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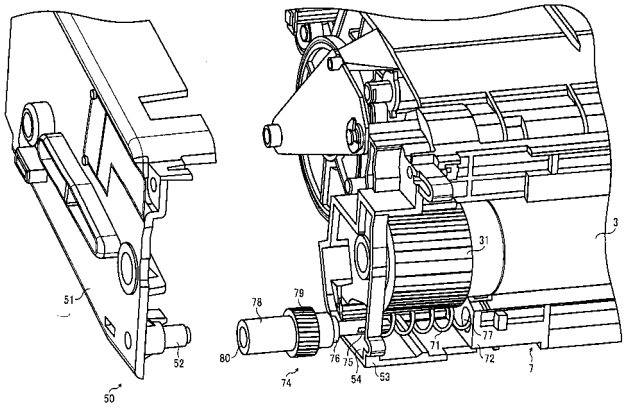
(54) Process cartridge and image forming apparatus

(57) A process cartridge (50) is configured to be mounted on a main body of an image forming apparatus (1) in a detachable manner. The process cartridge (50) includes an image carrier (3) on which a toner image is formed; a cleaning unit (7) that cleans the image carrier (3) by removing residual toner remained after transferring the toner image formed on the image carrier (3) onto a transfer medium, which includes a cleaning member (70) that removes the toner from the image carrier (3) and a toner conveying unit that conveys the toner removed by the cleaning member (70) in a longitudinal direction of the cleaning member (70), including a toner conveying member (71) that makes a rotation to convey the toner removed by the cleaning member (70) in a predetermined direction and a rotary supporting member (74) that supports the toner conveying member (71) at a predetermined position such that the toner conveying member (71) can be rotated and makes a rotation with a driving force from outside; a side wall (53) for supporting the image carrier (3) such that the image carrier (3) can be rotated; and an outer cover member (51) having a surface parallel to the side wall (53). The side wall (53) includes a through hole (54). The rotary supporting member (74) includes a holding unit (52, 80) that passes through the through hole (54) and is held at the outer cover member (51) in a rotatable manner.

FIG. 3



EP 2 073 073 A1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a process cartridge and an image forming apparatus using the process cartridge.

2. Description of the Related Art

[0002] In an image forming apparatus such as a copying machine, a printer, a facsimile, and a multifunction product (MFP), a full-color image formation is widely spread. In particular, a tandem-type image forming apparatus having a plurality of image carriers with a high-speed processing is becoming the mainstream of the image forming field. In addition, an apparatus employing a process cartridge including an image carrier and at least one of a charging unit, a developing unit, and a cleaning unit is also known.

[0003] The process cartridge is mounted on the main body of the image forming apparatus in a detachable manner, and can be taken out of the apparatus for its replacing work or maintenance work to avoid a work in a narrow space in the apparatus.

[0004] On the other hand, in a process cartridge including an image carrier and at least a cleaning unit, toners removed by the cleaning unit are conveyed out of the cartridge. In such a process cartridge, it is necessary to arrange a conveying coil spring, a conveying coil, or a conveying screw as a conveying unit for conveying toners in the longitudinal direction of the cleaning member. In this case, because the conveying unit is to be rotated, a gear is provided which engages with a gear of the image carrier.

[0005] In a conventional process cartridge configured as described above, as shown in Fig. 6, a photosensitive drum 101 has a rotating shaft laterally supported between the side walls of the casing of the process cartridge and both axial ends are supported at the side walls of the casing.

[0006] Meanwhile, as the cleaning unit, a cleaning blade (not shown) is fixed to the casing of the process cartridge with screws, the toners removed from the photosensitive drum 101 at the upstream side in the rotating direction of the photosensitive drum 101 are conveyed out by a conveying coil 102 in the longitudinal direction of the cleaning member and contained in a waste toner tank (not shown). The conveying coil 102 is inserted and held by a shaft 103 and rotatably supported at the casing through a sliding bearing 104, a gear 105 applying a driving force is fixed to the shaft 103 and rotatably held at the casing with an E-shaped fitting ring 106.

[0007] However, the conventional process cartridge requires a number of parts, causing a problem of its cost with a bulky size.

SUMMARY OF THE INVENTION

[0008] It is an object of the present invention to at least partially solve the problems in the conventional technology.

[0009] According to one aspect of the present invention, there is provided a process cartridge configured to be mounted on a main body of an image forming apparatus in a detachable manner. The process cartridge includes an image carrier on which a toner image is formed; a cleaning unit that cleans the image carrier by removing residual toner remained after transferring the toner image formed on the image carrier onto a transfer medium, which includes a cleaning member that removes the toner from the image carrier and a toner conveying unit that conveys the toner removed by the cleaning member in a longitudinal direction of the cleaning member, including a toner conveying member that makes a rotation to convey the toner removed by the cleaning member in a predetermined direction and a rotary supporting member that supports the toner conveying member at a predetermined position such that the toner conveying member can be rotated and makes a rotation with a driving force from outside; a side wall for supporting the image carrier such that the image carrier can be rotated; and an outer cover member having a surface parallel to the side wall. The side wall includes a through hole. The rotary supporting member includes a holding unit that passes through the through hole and is held at the outer cover member in a rotatable manner.

[0010] Furthermore, according to another aspect of the present invention, there is provided a process cartridge configured to be mounted on a main body of an image forming apparatus in a detachable manner. The process cartridge includes an image carrier on which a toner image is formed; a cleaning unit that cleans the image carrier by removing residual toner remained after transferring the toner image formed on the image carrier onto a transfer medium, which includes a cleaning member that removes the toner from the image carrier and a toner conveying unit that conveys the toner removed by the cleaning member in a longitudinal direction of the cleaning member, including a toner conveying member that makes a rotation to convey the toner removed by the cleaning member in a predetermined direction and a rotary supporting member that supports the toner conveying member at a predetermined position such that the toner conveying member can be rotated and makes a rotation with a driving force from outside; a side wall for supporting the image carrier such that the image carrier can be rotated; an outer cover member having a surface parallel to the side wall; and a holder for supporting the rotary supporting member. The side wall includes a through hole. The holder includes a holding unit that passes through the through hole and is held at the outer cover member in a rotatable manner.

