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Toner refill cartridge having structure in which driving force is transmitted through toner outlet

Abstract

A toner cartridge includes: a body to contain toner and including a toner outlet to discharge the toner to the outside; an agitating member to rotate about a central axis of the body and agitate the toner contained in the body; a shutter member to move along the central axis with respect to the body, and having an open position to open the toner outlet and a blocked position to block the toner outlet; a driving force receiver exposed to the outside through the toner outlet when the shutter member is in the blocked position, and to rotate by receiving a driving force from the outside; and a driving shaft to transmit a rotational force of the driving force receiver to the agitating member.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

(1) This application is a National Stage Application under 35 U.S.C. § 371 of PCT/US2022/071148, filed Mar. 15, 2022, which claims priority to Korean Patent Application No. 10-2021-0137698, filed Oct. 15, 2021, which are hereby incorporated by reference in their entireties.

BACKGROUND

(2) An electro-photographic image forming apparatus forms a visible toner image on a

photoconductor by supplying a toner to an electrostatic latent image formed on the photoconductor, transfers the toner image onto a printing medium via an intermediate transfer medium or directly, and then fuses the transferred toner image onto the printing medium.

(3) A developing cartridge contains the toner, and supplies the toner to the electrostatic latent image formed on the photoconductor to form the visible toner image. In a case where the toner contained in the developing cartridge is exhausted, the developing cartridge is removed from a main body of the image forming apparatus, and a new developing cartridge may be installed in the main body. New toner may be filled or refilled in the developing cartridge by using a toner refilling kit (toner refilling cartridge).

Description

BRIEF DESCRIPTION OF THE DRAWINGS

- (1) FIG. 1 is a schematic external perspective view of an electro-photographic image forming apparatus, according to an example.
- (2) FIG. 2 is a schematic configuration diagram of the electro-photographic image forming apparatus shown in FIG. 1, according to an example.
- (3) FIG. 3 is a perspective view of a developing cartridge employed in an example of the electro-photographic image forming apparatus shown in FIG. 1, according to an example.
- (4) FIG. 4 is an assembled perspective view of a toner refilling cartridge, according to an example.
- (5) FIG. 5 is an exploded perspective view of a toner refilling cartridge, according to an example.
- (6) FIG. 6 is a cross-sectional view of the toner refilling cartridge of FIG. 4.
- (7) FIG. 7 is a cross-sectional view in a case where a shutter member in the toner refilling cartridge of FIG. 6 is in an open position.
- (8) FIG. 8 is an assembled perspective view of a toner filling portion in which a toner refilling cartridge is installed, according to an example.
- (9) FIG. 9 is an exploded perspective view of the toner filling portion of FIG. 8, according to an example.
- (10) FIG. 10 is a cross-sectional view of the toner filling portion of FIG. 8.
- (11) FIG. 11 is a cross-sectional view of a second shutter member of the toner filling portion of FIG. 10, in a second open position.
- (12) FIGS. 12A to 12C are perspective views illustrating a process in which a toner refilling cartridge is installed in a toner filling portion of an image forming apparatus, according to an example.
- (13) FIGS. 13A to 13C are cross-sectional views illustrating a process in which the toner refilling cartridge of FIGS. 12A to 12C is installed in a toner filling portion of an image forming apparatus.
- (14) FIGS. 14A to 14C are diagrams illustrating a process in which a coupling portion is fixed by a locking portion in a case where the toner refilling cartridge of FIGS. 12A to 12C is installed in a toner filling portion of an image forming apparatus.
- (15) FIG. 15 is a cross-sectional view illustrating a state in which toner is supplied to an image forming apparatus from a toner refilling cartridge installed in the image forming apparatus, according to an example.
- (16) FIGS. 16A to 16C are diagrams illustrating a process in which a toner discharge cartridge is separated by a controller.
- (17) FIG. 17 is a perspective view of a toner refilling cartridge, according to another example.
- (18) FIG. 18 is an exploded perspective view of the toner refilling cartridge of FIG. 17, according to an example.
- (19) FIGS. 19 and 20 are diagrams illustrating an operation of the toner refilling cartridge of FIG. 17.

DETAILED DESCRIPTION

(20) In an example, a toner refilling cartridge is of a type in which a user directly presses the toner refilling cartridge to manually discharge the toner. In another example, a toner refilling cartridge is of a type in which the toner is automatically discharged by receiving a driving force from a main body of an image forming apparatus.

