

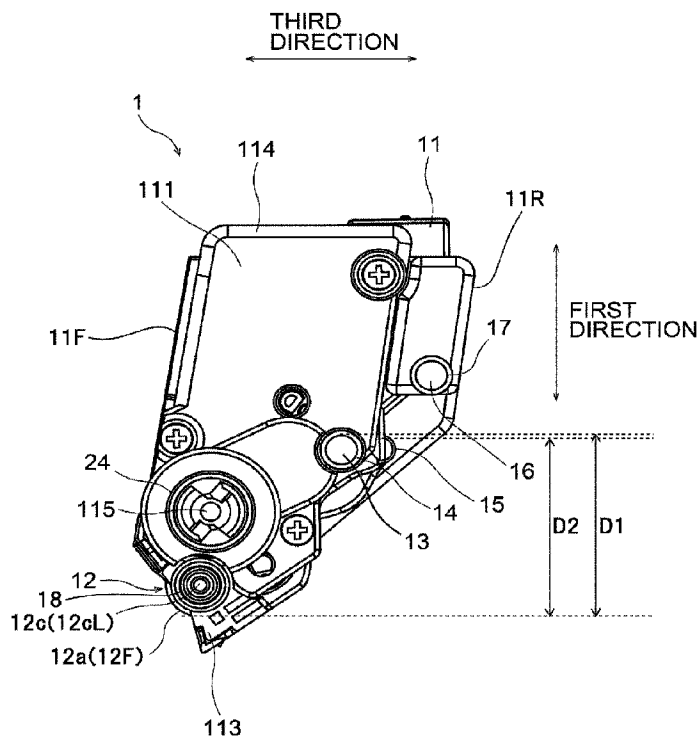


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(54) Titre : CARTOUCHE DE REVELATEUR

(54) Title: DEVELOPER CARTRIDGE



(57) Abrégé/Abstract:

A developing roller (12) is located closer to a first end (113) than to a second end (114) of a housing (11) in a first direction. A first boss (13) extends in a second direction and is movable together with the housing. The first boss bears the weight of a developer cartridge (1) when the first boss is supported by a support surface (41) of a first side plate (33) of a drum unit (3), and is located away from the developing roller in the first direction and the third direction. A first pressure receiving surface (15) is located farther away from the developing roller than the first boss is in the third direction. The pressure receiving surface receives a pressing force in the third direction from a pressing member (47) of the first side plate of the drum unit. The first boss is located away from the developing roller in the first direction by a first distance (D1). The first pressure receiving surface is located away from the developing roller in the first direction by the first distance or by a second distance (D2) smaller than the first distance.

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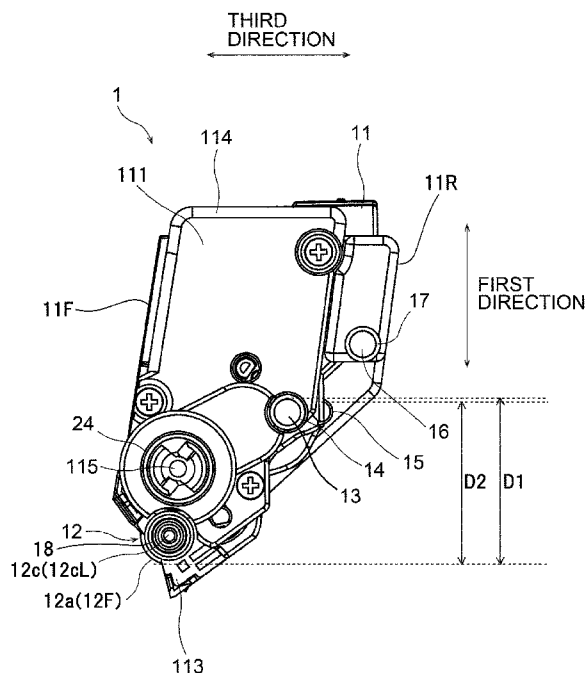
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(57) Abstract: A developing roller (12) is located closer to a first end (113) than to a second end (114) of a housing (11) in a first direction. A first boss (13) extends in a second direction and is movable together with the housing. The first boss bears the weight of a developer cartridge (1) when the first boss is supported by a support surface (41) of a first side plate (33) of a drum unit (3), and is located away from the developing roller in the first direction and the third direction. A first pressure receiving surface (15) is located farther away from the developing roller than the first boss is in the third direction. The pressure receiving surface receives a pressing force in the third direction from a pressing member (47) of the first side plate of the drum unit. The first boss is located away from the developing roller in the first direction by a first distance (D1). The first pressure receiving surface is located away from the developing roller in the first direction by the first distance or by a second distance (D2) smaller than the first distance.

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Description

Title of Invention: DEVELOPER CARTRIDGE

Technical Field

[0001] The present disclosure relates to a developer cartridge.

Background Art

[0002] Electrophotographic image forming apparatuses known in the art include laser printers and light-emitting diode (LED) printers. For example, PTL 1 discloses an image forming apparatus that includes developer cartridges and a drum unit. The drum unit includes a plurality of photosensitive drums. The developer cartridges are attachable to and removable from the drum unit. When a developer cartridge is attached to the drum unit, a developing roller of the developer cartridge contacts the corresponding photosensitive drum of the drum unit.

[0003] Each developer cartridge includes a developing roller shaft rotatable together with a developing roller. When the developer cartridge is attached to the drum unit, the developer cartridge rotates, due to weight of the developer cartridge, about the developing roller shaft relative to the drum unit. The developer cartridge is then positioned relative to the drum unit.

Citation List

Patent Literature

[0004] [PTL1] Japanese Patent Application Publication No. 2007-101635

Summary of Invention

Technical Problem

[0005] When the developer cartridge is attached to the drum unit, the developer cartridge pivots about the developing roller shaft relative to the drum unit. The developing roller of the developer cartridge may apply greatly varying contact pressures to the photosensitive drum of the drum unit depending on the remaining amount of toner in the developer cartridge. Such greatly varying contact pressures between the developing roller and the photosensitive drum may cause inappropriate transfer of toner (white patches or color unevenness) onto a sheet on which images are output.

[0006] In response to the above issue, one or more aspects of the present invention are directed to a structure that prevents contact pressure between a photosensitive drum of a drum unit and a developing roller of a developer cartridge from varying greatly depending on the amount of toner remaining in the developer cartridge.

Solution to Problem

[0007] (1) A first aspect of the disclosure provides a developer cartridge with the structure described below. The developer cartridge includes a housing, a developing roller, a

first boss, and a first pressure receiving surface. The housing extends in a first direction, and may contain toner. The housing has a first end in the first direction, and a second end located away from the first end in the first direction. The developing roller is rotatable about a roller axis extending in a second direction different from the first direction. The developing roller is located closer to the first end than to the second end in the first direction. The developing roller has an uncovered surface located at a first end of the developing roller in a third direction and exposed outside the housing, and a covered surface located at a second end of the developing roller in the third direction inside the housing. The first boss extends in the second direction and is movable together with the housing. The first boss is located at a first outer surface of the housing at a first end of the housing in the second direction. The first boss may bear a weight of the developer cartridge when the first boss is supported by a support surface of a first side plate of a drum unit. The first boss is located away from the developing roller in the first direction and the third direction. The first pressure receiving surface is located farther away from the developing roller than the first boss is from the developing roller in the third direction. The first pressure receiving surface may receive a pressing force in the third direction from a pressing member of the first side plate of the drum unit. The first boss is located away from the developing roller in the first direction by a first distance. The first pressure receiving surface is located away from the developing roller in the first direction by the first distance or by a second distance smaller than the first distance.

[0008] With this structure, contact pressure between a photosensitive drum of the drum unit and the developing roller of the developer cartridge can be suppressed from varying greatly depending on the amount of toner remaining in the developer cartridge.

[0009] (2) Preferably, in the developing cartridge according to the first aspect, the first direction is different from the third direction.

[0010] (3) Preferably, the developing cartridge according to the first aspect or the feature (2) is attachable to the drum unit in the first direction.

[0011] (4) Preferably, in the developing cartridge according to the first aspect or any one of the features (2)-(3), the first pressure receiving surface is configured to receive the pressing force directed from the covered surface toward the uncovered surface in the third direction from the pressing member of the first side plate of the drum unit.

[0012] (5) Preferably, when the developer cartridge according to the feature (4) is attached to the drum unit, the first boss is supported by the support surface of the first side plate of the drum unit, and the first boss bears the weight of the developer cartridge.

[0013] With this structure, the first pressure receiving surface can receive the pressing force directed from the covered surface toward the uncovered surface while the first boss bears the weight of the developer cartridge. Hence, the developing roller can be made

closer to the photosensitive drum without being affected by the weight of the developer cartridge.

[0014] (6) Further, when the developer cartridge according to the feature (5) is attached to the drum unit, preferably, the first pressure receiving surface receives the pressing force directed from the covered surface toward the uncovered surface in the third direction from the pressing member of the first side plate of the drum unit.

[0015] With this structure, when the developing cartridge is attached to the drum unit, the developing roller can be brought into contact with the photosensitive drum upon receipt of the pressing force directed from the covered surface toward the uncovered surface at the first pressure receiving surface, while the first boss is received by the support surface of the drum unit.

[0016] (7) Further, when the developer cartridge according to the feature (5) is attached to the drum unit, preferably, the first pressure receiving surface is pressed against the pressing member of the first side plate the drum unit to receive the pressing force directed from the covered surface toward the uncovered surface in the third direction.

[0017] With this structure, when the developing cartridge is attached to the drum unit, the first pressure receiving surface contacts the pressing member of the drum unit to be pressed toward the developing roller. The developing roller is thus made into contact with the photosensitive drum of the drum unit.

[0018] (8) Preferably, the developer cartridge according to the first aspect or any of the features (2)-(7) further includes a first collar rotatable about the first boss, the first collar being cylindrical or polygonal.

[0019] With this structure, the first boss can be slid relative to the support surface of the drum unit with a smaller friction force, thereby brining the developing roller close to the photosensitive drum of the drum unit.

[0020] (9) Preferably, in the developer cartridge according to any of the first aspect and the features (2)-(8), the first boss is a separate component from the housing.

[0021] With this structure, the first boss can be assembled to the housing. Hence, flexibility in assembly of the developing cartridge can be realized.

[0022] (10) Preferably, in the developer cartridge according to the first aspect or any of the features (2)-(9), the developing roller is located on a first end of the housing in the third direction, and the first pressure receiving surface is located on a second end of the housing located away from the first end in the third direction.

[0023] (11) Still preferably, the developer cartridge according to the first aspect or any of the features (2)-(10) further includes a second boss extending in the second direction and movable together with the housing. The second boss is located at the first outer surface. The second boss is located farther away from the developing roller than the first boss is from the developing roller in the first direction and the third direction. The

second boss is configured to receive a pressing force directed from the second end of the housing in the first direction toward the first end of the housing in the first direction.

[0024] (12) Further preferably, the developer cartridge according to the feature (11) is configured to pivot about the first boss in response to the second boss receiving the pressing force directed from the second end of the housing in the first direction to the first end of the housing in the first direction.

[0025] With this structure, the second boss can receive the pressing force directed from the second end toward the first end of the housing while the first boss bears the weight of the developer cartridge. Accordingly, the developing cartridge can be pivoted such that the developing roller can be made closer to the photosensitive drum without being affected by the weight of the developer cartridge.

[0026] (13) Preferably, in the developer cartridge according to the feature (11), the second boss is configured to receive the pressing force from a lock lever of the drum unit.

[0027] (14) In the developer cartridge according to the feature (11), it is further preferable that: the second boss receives the pressing force directed from the second end of the housing in the first direction toward the first end of the housing in the first direction from a lock lever of the drum unit when the developer cartridge is attached to the drum unit; and the first boss is supported by the support surface of the first side plate of the drum unit, and the first boss bears the weight of the developer cartridge.

[0028] (15) Preferably, the developer cartridge according to the feature (14) pivots about the first boss in response to the second boss receiving the pressing force directed from the second end to the first end in the first direction.

[0029] With this structure, the second boss receives the pressing force directed from the second end to the first end in the first direction when the developer cartridge is attached to the drum unit, thereby causing the developer cartridge to pivot about the first boss to move the developing roller toward the photosensitive drum.

[0030] (16) Preferably, the developer cartridge according to the feature (15) further includes a protrusion extending in the second direction, the protrusion being located on a first end of the developing roller in the second direction. The protrusion contacts a first guide surface of the drum unit in response to the developer cartridge pivots about the first boss.

[0031] With this structure, the protrusion contacts the first guide surface when the developer cartridge is attached to the drum unit to restrict further pivoting of the developer cartridge. Positioning of the developing roller relative to the photosensitive drum can be thus provided.

[0032] (17) In this the developer cartridge according to the feature (16), it is preferable that: the developing roller includes a developing roller shaft extending in the second

direction; and the protrusion is located at a first end of the developing roller shaft in the second direction.

[0033] With this structure, the first end of the developing roller shaft can be utilized as the protrusion.

[0034] (18) Further preferably, the developer cartridge according to any of the features (11)-(17) further includes a second collar rotatable about the second boss, the second collar being cylindrical or polygonal.

[0035] With this structure, the developing cartridge can be pivoted smoothly to be attached to the drum unit, with smaller friction force.

[0036] (19) Further preferably, the developer cartridge according to any of the features (11)-(18) further includes a third boss extending in the second direction and movable together with the housing. The third boss is located at a second outer surface of the housing located away from the first outer surface in the second direction. The third boss is configured to bear the weight of the developer cartridge when the third boss is supported by a second support surface of a second side plate of the drum unit. The third boss is located away from the developing roller in the first direction and the third direction.

[0037] With this structure, the first boss and the third boss positioned opposite to each other in the second direction can be supported respectively by the support surface and the second support surface of the drum unit. The developer cartridge can be supported stably.

