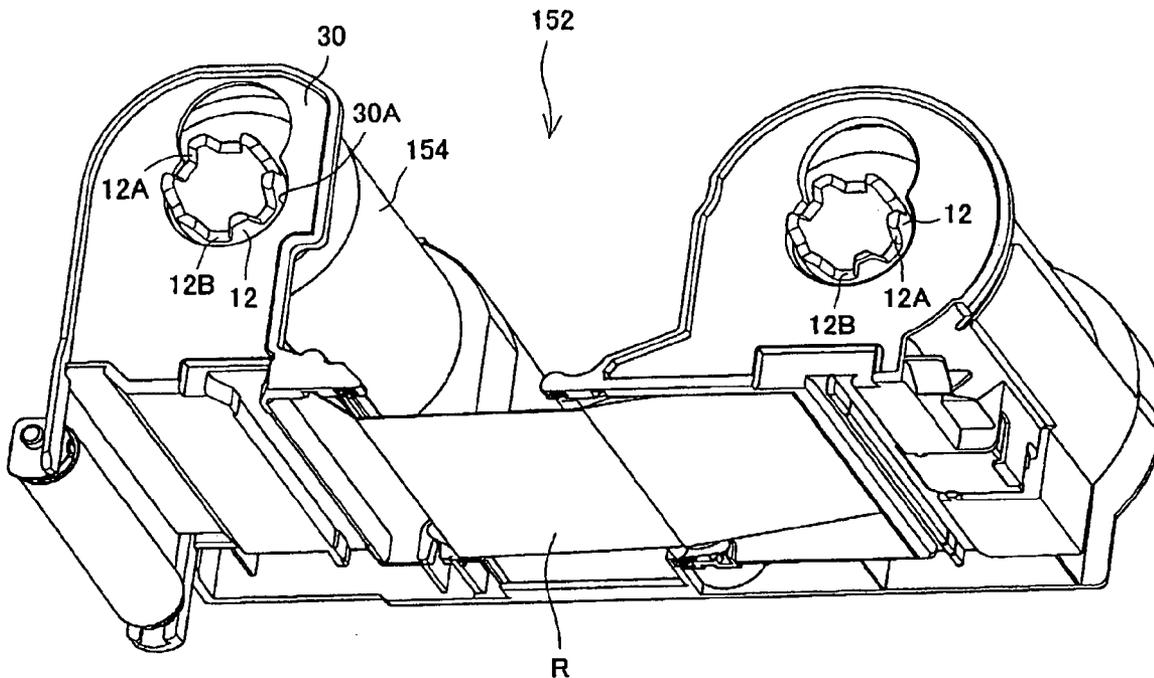


FIG.1

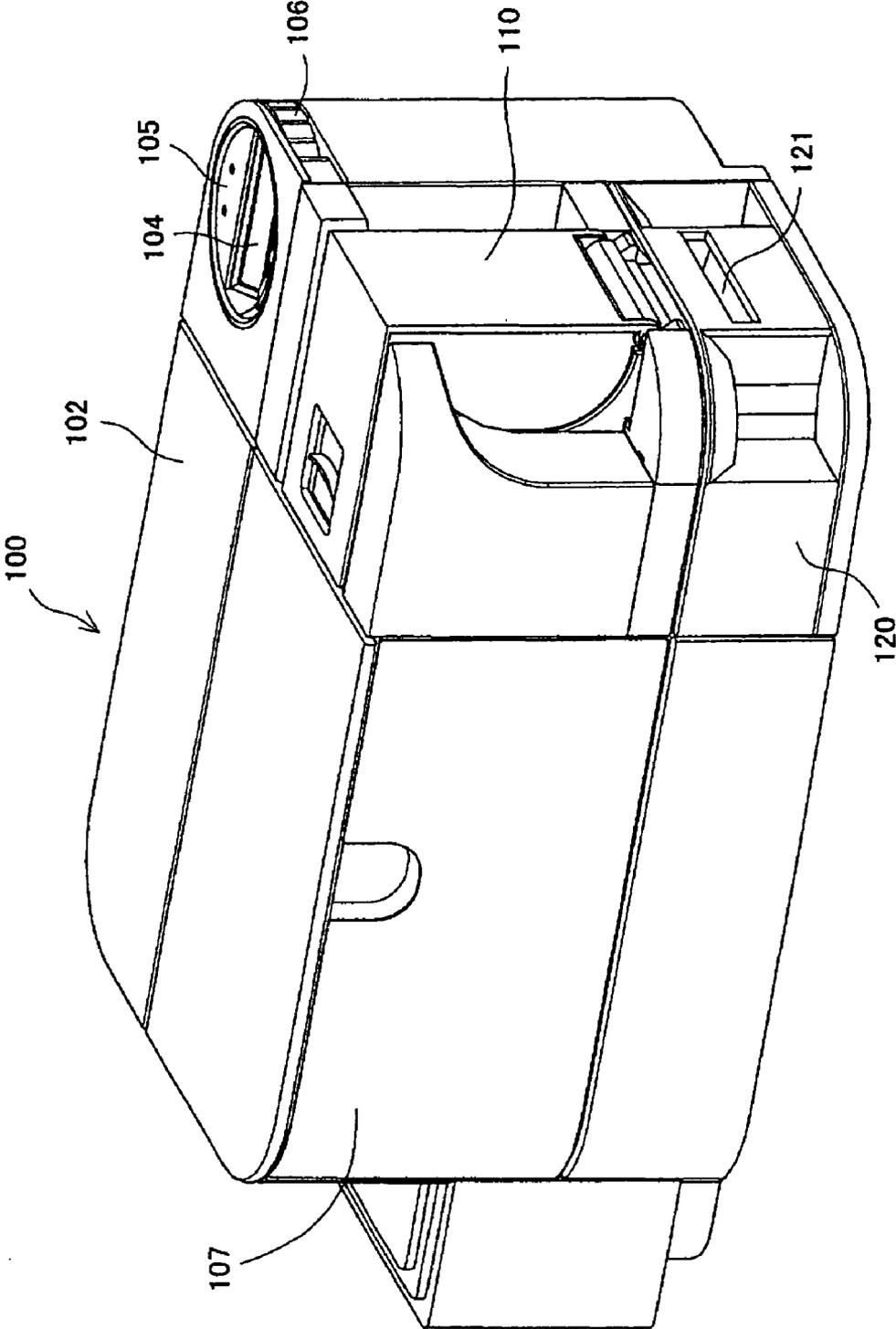


FIG.2