(21) A toner refilling cartridge that discharges the toner based on manual user application of a physical force to inject the toner into an image forming apparatus may be inconvenient to use for a user. A toner refilling cartridge that automatically discharges the toner does not use physical force from a user to inject the toner, which may enhance user convenience.

(22) However, a configuration of the toner refilling cartridge that automatically discharges the toner may have a complicated structure and increased size. For example, the toner refilling cartridge that automatically discharges the toner may include a driving force receiver to receive a driving force, and a separate connection opening, apart from a toner outlet, to expose the driving force receiver to the outside. Due to such a separate connection opening, a structure of one end portion of the toner refilling cartridge may be complicated and the size thereof may also increase.

(23) A toner refilling cartridge according to the some examples has a structure in which a driving force is transmitted through a toner outlet, so that a structure of the toner refilling cartridge connected to a main body of an image forming apparatus may be simplified and the size thereof may be reduced. For example, the toner refilling cartridge may include a shutter member configured to move along a central axis with respect to the main body during an installing process, and a driving force receiver arranged inside the shutter member and exposed to the outside through the toner outlet. Therefore, in a process of installing the toner refilling cartridge, the driving force receiver may be naturally connected to a driving force transmitter of the main body through the toner outlet, and the shutter member may move along the central axis to be naturally opened.

(24) The driving force transmitter of the main body may rotate along with a rotation conveying portion configured to convey the toner in the main body, and the driving force receiver of the toner refilling cartridge may rotate along with an agitating member configured to agitate the toner in the toner refilling cartridge. Therefore, in a case where the driving force transmitter and the driving force receiver rotate, the toner in the toner refilling cartridge is agitated by the agitating member to move in the gravitational direction, and, the toner in the main body is conveyed in the gravitational direction by the rotation conveying portion. Thus, the toner of the toner refilling cartridge may be quickly filled in the main body.

(25) Hereinafter, the toner refilling cartridge and an example of an image forming apparatus including the toner refilling cartridge are described in detail with reference to the accompanying drawings. In the present specification and the drawings, constituent elements having substantially the same functions are referenced by the same reference numerals, and thus, redundant descriptions thereof are omitted.

(26) FIG. 1 is a schematic external perspective view of an electro-photographic image forming apparatus, according to an example. FIG. 2 is a schematic configuration diagram of the electro-photographic image forming apparatus shown in FIG. 1, according to an example. FIG. 3 is a perspective view of a developing cartridge 2 employed in an example of the electro-photographic image forming apparatus shown in FIG. 1, according to an example. Referring to FIGS. 1, 2, and 3, an image forming apparatus may include a main body 1 and the developing cartridge 2 that is detachable from the main body 1. A door 3 may be provided in the main body 1. Although the door 3 configured to open an upper portion of the main body 1 is illustrated in FIG. 1, a door configured to open a side or all of the main body 1 may be employed. When the door 3 is opened, the developing cartridge 2 may be installed into or removed from the main body 1.

(27) The developing cartridge 2 according to the some examples includes a developing portion 310 in which a photosensitive drum 31 and a developing roller 32 are installed, a waste toner container 320 in which a waste toner removed from the photosensitive drum 31 is contained, and a toner

container **330** connected to the developing portion **310** and configured to contain the toner. In order to refill the toner container **330** with toner, a toner filling portion **10** provides an interface between a toner refilling cartridge **9** to be described later and the developing cartridge **2**.

(28) The waste toner container **320** is located above the developing portion **310**, and an optical path **350** is formed between the waste toner container **320** and the developing portion **310**. The waste toner removed from the photosensitive drum **31** by a cleaning member **36** is contained in the waste toner container **320**. The waste toner is conveyed into the waste toner container **320** by one or more waste toner conveying members **321**, **322**, and **323**.

(29) The toner container **330** is connected to the toner filling portion **10** to contain the toner. The toner container **330** is connected to the developing portion **310** by a toner supplier **334** as shown by dotted lines in FIG. **2**. The toner supplier **334** is located outside an effective width of an exposure light **L** so as not to interfere with the light **L** scanned in a main scanning direction by an optical scanner **4**. One or more toner supply members **331**, **332**, **333** to supply toner to the developing portion **310** through the toner supplier **334** may be installed in the toner container **330**. The toner supply member **333** may convey the toner in the main scanning direction and deliver the same to the toner supplier **334**.