[0038] (20) Further preferably, the developer cartridge according to the feature (19) further includes a second pressure receiving surface located farther away from the developing roller than the third boss is from the developing roller in the third direction. The second pressure receiving surface is located away from the first pressure receiving surface in the second direction. The second pressure receiving surface is configured to receive a pressing force acting in the third direction from a pressing member of the second side plate of the drum unit. The third boss is located away from the developing roller in the first direction by the first distance, and the second pressure receiving surface is located away from the developing roller in the first direction by the first distance or by the second distance.

[0039] With this structure, the developing cartridge can be pressed at the first pressure receiving surface and the second pressure receiving surface positioned opposite to each other in the second direction when the developing cartridge is attached to the drum unit. The developer cartridge can be stably moved toward the photosensitive drum to allow the developing cartridge to be attached to the drum unit.

[0040] (21) Further preferably, in the developer cartridge according to the first aspect or any one of the features (2)-(20), the first boss is located closer to the developing roller than

to the second end of the housing in the first direction.

[0041] (22) Further preferably, in the developer cartridge according to the first aspect or any one of the features (2)-(20), the first pressure receiving surface extends beyond at least a portion of the first outer surface of the housing in the third direction.

[0042] (23) A second aspect of the disclosure provides a developer cartridge with the structure below. The developer cartridge includes a housing, a developing roller, a first boss, and a second boss. The housing extends in a first direction and may contain toner. The housing has a first end in the first direction, and a second end located away from the first end in the first direction. The developing roller is rotatable about a roller axis extending in a second direction different from the first direction. The developing roller is located closer to the first end than to the second end in the first direction. The developing roller has an uncovered surface and a covered surface. The uncovered surface is located at a first end of the developing roller in a third direction and exposed outside the housing. The covered surface is located at a second end of the developing roller in the third direction inside the housing. The first boss extends in the second direction and is movable together with the housing. The first boss is located at a first outer surface of the housing at a first end of the housing in the second direction. The first boss is located away from the developing roller in the first direction and the third direction. The second boss extends in the second direction and is movable together with the housing. The second boss is located at the first outer surface. The second boss is located farther away from the developing roller than the first boss is from the developing roller in the first direction and the third direction.

[0043] With this structure, contact pressure between a photosensitive drum of the drum unit and the developing roller of the developer cartridge can be restrained from varying greatly depending on the amount of toner remaining in the developer cartridge.

[0044] (24) Preferably, the developing cartridge according to the second aspect further includes a first collar rotatable about the first boss.

[0045] With this structure, the first boss can be slid smoothly relative to the drum unit with a smaller friction force.

[0046] (25) Preferably, the developing cartridge according to the feature (24) further includes a second collar rotatable about the second boss.

[0047] With this structure, the second boss can also be slid smoothly relative to the drum unit with a smaller friction force.

[0048] (26) Preferably, in the developing cartridge according to the second aspect or any one of the features (24)-(25), the first boss is located closer to the developing roller than to the second end of the housing in the first direction.

[0049] (27) Preferably, the developing cartridge according to the second aspect or any one of the features (24)-(26) further includes a pressure receiving surface extending beyond

at least a portion of the first outer surface of the housing in the third direction.

[0050] (28) Preferably, the developing cartridge according to the second aspect or any one of the features (24)-(27) further includes a coupling extending from the first outer surface of the housing in the second direction. The coupling is rotatable about a coupling axis extending in the second direction, and the coupling axis is located between the developing roller and the first boss in the first direction.

[0051] (29) Alternatively, the developing cartridge according to the second aspect or any one of the features (24)-(27) may further include a coupling extending from the first outer surface of the housing in the second direction. The coupling is rotatable about a coupling axis extending in the second direction. The first boss is located between the coupling axis and the second boss in the first direction and in the third direction.

[0052] (30) Still preferably, in the developing cartridge according to the second aspect or any one of the features (24)-(29), the first direction is different from the third direction.

[0053] (31) Preferably, the developing cartridge according to the second aspect or any one of the features (24)-(30) is attachable to a drum unit in the first direction.

[0054] (32) Still preferably, in the developing cartridge according to the second aspect or any one of the features (24)-(31), the first boss is configured to bear a weight of the developer cartridge.

[0055] (33) Still preferably, in the developing cartridge according to the feature (32), the first boss is configured to bear the weight of the developer cartridge when the first boss is supported by a support surface of a first side plate of a drum unit.

[0056] With this structure, the developing cartridge can be pivoted, while the first boss bears the weight of the developer cartridge.

[0057] (34) Still preferably, in the developing cartridge according to the second aspect or any one of the features (24)-(33), the second boss is configured to receive a pressing force directed from the second end of the housing in the first direction toward the first end of the housing in the first direction.

[0058] (35) Still preferably, the developing cartridge according to the feature (34) is configured to pivot about the first boss in response to the second boss receiving the pressing force directed from the second end of the housing in the first direction toward the first end of the housing in the first direction.

[0059] With this structure, the developing cartridge can be pivoted about the first boss toward the photosensitive drum of the drum unit, by the second boss receiving the pressing force directed from the second end toward the first end of the housing while the first boss bears the weight of the developer cartridge.

[0060] (36) Still alternatively, in the developing cartridge according to the feature (34) or the feature (35), the second boss is configured to receive the pressing force directed from the second end of the housing in the first direction toward the first end of the housing

in the first direction from a lock lever of a drum unit.

Advantageous Effects of Invention

[0061] With the structure according to the first and second aspects of the disclosure, contact pressure between the photosensitive drum of the drum unit and the developing roller of the developer cartridge can be restrained from varying greatly depending on the amount of toner remaining in the developer cartridge.

Brief Description of Drawings

[0062] [fig.1]Fig. 1 is a conceptual diagram of an image forming apparatus;
[fig.2]Fig. 2 is a perspective view of a drum unit and developer cartridges;
[fig.3]Fig. 3 is a perspective view of a developer cartridge;
[fig.4]Fig. 4 is a perspective view of the developer cartridge as viewed in a direction different from Fig. 3;
[fig.5]Fig. 5 is a side view of the developer cartridge at one end of the developer cartridge in a second direction;
[fig.6]Fig. 6 is a side view of the developer cartridge at other end of the developer cartridge in the second direction;
[fig.7]Fig. 7 is a perspective view of the drum unit;
[fig.8]Fig. 8 is a side view of the drum unit showing inner structure of the drum unit in the process of attaching one developer cartridge to the drum unit;
[fig.9]Fig. 9 is a side view of the drum unit showing inner structure of the drum unit, in which the developer cartridge is attached to the drum unit;
[fig.10]Fig. 10 is a side view of the developer cartridge in the process of being attached to the drum unit;
[fig.11]Fig. 11 is a side view of the developer cartridge that be attached to the drum unit; and
[fig.12]Fig. 12 is a schematic diagram describing forces acting relative to one another in the process of attaching the developer cartridge to the drum unit.

Description of Embodiments

[0063] An embodiment of the present disclosure will now be described with reference to the drawings.

[0064] A first direction herein refers to a longitudinal direction of each end face of a developer cartridge. A second direction herein refers to a direction along the axis of rotation of a photosensitive drum. A third direction herein refers to a direction in which a plurality of photosensitive drums is aligned with one another. The first direction, the second direction, and the third direction intersect with one another (preferably, at right angles).

[0065] 1. Structure of Image Forming Apparatus

[0066] Fig. 1 is a conceptual diagram of an image forming apparatus 100 according to the embodiment. The image forming apparatus 100 is an electrophotographic printer. The image forming apparatus 100 may be a laser printer or a light-emitting diode (LED) printer. As shown in Fig. 1, the image forming apparatus 100 includes a drum unit 3 and a plurality of developer cartridges 1. The drum unit 3 includes a frame that is configured to hold the developer cartridges 1.

[0067] Fig. 2 is a perspective view of the drum unit 3 and the developer cartridges 1. The developer cartridges 1 are individually attachable to the drum unit 3. The drum unit 3 holding the developer cartridges 1 is configured to be attached to a body casing 101 of the image forming apparatus 100 (refer to Fig. 1). The developer cartridges 1 each contain toner (developer) of a different color (e.g., cyan, magenta, yellow, or black). The image forming apparatus 100 is configured to form (output) an image on a recording surface of a print sheet with toner supplied from the developer cartridges 1. The drum unit 3 in the present embodiment is configured to hold four developer cartridges 1. In some embodiments, the drum unit 3 may hold one to three, or five or more developer cartridges 1.

[0068] 2. Structure of Developer Cartridge

[0069] Figs. 3 and 4 are perspective views of the developer cartridge 1. Figs. 5 and 6 show end faces of the developer cartridge 1 as viewed in the second direction. As shown in Figs. 3 to 6, each of the developer cartridges 1 according to the present embodiment includes a housing 11, a developing roller 12, an agitator (not shown), and a coupling 24.

[0070] The housing 11 is a casing configured to contain toner. The housing 11 has a chamber (not shown) configured to contain toner. The housing 11 extends in the second direction. The housing 11 has a first outer surface 111, and a second outer surface 112 located away from the first outer surface 111 in the second direction. The first outer surface 111 is one end face (first end face) of the housing 11 in the second direction. The longitudinal direction of the first outer surface 111 corresponds to the first direction. The second outer surface 112 is the other end face (second end face) of the housing 11 in the second direction. The longitudinal direction of the second outer surface 112 corresponds to the first direction. The housing 11 has a first end 113 in the first direction, and a second end 114 located away from the first end 113 in the first direction. The housing 11 has a first end 11F in the third direction, and a second end 11R located away from the first end 11F in the third direction.

[0071] The developing roller 12 is rotatable about a roller axis extending in the second direction. The developing roller 12 is located between the first outer surface 111 and the second outer surface 112 of the housing 11 in the second direction. The developing roller 12 is located closer to the first end 113 than to the second end 114 in the first

direction. The developing roller 12 is located at one end (the first end 11F) of the housing 11 in the third direction. In other words, the developing roller 12 is located at one outer surface (third outer surface) of the housing 11 in the third direction.

[0072] More specifically, the developing roller 12 includes a cylindrical developing roller body and a cylindrical developing roller shaft 12c. The developing roller shaft 12c extends through a center of the developing roller body in the second direction. The developing roller body rotates together with the developing roller shaft 12c. The developing roller shaft 12c has two ends in the second direction each rotatably supported by the corresponding end face of the housing 11 in the second direction. More specifically, the developing roller shaft 12c has a first end 12cL in the second direction rotatably supported by the first outer surface 111 of the housing 11, and a second end 12cR in the second direction rotatably supported by the second outer surface 112 of the housing 11.

[0073] The developing roller 12 (developing roller body) has an uncovered surface 12a and a covered surface 12b. The uncovered surface 12a is located on one end (first end 12F) of the developing roller 12 in the third direction, and is exposed outside the housing 11. The covered surface 12b is located on the other end (second end 12R) of the developing roller 12 in the third direction, and is located inside the housing 11. When the developer cartridge 1 is attached to the drum unit 3, a peripheral surface of the developing roller 12 contacts a peripheral surface of a corresponding photosensitive drum 31.

[0074] The agitator (not shown) is rotatable about an agitator axis extending in the second direction. The agitator includes a plurality of agitation blades. The agitator is located between the first outer surface 111 of the housing 11 and the second outer surface 112 of the housing 11 in the second direction. In the first direction, the agitator is located closer to the second end 114 than to the developing roller 12. The agitator rotates to agitate the toner contained in the chamber of the housing 11.

[0075] The coupling 24 shown in Figs. 3 and 5 is configured to receive a drive force from the body casing 101 of the image forming apparatus 100. The coupling 24 is rotatable about a coupling axis extending in the second direction. The coupling 24 is located closer to the second end 114 than to the developing roller 12 in the first direction. The coupling 24 has a recess 115 that is recessed inward in the second direction. When the developer cartridge 1 attached to the drum unit 3 is attached to the body casing 101 of the image forming apparatus 100, a drive shaft of the body casing 101 of the image forming apparatus 100 is received in the recess 115. The coupling 24 is thus connected to the drive shaft so as not to rotate relative to the drive shaft. The rotation of the drive shaft rotates the coupling 24. The rotation of the coupling 24 then rotates the developing roller 12 and the agitator.

[0076] 3. Structure of Drum Unit

[0077] The structure of the drum unit 3 will now be described with reference mainly to Fig. 7. Fig. 7 is a perspective view of the drum unit 3.

[0078] As shown in Figs. 7 to 9, the drum unit 3 includes a plurality of photosensitive drums 31, a first side plate 33, a second side plate 34, and a pullout plate 35. In the present embodiment, the drum unit 3 includes four photosensitive drums 31.

[0079] The photosensitive drums 31 are configured to transfer toner fed from the developer cartridges 1 to a print sheet. The photosensitive drums 31 are arranged in line at intervals in the third direction. Each photosensitive drum 31 is cylindrical. Each photosensitive drum 31 has a peripheral surface. Each photosensitive drum 31 extends in the second direction. The peripheral surface of the photosensitive drum 31 is coated with a photosensitive material. Each photosensitive drum 31 is rotatable about a drum axis extending in the second direction.

[0080] The first side plate 33, the second side plate 34, and the pullout plate 35 together define a frame. The frame is configured to hold the photosensitive drums 31. The frame has an opening located on one end of the frame in the first direction (in a direction opposite the force of gravity in the present embodiment).

[0081] The first side plate 33 supports first ends of the photosensitive drums 31 in the second direction. The first side plate 33 extends perpendicular to the second direction. The first side plate 33 extends in the third direction. The first side plate 33 is a plate. The first side plate 33 includes a plurality of (four in the present embodiment) developer cartridge holders 30. The developer cartridge holders 30 are located on an inner surface of the first side plate 33 in the second direction. The developer cartridge holders 30 are arranged in line at intervals in the third direction. The developer cartridge holders 30 of the first side plate 33 are configured to receive first ends 1L of the developer cartridges 1 in the second direction (ends at the first outer surfaces 111), respectively.