[0011] The above and other objects, features, advantages and technical and industrial significance of the

present invention will be better understood by reading the following detailed description of presently preferred embodiments of the invention, when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a schematic diagram of a color printer as an image forming apparatus according to the present invention;

Fig. 2 is a schematic diagram of a process cartridge in the color printer shown in Fig. 1;

Fig. 3 is a partial exploded perspective view of a process cartridge according to a first embodiment of the present invention;

Fig. 4 is a partial exploded perspective view of a process cartridge according to a second embodiment of the present invention;

Fig. 5 is a partial exploded perspective view of the process cartridge shown in Fig. 4 from which a photosensitive drum is removed; and

Fig. 6 is a partial exploded perspective view of a conventional process cartridge.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] Exemplary embodiments of the present invention will be explained in detail below with reference to the accompanying drawings.

[0014] Fig. 1 is a schematic diagram of an example of an image forming apparatus 1 that forms a full-color image employing a process cartridge according to the present invention. The image forming apparatus 1 includes image forming units 2Y, 2C, 2M, and 2K corresponding to four different colors, an intermediate transfer belt 10 arranged in opposition to the image forming units 2Y, 2C, 2M, and 2K, and a sheet feeding unit 20 for feeding a recording sheet.

[0015] The image forming units 2Y, 2C, 2M, and 2K are used for developing yellow, cyan, magenta, and black, respectively. The configuration of the image forming unit 2K will be described as a representing one of the image forming units 2Y, 2C, 2M, and 2K because they have virtually the same configuration.

[0016] Fig. 2 is a schematic diagram of a process cartridge 50k of the image forming apparatus 1. As shown in Figs .1 and 2, the image forming unit 2K includes a photosensitive drum 3K as an image carrier, a charging unit 4K, a developing unit 5K, and a cleaning unit 7K arranged in sequence along a rotating direction of the photosensitive drum 3K. An electrostatic latent image is formed according to image information by a writing light L from a writing unit 8 between the charging unit 4K and the developing unit 5K. As the image carrier, a belt-like carrier may also be used instead of the drum-like carrier. In the case of the present embodiment, the image forming unit 2K is made such that the photosensitive drum 3K, the charging unit 4K, the developing unit 5K, and the cleaning unit 7K arranged around the photosensitive drum 3K are constituted as a process cartridge 50K stored in a single cartridge.

[0017] In the image forming apparatus configured as described above, the photosensitive drum 3K is rotationally driven by a main motor (not shown), and when it is uniformly charged by the charging unit 4K, a writing process is executed.

[0018] A target image is written according to digital image data from a control unit (not shown) to form an electrostatic latent image under application of the writing unit 8. The electrostatic latent image formed on the photosensitive drum 3K is developed by the developing unit 5K. For example, with an application of a DC voltage with an AC bias to a developing sleeve, toners adhere only to image portions of low electric potentials through an irradiation of the writing light, and toners are developed to form a toner image.

[0019] The toner image of each of the colors is electrostatically transferred from the photosensitive drum 3k to the intermediate transfer belt 10 with an application of a bias having a polarity opposite to that of the toners to a primary transfer device constituted as a primary transfer roller 6k oppositely arranged against the photosensitive drums 3k. Then, the toner images of four colors are transferred onto the intermediate transfer belt 10 in a superimposed manner, and collectively transferred onto a recording sheet fed from the sheet feeding unit 20 by a secondary transfer roller 11.

[0020] The sheet feeding unit 20 includes a sheet feeding cassette 21. The recording sheet fed from the sheet feeding cassette 21 is conveyed to a secondary transferring device by a pair of registration rollers 22 at an appropriate timing at which the toner images are transferred onto the intermediate transfer belt 10. The recording sheet passed through the transferring process is separated from a roller 12 and further conveyed toward a fixing unit 13. At the fixing unit 13, the toner images are fixed on the recording sheet when the recording sheet passes through a fixing nip constituted by rollers, and then the recording sheet is discharged to a sheet discharging tray 15 through sheet discharging rollers 14.

[0021] The sheet discharging rollers 14 are used as switch-back conveying members when a duplex image formation is performed. That is, the image forming apparatus 1 is constructed to perform not only a single-sided image formation but also a duplex image formation. Therefore, in the case of the duplex image formation, the recording sheet after fixing the image formed thereon is once conveyed to the sheet discharging tray 15 by the sheet discharging rollers 14, and then the sheet discharging rollers 14 are rotated in the reverse direction with the trailing edge of the recording sheet being held between the rollers. With this arrangement, the recording sheet is conveyed from the sheet discharging tray 15 to a reverse

feeding path and fed toward the registration rollers 22 positioned at a merging part between the reverse feeding path and a feeding path from the sheet feeding cassette 21. A changing-over of the conveying paths for the recording sheet at the time of forming images at the single and the both sides is carried out by a conveying path changing-over claw arranged at the rear side of the fixing unit 13.

[0022] Fig. 3 is a partial exploded perspective view of a process cartridge 50 according to a first embodiment of the present invention. As shown in Fig. 3, a cleaning unit 7 arranged inside the process cartridge 50 includes a cleaning blade 70 and a conveying coil spring 71 for conveying toners removed from a photosensitive drum 3 by the cleaning blade 70 outside the process cartridge 50. The cleaning blade 70 is fixed with a screw 73 to a side wall 72.

[0023] On one end of the conveying coil spring 71, a rotary supporting member 74 is provided. The rotary supporting member 74 includes a connecting part 75 formed into a split pin shape that is inserted and connected to be contacted with the inner peripheral part of the conveying coil spring 71, a shaft part 76 subsequent to the connecting part 75 so as to hold a cylindrical seal member (not shown), a driving shaft 78 inserted into a shaft hole 77 formed at the side wall 72 of the cleaning unit 7 and rotatably supporting a position setting hole 80, and a gear 79 for transmitting a driving action of the conveying coil spring 71 arranged at the driving shaft 78. Further, the gear 79 directly receives a rotary driving force from a gear 31 of the photosensitive drum 3.