(30) The developing cartridge **2** supplies the toner contained in the toner container **330** to an electrostatic latent image formed on the photosensitive drum **31** to form a visible toner image. The developing cartridge **2** is detachable from the main body **1**. In the image forming apparatus according to the some examples, while the developing cartridge **2** is installed in the main body **1**, and is not in the process of being removed from the main body **1**, the developing cartridge **2** may be refilled with toner.

(31) Referring to FIGS. **1** and **3**, the toner refilling cartridge **9** contains toner and discharges the toner through a toner outlet **212**. Although not shown, the toner refilling cartridge **9** may include a communication portion to communicate with the main body **1**. The communication portion is electrically connected to the main body **1**, in a case where the toner refilling cartridge **9** is installed in the toner filling portion **10**. The communication portion may perform functions such as indicating whether the toner refilling cartridge **9** is installed in the toner filling portion **10**, and perform information transmission of the toner refilling cartridge **9**. The communication portion may include a customer replaceable unit monitor (CRUM).

(32) A communicating portion **8** is provided in the main body **1** such that the developing cartridge **2** has access to the toner filling portion **10** from the outside of the main body **1**, while being installed in the main body **1**. For example, the communicating portion **8** may be provided on an upper surface **1-1** of the main body **1**, which is close to a front surface **1-2**. The toner filling portion **10** is located at a lower portion of the communicating portion **8**. When the toner refilling cartridge **9** is inserted into the communicating portion **8** from an upper side of the main body **1**, the toner refilling cartridge **9** may be connected to the toner filling portion **10** as shown in FIG. **3**. That is, by moving the toner refilling cartridge **9** in the direction of gravity and inserting the same into the communicating portion **8**, the toner refilling cartridge **9** and the toner filling portion **10** may be connected to each other. In that case, the toner stored in the toner refilling cartridge may be discharged and supplied to the toner container **330** of the developing cartridge **2** through the toner filling portion **10**. The toner refilling cartridge **9** is removed from the communicating portion **8** after toner refilling.

(33) FIG. **4** is an assembled perspective view of the toner refilling cartridge **9**, according to an example, and FIG. **5** is an exploded perspective view of the toner refilling cartridge **9**, according to an example. FIG. **6** is a cross-sectional view of the toner refilling cartridge **9** of FIG. **4**, with a shutter member **230** in the toner refilling cartridge **9** in a blocked position **2302**. FIG. **7** is a cross-sectional view of the toner refilling cartridge **9** with the shutter member **230** in an open position **2301**.

(34) Referring to FIGS. **4** to **6**, the toner refilling cartridge **9** includes a body **210**, an agitating

member **220**, the shutter member **230**, a pressing member **240**, a driving force receiver **250**, and a driving shaft **260**.

(35) The body **210** forms the exterior of the toner refilling cartridge **9**, contains toner therein, and includes the toner outlet **212** configured to discharge the contained toner to the outside. The agitating member **220**, the shutter member **230**, the pressing member **240**, the driving force receiver **250**, and the driving shaft **260** are arranged in the body **210**.

(36) The toner outlet **212** may be provided at one end portion of the body **210**, and a lid **211** may be coupled to another end portion of the body **210**. A status displayer **2111** may be arranged on the lid **211**, and the status displayer **2111** is configured to indicate whether the toner is used up inside the toner refilling cartridge **9**.

(37) A plurality of coupling portions **214** are provided on an outer circumferential surface of the body **210**. The plurality of coupling portions **214** protrude from the outer circumferential surface of the body **210**. When the toner refilling cartridge **9** is inserted into the toner filling portion **10**, the plurality of coupling portions **214** fix the toner refilling cartridge **9** to the toner filling portion **10** of an image forming apparatus, and prevent the toner refilling cartridge **9** from rotating in the toner filling portion **10**.

(38) The body **210** includes an accommodation space **2101** to contain the toner and a discharge space **2102** in which the toner outlet **212** is formed. A width of the discharge space **2102** may be less than a width of the accommodation space **2101**. The width of the accommodation space **2101** may be greater than a rotation diameter of the agitating member **220**, and the width of the discharge space **2102** may be less than the rotation diameter of the agitating member **220**. A connection space **2103** is provided between the accommodation space **2101** and the discharge space **2102**, and the connection space **2103** narrows in width as the connection space **2103** extends towards the discharge space **2102**.