[0082] The second side plate 34 supports second ends of the photosensitive drums 31 in the second direction. The second side plate 34 extends perpendicular to the second direction. The second side plate 34 extends in the third direction. The second side plate 34 is a plate. The second side plate 34 includes a plurality of (four in the present embodiment) developer cartridge holders (not shown). The developer cartridge holders are located on an inner surface of the second side plate 34 in the second direction. The number of the developer cartridge holders of the second side plate 34 is equal to the number of the developer cartridge holders 30 of the first side plate 33. The developer cartridge holders of the second side plate 34 are configured to receive second ends 1R of the developer cartridges 1 in the second direction (ends at the second outer surfaces 112), respectively.

- [0083] The pullout plate 35 connects a second end 33F of the first side plate 33 in the third direction and a second end 34F of the second side plate 34 in the third direction. The pullout plate 35 extends perpendicular to the third direction. The pullout plate 35 extends in the second direction. The pullout plate 35 is a plate. The pullout plate 35 has a handle 36. The handle 36 is located on an outer side surface of the pullout plate 35 in the third direction. The handle 36 is gripped by a user to pull or push the drum unit 3 out of or into the body casing 101.
- [0084] When the developer cartridge 1 is attached to the drum unit 3, a first end of the housing 11 in the second direction (first outer surface 111) is held by the developer cartridge holder 30 of the first side plate 33 and a second end of the housing 11 in the second direction (second outer surface 112) is held by the developer cartridge holder in the second side plate 34. When the developer cartridge 1 is attached to the drum unit 3, the peripheral surface (uncovered surface 12a) of the developing roller 12 contacts the peripheral surface of the corresponding photosensitive drum 31.
- [0085] The image forming apparatus 100 with the above structure is configured to form an image on a print sheet. As the corresponding coupling 24 and the photosensitive drum 31 rotate, the toner is fed from the chamber of the housing 11 to the peripheral surface of the photosensitive drum 31 through the developing roller 12. The toner retained on the peripheral surface of the developing roller 12 moves from the developing roller 12 to the corresponding photosensitive drum 31 in accordance with an electrostatic latent image formed on the peripheral surface of the photosensitive drum 31. The electrostatic latent image is thus developed into a visible toner image on the peripheral surface of the photosensitive drum 31. The toner image on the photosensitive drum 31 is then transferred onto the print sheet.
- [0086] 4. Detailed Structure for Attachment and Removal
- [0087] The structure according to the present embodiment for attaching and removing the developer cartridges 1 to and from the drum unit 3 will now be described with reference to Figs. 3 to 12. Fig. 8 is a side view of the drum unit 3 showing inner structure of the drum unit 3 in the process of attaching one developer cartridge 1. Fig. 9 is a side view of the drum unit 3 showing inner structure of the drum unit 3, in which the developer cartridge 1 is attached to the drum unit 3. Fig. 10 is a side view of the developer cartridge 1 in the process of being attached to the developer cartridge holder 30 of the drum unit 3. Fig. 11 is a side view of the developer cartridge 1 that is attached to the developer cartridge holder 30 of the drum unit 3. Fig. 12 is a schematic diagram describing forces acting relative to one another in the process of attaching the developer cartridge 1 to the developer cartridge holder 30 of the drum unit 3.
- [0088] The developer cartridge 1 according to the present embodiment includes a first boss 13, a first collar 14, a first pressure receiving surface (pressure receiving surface) 15, a

second boss 16, a second collar 17, a first protrusion 18, a third boss 19, a second pressure receiving surface 21, a fourth boss 22, and a second protrusion 23.

[0089] The first boss 13 extends in the second direction. The first boss 13 in the present embodiment is a separate component from the housing 11, and is fixed to the housing 11. In some embodiments, the first boss 13 may be integral with the housing 11. The first boss 13 is movable together with the housing 11. The first boss 13 is located at the first outer surface 111. More specifically, the first boss 13 protrudes from the first outer surface 111 outward in the second direction. As described in detail later, the first boss 13 can bear the weight of the developer cartridge 1. The first boss 13 is located away from the developing roller 12 in the first direction and in the third direction. As described in detail later, the first boss 13 is supported by a support surface 41 (described later) of the drum unit 3 when the developer cartridge 1 is attached to the drum unit 3.

[0090] The first collar 14 is cylindrical. The first collar 14 is rotatable about the first boss 13. The first collar 14 has a hollow. The first collar 14 receives the first boss 13 in the hollow. In some embodiments, the first collar 14 may not be cylindrical. For example, the first collar 14 may be polygonal. The developer cartridge 1 may not include the first collar 14. In this case, a peripheral surface of the first boss 13 may serve as the first collar.

[0091] The first pressure receiving surface 15 is an arcuate-shaped surface curved along an arc centered on a straight line extending in the second direction. The first pressure receiving surface 15 is located inward relative to the first outer surface 111 in the second direction. In the third direction, the first pressure receiving surface 15 is located farther away from the developing roller 12 than the first boss 13 is from the developing roller 12. The first pressure receiving surface 15 is located at the second end 11R of the housing 11 (opposite to the developing roller 12) in the third direction. In other words, the first pressure receiving surface 15 is located on an outer surface of the second end 11R of the housing 11 in the third direction. The first pressure receiving surface 15 extends beyond at least a portion of the first outer surface 111 of the housing 11 in the third direction.

[0092] The first boss 13 is located away from the developing roller 12 by a first distance D1 in the first direction. The first pressure receiving surface 15 is located away from the developing roller 12 by the first distance D1 or by a second distance D2 smaller than the first distance D1 ($D2 \leq D1$) in the first direction. In the present embodiment, as shown in Figs. 5 and 6, a distance between the first pressure receiving surface 15 and the developing roller 12 in the first direction is substantially equal to the first distance D1.

[0093] In the present embodiment, the first distance D1 can be defined as a maximum

distance between a peripheral surface of the first boss 13 and the peripheral surface of the developing roller 12 in the first direction, and the second distance D2 can be defined as a maximum distance between an outer surface of the first pressure receiving surface 15 and the peripheral surface of the developing roller 12 in the first direction. In some embodiments, these distances may be defined differently. For example, the first distance D1 may be defined as a distance between the center of the first boss 13 and the center (axis) of rotation of the developing roller 12 in the first direction, and the second distance D2 may be defined as a distance between the center of the arc defined by the outer surface of the first pressure receiving surface 15 and the center (axis) of rotation of the developing roller 12 in the first direction. In other embodiments, the first distance D1 may be a distance between the peripheral surface of the first boss 13 and a peripheral surface of the developing roller shaft 12c in the first direction, and the second distance D2 may be a distance between the outer surface of the first pressure receiving surface 15 and the peripheral surface of the developing roller shaft 12c in the first direction.

[0094] The second boss 16 extends in the second direction. The second boss 16 in the present embodiment is a separate component from the housing 11, and is fixed to the housing 11. In some embodiments, the second boss 16 may be integral with the housing 11. The second boss 16 is movable together with the housing 11. The second boss 16 is positioned at the first outer surface 111. More specifically, the second boss 16 protrudes outward in the second direction from the first outer surface 111. The second boss 16 is located farther away from the developing roller 12 than the first boss 13 is from the developing roller 12 in both of the first and third directions. In other words, the second boss 16 is positioned opposite to the developing roller 12 with respect to the first boss 13 in the first direction. The second boss 16 is positioned opposite to the developing roller 12 with respect to the first boss 13 in the third direction. As will be described in detail later, the second boss 16 is configured to receive a pressing force directed from the second end 114 toward the first end 113 in the first direction when the developer cartridge 1 is attached to the drum unit 3.

[0095] The second collar 17 is cylindrical. The second collar 17 is rotatable about the second boss 16. The second collar 17 has a hollow. The second collar 17 receives the second boss 16 in the hollow. In some embodiments, the second collar 17 may not be cylindrical. For example, the second collar 17 may have a polygonal shape. The developer cartridge 1 may not include the second collar 17. In this case, a peripheral surface of the second boss 16 may serve as the second collar.

[0096] The first protrusion 18 extends in the second direction. The first protrusion 18 is located at a first end of the developing roller 12 in the second direction. More specifically, the first protrusion 18 is located at the first end 12cL of the developing

roller shaft 12c in the second direction. The first protrusion 18 is a separate component from the developing roller 12, and is attached to the developing roller 12. More specifically, the first protrusion 18 is a separate component from the developing roller shaft 12c, and is attached to the developing roller shaft 12c. In some embodiments, the first protrusion 18 may be integral with the developing roller 12. More specifically, the first protrusion 18 may be integral with the developing roller shaft 12c. As described in detail later, the first protrusion 18 contacts a guide 49 of the drum unit 3 when the developer cartridge 1 is attached to the drum unit 3. The first protrusion 18 thus serves to position the developer cartridge 1 relative to the drum unit 3.

[0097] The third boss 19 shown in Figs. 4 and 6 extends in the second direction. The third boss 19 in the present embodiment is a separate component from the housing 11, and is fixed to the housing 11. In some embodiments, the third boss 19 may be integral with the housing 11. The third boss 19 is movable together with the housing 11. The third boss 19 is located at the second outer surface 112. More specifically, the third boss 19 protrudes from the second outer surface 112 outward in the second direction. The third boss 19 is located on an axis of the first boss 13 extending in the second direction. As described in detail later, the third boss 19 and the first boss 13 together are configured to bear the weight of the developer cartridge 1. The developer cartridge 1 further includes a third collar (shown without a reference numeral) that is rotatable about the third boss 19, which is similar to the first collar 14.

[0098] The second pressure receiving surface 21 is an arcuate-shaped surface curved along an arc centered on a straight line extending in the second direction. The second pressure receiving surface 21 is located away from the first pressure receiving surface 15 in the second direction. The second pressure receiving surface 21 is located inward relative to the second outer surface 112 in the second direction. The second pressure receiving surface 21 overlaps the first pressure receiving surface 15 when viewed in the second direction. In other words, the second pressure receiving surface 21 is located farther away from the developing roller 12 than the third boss 19 is from the developing roller 12 in the third direction.

[0099] The third boss 19 is located away from the developing roller 12 by the first distance D1 in the first direction. The second pressure receiving surface 21 is located away from the developing roller 12 by the first distance D1 or the second distance D2 smaller than the first distance D1 in the first direction ($D2 \leq D1$).

[0100] The fourth boss 22 extends in the second direction. The fourth boss 22 in the present embodiment is a separate component from the housing 11, and is fixed to the housing 11. In some embodiments, the fourth boss 22 may be integral with the housing 11. The fourth boss 22 is movable together with the housing 11. The fourth boss 22 is located at the second outer surface 112. More specifically, the fourth boss 22 protrudes from

the second outer surface 112 outward in the second direction. The fourth boss 22 is located on an axis of the second boss 16 extending in the second direction. The developer cartridge 1 has a fourth collar (shown without a reference numeral) that is rotatable about the fourth boss 22, which is similar to the second collar 17.

[0101] The second protrusion 23 extends in the second direction. The second protrusion 23 is located at a second end of the developing roller 12 in the second direction. More specifically, the second protrusion 23 is located at the second end 12cR of the developing roller shaft 12c in the second direction. The second protrusion 23 is a separate component from the developing roller 12, and is attached to the developing roller 12. More specifically, the second protrusion 23 is a separate component from the developing roller shaft 12c, and is attached to the developing roller shaft 12c. In some embodiments, the second protrusion 23 may be integral with the developing roller 12. More specifically, the second protrusion 23 may be integral with the developing roller shaft 12c. The second protrusion 23 is located on an axis of the first protrusion 18 extending in the second direction. As described in detail later, the second protrusion 23 and the first protrusion 18 together serve to position the developer cartridge 1 relative to the drum unit 3.

[0102] The image forming apparatus 100 according to the present embodiment includes the developer cartridge holders 30 of the first side plate 33 and the developer cartridge holders of the second side plate 34. More specifically, the developer cartridge holders 30 of the first side plate 33 and the developer cartridge holders of the second side plate 34 in the present embodiment each include a support 46, a pressing member 47, a lock lever 48, and the guide 49 as shown in Figs. 8 and 9. The support 46, the pressing member 47, the lock lever 48, and the guide 49 of each developer cartridge holder 30 of the first side plate 33 are paired with these components in the corresponding developer cartridge holder of the second side plate 34. Since each developer cartridge holder of the second side plate 34 has a symmetrical structure with each of the developer cartridge holders 30 of the first side plate 33, the developer cartridge holders 30 of the first side plate 33 will be mainly described hereinafter, without repeatedly describing the developer cartridge holders of the second side plate 34.

[0103] The support 46 has the support surface 41 as shown in Fig. 10. The support 46 protrudes inward from the inner surface of the first side plate 33 in the second direction. The support surface 41 faces in the direction opposite the force of gravity. The support surface 41 is a flat surface perpendicular to the first direction. The support surface 41 supports the first boss 13 through the first collar 14 when the developer cartridge 1 is attached to the developer cartridge holder 30 of the drum unit 3.

[0104] The pressing member 47 has a first pressing surface 42. The pressing member 47 is located on the inner surface of the first side plate 33. The first pressing surface 42 is a

flat surface substantially perpendicular to the third direction. The first pressing surface 42 is slidable in the third direction relative to the first side plate 33. The pressing member 47 includes a spring (not shown), which is an elastic member. When the first pressing surface 42 moves toward a second end 3R of the drum unit 3 in the third direction (in a direction away from the pullout plate 35), the spring of the pressing member 47 presses back the first pressing surface 42 toward a first end 3F of the drum unit 3 in the third direction (toward the pullout plate 35). The first pressing surface 42 contacts the first pressure receiving surface 15 of the housing 11 of the corresponding developer cartridge 1 when the developer cartridge 1 is attached to the developer cartridge holder 30 of the drum unit 3. The first pressure receiving surface 15 receives, from the first pressing surface 42, a pressing force directed from the second end 3R of the drum unit 3 in the third direction toward the first end 3F of the drum unit 3 in the third direction.