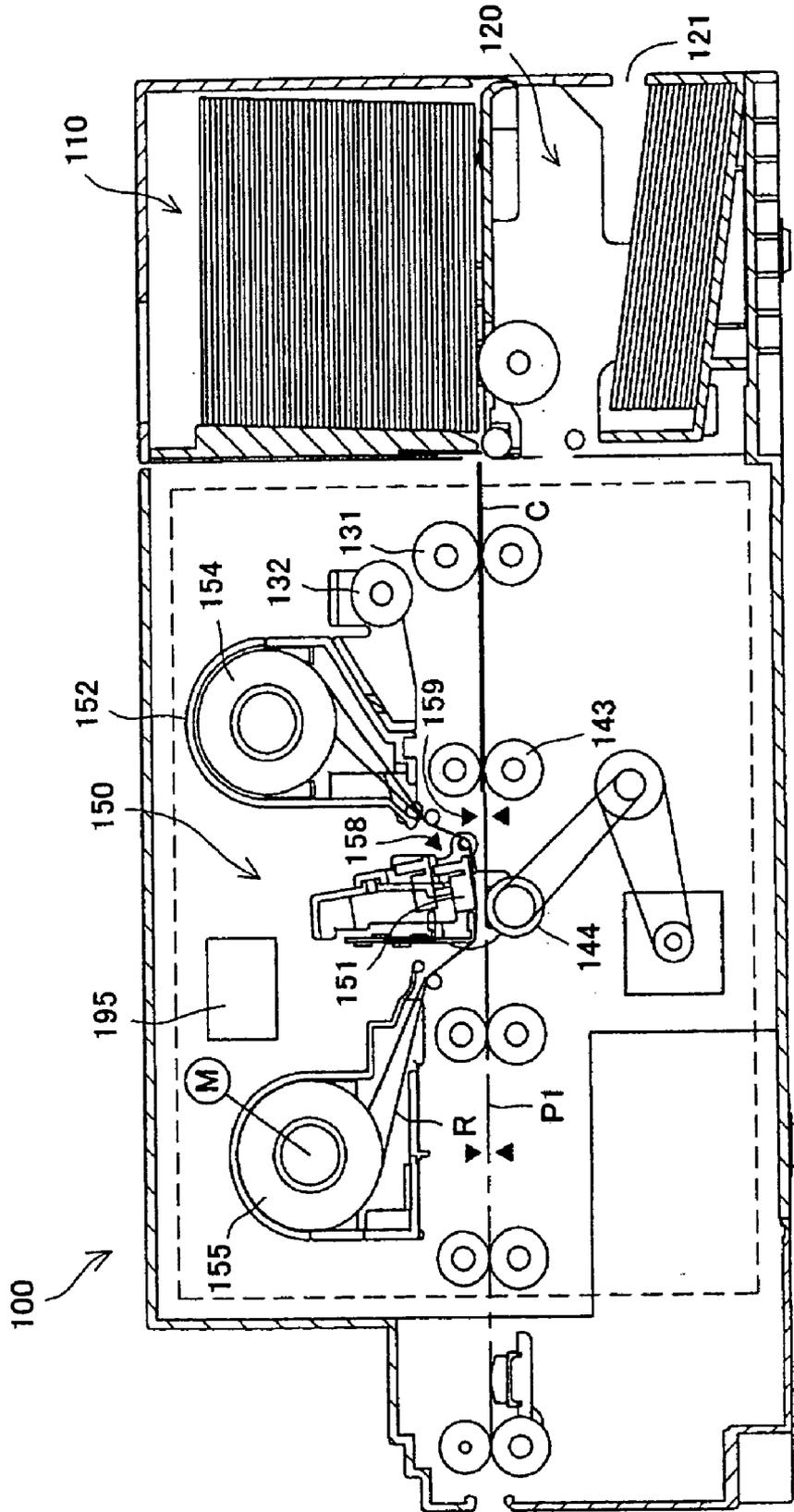


FIG. 3

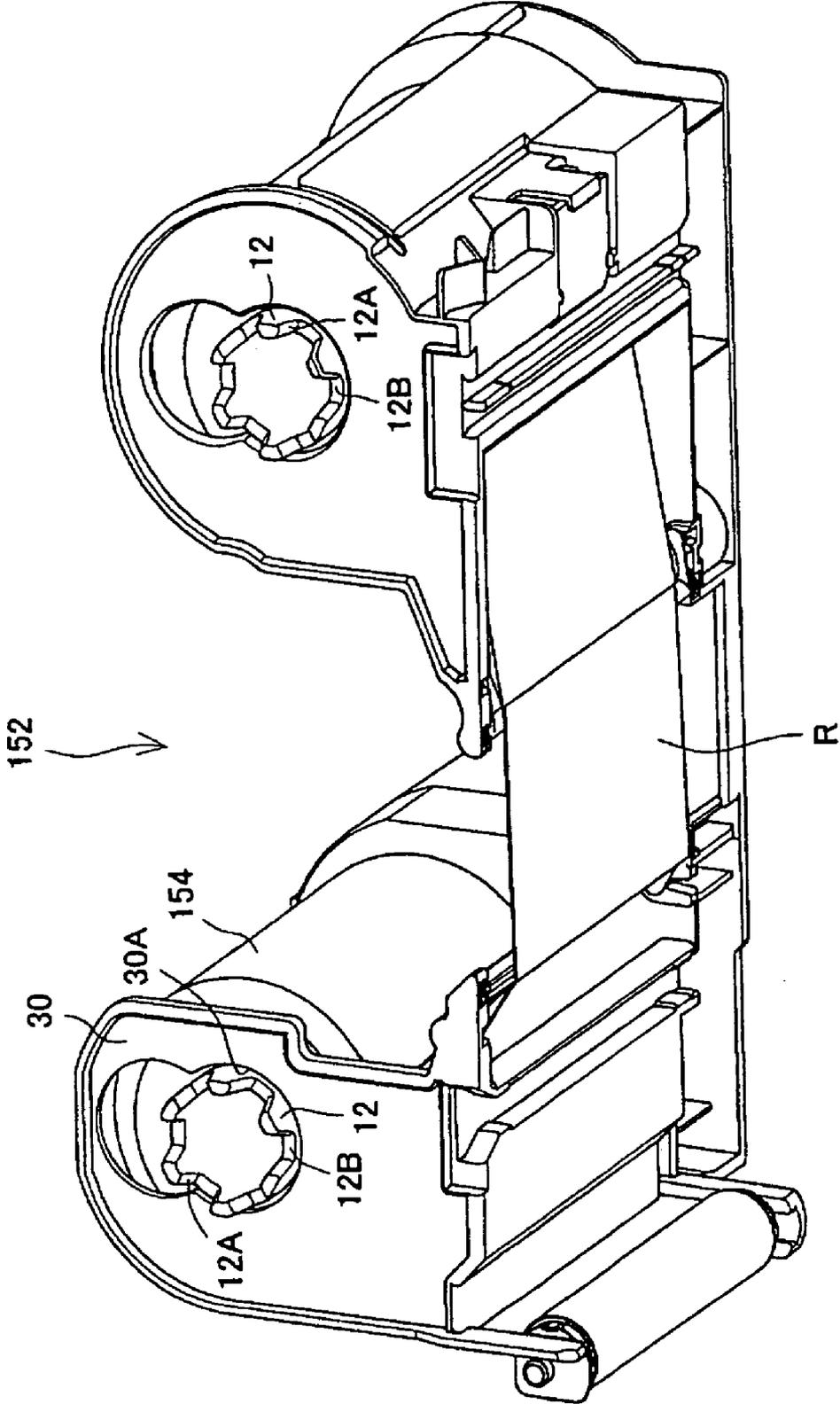


FIG.4