(39) The agitating member **220** is arranged in the accommodation space **2101** and rotates to agitate the toner. The agitating member **220** may rotate about a central axis CX of the body **210**. For example, one end portion of the agitating member **220** may be supported by the lid **211** to be rotatable. The agitating member **220** includes a rotation shaft **221** arranged on the central axis CX of the body **210** and an agitating blade **222** installed on the rotation shaft **221**. While the agitating blade **222** rotates, the toner contained in the accommodation space **2101** is agitated. The agitated toner may have increased fluidity and move downwardly due to gravity.

(40) The shutter member **230** may move along the central axis CX of the body **210**. A direction of the central axis CX of the body **210** may be a longitudinal direction of the body **210** or an extension direction of the rotation shaft **221** of the agitating member **220**, and may be parallel with the direction of gravity, when the toner refilling cartridge **9** is installed in the main body **1**. The shutter member **230** has an open position **2301** to open the toner outlet **212** and a blocked position **2302** to block the toner outlet **212**. The shutter member **230** moves between the open position **2301** and the blocked position **2302** along the central axis CX. The body **210** may have a step **213** to hold the shutter member **230** in the blocked position **2302**. For example, the step **213** may be arranged in the discharge space **2102**.

(41) The pressing member **240** may press the shutter member **230** to move the shutter member **230** from the open position **2301** to the blocked position **2302** along the central axis CX. For example, the pressing member **240** provides an elastic force to press the shutter member **230** in a direction closer to the toner outlet **212**. The shutter member **230** is pressed by the pressing member **240** to move until the shutter member **230** comes into contact with the step **213** of the body **210**. In a state where no external force is applied to the toner refilling cartridge **9**, the shutter member **230** may be held in the blocked position **2302** by the elastic force of the pressing member **240**.

(42) In a process of installing the toner refilling cartridge **9**, in a case where an external force greater than the elastic force of the pressing member **240** is applied to the toner refilling cartridge **9** by a user, the shutter member **230** moves from the blocked position **2302** to the open position **2301**.

despite the elastic force of the pressing member **240**. In a case where the external force applied to the toner refill cartridge **9** is released, the shutter member **230** moves from the open position **2301** to the blocked position **2302** by the elastic force of the pressing member **240**, and the toner outlet **212** is blocked.

(43) The shutter member **230** includes a first shutter **231** to block the toner outlet **212** and a second shutter **232** to block the inside of the discharge space **2102**. The first shutter **231** has a first outer diameter corresponding to a width of the toner outlet **212**, and the second shutter **232** has a second outer diameter corresponding to the width of the discharge space **2102**. The first outer diameter may be less than the second outer diameter. The first shutter **231** and the second shutter **232** are connected to each other by a shutter connector **233**. The first shutter **231**, the shutter connector **233**, and the second shutter **232** may be a single body. When the shutter member **230** moves, the first shutter **231**, the shutter connector **233**, and the second shutter **232** may move together.

(44) In some examples, the second shutter **232** blocks the inside of the discharge space **2102**. However, in other examples, the second shutter **232** may have a different arrangement. If the second shutter **232** blocks the inside of the body **210** apart from the toner outlet **212**, a shape of the second shutter **232** may be modified. For example, the second shutter **232** may block a space between the accommodation space **2101** and the discharge space **2102**, rather than the inside of the discharge space **2102**. In other words, the second shutter **232** may block the connection space **2103** between the accommodation space **2101** and the discharge space **2102**.

(45) A first sealing member **234** may be arranged around the first shutter **231**, and a second sealing member **235** may be arranged around the second shutter **232**. When the shutter member **230** is in the blocked position **2302**, the first sealing member **234** and the second sealing member **235** are pressed by an inner circumferential surface of the body **210**, the first shutter **231** and the second shutter **232**; as a result, the first sealing member **234** and the second sealing member **235** seal between the shutter member **230** and the body **210**. When the shutter member **230** is in the open position **2301**, the first and second sealing members **234** and **235** do not come into contact with the inner circumferential surface of the body **210**; as a result, the toner may move between the first and second sealing members **234** and **235** and the body **210**.

(46) The driving force receiver **250** rotates by receiving a driving force from the outside. The driving force receiver **250** may be a driven coupler configured to receive a driving force from an image forming apparatus.