[0105] The lock lever 48 is located on a first end 33U of the first side plate 33 in the first direction (the end in the direction opposite the force of gravity). The lock lever 48 has a second pressing surface 43 and a guide surface 51. The guide surface 51 is an arcuate-shaped surface protruding inward in the second direction (see Fig. 7). The second pressing surface 43 is a flat surface continuous with the guide surface 51. The lock lever 48 is pivotable about a pivot axis extending in the third direction between a lock position and a release position. When the lock lever 48 is at the lock position, the guide surface 51 is at least partially located between the first side plate 33 and the second side plate 34, and the second pressing surface 43 is substantially perpendicular to the first direction and faces toward the second end 3D of the drum unit 3 in the first direction. When the lock lever 48 is at the release position, the guide surface 51 is located farther away from the second side plate 34 in the second direction than when the lock lever 48 is at the lock position. The lock lever 48 includes a spring (not shown), which is an elastic member. The spring in the lock lever 48 presses the second pressing surface 43 toward the lock position. The second pressing surface 43 contacts the second boss 16 through the second collar 17 when the corresponding developer cartridge 1 is attached to the developer cartridge holder 30 of the drum unit 3. The second boss 16 receives, from the second pressing surface 43, a pressing force directed from the first end 3U toward the second end 3D of the drum unit 3 in the first direction (downward).

[0106] The guide 49 has a first guide surface 44 and a second guide surface 45. The guide 49 is located on the inner surface of the first side plate 33. The guide 49 is arcuate-shaped in a side view. The first guide surface 44 is a flat surface substantially perpendicular to the first direction. The first guide surface 44 contacts the first protrusion 18 when the developer cartridge 1 pivots about the first boss 13 to move the de-

veloping roller 12 toward the photosensitive drum 31 in the process of being attached to the developer cartridge holder 30 of the drum unit 3. The first guide surface 44 thus serves to position the developer cartridge 1 relative to the drum unit 3.

[0107] The second guide surface 45 has a flat surface and a slope surface continuous with the flat surface. The flat surface is substantially perpendicular to the first direction. One end of the slope surface in the third direction (the end closer to the first guide surface 44) is connected to the flat surface. The slope surface is a sloped surface extending from the flat surface toward the second end 33D of the first side plate 33 in the first direction and toward the second end 33F of the first side plate 33 in the third direction. The second guide surface 45 is spaced from the first protrusion 18 in the first direction when the developer cartridge 1 pivots about the first boss 13 to move the developing roller 12 toward the photosensitive drum 31 in the process of being attached to the developer cartridge holder 30 of the drum unit 3.

[0108] 5. Forces Acting Relative to One Another in Attaching Developer Cartridge

[0109] The forces acting relative to one another in the process of attaching the developer cartridge 1 to the drum unit 3 will now be described with reference to Figs. 8 to 12.

[0110] To attach the developer cartridge 1 to the drum unit 3, the user first holds the developer cartridge 1 with the first end 113 of the housing 11 in the first direction facing the second end 3D of the drum unit 3 in the first direction. The user then inserts the developer cartridge 1 into the corresponding developer cartridge holders (the developer cartridge holder 30 of the first side plate 33 and the developer cartridge holder of the second side plate 34) in the first direction toward the second end 3D of the drum unit 3 (refer to Fig. 8). As a result, the first boss 13 is supported by the support surface 41 of the drum unit 3 in the first direction through the first collar 14. Likewise, the third boss 19 is supported by the support surface 41 of the drum unit 3 in the first direction through the third collar. The support surfaces 41 bear the weight of the developer cartridge 1.

[0111] In the meantime, as the user inserts the developer cartridge 1 into the drum unit 3 toward the second end 3D of the drum unit 3 in the first direction, the arcuate-shaped guide surface 51 is pushed by the second boss 16 (second collar 17) to smoothly pivot outward in the second direction against the pressing force of the spring of the lock lever 48. The lock lever 48 of the developer cartridge holder 30 is thus moved to the release position. Likewise, in the developer cartridge holder of the second side plate 34, the guide surface 51 is pushed by the fourth boss 22 (fourth collar) to smoothly pivot outward in the second direction against the pressing force of the spring of the lock lever 48 to move the lock lever 48 to the release position. The developer cartridge 1 is thus allowed to move toward the second end 3D of the drum unit 3 in the first direction. The second boss 16 is positioned closer to the second end 3D of the drum

unit 3 in the first direction than the lock lever 48 is to the second end 3D of the drum unit 3 in the first direction. The fourth boss 22 is positioned closer to the second end 3D of the drum unit 3 in the first direction than the corresponding lock lever 48 is to the second end 3D of the drum unit 3 in the first direction. Subsequently, the second pressing surface 43 under the pressing force of the spring of the corresponding lock lever 48 pivots inward in the second direction, and places the lock lever 48 to the lock position.

[0112] As shown in Fig. 10, the second boss 16 (second collar 17) contacts the second pressing surface 43 at the lock position to receive, from the second pressing surface 43, a pressing force directed from the second end 114 of the housing 11 toward the first end 113 of the housing 11 in the first direction. Similarly, the fourth boss 22 (fourth collar) contacts the second pressing surface 43 at the lock position to receive, from the second pressing surface 43, a pressing force directed from the second end 114 of the housing 11 toward the first end 113 of the housing 11 in the first direction. At this position, the first boss 13 and third boss 19 are supported respectively by the corresponding support surfaces 41 from below (from the side of the second end 3D of the drum unit 3) in the first direction. As a result, a rotation moment about the first boss 13 (about the third boss 19) is generated in the developer cartridge 1. The developer cartridge 1 is hence caused to slightly pivot about the first boss 13 (about the third boss 19) in the drum unit 3 to move the developing roller 12 toward the photosensitive drum 31. As the developing roller 12 moves toward the photosensitive drum 31, the first protrusion 18 contacts the first guide surface 44 to stop the pivotal movement of the developer cartridge 1 about the first boss 13. In the meantime, the second protrusion 23 contacts the first guide surface 44 to stop the pivotal movement of the developer cartridge 1 about the third boss 19. This contact determines the angle of contact between the developing roller 12 and the photosensitive drum 31, and the developing roller 12 is suitably positioned relative to the photosensitive drum 31. In other words, the developer cartridge 1 is positioned in the drum unit 3.

[0113] Further, as the user inserts the developer cartridge 1 into the drum unit 3 toward the second end 3D of the drum unit 3 in the first direction, each first pressing surface 42 is pushed by the first pressure receiving surface 15 or the second pressure receiving surface 21, and is moved toward the second end 3R of the drum unit 3 in the third direction against the pressing force of the spring in the pressing member 47. The first pressure receiving surface 15 thus receives, from the corresponding first pressing surface 42, a pressing force directed from the covered surface 12b toward the uncovered surface 12a in the third direction at the same time as or subsequently to slight pivoting of the developer cartridge 1 about the first boss 13. Likewise, the second pressure receiving surface 21 receives, from the corresponding first pressing

surface 42, the pressing force directed from the covered surface 12b toward the uncovered surface 12a in the third direction at the same time as or subsequently to slight pivoting of the developer cartridge 1 about the third boss 19. At this position, the support surface 41 receives the weight of the developer cartridge 1 applied through the first boss 13 and third boss 19. Each of the first boss 13 (first collar 14) and third boss 19 (third collar) thus slides toward the first end 3F of the drum unit 3 in the third direction while being supported by the corresponding support surface 41. This moves the developing roller 12 further toward the photosensitive drum 31, and allows the peripheral surface of the developing roller 12 (developing roller body) to contact the peripheral surface of the photosensitive drum 31 with an appropriate contact pressure. At this position, since the support surfaces 41 bear the weight of the developer cartridge 1, the weight of the developer cartridge 1 is less likely to affect the contact pressure between the developing roller 12 and the photosensitive drum 31. This structure can suppress the contact pressure between the developing roller 12 and the photosensitive drum 31 from varying greatly depending on the amount of toner remaining in the developer cartridge 1.

[0114] Immediately before the peripheral surface of the developing roller 12 (developing roller body) contacts the peripheral surface of the photosensitive drum 31, the first protrusion 18 is held between the first guide surface 44 and the second guide surface 45 in the first direction (refer to Fig. 10). The developing roller 12 can be suitably positioned relative to the photosensitive drum 31. The slope surface of the second guide surface 45 smoothly guides the developing roller 12 toward a position between the first guide surface 44 and the flat surface of the second guide surface 45.

[0115] In the manner described above, the developer cartridge 1 is appropriately positioned relative to the drum unit 3 when attached to the drum unit 3. At this time, since the lock levers 48 are at the lock position, the developer cartridge 1 does not easily separate from the drum unit 3 even if vibrations or impact are applied to the image forming apparatus 100. The structure according to the present embodiment enables reliable attachment and removal of the developer cartridge 1 to and from the drum unit 3.

Reference Signs List

[0116] 1: developer cartridge
11: housing
12: developing roller
12a: uncovered surface
12b: covered surface
12c: developing roller shaft

13: first boss
14: first collar
15: first pressure receiving surface
16: second boss
17: second collar
18: first protrusion
19: third boss
22: fourth boss
23: second protrusion
31: photosensitive drum
41: support surface
42: first pressing surface
43: second pressing surface
44: first guide surface
45: second guide surface
48: lock lever
100: image forming apparatus
111: first outer surface
112: second outer surface
113: first end
114: second end
D1: first distance
D2: second distance

Claims

1. A developer cartridge, comprising:

a housing extending in a first direction and configured to contain toner, the housing having a first end in the first direction, and a second end located away from the first end in the first direction;

a developing roller rotatable about a roller axis extending in a second direction different from the first direction, the developing roller being located nearer the first end than the second end in the first direction, the developing roller having an uncovered surface located at a first end of the developing roller in a third direction and exposed outside the housing, and a covered surface located at a second end of the developing roller in the third direction and located inside the housing;

a first boss extending in the second direction and movable together with the housing, the first boss being located at a first outer surface of the housing in the second direction, the first boss being configured to bear a weight of the developer cartridge when the first boss is supported by a support surface of a first side plate of a drum unit, the first boss being located away from the developing roller in the first direction and the third direction;

a second boss extending in the second direction and movable together with the housing, the second boss being located at the first outer surface, the second boss being located farther away from the developing roller than the first boss in the first direction and the third direction, the second boss being configured to receive a pressing force directed from the second end of the housing in the first direction toward the first end of the housing in the first direction; and

a pressure receiving surface located farther away from the developing roller than the first boss in the third direction, the pressure receiving surface being configured to receive a pressing force in the third direction from a pressing member of the first side plate of the drum unit,

wherein the first boss is located away from the developing roller in the first direction by a first distance,

wherein the pressure receiving surface is located away from the developing roller in the first direction by the first distance or by a second distance smaller than the first distance, and

wherein the developer cartridge is configured to rotate about the first boss in response to the second boss receiving the pressing force directed from the second end of the housing in the first direction to the first end of the housing in the first direction.

2. The developer cartridge according to claim 1, wherein the first direction is different from the third direction.
3. The developer cartridge according to claim 1, wherein the developer cartridge is attachable to the drum unit in the first direction.
4. The developer cartridge according to claim 1, wherein the pressure receiving surface is configured to receive the pressing force from the pressing member of the first side plate of the drum unit directed from the covered surface toward the uncovered surface in the third direction.
5. The developer cartridge according to claim 4, wherein when the developer cartridge is attached to the drum unit, the first boss is supported by the support surface of the first side plate of the drum unit, and the first boss bears the weight of the developer cartridge.
6. The developer cartridge according to claim 5, wherein the pressure receiving surface receives the pressing force from the pressing member of the first side plate of the drum unit directed from the covered surface toward the uncovered surface in the third direction.
7. The developer cartridge according to claim 5, wherein the pressure receiving surface is pressed against the pressing member of the first side plate of the drum unit to

receive the pressing force directed from the covered surface toward the uncovered surface in the third direction.

8. The developer cartridge according to claim 1, further comprising: a first collar rotatable about the first boss, the first collar being cylindrical or polygonal.

9. The developer cartridge according to claim 1, wherein the first boss is a separate component from the housing.

10. The developer cartridge according to claim 1, wherein the developing roller is located at a first end of the housing in the third direction, and the pressure receiving surface is located at a second end of the housing in the third direction.

11. The developer cartridge according to claim 1, wherein the second boss is configured to receive the pressing force from a lock lever of the drum unit.

12. The developer cartridge according to claim 1, wherein the second boss receives the pressing force directed from the second end of the housing in the first direction toward the first end of the housing in the first direction from a lock lever of the drum unit when the developer cartridge is attached to the drum unit, the first boss is supported by the support surface of the first side plate of the drum unit, and the first boss bears the weight of the developer cartridge.

13. The developer cartridge according to claim 12, wherein the developer cartridge rotates about the first boss in response to the second boss receiving the pressing force directed from the second end to the first end in the first direction.

14. The developer cartridge according to claim 13, further comprising:

a protrusion extending in the second direction, the protrusion being located at a first end of the developing roller in the second direction,

wherein the protrusion contacts a first guide surface of the drum unit in response to the developer cartridge rotates about the first boss.

15. The developer cartridge according to claim 14, wherein the developing roller includes a developing roller shaft extending in the second direction, and the protrusion is located at a first end of the developing roller shaft in the second direction.

16. The developer cartridge according to claim 1, further comprising:

a second collar rotatable about the second boss, the second collar being cylindrical or polygonal.

17. The developer cartridge according to claim 1, further comprising:

a third boss extending in the second direction and movable together with the housing, the third boss being located at a second outer surface of the housing in the second direction, the third boss being configured to bear the weight of the developer cartridge when the third boss is supported by a second support surface of a second side plate of the drum unit, the third boss being located away from the developing roller in the first direction and the third direction.

18. The developer cartridge according to claim 17, further comprising:

a second pressure receiving surface located farther away from the developing roller than the third boss in the third direction, the second pressure receiving surface being located away from the pressure receiving surface in the second direction, the second pressure receiving surface being configured to receive a pressing force in the third direction from a pressing member of the second side plate of the drum unit,

wherein the third boss is located away from the developing roller in the first direction by the first distance, and the second pressure receiving surface is located away from the developing roller in the first direction by the first distance or by the second distance.