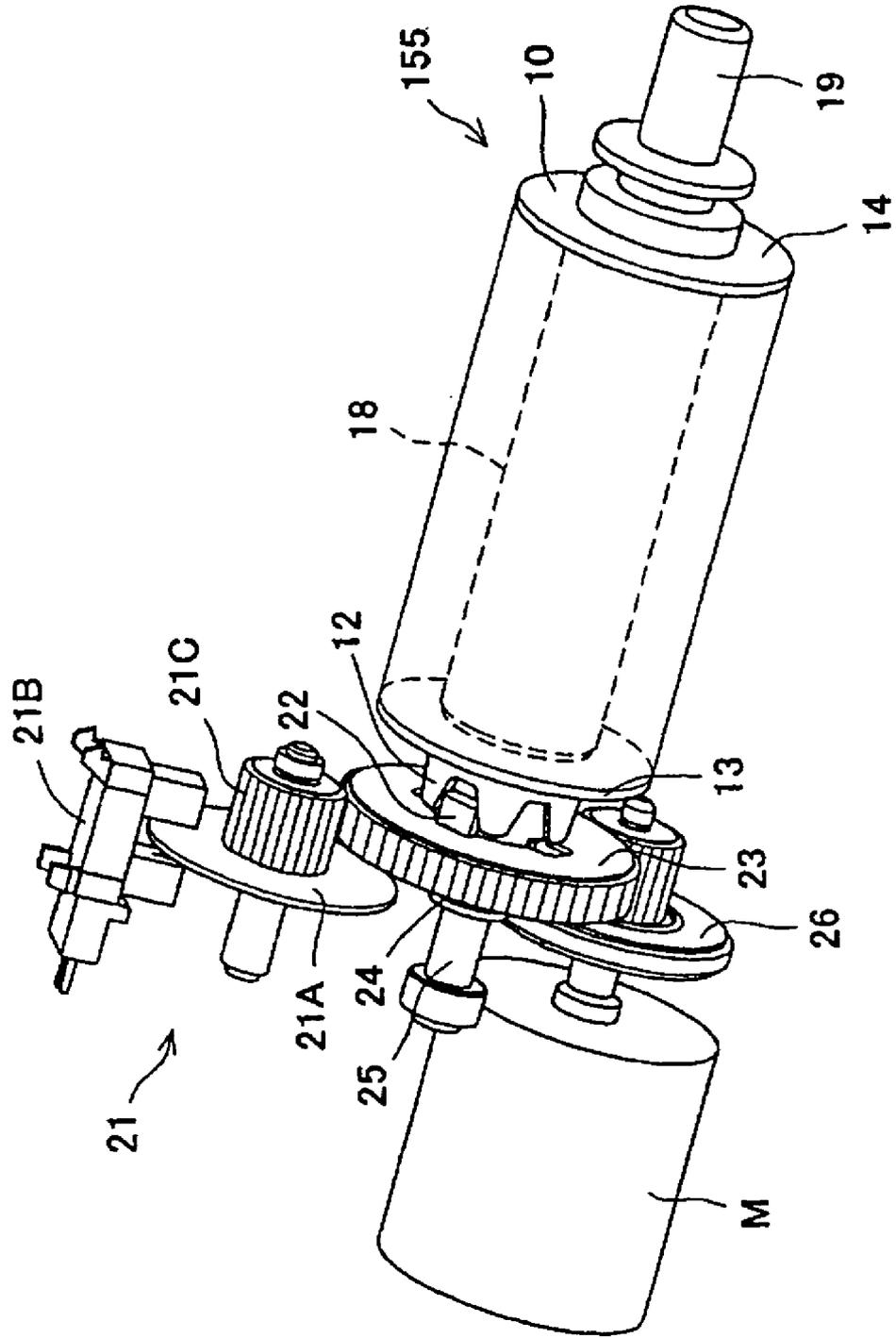


FIG. 5A

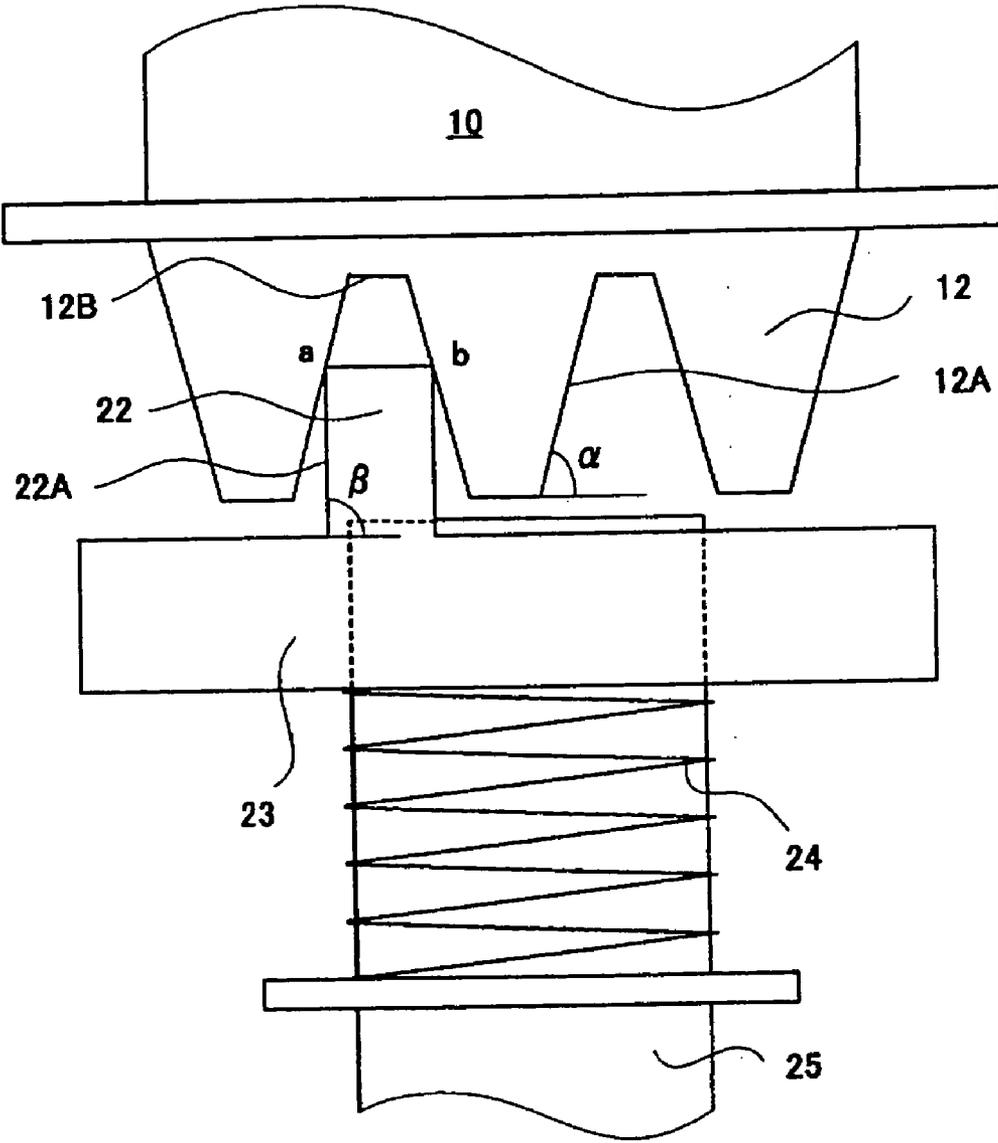


FIG. 5B

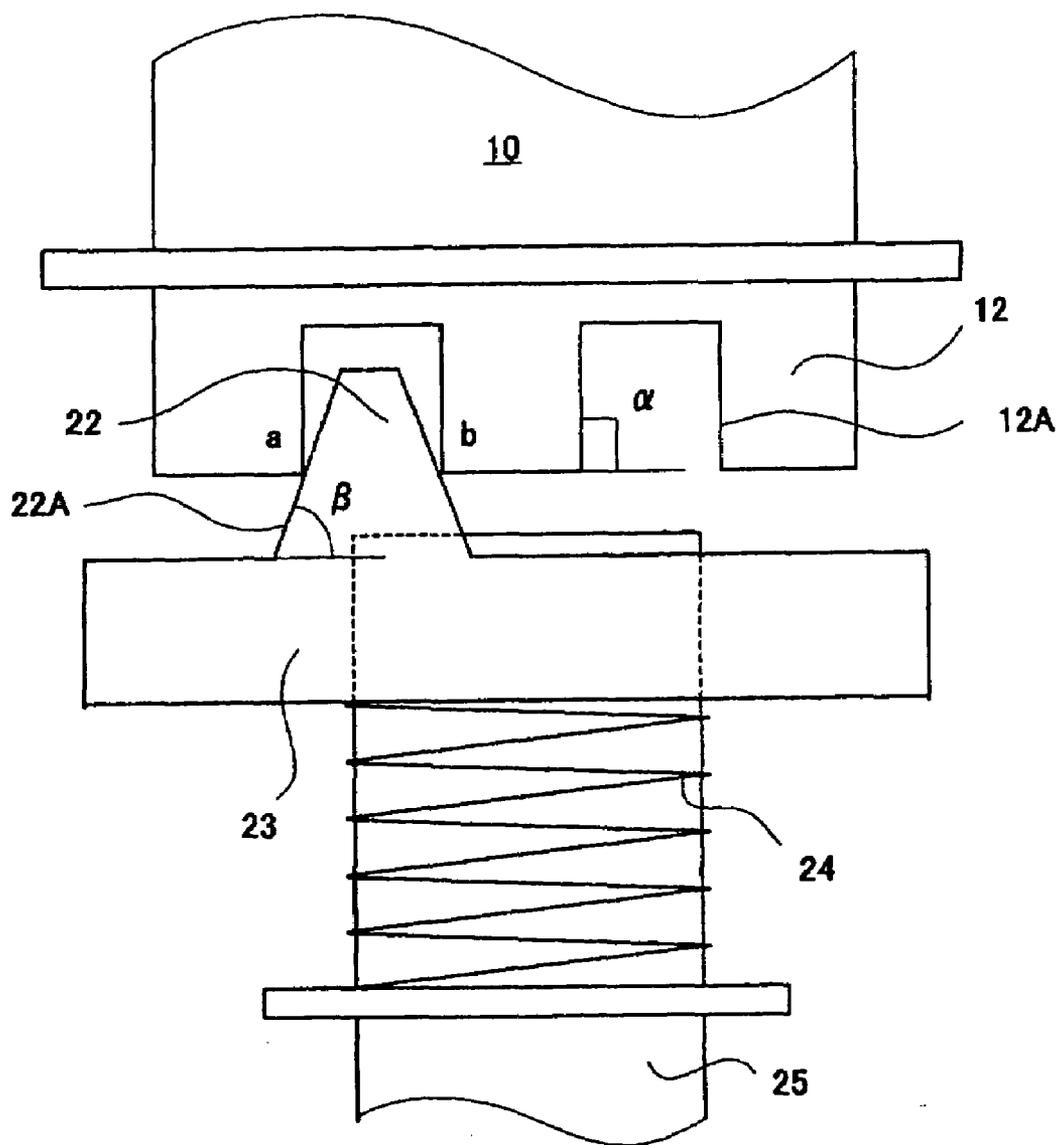