[0024] The process cartridge 50 further includes an outer cover member 51, and the outer cover member 51 is provided with a pin 52 for use in position setting and supporting the rotary supporting member 74. The pin 52 oppositely faces against the driving shaft 78 at the extremity end of the rotary supporting member 74 and the surface of the driving shaft 78 opposing against the pin 52 is formed with the position setting hole 80 into which the pin 52 is rotatably fitted. The holding unit according to the first embodiment is constituted by the pin 52 and the position setting hole 80, the pin 52 is fitted into the position setting hole 80 at the time of assembling operation, thereby the conveying coil spring 71 can be positively supported and rotated in a high precision. Further, it may also be applicable that the holding unit has a configuration opposite to the aforesaid one, where the outer cover member 51 is provided with the position setting hole 80 and the rotary supporting member 74 is provided with the pin 52 inserted into the position setting hole 80.

[0025] The cleaning unit 7 constituted as described above is operated such that the toners removed from the photosensitive drum 3 by the cleaning blade 70 are temporarily stored in a space where the conveying coil spring 71 is arranged, and the removed toners are transported in a direction in parallel with a longitudinal direction of the cleaning blade 70 under a rotation of the conveying coil spring 71. Then, the toners are transported out of the process cartridge 50 and stored in a waste toner tank not shown. Further, as means for conveying toners, either the conveying coil or a conveying screw may be used in place of the conveying coil spring 71.

[0026] It is preferable that the rotary supporting member 74 is integrally molded through an injection molding process with polyacetal resin for the connecting part 75, the shaft part 76, the driving shaft 78, the gear 79 and the position setting hole 80 and the number of component parts is substantially reduced. Further, in place of polyacetal resin, the rotary supporting member 74 may be made of polyamide resin, fluorine resin, polyimide resin, polyamide-imide resin, polyphenylene sulfide resin, polyethylene resin, polypropylene resin and these alloy resins and the like. Additionally, as a reinforcing member, either single or more of glass, potassium titanate, talc, mica, lewistonite and natural ores may be added and it is a general process to add these reinforcing members by 5% to 50%.

[0027] As the cylindrical seal member supported by the shaft part 76, it is possible to use members made of foamed material, non-woven fabric and woven-fabric and the like.

[0028] The outer cover member 51 has a hole for holding the rotating shaft inserted into the photosensitive drum 3 and a hole for holding the rotating shaft inserted into the developing unit 5 and an inter-shaft distance between the photosensitive drum 3 and the developing unit 5 is restricted by both holding holes. Then, the rotary supporting member 74 supporting the conveying coil spring 71 passes through a through hole 54 formed at a side wall 53 of the process cartridge 50, the pin 52 of the outer cover member 51 is fitted to the position setting hole 80, thereby assembled into the process cartridge 50.

[0029] In addition, in view of productivity, the outer cover member 51 and the side wall 53 of the process cartridge 50 are constituted by resin formed through an injection molding, polycarbonate resin, acrylonitrile-butadienestyrene resin, styrene resin, polyphenylene-ether resin, polyphenylene-oxide resin, polyether-terephthalate resin and these alloy resins and the like can be used, and additionally, either single or more of glass, potassium titanate, talc, mica, lewistonite and natural ores may be added to these resins and it is a general process to add these reinforcing members by 5% to 50%.

[0030] The process cartridge 50 constructed in such a way as above can be assembled only by fitting the pin 52 of the outer cover member 51 into the position setting hole 80 of the rotary supporting member 74 supporting the conveying coil spring 71. Accordingly, as found in the prior art cartridge shown in Fig. 6, comparing the present invention with the prior art assembling method in which the E-shaped fixing rings are applied to hold the cartridge at both sides of a casing shows that it has a less number of component parts and a small-sized formation can be realized and their assembling operation also becomes quite easy. Further, the conveying coil spring 71 is positively supported by the rotary supporting member 74 and

a removal of the gear 79 and the like is also prevented.

[0031] Fig. 4 is a partial exploded perspective view of a process cartridge 50 according to a second embodiment of the present invention; and Fig. 5 is a partial exploded perspective view of the process cartridge 50 shown in Fig. 4 from which a photosensitive drum 3 is removed.

[0032] As shown in Figs. 4 and 5, a cleaning unit 7 arranged in the process cartridge 50 includes a cleaning blade 70 acting as a cleaning member and a conveying coil spring 71 for conveying toners removed from the photosensitive drum 3 by the cleaning blade 70 out of the process cartridge 50, the cleaning blade 70 is fixed to a side wall 72 of the cleaning unit 7 with a screw 73.

[0033] On one end of the conveying coil spring 71, a rotary supporting member 74 is provided. The rotary supporting member 74 includes a connecting part 75 formed like a split-pin shape inserted to be contacted with an inner periphery of the conveying coil spring 71 and connected to it, a shaft part 76 subsequent to the connecting part 75 to hold the cylindrical seal member not shown, a driving shaft 78 inserted into a shaft hole 77 formed at the side wall 72 of the cleaning unit 7 and rotatably supporting a position setting hole 80, and a gear 79 for transmitting a driving action of the conveying coil spring 71 arranged at the driving shaft 78.

[0034] The rotary supporting member 74 is made such that the position setting hole 80 is formed at the extremity end of the driving shaft 78 and a pin 82 arranged at a holder 81 is fitted into the position setting hole 80. The holder 81 is arranged between the rotary supporting member 74 and the outer cover member 51 as described later in detail, and the rotary supporting member 74 is rotatably supported at the holder 81 supported by the outer cover member 51. An idler gear 83 for use in transmitting a rotation of the photosensitive drum 3 to the gear 79 is rotatably supported at the holder 81.

[0035] Although the cleaning unit 7 according to the second embodiment is operated such that the conveying coil spring 71 is driven by the photosensitive drum 3, rotation of the photosensitive drum 3 is transmitted through the idler gear 83 to cause its rotating direction to be the same as that of the photosensitive drum 3. Rotating direction of the conveying coil spring 71 is set to be the same direction as that of the photosensitive drum 3 to enable the conveying coil spring 71 to transport the removed toners in an opposite direction to that of the photosensitive drum 3, i.e., while they are being displaced to a side separate from the peripheral surface of the photosensitive drum 3.

[0036] A connecting shaft 84 having its axial center coincided with that of the driving shaft 78 is formed at the holder 81 and the extremity end of the connecting shaft 84, i.e., an end part oppositely facing against the outer cover member 51 of the process cartridge 50 is provided with a fitting hole 85. In turn, the outer cover member 51 is provided with the pin 52, the pin 52 oppositely faces against the connecting shaft 84 at the extremity end of the holder 81 and the pin 52 is fitted into the fitting hole 85 formed at the connecting shaft 84.