19. The developer cartridge according to claim 1, wherein the first boss is located closer to the developing roller than the second end of the housing in the first direction.

20. The developer cartridge according to claim 1, wherein the pressure receiving surface extends beyond at least a portion of the first outer surface of the housing in the third direction.

21. A developer cartridge, comprising:

a housing extending in a first direction and configured to contain toner, the housing having a first end in the first direction, and a second end located away from the first end in the first direction;

a developing roller rotatable about a roller axis extending in a second direction different from the first direction, the developing roller being located nearer the first end than the second end in the first direction, the developing roller having an uncovered surface located at a first end of the developing roller in a third direction and exposed outside the housing, and a covered surface located at a second end of the developing roller in the third direction and located inside the housing;

a first boss extending in the second direction and movable together with the housing, the first boss being located at a first outer surface of the housing in the second direction, the first boss being located away from the developing roller in the first direction and the third direction; and

a second boss extending in the second direction and movable together with the housing, the second boss being located at the first outer surface, the second boss being located farther away from the developing roller than the first boss in the first direction and the third direction,

wherein the second boss is configured to receive a pressing force directed from the second end of the housing in the first direction toward the first end of the housing in the first direction, and

wherein the developer cartridge is configured to rotate about the first boss in response to the second boss receiving the pressing force directed from the second end of the housing in the first direction toward the first end of the housing in the first direction.

22. The developer cartridge according to claim 21, further comprising: a

first collar rotatable about the first boss.

23. The developer cartridge according to claim 22, further comprising:
a second collar rotatable about the second boss.
24. The developer cartridge according to claim 21, wherein the first boss is located closer to the developing roller than the second end of the housing in the first direction.
25. The developer cartridge according to claim 21, further comprising a pressure receiving surface extending beyond the first outer surface of the housing in the third direction.
26. The developer cartridge according to claim 21, further comprising:
a coupling extending from the first outer surface of the housing in the second direction, wherein the coupling is rotatable about a coupling axis extending in the second direction, and the coupling axis is located between the developing roller and the first boss in the first direction.
27. The developer cartridge according to claim 21, further comprising:
a coupling extending from the first outer surface of the housing in the second direction, wherein the coupling is rotatable about a coupling axis extending in the second direction and the first boss is located between the coupling axis and the second boss in the first direction and in the third direction.
28. The developer cartridge according to claim 21, wherein the first direction is different from the third direction.
29. The developer cartridge according to claim 21, wherein the developer cartridge is attachable to a drum unit in the first direction.
30. The developer cartridge according to claim 21, wherein the first boss is configured to bear a weight of the developer cartridge.
31. The developer cartridge according to claim 30, wherein the first boss is configured to bear a weight of the developer cartridge when the first boss is supported by a support surface of a first side plate of a drum unit.

32. The developer cartridge according to claim 21, wherein the second boss is configured to receive the pressing force directed from the second end of the housing in the first direction toward the first end of the housing in the first direction from a lock lever of a drum unit.

33. A developer cartridge, comprising:

a housing extending in a first direction and configured to contain toner, the housing having a first end in the first direction, and a second end located away from the first end in the first direction;

a developing roller rotatable about a roller axis extending in a second direction different from the first direction, the developing roller being located nearer the first end than the second end in the first direction, the developing roller having an uncovered surface located at a first end of the developing roller in a third direction and exposed outside the housing, and a covered surface located at a second end of the developing roller in the third direction and located inside the housing;

a first boss extending in the second direction and movable together with the housing, the first boss being located at a first outer surface of the housing in the second direction, the first boss being configured to bear a weight of the developer cartridge when the first boss is supported by a support surface of a first side plate of a drum unit, the first boss being located away from the developing roller in the first direction and the third direction;

a second boss extending in the second direction and movable together with the housing, the second boss being located at the first outer surface, the second boss being located farther away from the developing roller than the first boss in the first direction and the third direction, the second boss being configured to receive a pressing force directed from the second end of the housing in the first direction toward the first end of the housing in the first direction; and

a pressure receiving surface located farther away from the developing roller than the first boss in the third direction, the pressure receiving surface being

configured to receive a pressing force in the third direction from a pressing member of the first side plate of the drum unit,

wherein the first boss is located away from the developing roller in the first direction by a first distance,

wherein the pressure receiving surface is located away from the developing roller in the first direction by the first distance or by a second distance smaller than the first distance,

wherein the second boss receives the pressing force directed from the second end of the housing in the first direction toward the first end of the housing in the first direction from a lock lever of the drum unit when the developer cartridge is attached to the drum unit, the first boss is supported by the support surface of the first side plate of the drum unit, and the first boss bears the weight of the developer cartridge, and

wherein the developer cartridge rotates about the first boss in response to the second boss receiving the pressing force directed from the second end to the first end in the first direction.

34. A developer cartridge comprising:

a housing extending in a first direction and configured to contain toner, the housing having a first end and a second end located away from the first end in the first direction;

a developing roller rotatable about a roller axis extending in a second direction different from the first direction, the developing roller being located nearer the first end than the second end in the first direction;

a first boss fixed to a first outer surface of the housing and extending from the first outer surface in the second direction, the first boss being located away from the developing roller in the first direction and a third direction perpendicular to the first direction and the second direction; and

a second boss fixed to the first outer surface and extending from the first outer surface in the second direction, the second boss being located farther away from the developing roller than the first boss in the first direction and the third direction.

35. A developer cartridge comprising:

a housing extending in a first direction and configured to contain toner, the housing having a first end and a second end located away from the first end in the first direction;

a developing roller rotatable about a roller axis extending in a second direction different from the first direction, the developing roller being located nearer the first end than the second end in the first direction;

a first boss fixed to a first outer surface of the housing and extending from the first outer surface in the second direction, the first boss being located away from the developing roller in the first direction and a third direction different from the first direction and the second direction; and

a second boss fixed to the first outer surface and extending from the first outer surface in the second direction, the second boss being located farther away from the developing roller than the first boss in the first direction and the third direction;

wherein the housing includes a second outer surface located away from the first outer surface in the second direction,

wherein the first outer surface includes a first planar portion and a second planar portion, the second planar portion located closer to the second outer surface in the second direction than the first planar portion,

wherein the first boss extends from the first planar portion in the second direction, and

wherein the second boss extends from the second planar portion in the second direction.

36. A developer cartridge comprising:

a housing extending in a vertical direction and configured to contain toner, the housing having a first end and a second end located away from the first end in the vertical direction;

a developing roller rotatable about a roller axis extending in an axial direction perpendicular to the vertical direction, the developing roller being located nearer the first end than the second end in the vertical direction;

a first boss fixed to a first outer surface of the housing and extending from the first outer surface in the axial direction, the first boss being located away from the developing roller in the vertical direction and a horizontal direction perpendicular to the vertical direction and the axial direction; and

a second boss fixed to the first outer surface and extending from the first outer surface in the axial direction, the second boss being located farther away from the developing roller than the first boss in the vertical direction and the horizontal direction.

37. A developer cartridge comprising:

a housing extending in a first direction and configured to contain toner, the housing having a first end and a second end located away from the first end in the first direction;

a developing roller rotatable about a roller axis extending in a second direction different from the first direction, the developing roller being located nearer the first end than the second end in the first direction;

a first boss positioned at a first outer surface of the housing and extending from the first outer surface in the second direction, the first boss being located away from the developing roller in the first direction and a third direction different from the first direction and the second direction; and

a second boss positioned at the first outer surface and extending from the first outer surface in the second direction, the second boss being located farther away from the developing roller than the first boss in the first direction and the third direction,

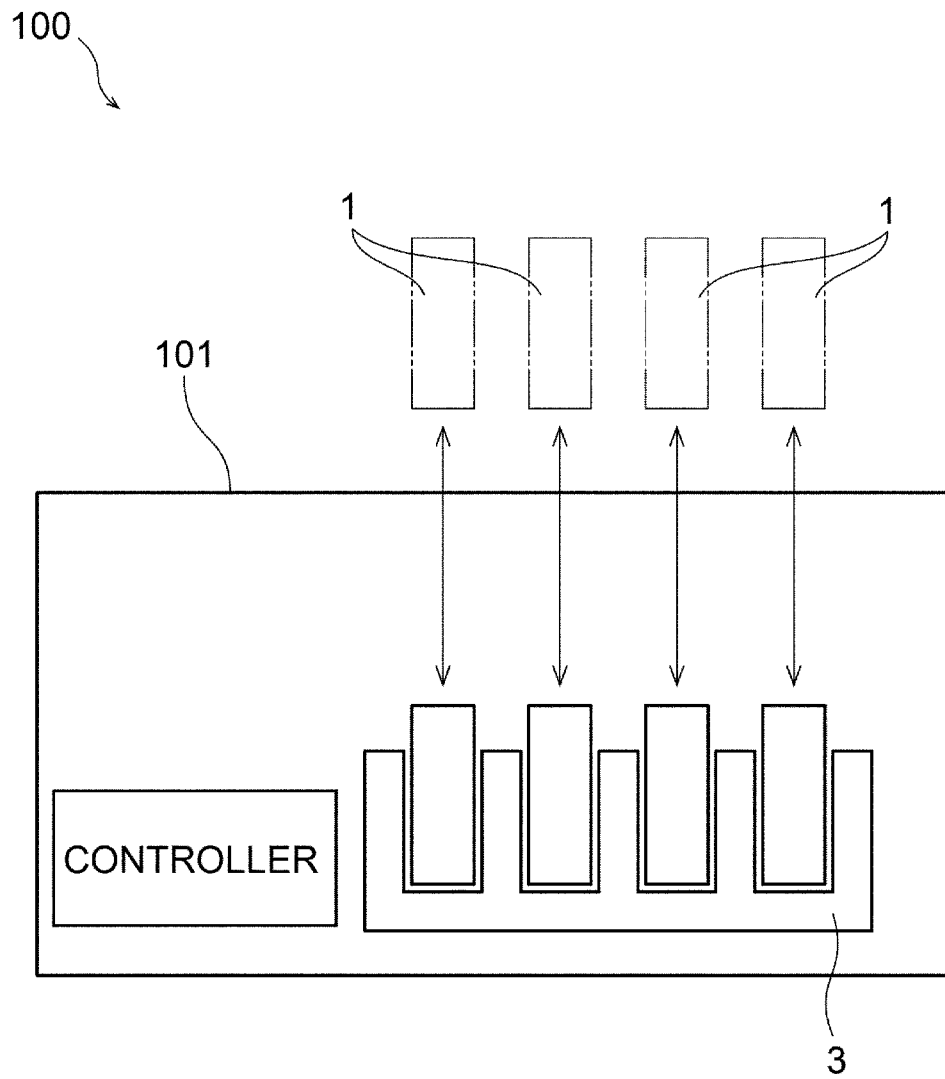
wherein the housing includes a second outer surface located away from the first outer surface in the second direction,

wherein the first outer surface includes a first planar portion and a second planar portion, the second planar portion being located closer to the second outer surface in the second direction than the first planar portion,

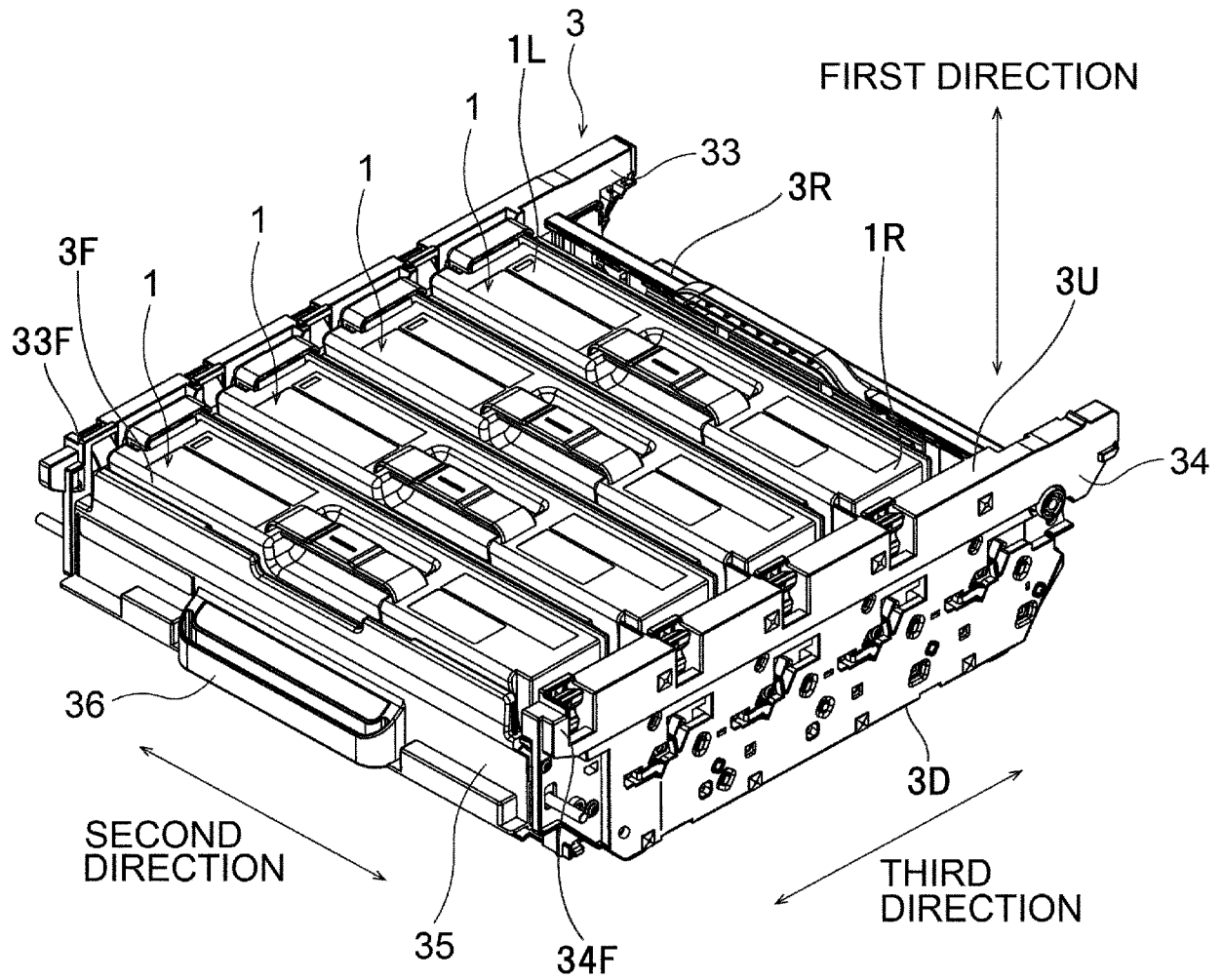
wherein the first boss extends from the first planar portion in the second direction, and

wherein the second boss extends from the second planar portion in the second direction.