FIG. 5C

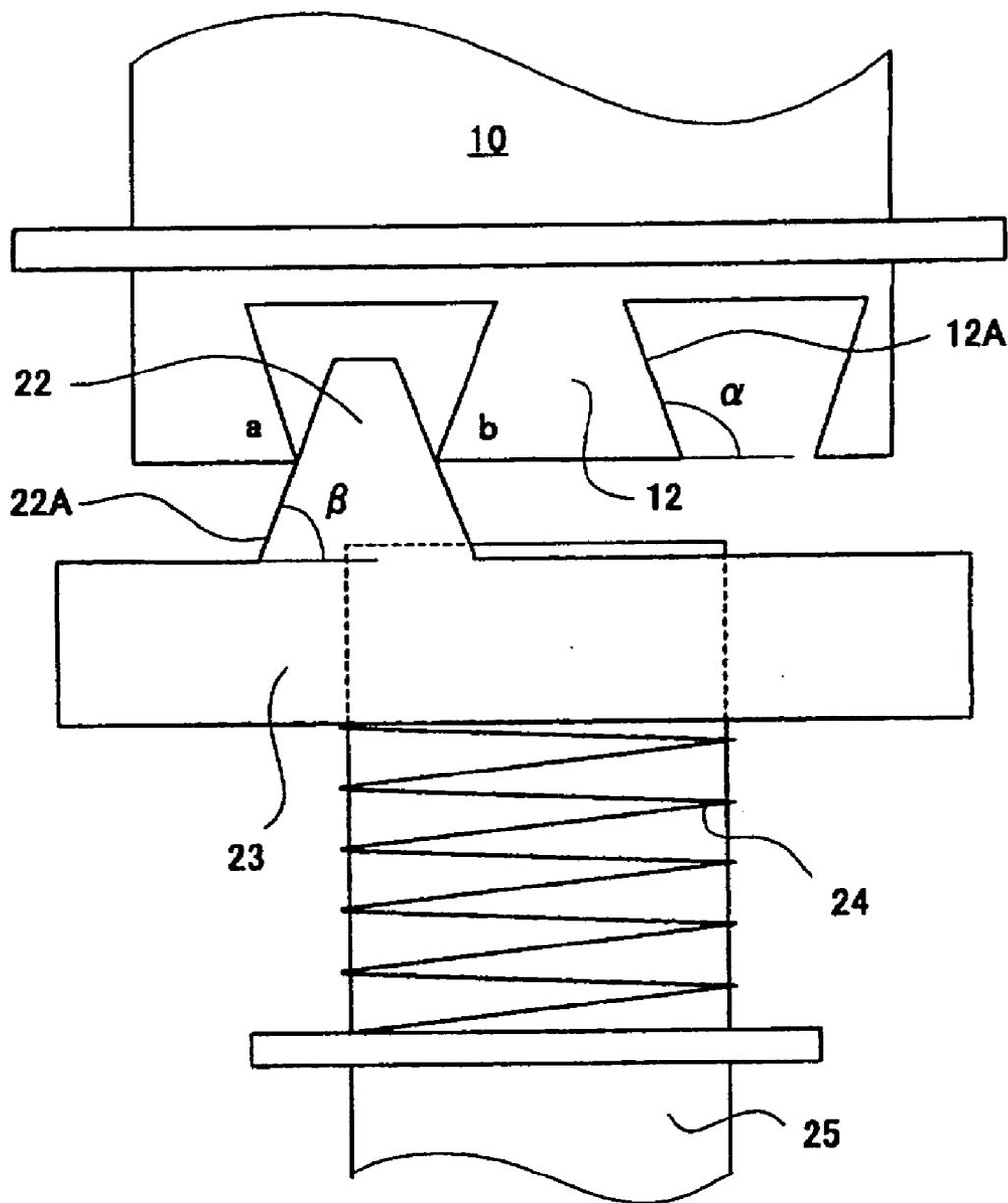
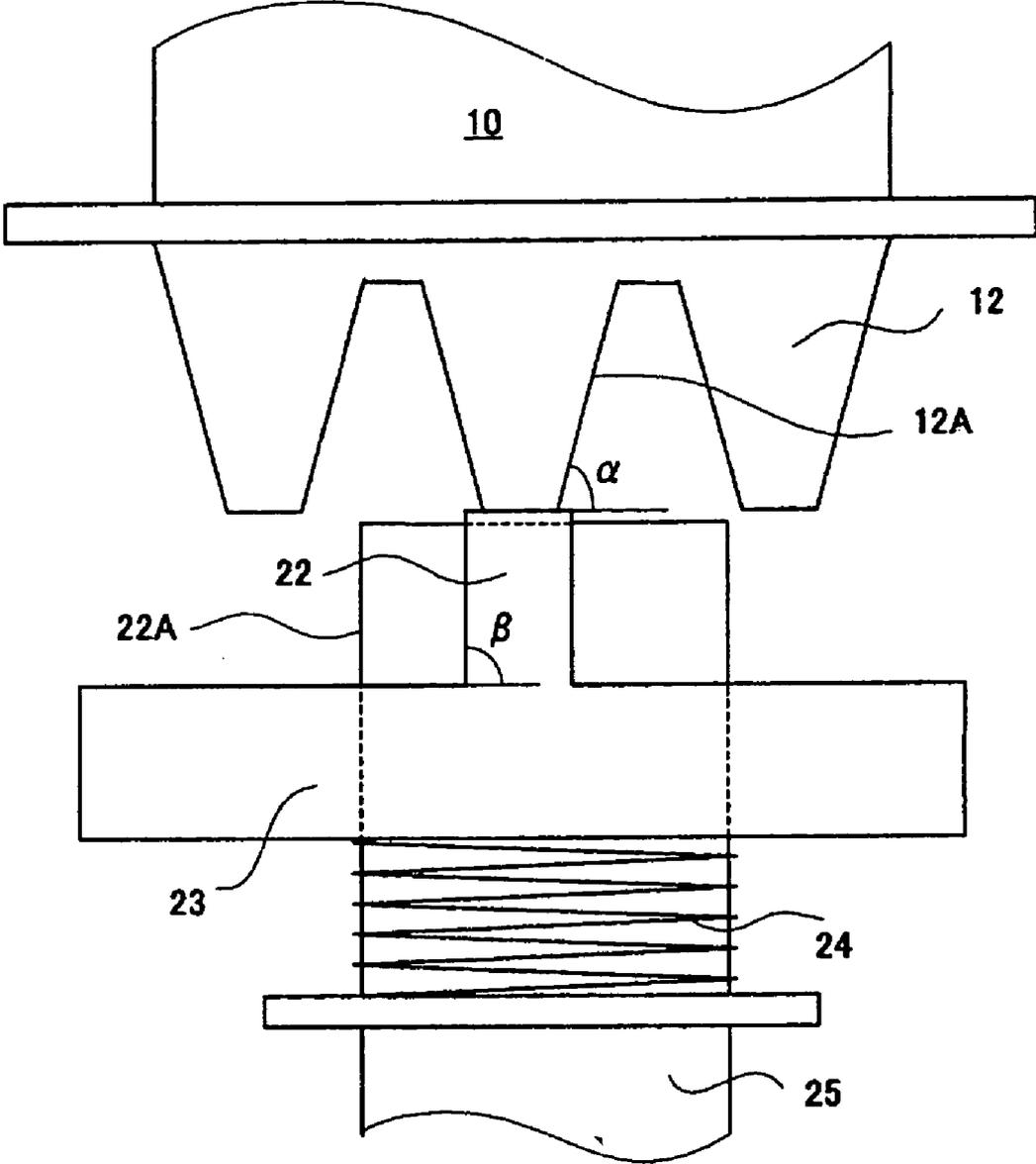