[0037] In this way, the process cartridge 50 according to the second embodiment is made such that the rotary supporting member 74 for supporting the conveying coil spring 71 is held indirectly through the holder 81 to hold the conveying coil spring 71 positively and at the same time to enable the conveying coil spring to be rotated in a high precise manner.

[0038] The cleaning unit 7 constituted in this way is operated such that the toners removed from the photosensitive drum 3 by the cleaning blade 70 are temporarily stored in a space having the conveying coil spring 71 arranged therein, and rotation of the conveying coil spring 71 causes the removed toners to be transported in a direction parallel with a longitudinal direction of the cleaning blade 70. At this time, since the rotating direction of the conveying coil spring 71 is the same as that of the photosensitive drum 3, the conveying coil spring 71 transports the removed toners while they are being displaced to a side spaced apart from the peripheral surface of the photosensitive drum 3. Then, the removed toners are transported out of the process cartridge 50 and stored in a waste toner tank not shown.

[0039] The rotary supporting member 74 and the holder 81 are preferably molded integrally through an injection molding process using polyacetal resin, thereby the number of component parts is substantially reduced. Further, in place of polyacetal resin, the rotary supporting member 74 and the holder 81 may be made of polyamide resin, fluorine resin, polyimide resin, polyamide-imide resin, polyphenyl-sulfide resin, polyethylene resin, polyprene resin and these alloy resins and the like. In addition, as a reinforcing member, either single or more of glass, potassium titanate, talc, mica, lewistonite and natural ores may be added and it is a general process to add these reinforcing members by 5% to 50%.

[0040] In Figs. 4 and 5, reference numeral 53 denotes a side wall of the process cartridge 50 and reference numeral 54 denotes a through hole formed at the side wall 53, and the outer cover member 51 and the side wall 53 in the preferred embodiment are also made of the same materials as those of the aforesaid preferred embodiment.

[0041] The process cartridge 50 constituted in this way also has an advantage that the number of component parts is less as compared with that of the assembling process for holding both sides of the casing under application of an E-shape fixing ring, further a small-sized formation through concentration of the functions of the component parts may also become possible and its assembling process may also become quite easy.

[0042] According to one aspect of the present invention, the toner conveying member is rotatably supported at the predetermined position and at the same time the toner conveying member has a rotary supporting member rotated upon receiving a driving force from outside and the rotary supporting member is rotatably held at the

outer cover member by the holding unit, so that the number of component parts is reduced and further a small-sized formation can be realized by concentrating the functions of the component parts and their assembling work can be carried out quite easily.

[0043] Although the invention has been described with respect to specific embodiments for a complete and clear disclosure, the appended claims are not to be thus limited but are to be construed as embodying all modifications and alternative constructions that may occur to one skilled in the art that fairly fall within the basic teaching herein set forth.

Claims

1. A process cartridge (50) configured to be mounted on a main body of an image forming apparatus (1) in a detachable manner, the process cartridge (50) comprising:

an image carrier (3) on which a toner image is formed;
a cleaning unit (7) that cleans the image carrier (3) by removing residual toner remained after transferring the toner image formed on the image carrier (3) onto a transfer medium, the cleaning unit (7) including
a cleaning member (70) that removes the toner from the image carrier (3), and
a toner conveying unit that conveys the toner removed by the cleaning member (70) in a longitudinal direction of the cleaning member (70), the toner conveying unit including
a toner conveying member (71) that makes a rotation to convey the toner removed by the cleaning member (70) in a predetermined direction, and
a rotary supporting member (74) that supports the toner conveying member (71) at a predetermined position such that the toner conveying member (71) can be rotated and makes a rotation with a driving force from outside;
a side wall (53) for supporting the image carrier (3) such that the image carrier (3) can be rotated; and
an outer cover member (51) having a surface parallel to the side wall (53), wherein
the side wall (53) includes a through hole (54), and
the rotary supporting member (74) includes a holding unit (52, 80) that passes through the through hole (54) and is held at the outer cover member (51) in a rotatable manner.

2. A process cartridge (50) according to claim 1, wherein
the holding unit (52, 80) includes a convex part fitted to one of the rotary supporting member (74) and the outer cover member (51) and a concave part to which the convex part is fitted at the other of the rotary supporting member (74) and the outer cover member (51).

3. A process cartridge (50) according to claim 1 or 2, wherein
the rotary supporting member (74) is constituted by supporting parts for supporting the toner conveying member (71), a gear (79) for rotationally driving the toner conveying member (71), and one of the holding unit (52, 80) is integrally formed with resin through an injection molding process.

4. A process cartridge (50) according to claim 3, wherein
the resin is any one of polyscetal resin, polyamide resin, fluorine resin, polyimide resin, polyamide-imide resin, polyphenylene-sulfide resin, polyethylene resin, polyprene resin, and an alloy resin of above resins.

5. A process cartridge (50) configured to be mounted on a main body of an image forming apparatus (1) in a detachable manner, the process cartridge (50) comprising:

an image carrier (3) on which a toner image is formed;
a cleaning unit (7) that cleans the image carrier (3) by removing residual toner remained after transferring the toner image formed on the image carrier (3) onto a transfer medium, the cleaning unit (7) including
a cleaning member (70) that removes the toner from the image carrier (3), and
a toner conveying unit that conveys the toner removed by the cleaning member (70) in a longitudinal direction of the cleaning member (70), the toner conveying unit including
a toner conveying member (71) that makes a rotation to convey the toner removed by the cleaning member (70) in a predetermined direction, and
a rotary supporting member (74) that supports the toner conveying member (71) at a predetermined position such that the toner conveying member (71) can be rotated and makes a rotation with a driving force from outside;
a side wall (53) for supporting the image carrier (3) such that the image carrier (3) can be rotated;
an outer cover member (51) having a surface parallel to the side wall (53); and
a holder (81) for supporting the rotary supporting member (74), wherein
the side wall (53) includes a through hole (54), and

the holder (81) includes a holding unit (52, 80) that passes through the through hole (54) and is held at the outer cover member (51) in a rotatable manner.