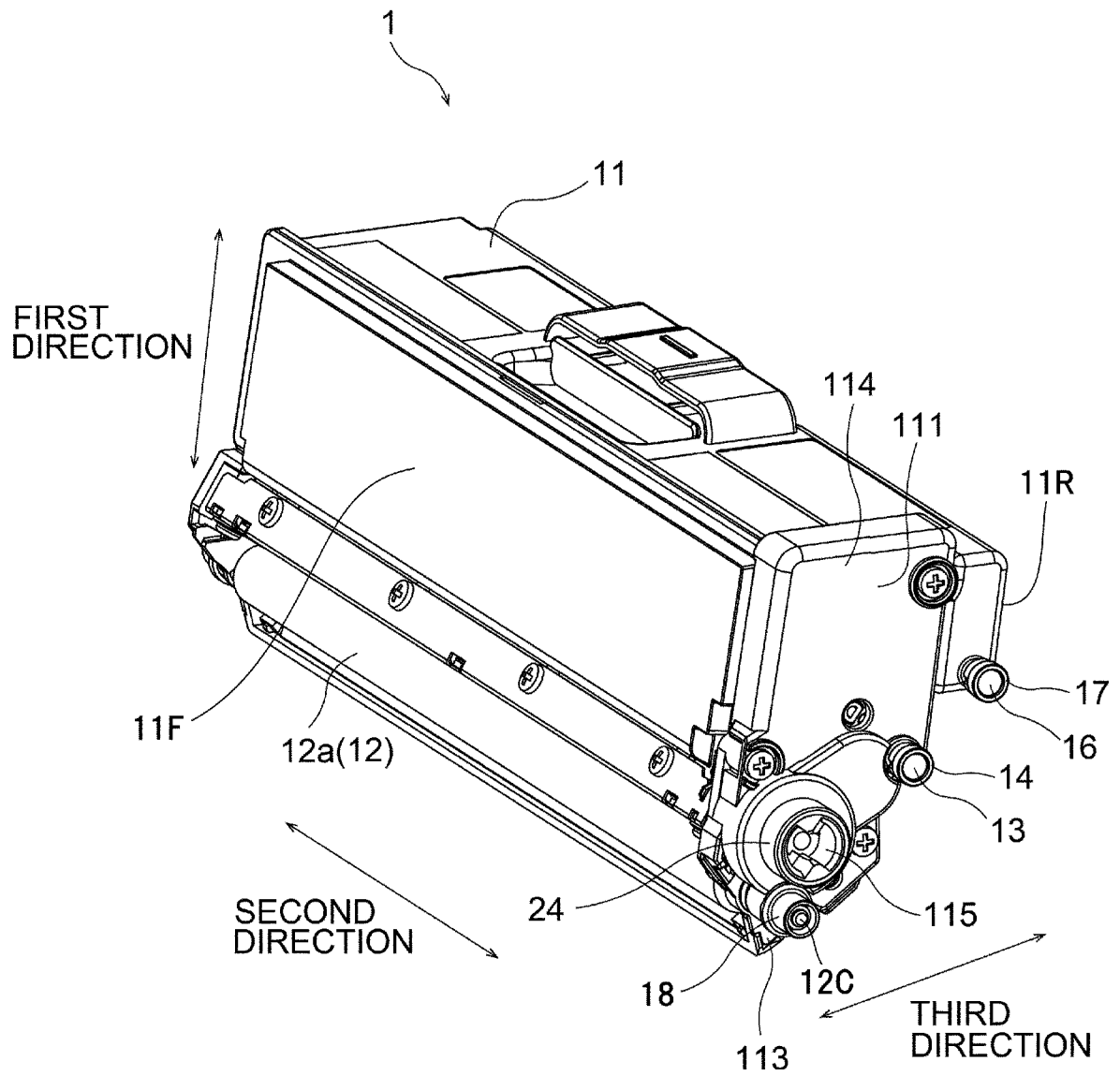
[Fig. 1]



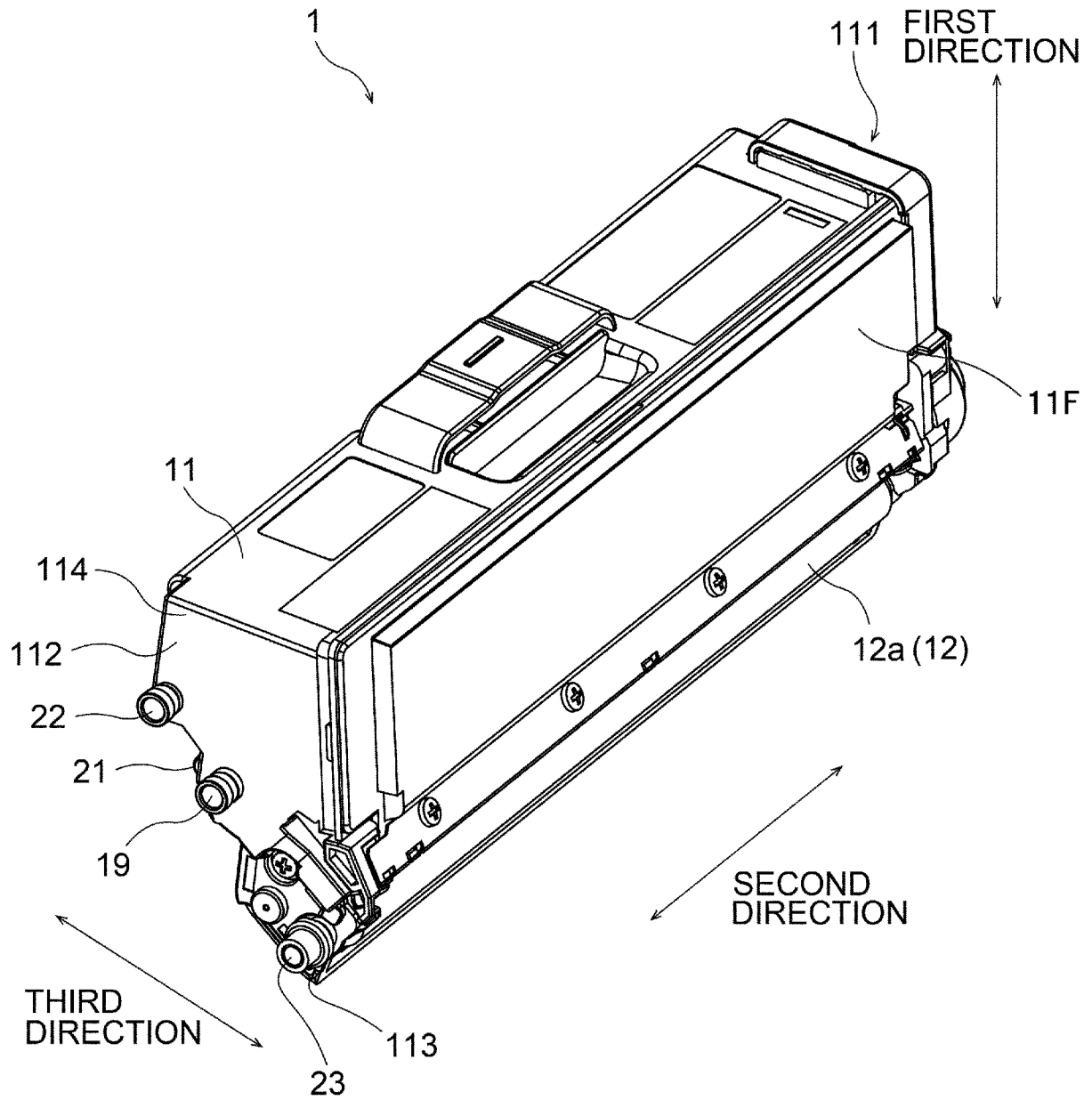
[Fig. 2]



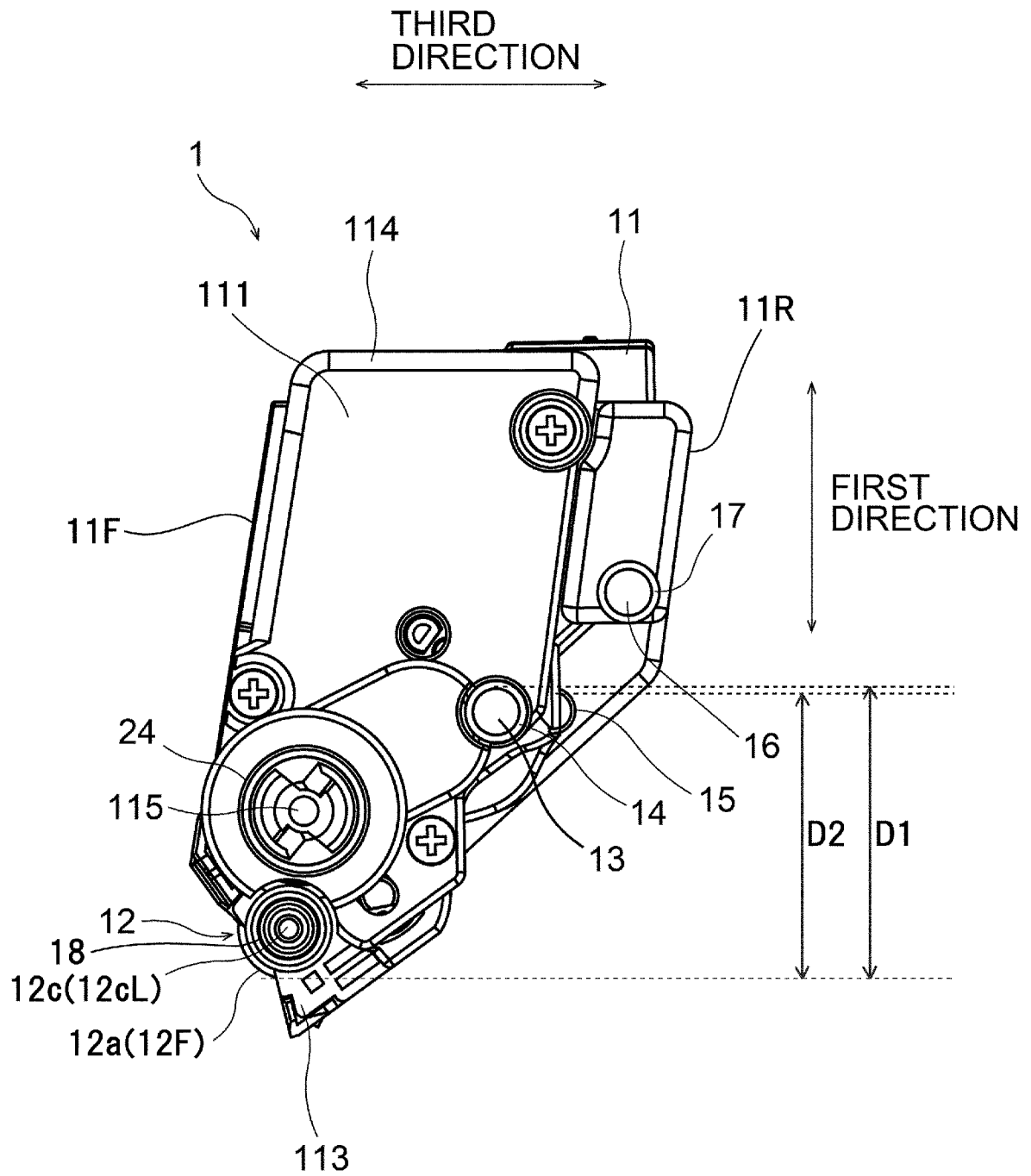
[Fig. 3]