FIG.6



RIBBON SPOOL, RIBBON CASSETTE, AND PRINTING APPARATUS

BACKGROUND OF THE INVENTION AND RELATED ART STATEMENT

[0001] The present invention relates to a ribbon spool, a ribbon cassette, and a printing apparatus. In particular, the present invention relates to a printing apparatus that forms an image on a recording medium by using a ribbon spool detachably attached to the printing apparatus, a ribbon cassette including the ribbon spool, and an ink ribbon.

[0002] Conventionally, a printing apparatus has been known to be used to prepare a card such as a credit card, a cash card, a license card, or an ID card, for example. In the case of the printing apparatus as described above and an image recording apparatus through which a plain paper or a thermosensitive paper can be printed, an image is generally printed via an ink ribbon stored in a cartridge onto a card or a recording paper that is pushed to a thermal head and that has one surface supported by a platen roller for example. The ink ribbon is generally retained by a ribbon spool. The ribbon spool is connected to the body of the printing apparatus to carry the ink ribbon, thereby conducting a printing operation.

[0003] The ribbon spool may be connected to the printing apparatus in various forms. One of such forms of connections, for example, is to form a notch at one end of the ribbon spool to engage the notch with a protrusion provided in a printing apparatus. Another form of such connections is disclosed in Japanese Patent Examined Publication No. H07-100555 (Patent Document 1). In Patent Document 1, an engaging portion is provided at the inner side of a cylindrical ribbon spool and is inserted to a printing apparatus having a spool axis.

[0004] When an ink ribbon is continually subjected to a printing operation, the ink ribbon has different roll diameters at the supply side and at the rolled side. A small roll diameter and a large roll diameter cause differences in amounts of ink ribbons to be carried. To prevent this problem, a printing apparatus has been developed and disclosed in Japanese Patent Laid-Open No. 05-330209 (Patent Document 2). In Patent Document 2, an encoder for detecting the carrying amount of the ink ribbon is provided, and a rotation amount detection mechanism of the ribbon spool (encoder) is installed in a driving transmission system of the ribbon spool.

[0005] In the case of the above printing apparatus, however, the concave portion of any one of the ribbon spool and the engaging portion of the printing apparatus is engaged with the convex portion having the same shape (or the concave portion has a contact with the convex portion in a linear manner), and, thus, it results in a gap in the engaging portion. In the case of the engaging portion as described above, a backlash is generated in the engaging portion (driving transmission system) during a printing operation (or at the moment when the head is raised at the completion of the printing). Since the printing apparatus has a structure in which the encoder is installed in the ribbon spool driving transmission system, the backlash generated in the driving transmission system has a disadvantageous influence that generates a difference between the actual rotation amount of the ribbon spool and the rotation amount detected by the encoder. The difference between the actual rotation amount of the ribbon spool and the rotation amount detected by the encoder impairs an accuracy of a ribbon locating. Particularly, when the difference between the actual rotation amount of the ribbon spool and the rotation

amount detected by the encoder occurs at the same time the ribbon passes by a sensor, this difference remains and impairs the subsequent ribbon locating, and therefore, it may result in different colors to be printed in the worst case.

[0006] In view of the problems stated above, it is an objective of the present invention to provide a ribbon spool engaging with an engaging member of a printing apparatus without a backlash, a ribbon cassette having the ribbon spool, and a printing apparatus engaging the ribbon spool without the backlash.

[0007] Further objects and advantages of the invention will be apparent from the following description of the invention.

SUMMARY OF THE INVENTION

[0008] In order to achieve the above objective, as for the first aspect of the present invention, a ribbon spool is detachably attached to a printing apparatus, said printing apparatus including an engaging member having an engaging convex portion engaged with an engaging portion of a ribbon spool and using an ink ribbon to form an image on a recording medium. The ribbon spool comprises: a ribbon retaining portion for retaining the ink ribbon; and an engaging portion provided at one side end and having a plurality of inclined grooves. The grooves of the engaging portion have a different inclination angle from that of a side face of the engaging convex portion engaging with the engaging portion. At least one groove of the grooves of the engaging portion is in a point contact with the engaging convex portion at two points to be engaged therewith.

[0009] According to the first aspect, the ribbon spool includes the ribbon retaining portion for retaining an ink ribbon and the engaging portion that is provided at one side end and that has a plurality of inclined grooves. The engaging portion has grooves having a different inclination angle from that of the side face of the engaging convex portion engaged with the engaging portion. At least one of the grooves of the engaging portion is in a point contact with the side face of the engaging convex portion at two points. According to this aspect of the invention, at least one of the grooves of the engaging portion is in a point contact with the side face of the engaging convex portion at two points to be engaged therewith. This configuration prevents a backlash when the engaging portion of the ribbon spool is engaged with the engaging convex portion of the engaging member of the printing apparatus. Thus, on the printing apparatus side, the actual rotation amount of the ribbon spool can be accurately detected by an encoder.

[0010] According to the first aspect, convex portions forming the grooves of the engaging portion preferably have a different shape from the shape of the engaging convex portion. When the grooves of the engaging portion have an inclination angle α , the side face of the engaging convex portion has an inclination angle β , and α is $0^\circ < \alpha < 90^\circ$ (where $\alpha < \beta$), it is desirable that the two points correspond inclined surfaces of the convex portions forming the grooves of the engaging portion and vertexes of the engaging convex portion. When α is $90^\circ \leq \alpha < 180^\circ$ (where $\beta < 90^\circ$), the two points correspond vertexes of the convex portions forming the grooves of the engaging portion and side faces of the engaging convex portion. The ribbon retaining portion has a flange that regulates the position of the ink ribbon in an axial direction, and the engaging portion may be provided to be adjacent to the flange.

[0011] In order to overcome the above disadvantage, according to the second aspect of the present invention, a

ribbon cassette includes a supply spool for supplying an ink ribbon, a winder spool around which the ink ribbon is wound, and a case for storing the supply spool and the winder spool in a rotatable manner. The ribbon spool according to the first aspect is provided to at least one of the supply spool and the winder spool. The second aspect of the invention also can provide the same effect as that of the first aspect.

[0012] In order to overcome the above disadvantage, according to the third aspect of the present invention, a printing apparatus has an engaging member engaged with an engaging portion of a ribbon spool including a ribbon retaining portion for retaining an ink ribbon and the engaging portion that is provided at one side end and that has a plurality of inclined grooves, and the printing apparatus uses the ink ribbon to form an image on a recording medium. The engaging member has an engaging convex portion engaged with at least one groove of the grooves of the engaging portion, a side face of the engaging convex portion engaged with the engaging portion has a different inclination angle from those of the grooves of the engaging portion, and the engaging convex portion has a point contact with the at least one groove at two points. According to the third aspect of the invention, the engaging convex portion of the printing apparatus is in a point contact with at least one groove of the grooves of the engaging portion of the ribbon spool at two points to be engaged therewith. This configuration prevents a backlash when the engaging convex portion of the printing apparatus is engaged with the engaging portion of the ribbon spool. Thus, the actual rotation amount of the ribbon spool can be accurately detected.