6. A process cartridge (50) according to claim 5, wherein
the rotary supporting member (74) includes a gear (79) for rotationally driving the toner conveying member (71), the gear (79) is drivingly connected to a gear (31) arranged at the image carrier (3) through an idler gear (83) arranged at the holder (81).

7. An image forming apparatus comprising:

a process cartridge (50) according to any one of claims 1 to 6.

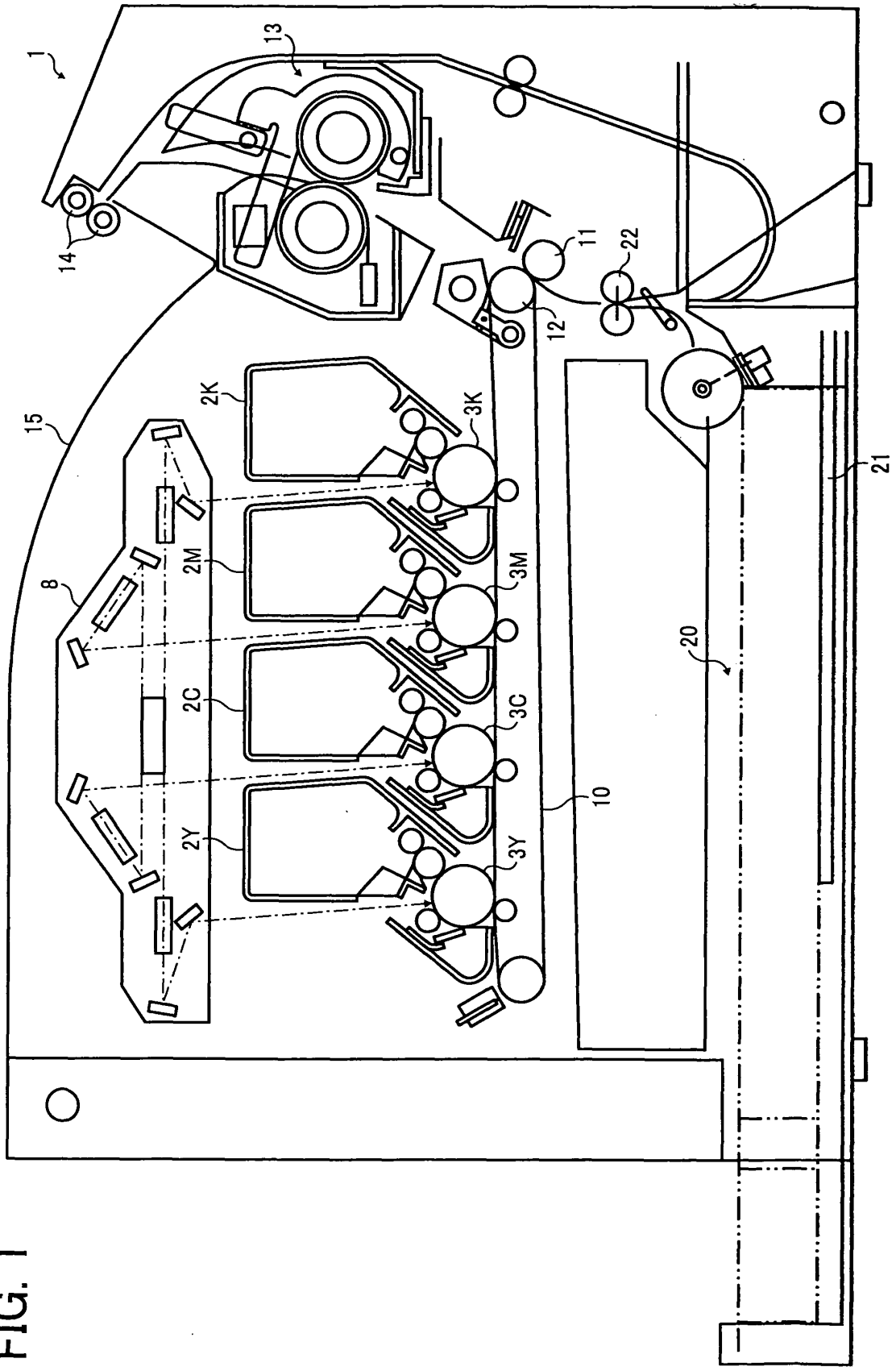


FIG. 1

FIG. 2

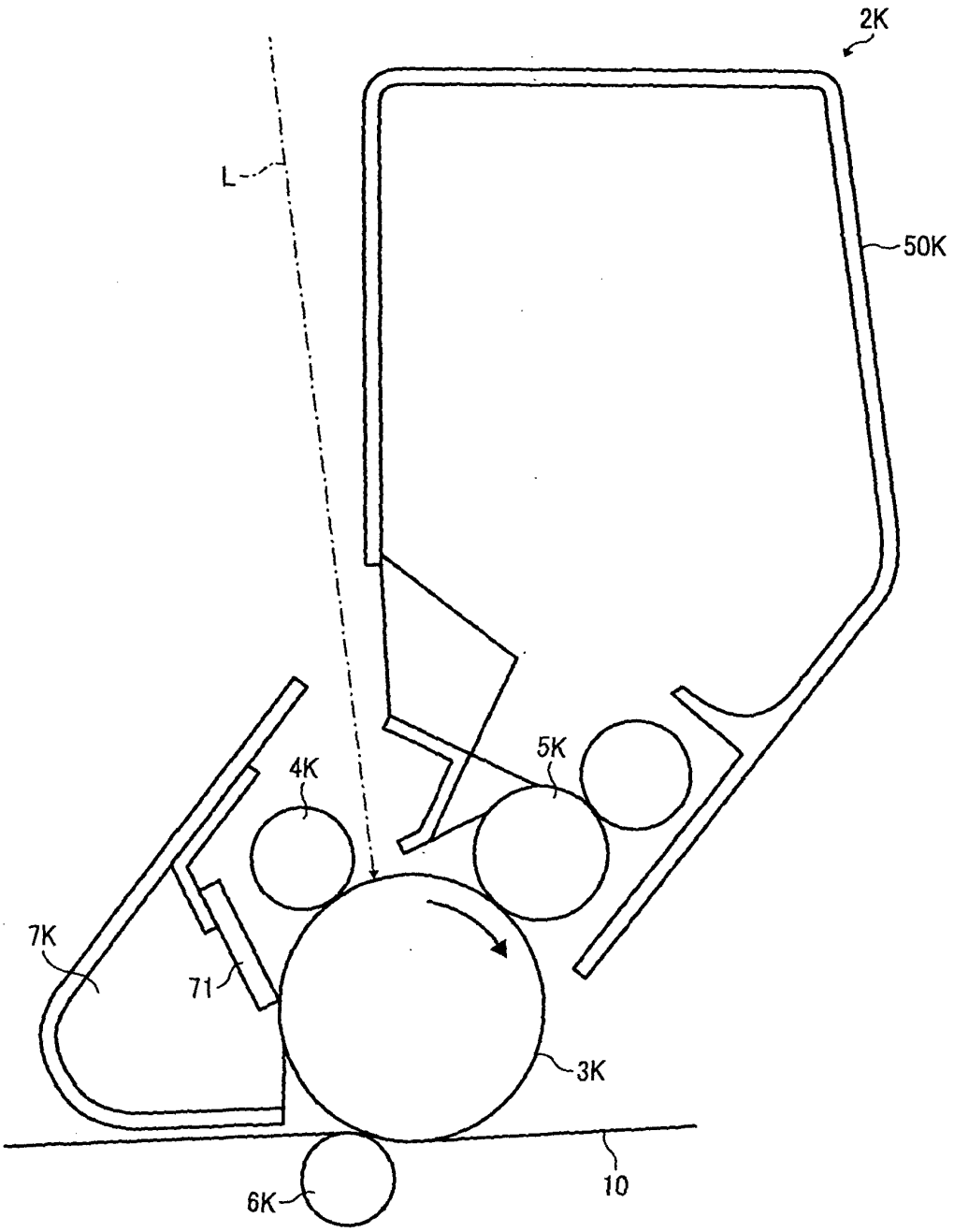


FIG. 3

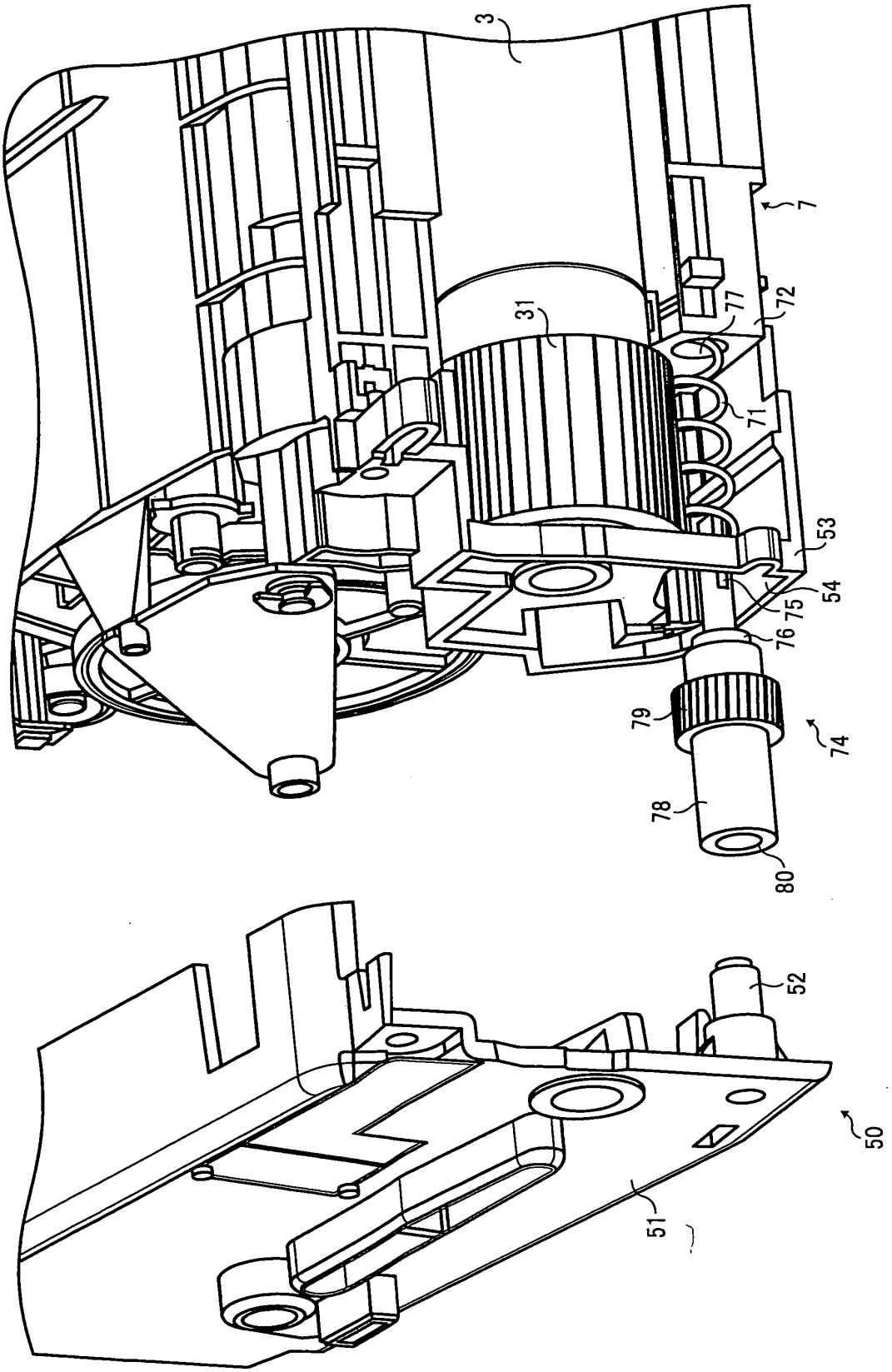
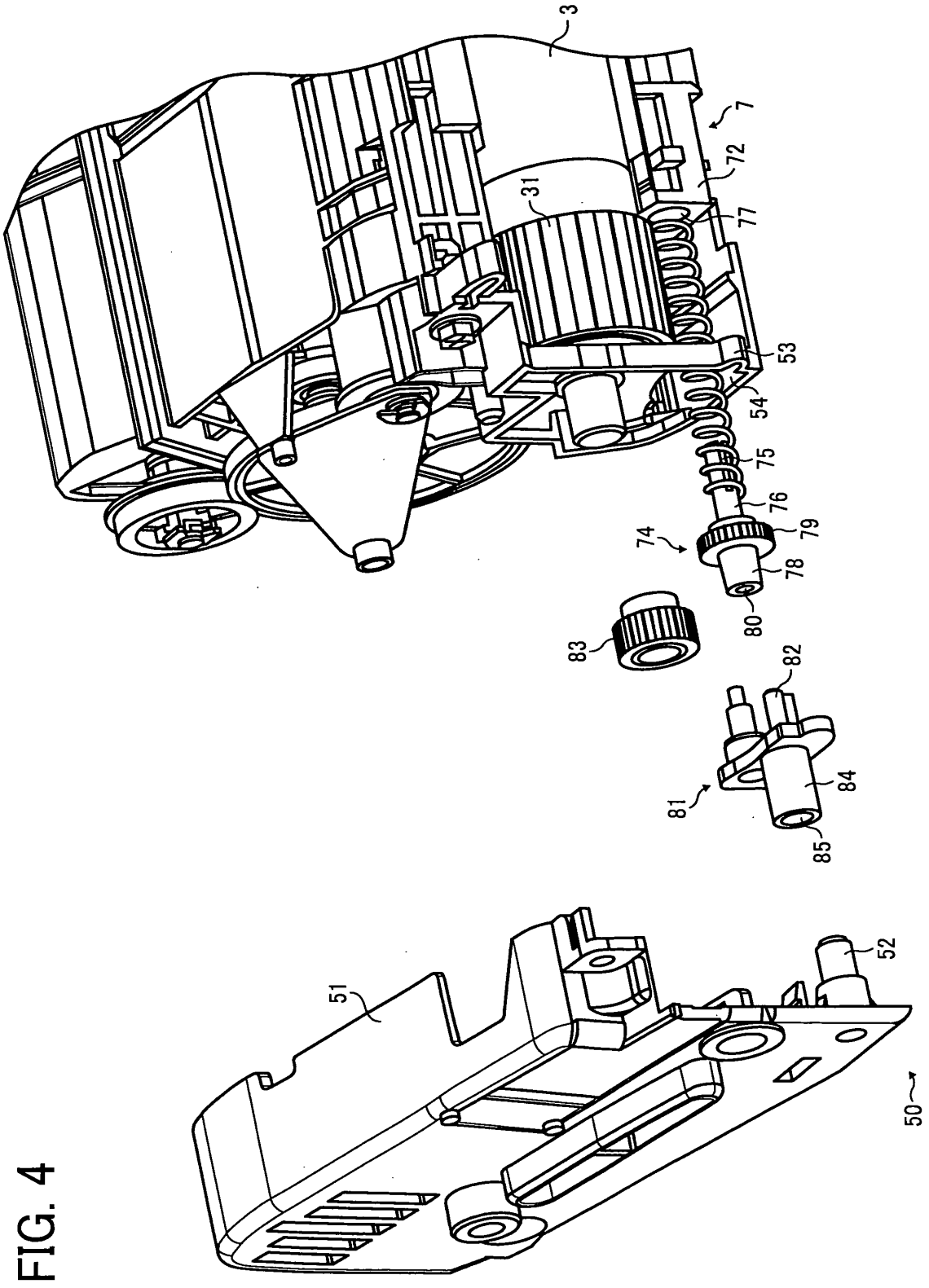