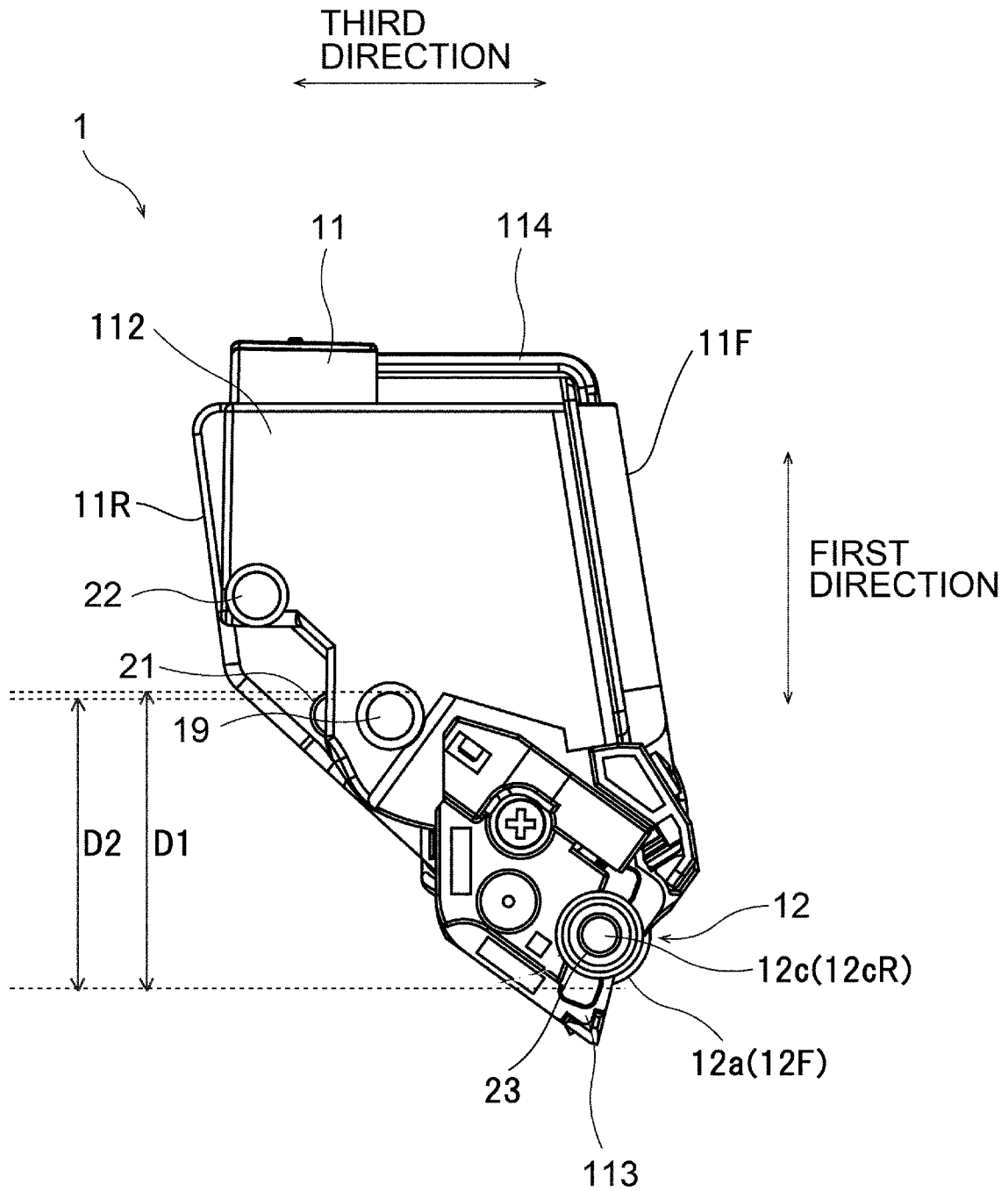
[Fig. 4]



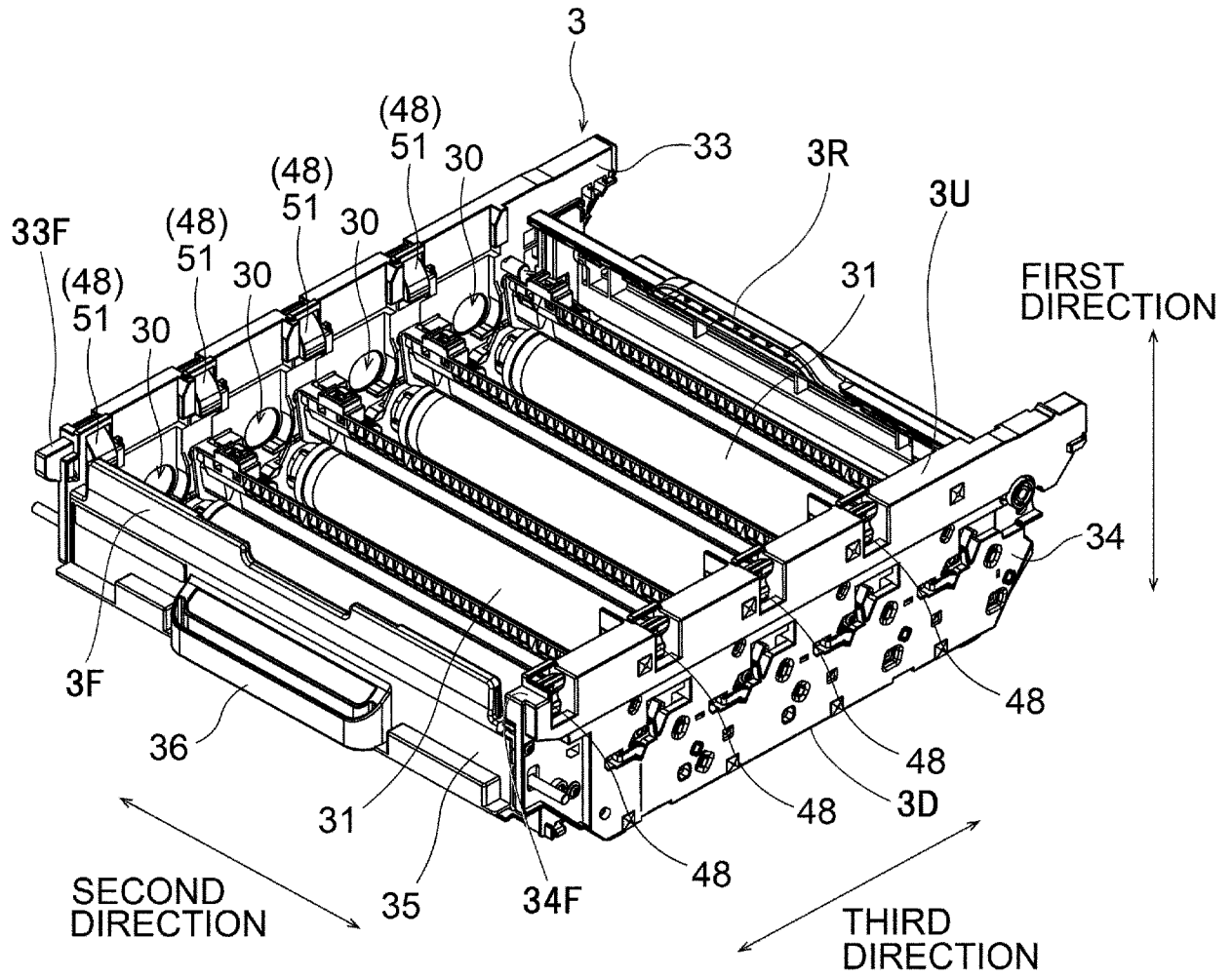
[Fig. 5]



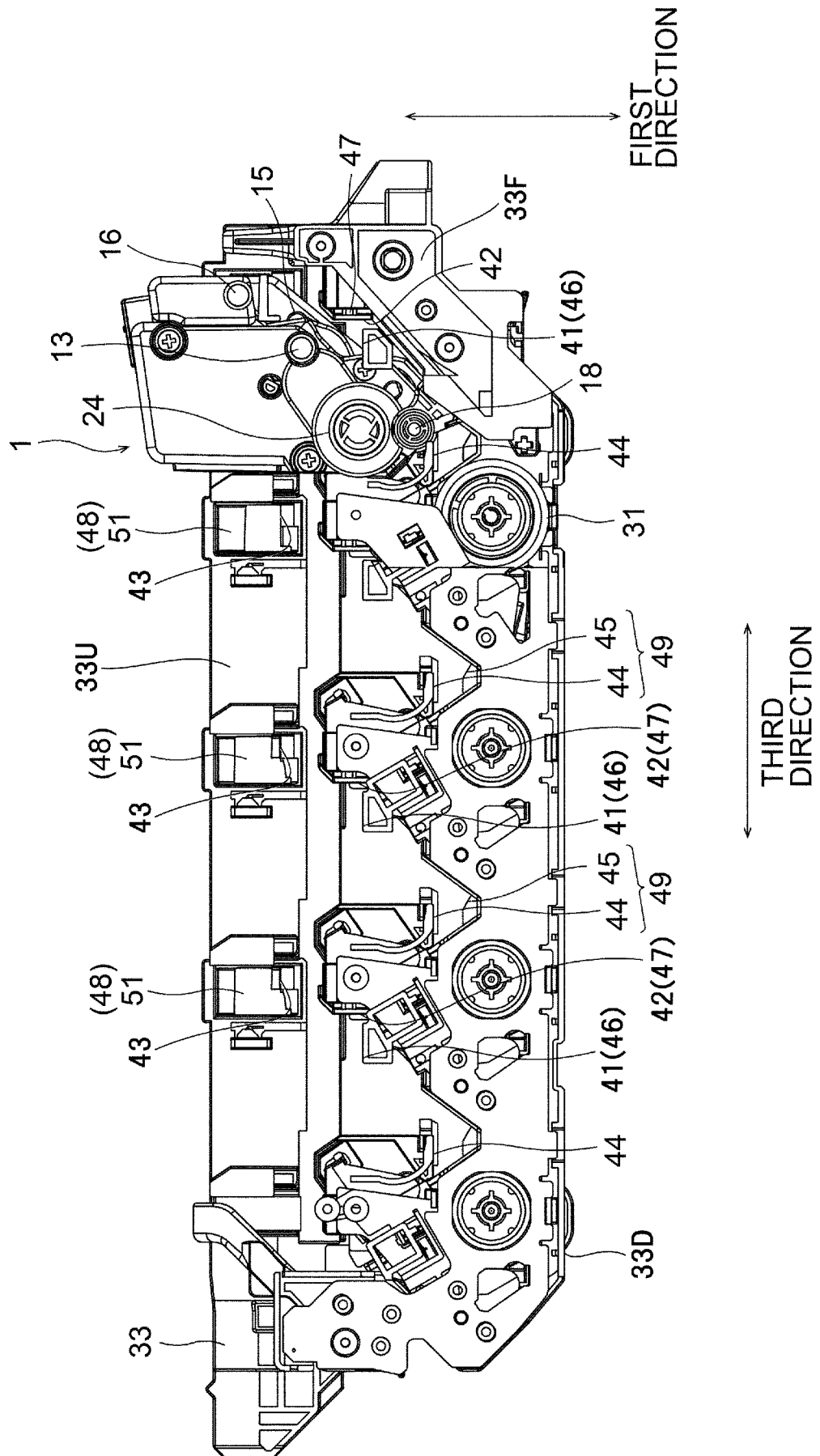
[Fig. 6]



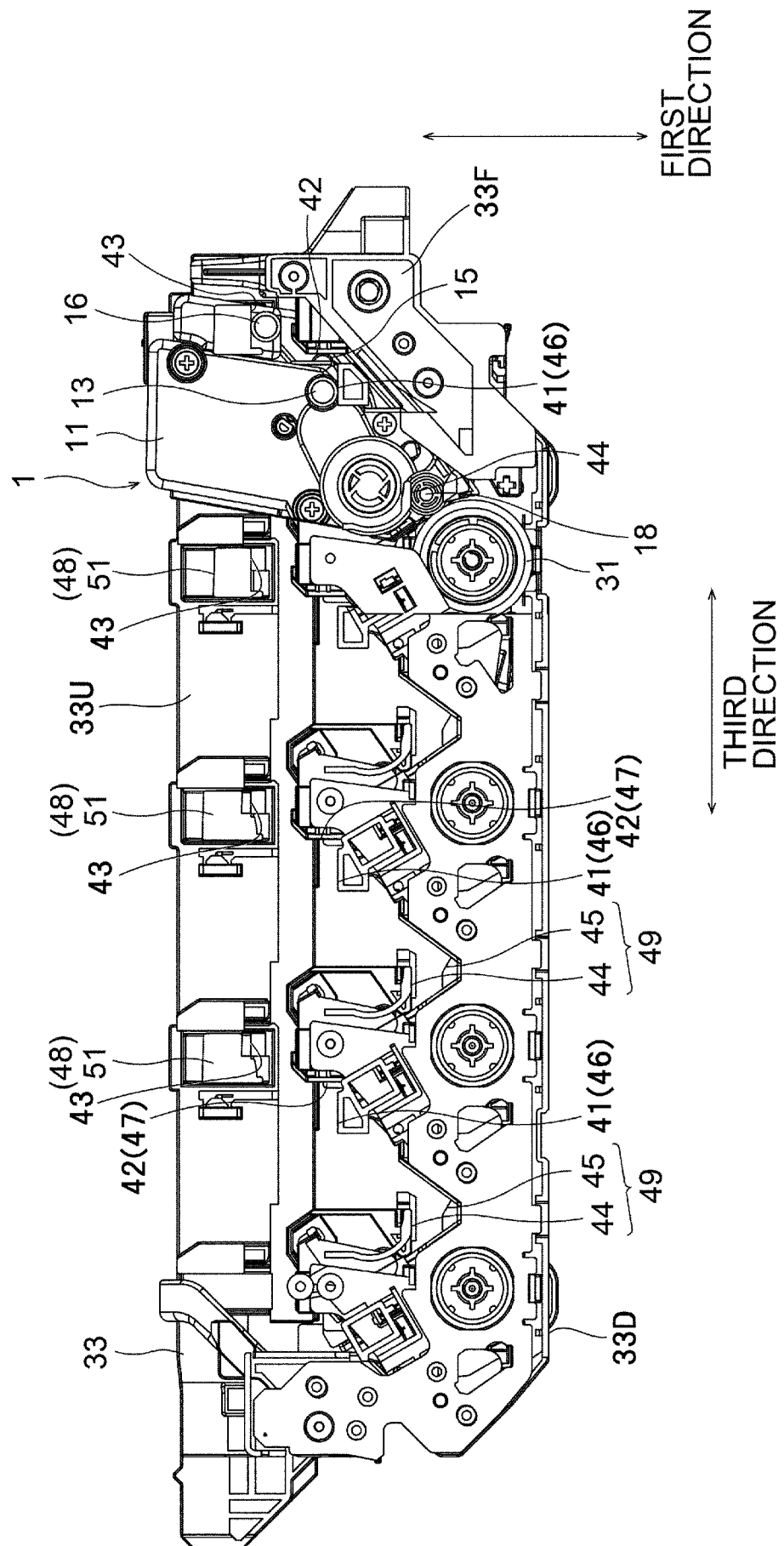
[Fig. 7]