[0013] According to the third aspect, the engaging convex portion preferably has a different shape from those of the convex portions forming the grooves of the engaging portion. When the grooves of the engaging portion have an inclination angle α , the side face of the engaging convex portion has an inclination angle β , and α is $0^\circ < \alpha < 90^\circ$ (where $\alpha < \beta$), it is desirable that the two points correspond inclined surfaces of the convex portions forming the grooves of the engaging portion and vertexes of the engaging convex portion. When α is $90^\circ \leq \alpha < 180^\circ$ (where $\beta < 90^\circ$), the two points correspond vertexes of the convex portions forming the grooves of the engaging portion and side faces of the engaging convex portion. The engaging member has a biasing means for biasing the ribbon spool and the biasing means may bias the engaging convex portion toward the engaging portion. The engaging member may be connected to an encoder for detecting a rotation amount of the ribbon spool.

[0014] According to the first and second aspects of the present invention, at least one groove of the engaging portion has a point contact with the side faces of the engaging convex portion at two points to be engaged therewith. Therefore, a backlash can be advantageously prevented when the engaging portion of the ribbon spool is engaged with the engaging convex portion of the engaging member of the printing apparatus. According to the third aspect, the engaging convex portion of the printing apparatus is in a point contact with at least one groove of the engaging portion of the ribbon spool to be engaged therewith. This configuration can advantageously prevent a backlash when the engaging convex portion of the printing apparatus is engaged with the engaging portion of the ribbon spool, thus accurately detecting the actual rotation amount of the ribbon spool.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is a perspective view illustrating a printer apparatus to which the present invention can be applied.

[0016] FIG. 2 is a schematic cross-portional view illustrating the printer apparatus in which a cleaning roller and a carry roller are positioned at the first position.

[0017] FIG. 3 is a perspective view illustrating a ribbon cassette detachably attached to the printer apparatus.

[0018] FIG. 4 is a perspective view illustrating an engaging portion of the printer apparatus engaged with a spool body of a winder spool.

[0019] FIGS. 5A to 5C schematically illustrate how the engaging portion of the printer apparatus engages the engaging portion of a supply spool, wherein FIG. 5A illustrates how the engaging portion of the printer apparatus of the embodiment is engaged with the engaging portion of the supply spool, FIG. 5B illustrates how the engaging portion of the printer apparatus engages the engaging portion of the supply spool according to another embodiment, and FIG. 5C illustrates how the engaging portion of the printer apparatus engages the engaging portion of the supply spool according to another embodiment.

[0020] FIG. 6 schematically illustrates how a tip end of an engaging convex portion provided in the engaging member of the printer apparatus of the embodiment abuts against a tip end of the convex portion of the engaging portion of the spool body.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] Hereinafter, with reference to the drawings, embodiments will be described, wherein the present invention is applied to a printer apparatus for printing characters or an image on a card-like recording medium (hereinafter simply referred to as a card).

[0022] The printer apparatus of this embodiment is connected to a high order apparatus (e.g., a host computer such as a personal computer) via an interface (not shown). Printing record data or magnetic recording data or the like can be transmitted from the high order apparatus to the printer apparatus to instruct a recording operation or the like. It is noted that, as described later, the printer apparatus has an operation panel portion (operation display portion) **105** (see FIG. 1) through which a recording operation instruction from the high order apparatus can be received. A recording operation instruction also can be sent from the operation panel portion **105**. The high order apparatus is generally connected to an image input apparatus for reading an image recorded on a document (e.g., scanner), an input apparatus for inputting an instruction or data to the high order apparatus (e.g., keyboard, mouse), and a monitor for displaying data or the like generated by the high order apparatus (e.g., liquid crystal display).

[0023] As shown in FIG. 1, the printer apparatus **100** of this embodiment includes: a card supply portion **110** that is provided at one side of a casing **102**, that can store therein a plurality of layered blank cards (about 100 blank cards) not yet subjected to a recording processing, and that is detachably attached to the casing **102**; a card container **120** that is similarly provided at the one side of the casing **102** and at the lower part of the card supply portion **110**, that can store therein cards (about 30 cards) subjected to the recording processing in an inclined manner, and that is detachably attached to the casing **102**; a display portion **104** that is provided at the one side of the casing **102** and at a position adjacent to the card supply portion **110** and that displays an operation state including an error state of the printer apparatus **100**; and an operation panel portion **105** for carrying out

various settings such as a printing processing or a magnetic recording processing. It is noted that the operation panel portion 105 is attached so as to be synchronous with the rotation of a dial 106.

[0024] A part of the card container 120 has a card outlet 121 through which cards that are subjected to the recording processing and that cannot be stored anymore in the card container 120 can be discharged to the exterior of the apparatus. One face of the printer apparatus 100 has an open/close cover 107 that is used to provide an access to the interior of the apparatus in order to attach or detach a ribbon cassette 152 including an ink ribbon R used for printing and recording operations. The open/close cover 107 constitutes apart of the casing 102.

[0025] A basic structure of the printer apparatus 100 is disclosed in U.S. patent application Ser. No. 12/003,260, the disclosure of which is incorporated herein.

[0026] The following portion will describe the ribbon cassette 152 detachably attached to the apparatus body of the printer apparatus 100 of this embodiment.

[0027] As shown in FIG. 3, the ribbon cassette 152 includes: a supply spool 154 that supplies the ink ribbon R; a winder spool 155 around which the ink ribbon R is wound; and a cassette case 30 that stores the supply spool 154 and the winder spool 155 via a notch 30A (or while the supply spool 154 and the winder spool 155 being axially supported by the notch 30A) in a rotatable manner. The supply spool 154 and the winder spool 155 have therebetween the ink ribbon R exposed out of the cassette case 30 so that the ink ribbon R can be abutted to a thermal head 151 (which will be described later) (see FIG. 2). It is noted that the ribbon cassette 152 has a roller-like cleaner 132 that is engaged with a cleaning roller 131 (which will be described later) to remove the dust attached to the cleaning roller 131.

[0028] FIG. 4 illustrates how the engaging portion 12 of the winder spool 155 is engaged with an engaging member 23 of the apparatus body (engaging convex portion 22). The supply spool 154 and the winder spool 155 shown in FIG. 3 are obtained by winding (or retaining) the ink ribbon R around a spool body 10, respectively. The ink ribbon R not yet used is wound around the supply spool 154. The ink ribbon R already used (the ink ribbon R already subjected to the thermal transfer by the thermal head 151) is wound around the winder spool 155.

[0029] The spool body 10 has: the cylindrical ribbon retaining portion 18 that has flanges 13 and 14 at both sides and that retains the ink ribbon R; the engaging portion 12 that is provided at one side end so as to be adjacent to the flange 13; and an axis portion 19 that is provided at the opposite side of the engaging portion 12 so as to be adjacent to the flange 14 and that has a smaller diameter than that of the cylindrical portion of the ribbon retaining portion 18.

[0030] The flanges 13 and 14 regulate the position of the ink ribbon R wound around the ribbon retaining portion 18 in the axial direction of the spool body 10. Thus, even when the spool body 10 is rotated, the not-yet-used ink ribbon R is supplied without being dislocated from the ribbon retaining portion 18 (in the case of the supply spool 154) and the already-used ink ribbon R is appropriately wound around a ribbon retaining portion 18 (in the case of the winder spool 155). It is noted that the axis portion 19 is rotatably supported by a circular notch (not shown) formed in the cassette case 30.

[0031] The engaging portion 12 has six trapezoidal convex portions protruding in the end direction (the left side of FIG.

4). In other words, as shown in FIG. 3, the engaging portion 12 has grooves each of which is formed by an inclined surface 12A that is formed at the side face of the convex portion to draw a straight line and that has a predetermined inclination angle and a bottom portion 12B connecting inclined surfaces of neighboring convex portions (see also FIG. 5A).

[0032] The ribbon cassette 152 is manually attached by an operator to a cassette attachment portion in the apparatus body. The cassette attachment portion is configured as a part of a printing portion 150 (which will be described later). The cassette attachment portion has: a cassette retaining member (not shown) that is abutted to the cassette case 30 to retain the ribbon cassette 152 at a plurality of positions; an engaging portion for engaging the engaging portion 12 to the apparatus body; and a touch sensor (not shown) for detecting the attachment of the ribbon cassette 152.