FIG. 4



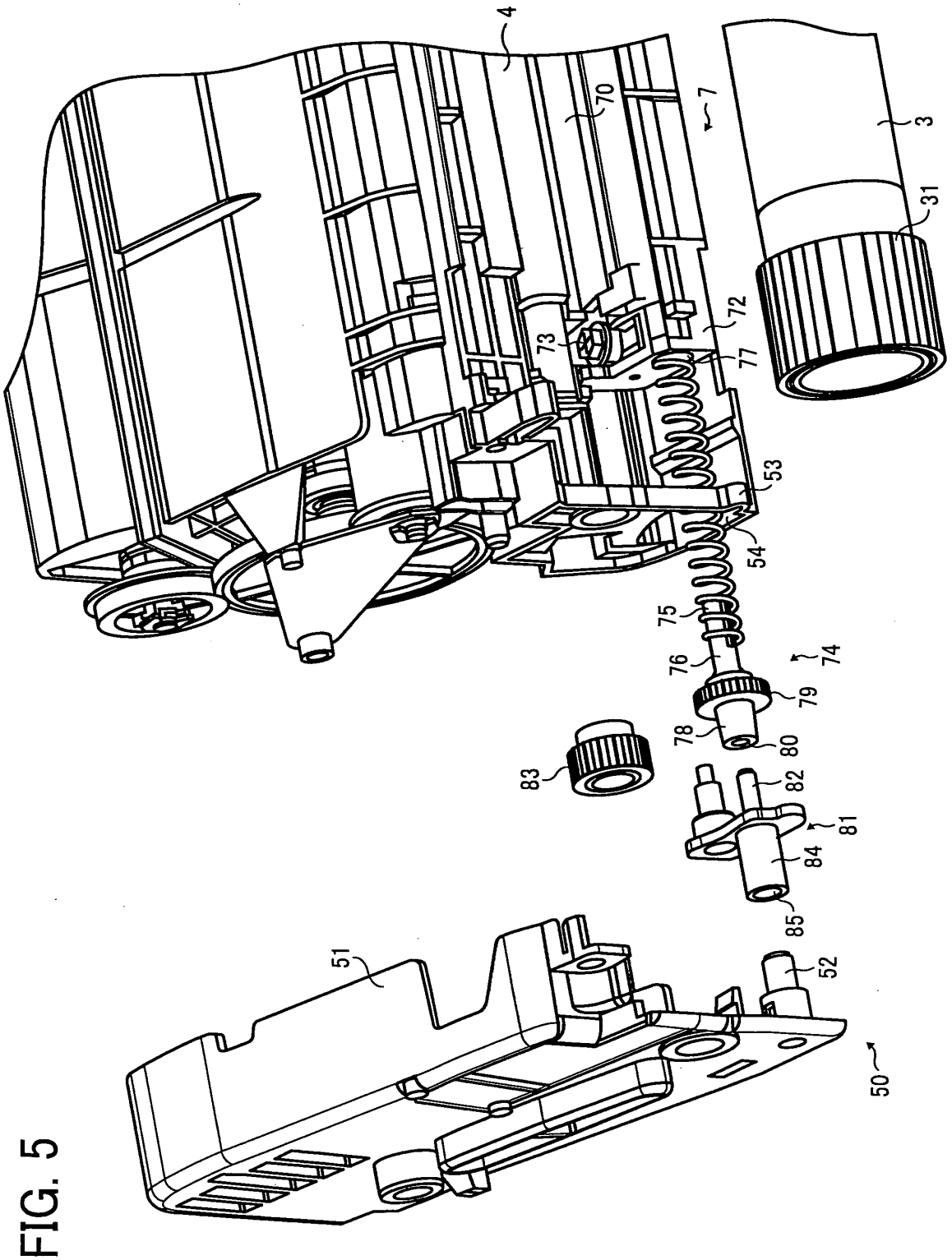


FIG. 5

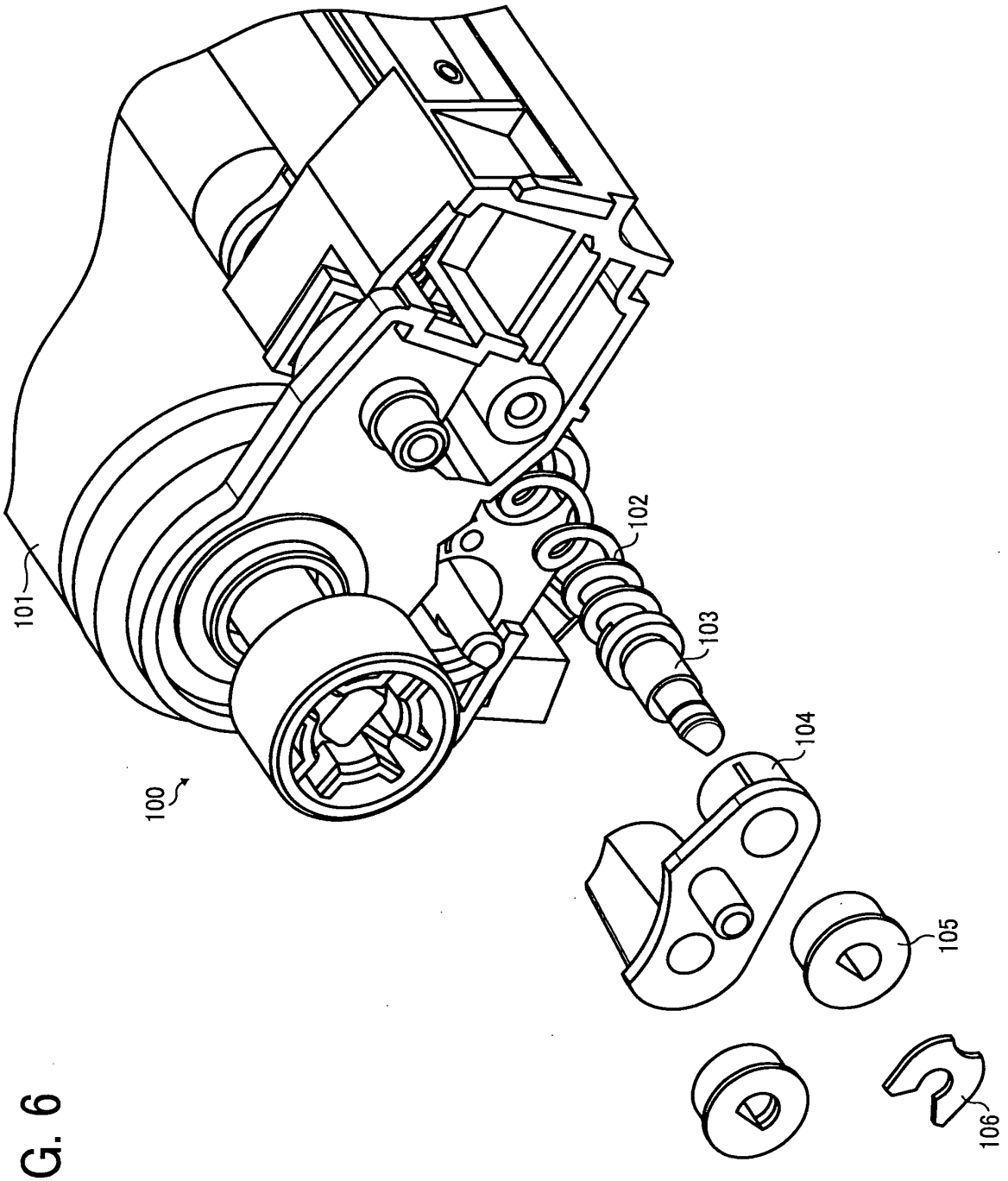


FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 08 25 4003

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2001/026707 A1 (MIYABE SHIGEO [JP] ET AL) 4 October 2001 (2001-10-04) * paragraphs [0065], [0067], [0165]; figures 7,28 *	1-7	INV. G03G21/18
X	EP 0 827 049 A (CANON KK [JP] CANON KK) 4 March 1998 (1998-03-04) * column 11, lines 15-36,58 - column 12, line 13; figures 4,10,20,31,43 * * column 26, line 41 - column 27, line 2 * * column 30, line 31 - column 31, line 16 *	1-7	
X	JP 2004 117696 A (CANON KK) 15 April 2004 (2004-04-15) * paragraphs [0058], [0059], [0061]; figures 6,8,9 *	1-7	
X	JP 2007 133045 A (RICOH KK) 31 May 2007 (2007-05-31) * abstract; figures 1,2 *	1	
A	US 2005/238384 A1 (SAMPE ATSUSHI [JP] ET AL) 27 October 2005 (2005-10-27) * paragraphs [0023], [0033]; figure 6 *	1-7	TECHNICAL FIELDS SEARCHED (IPC) G03G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19 May 2009	Van Ouytsel, Krist'l

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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