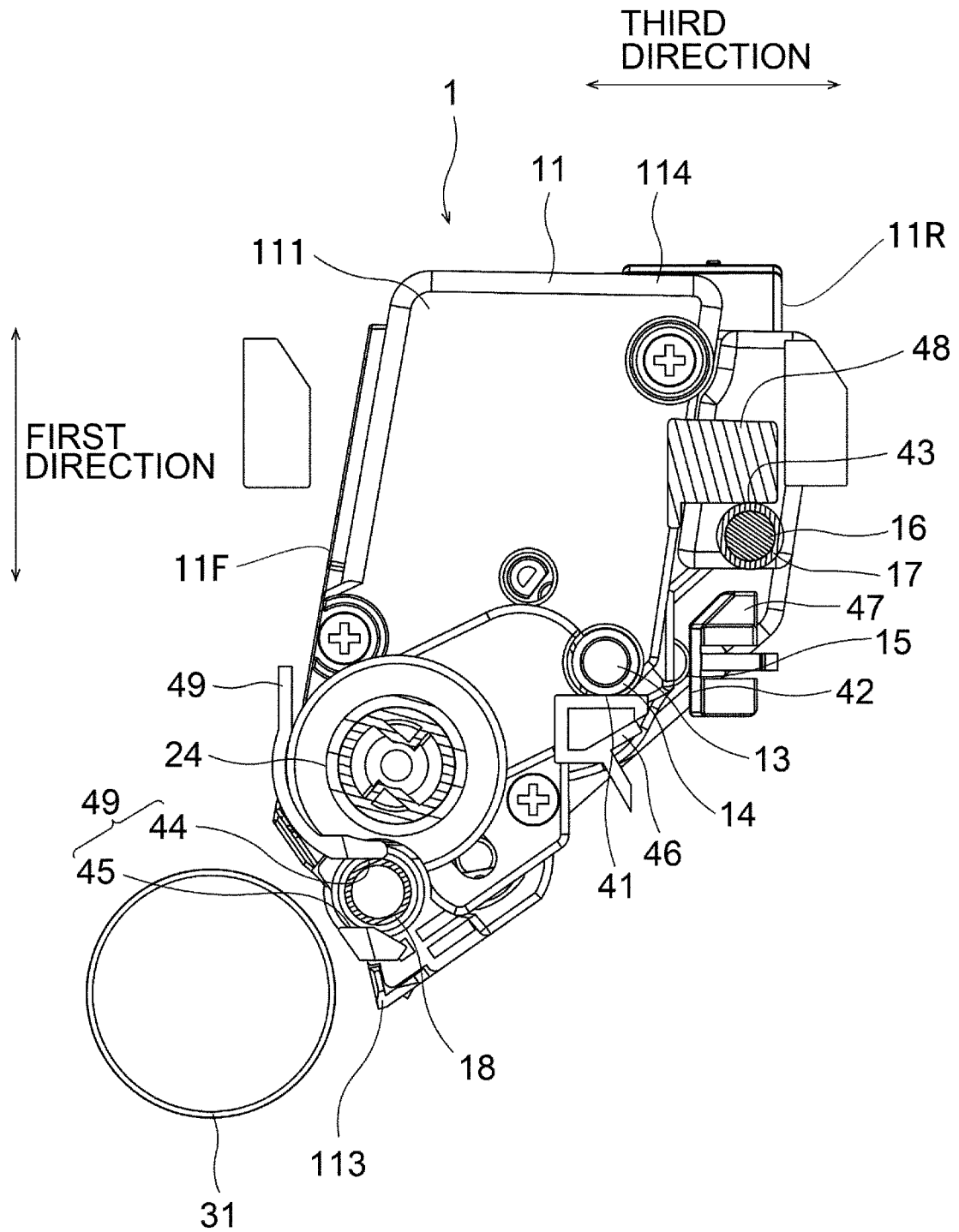
[Fig. 8]



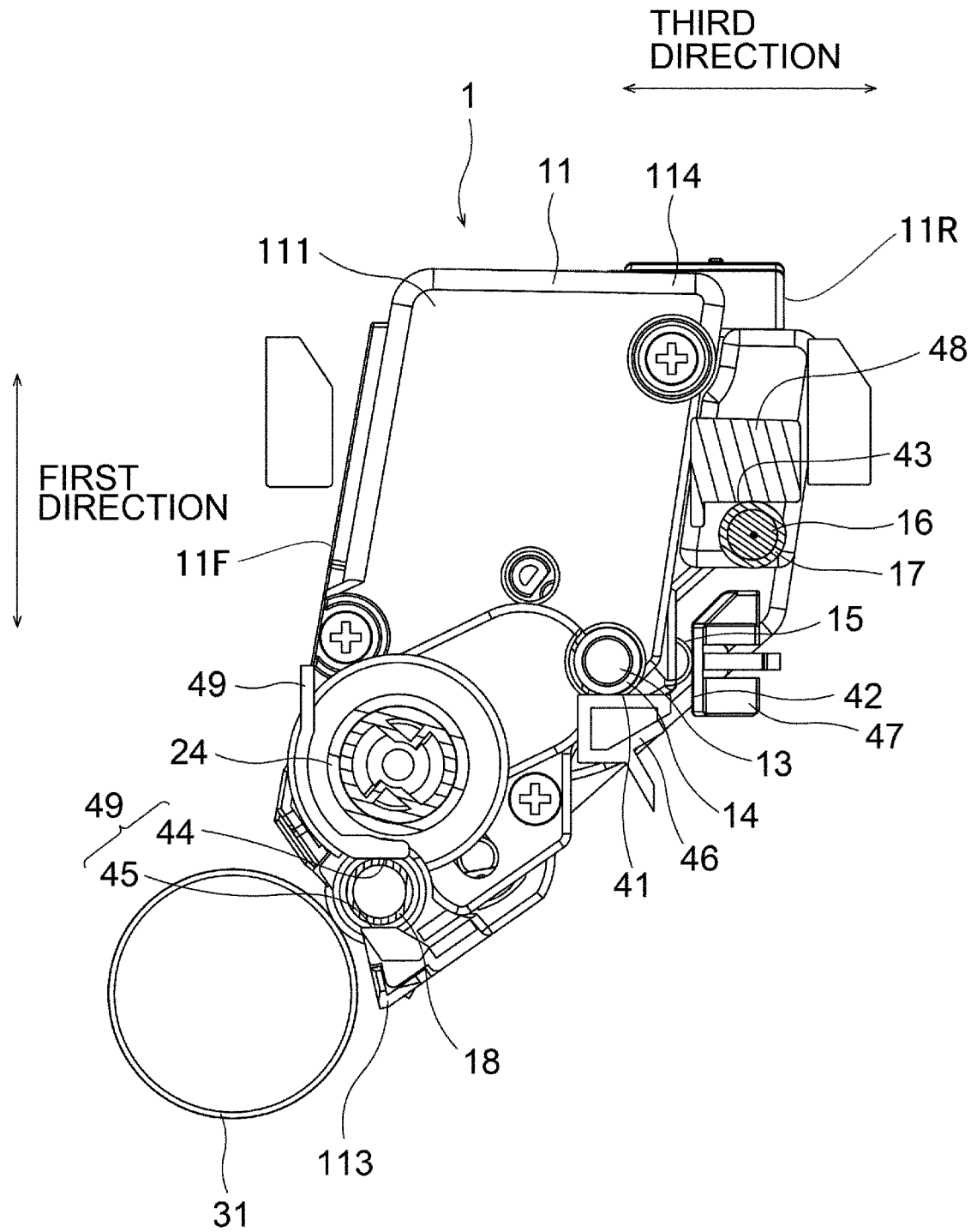
[Fig. 9]



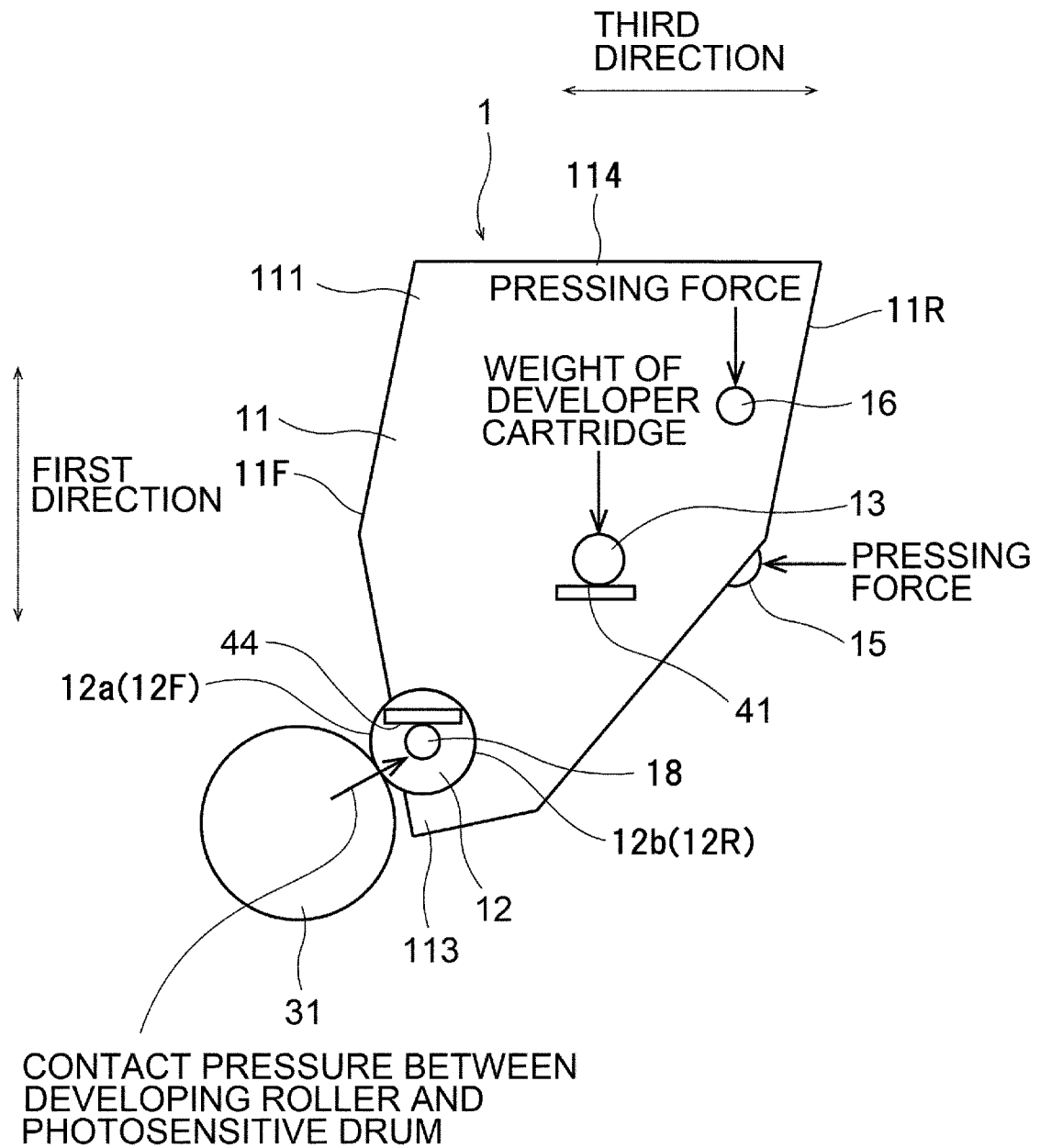
[Fig. 10]



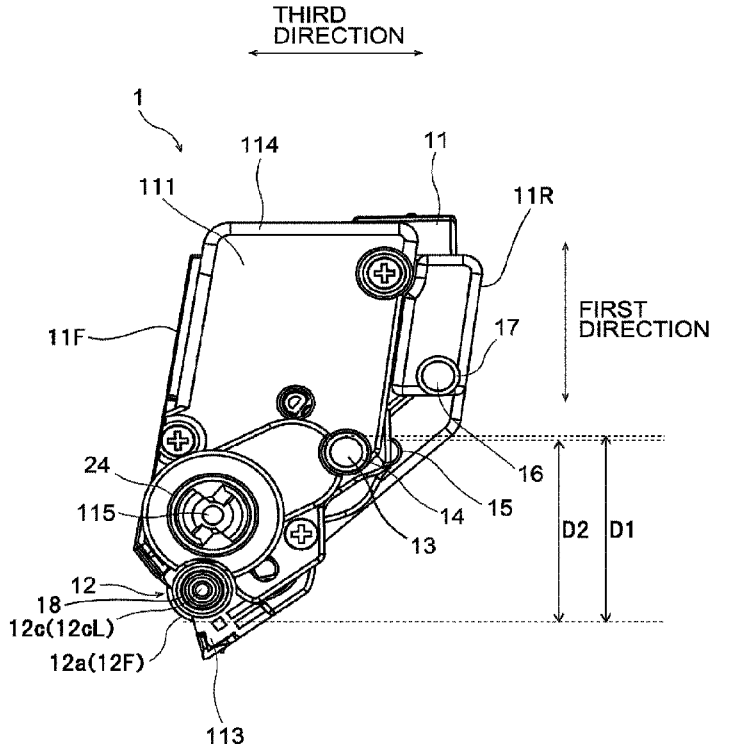
[Fig. 11]



[Fig. 12]



THIRD
DIRECTION



A perspective view of a mechanical assembly, generally designated by the numeral 1. The assembly is shown from a perspective that allows for the identification of its three-dimensional structure. It features a main body with several circular components, some of which are secured with screws. The assembly is oriented such that its top and bottom surfaces are visible. Two dashed horizontal lines are drawn across the lower portion of the assembly to indicate specific vertical dimensions, labeled D1 and D2. D1 represents the distance from a lower reference plane to the top surface of the main body, while D2 represents the distance from the same lower reference plane to the top surface of a circular component at the bottom. The assembly is also characterized by various other features, including a large circular opening on the front face, several smaller circular ports or openings, and a complex internal structure visible through the front opening. The overall shape is somewhat rectangular with rounded corners and a complex internal structure. The assembly is shown in a perspective view that highlights its three-dimensional nature and the various components that make up its structure.