[0033] As shown in FIG. 4, the apparatus body-side engaging portion to the engaging portion 12 of the winder spool 155 is configured by a plurality of members. Specifically, a support axis 25 is fixed to the apparatus frame (the casing 102). The support axis 25 axially supports the engaging member 23 in a rotatable manner. The engaging member 23 has a disk-like shape and has gears at the outer edge. A side of the engaging member 23 engaged with the engaging portion 12 has two engaging convex portions 22 provided in a protruded manner. The engaging convex portions 22 have a shape different from those of the convex portions (groove portions) of the engaging portion 12 and are provided so as to be opposed to each other (so as to create a phase difference of 180° in the rotation direction of the engaging member 23). A spring 24 is wound around the support axis 25. This spring 24 biases the engaging member 23 (the engaging convex portion 22) toward the engaging portion 12 in a slidable manner (see also FIG. 5A).

[0034] As shown in FIG. 6, there may be a case where, when the ribbon cassette 152 is attached to the cassette attachment portion, the tip end of the convex portion of the engaging portion 12 of the spool body 10 is abutted to (or collides with) the tip end of the engaging convex portion 22 provided in the apparatus body-side engaging member 23 and is prevented from being smoothly inserted. The engaging member 23 is slidably provided in the axial direction of the support axis 25. Thus, when the tip end of the convex portion of the engaging portion 12 collides with the tip end of the engaging convex portion 22, the engaging convex portion 22 is once evacuated to the apparatus frame-side (the opposite side of the spool body 10). Thereafter, when the engaging member 23 or the spool body 10 is rotated, the engaging convex portion 22 enters the groove between the convex portions of the engaging portion 12 and is biased by the spring 24 toward the spool body 10 and the engaging convex portion 22 is in a point contact with (the groove) between the convex portions the engaging portion 12 at two points (see FIG. 5A).

[0035] As shown in FIG. 4, the gear of the engaging member 23 is meshed with a gear 21C. The gear 21C is fixed with a rotation plate 21A in which a slit (not shown) is coaxially provided. At a position adjacent to the rotation plate 21A, a transmission integration-type sensor 21B consisting of a light-emitting element and a light-receiving element is provided. Thus, the rotation plate 21A and the sensor 21B configure an encoder 21 that detects the rotation amount of the winder spool 155 around which the ink ribbon R is wound. The gear of the engaging member 23 is meshed with the gear

26. The gear **26** is coaxially engaged with the motor axis of the stepping motor M (see also FIG. 2).

[0036] On the other hand, the apparatus body-side engaging portion of the supply spool **154** to the engaging portion **12** is basically the same as the above-described apparatus body-side engaging portion of the winder spool **155** to the engaging portion **12**. However, the former is different from the latter in that the gear **26** and a motor M are substituted with a gear meshed with the gear of the engaging member **23** and a torque limiter (not shown) that is coaxially provided with this gear and that applies a back tension to the ink ribbon R.

[0037] The following portion will describe, with reference to FIG. 5, one feature of the present invention by describing how the engaging convex portions **22** of the supply spool **154** and the winder spool **155** are engaged with the engaging portion **12** of the spool body **10**.

[0038] FIG. 5A illustrates how the engaging convex portion **22** is engaged with the engaging portion **12**. In FIG. 5A, it is notable that: (1) the engaging convex portion **22** has a different shape from that of the convex portion of the engaging portion **12** (the inclination angle of the side face **22A** of the engaging convex portion **22** is different from the inclination angle of the groove formed by the convex portions of the engaging portion **12**); and (2) the engaging convex portion **22** is in a point contact with (the groove formed by) the convex portions of the engaging portion **12** at two points. In the case of the conventional printing apparatus such as a printer apparatus, the convex portion of the apparatus body is engaged with the convex portion of the spool body having the same shape as that of the convex portion of the apparatus body, which has caused a backlash due to the line contact of the engaged portions. According to this engaging form, the former and the latter have different shapes to have a point contact at two-points to prevent a backlash. The engaging convex portion **22** is biased by the spring **24** toward the engaging portion **12** to secure a stronger engaging state therebetween, thus reducing a possibility of the generation of the backlash.

[0039] However, as shown in FIG. 5B and FIG. 5C, the engaging form as described above also can be applied to other forms. Specifically, the following is established when an inclination angle from the horizontal plane of the convex portion of the engaging portion **12** is represented as α , and an inclination angle from the horizontal plane of the engaging convex portion **22** is represented as β .

i) In the case of $0^\circ < \alpha < 90^\circ$

[0040] Contact points (abutting points) a and b of the engaging portion **12** and the engaging convex portion **22** are the inclined surface **12A** of the convex portion of the engaging portion **12** and the vertex (corner) of the engaging convex portion **22**. In this case, $\alpha < \beta$ is established.

ii) In the Case of $90^\circ \leq \alpha < 180^\circ$

[0041] The contact points a and b of the engaging portion **12** and the engaging convex portion **22** are the vertex (corner) of the convex portion of the engaging portion **12** and the side face **22A** of the engaging convex portion. In this case, $\beta < 90^\circ$ is established.

[0042] As shown in FIG. 2, at the downstream of the direction along which a card is carried by the carry roller **143**, the printing portion **150** is provided. The printing portion **150** prints predetermined characters or image on the surface of a card C cleaned by the cleaning roller **131**.

[0043] In this form, the printing portion **150** is composed by a thermal transfer printer. The printing portion **150** has the thermal head **151** that is provided so as to be able to move closer to or away from a platen roller **144** provided at the printing position on a card carrying path P1. The platen roller **144** and the thermal head **151** have therebetween the ink ribbon R on which a plurality of colors such as ink layers Y (yellow), M (magenta), C (cyan), Bk (black) or the like are frame-sequentially repeated.

[0044] When information such as the one for characters or image is recorded on the card C moved along the card carrying path P1 through thermal transfer, the ink ribbon R is supplied from the supply spool **154** and is carried while the substantially entire surface thereof is abutted to the tip end of the thermal head **151** and is wound around the winder spool **155**. The supply spool **154** and the winder spool **155** are rotated by the driving by the motor M. Then, a heating element of the thermal head **151** is selectively operated while pressurizing the thermal head **151** to the card C having thereon the ink ribbon R to print the predetermined characters or image on the card C. The path along which the ink ribbon R is carried has a transmission-type sensor. The transmission-type sensor consists of a plurality of guide shafts, a light-emitting element **158** for detecting the ink layer Bk (black) to locate a predetermined ink layer (ink layer Y in this form), and a light-receiving element **159**.

[0045] The following portion will describe the locating of the ink ribbon R carried out just before a printing processing. The CPU provided in a controller **195** drives a motor (not shown) to wind the ink ribbon R in the ribbon cassette **152** around the winder spool **155**. When a transmission-type sensor consisting of the light-emitting element **158** and the light-receiving element **159** detects an end of the ink layer Bk (black) (when the light-receiving element **159** detects that the light emitted from the light-emitting element **158** once blocked by the ink layer Bk is now transmitted), the CPU triggers the further driving of a motor (not shown) of a predetermined number of steps to locate the ink ribbon R so that the tip end of the ink layer Y (yellow) is positioned at the positions of the thermal head **151** and the platen roller **144**.

[0046] It is noted that, since the width of the ink layer Bk of the ink ribbon R (a width between the tip end and a rear end) is fixed (or known) in this form, the CPU counts the number of pulses inputted to the motor M to use the transmission-type sensor consisting of the light-emitting element **158** and the light-receiving element **159** to detect the tip end and the rear end of the ink layer Bk. The CPU also can know the rotation amount of the encoder **2** of the supply spool **154** (and optionally the rotation amount of the encoder of the winder spool **155**) to accurately calculate the carrying amount of the ink ribbon R.

[0047] A subsequent printing processing is disclosed in U.S. Ser. No. 12/003,260.

[0048] Next, the effect or the like of the printer apparatus **100** of this embodiment will be described together with the effect or the like of the ribbon cassette **152** (the spool body **10**) attached to or detached from the printer apparatus **100**.

[0049] As described above, in this embodiment, the convex portion of the engaging convex portion **22** has a different shape from that of the convex portion of the engaging portion **12** and the convex portion of the engaging convex portion **22** has a point contact with the convex portion of the engaging portion **12** at two points (see FIG. 6). According to the printer apparatus **100** of this embodiment, the engaging convex por-

tion 22 having a point contact with the engaging portion 12 at two points can allow the engaging portion 12 of the spool body 10 to engage the engaging convex portion 22 of the apparatus body-side engaging member 23 without having a backlash, thus allowing the encoder 21 to accurately detect the actual rotation amount of the spool body 10. Therefore, the ink ribbon R can be accurately located and can be prevented from being mislocated, thus preventing a printing error such as a case where an unintended color is printed for example.

[0050] Furthermore, in this embodiment, the engaging convex portion 22 can be biased by the spring 24 toward the engaging portion 12 to secure a stronger engaging state between the engaging convex portion 22 and the engaging portion 12. Thus, this embodiment reduces the possibility of a backlash.

[0051] It is noted that, although this embodiment has described an example in which the flanges 13 and 14 are provided at both sides of the ribbon retaining portion 18 of the spool body 10, the present invention is not limited to this example. For example, the flange 14 also may be provided to the cassette case 30 so as to regulate the position of the ink ribbon R in the axial direction of the spool body 10. Although this embodiment has described an example in which the axis portion 19 of the spool body 10 is provided to protrude from the flange 14, the present invention is not limited to this. For example, the cassette case 30 also may have an axis portion to support the ribbon spool body 10 in a rotatable manner.

[0052] Although this embodiment has described an example in which both of the supply spool 154 and the winder spool 155 use the spool body 10 shown in FIG. 4, the spool body 10 shown in FIG. 4 provided at any one of the supply spool 154 and the winder spool 155 also can contribute to an improved operability or the apparatus having a smaller size to some extent. Although this embodiment has shown an embodiment in which the groove of the engaging portion 12 of the ribbon spool is engaged with the engaging convex portion 22A of the engaging member 23, the same effect also can be obtained by another configuration where the engaging member 23 includes a groove that is engaged with the convex portion 12 of the ribbon spool.

[0053] The disclosure of Japanese Patent Application No. 2007-172511, filed on Jun. 29, 2007, is incorporated in the application.

[0054] While the invention has been explained with reference to the specific embodiments of the invention, the explanation is illustrative and the invention is limited only by the appended claims.

What is claimed is:

1. A ribbon spool for detachably attaching to a printing apparatus for forming an image on a recording medium by an ink ribbon, said printing apparatus having an engaging member including an engaging convex portion, comprising:
 a ribbon retaining portion for retaining the ink ribbon; and
 an engaging portion provided at one lateral side end of the ribbon spool for engaging the engaging convex portion and having a plurality of inclined grooves,
 wherein the grooves have an inclination angle different from that of a lateral side face of the engaging convex portion, at least one of the grooves of the engaging portion having a point contact with the engaging convex portion at two points to engage the engaging convex portion.

2. A ribbon spool according to claim 1, wherein the grooves of the engaging portion have convex portions in a shape different from a shape of the engaging convex portion.

3. A ribbon spool according to claim 1, wherein in case the grooves of the engaging portion have an inclination angle α and the lateral side face of the engaging convex portion has an inclination angle β , when α is $0^\circ < \alpha < 90^\circ$ (wherein $\alpha < \beta$), the two points correspond to inclined surface of the convex portion of the engaging portion and vertex of the engaging convex portion, and wherein, when α is $90^\circ \leq \alpha < 180^\circ$ (wherein $\beta < 90^\circ$), the two points correspond to vertexe of the convex portion of the engaging portion and lateral side face of the engaging convex portion.

4. A ribbon spool according to claim 1, wherein the ribbon retaining portion has a flange for regulating a position of the ink ribbon in an axial direction, and the engaging portion is adjacent to the flange.

5. A ribbon cassette, comprising:
 a supply spool for supplying an ink ribbon;
 a winder spool around which the ink ribbon is wound; and
 a case for rotatably storing the supply spool and the winder spool;
 wherein at least one of the supply spool and the winder spool is the ribbon spool according to claim 1.

6. A ribbon cassette, comprising:
 a supply spool for supplying the ink ribbon;
 a winder spool around which the ink ribbon is wound; and
 a case for rotatably storing the supply spool and the winder spool;
 wherein at least one of the supply spool and the winder spool is the ribbon spool according to claim 2.

7. A ribbon cassette, comprising:
 a supply spool for supplying the ink ribbon;
 a winder spool around which the ink ribbon is wound; and
 a case for rotatably storing the supply spool and the winder spool;
 wherein at least one of the supply spool and the winder spool is the ribbon spool according to claim 3.

8. A ribbon cassette, comprising:
 a supply spool for supplying the ink ribbon;
 a winder spool around which the ink ribbon is wound; and
 a case for rotatably storing the supply spool and the winder spool;
 wherein at least one of the supply spool and the winder spool is the ribbon spool according to claim 4.

9. A printing apparatus for forming an image on a recording medium by an ink ribbon situated in a ribbon spool having a ribbon retaining portion for retaining the ink ribbon, and an engaging portion provided at one lateral side end and having a plurality of inclined grooves, comprising:

an engaging member for engaging the engaging portion of the ribbon spool, said engaging member having an engaging convex portion for engaging at least one of the grooves of the engaging portion,
 wherein the engaging convex portion for engaging the engaging portion has a lateral side face with inclination angle different from that of the grooves of the engaging portion, and the engaging convex portion has a point contact with the at least one groove at two points.

10. A printing apparatus according to claim 9, wherein the engaging convex portion has a shape different from those of the convex portions of the engaging portion.

11. A printing apparatus according to claim 9, wherein in case the grooves of the engaging portion have an inclination

angle α , and the lateral side face of the engaging convex portion has an inclination angle β , when α is $0^\circ < \alpha < 90^\circ$ (wherein $\alpha < \beta$), the two points correspond to an inclined surface of the convex portions of the engaging portion and vertex of the engaging convex portion, and wherein when α is $90^\circ \leq \alpha < 180^\circ$ (wherein $\beta < 90^\circ$), the two points correspond to vertex of the convex portions of the engaging portion and a side face of the engaging convex portion.

12. A printing apparatus according to claim 9, wherein the engaging member has biasing means for biasing the ribbon spool, and the biasing means biases the engaging convex portion toward the engaging portion.

13. A printing apparatus according to claim 9, further comprising an encoder connected to the engaging member for detecting a rotation amount of the ribbon spool.

14. A combination of a ribbon spool and a printing apparatus for forming an image on a recording medium by an ink ribbon,

wherein said printing apparatus includes an engaging member having an engaging convex portion, and wherein said ribbon spool includes a ribbon retaining portion for retaining the ink ribbon; and an engaging portion provided at one lateral side end of the ribbon spool for engaging the engaging convex portion and having a plurality of inclined grooves,

wherein the grooves have an inclination angle different from that of a lateral side face of the engaging convex portion, at least one of the grooves of the engaging portion having a point contact with the engaging convex portion at two points to engage the engaging convex portion.

15. A combination according to claim 14, wherein the grooves of the engaging portion have convex portions in a shape different from a shape of the engaging convex portion.

16. A combination according to claim 14, wherein in case the grooves of the engaging portion have an inclination angle α and the lateral side face of the engaging convex portion has an inclination angle β , when α is $0^\circ < \alpha < 90^\circ$ (wherein $\alpha < \beta$), the two points correspond to inclined surface of the convex portion of the engaging portion and vertex of the engaging convex portion, and wherein when α is $90^\circ \leq \alpha < 180^\circ$ (wherein $\beta < 90^\circ$), the two points correspond to vertex of the convex portion of the engaging portion and lateral side face of the engaging convex portion.

17. A combination according to claim 14, wherein the ribbon retaining portion has a flange for regulating a position of the ink ribbon in an axial direction, and the engaging portion is adjacent to the flange.

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