(47) The driving force receiver **250** may be exposed to the outside through the toner outlet **212**. For example, when the shutter member **230** is in the blocked position **2302**, the driving force receiver **250** may be exposed to the outside through the toner outlet **212**. As an example, the driving force receiver **250** may be arranged inside the shutter member **230**. For example, the driving force receiver **250** may be provided inside the shutter connector **233**. Even when the toner outlet **212** is blocked by the shutter member **230** in the blocked position **2302**, the driving force receiver **250** inside the shutter member **230** may be exposed to the outside through the toner outlet **212**.

(48) As the driving force receiver **250** is exposed to the outside through the toner outlet **212**, a separate opening does not have to be employed to expose the driving force receiver **250** to the outside of the toner refilling cartridge **9**. Thus, a connection structure of the toner refilling cartridge **9** and the toner filling portion **10** may be designed in a compact manner. In addition, as the driving force receiver **250** is arranged inside the shutter member **230**, an additional space other than the shutter member **230** for the driving force receiver **250** does not have to be provided inside the body **210**. Thus, it is possible to save space in the toner refilling cartridge **9** apart from the space to accommodate the toner.

(49) The driving force receiver **250** transmits a rotational force to the agitating member **220** through the driving shaft **260**. The driving shaft **260** transmits the rotational force of the driving force receiver **250** to the agitating member **220**. For example, the driving shaft **260** may be fixed to the shutter member **230** and receive the rotational force of the driving force receiver **250** through

the shutter member **230**.

(50) The driving shaft **260** may be configured to be movable in the direction of the central axis CX with respect to the agitating member **220**. For example, the driving shaft **260** extends along the central axis CX, and a first end portion of the driving shaft **260** is inserted into the agitating member **220**. The agitating member **220** includes a shaft groove **223** configured to receive the rotational force from the driving shaft **260**, and the first end portion of the driving shaft **260** is inserted into the shaft groove **223**. The first end portion of the driving shaft **260** and a cross-sectional shape of the shaft groove **223** may correspond to each other. In order to prevent relative rotation, any one of the first end portion of the driving shaft **260** and the shaft groove **223** may have a rotation prevention protrusion **2611**, and the other one of the first end portion of the driving shaft **260** and the shaft groove **223** may have a rotation prevention groove **2231** into which the rotation prevention protrusion **2611** is inserted.

(51) Referring to FIGS. **6** and **7**, while the toner refilling cartridge **9** is installed, the shutter member **230** may move in the direction of the central axis CX with respect to the body **210**. The shutter member **230** may move from the blocked position **2302** to the open position **2301**. The agitating member **220** may rotate with respect to the body **210**, but the agitating member **220** remains fixed in the central axis CX direction. Accordingly, when the shutter member **230** moves along the central axis CX, the driving shaft **260** fixed to the shutter member **230** moves along the central axis CX with respect to the agitating member **220**. In other words, when the shutter member **230** moves from the blocked position **2302** to the open position **2301**, the driving shaft **260** moves along the central axis CX. As the driving shaft **260** moves along the central axis CX, a depth at which the driving shaft **260** is inserted into the agitating member **220** varies. When the shutter member **230** moves along the central axis CX, a depth at which the driving shaft **260** is inserted into the shaft groove **223** varies. For example, while a depth at which the driving shaft **260** is inserted into the shaft groove **223** when the shutter member **230** is in the blocked position **2302** is a first depth D1, the depth at which the driving shaft **260** is inserted into the shaft groove **223** when the shutter member **230** is in the open position **2301** may be a second depth D2 greater the first depth D1.

(52) The pressing member **240** may be an elastic member that surrounds a circumference of the driving shaft **260** and is compressible and expandable in the direction of the central axis CX. For example, the elastic member may be a coil spring. A first end portion of the pressing member **240** may be supported by the agitating member **220**. For example, the first end portion of the pressing member **240** may be supported by a first support groove **224**. The first support groove **224** may be arranged coaxially with the shaft groove **223**, and a width of the first support groove **224** may be greater than a width of the shaft groove **223**. A second end portion of the pressing member **240** may be supported by the shutter member **230**. The shutter member **230** and the driving force receiver **250** are in a state in which a force is applied in a direction away from the agitating member **220** by the pressing member **240**.

(53) The shutter member **230** may be fixed to the driving force receiver **250**. For example, the shutter member **230** and the driving force receiver **250** may be formed as a single body. While the toner refilling cartridge **9** is installed, the shutter member **230** and the driving force receiver **250** move relative to the body **210** in the direction of the central axis CX. When a rotational force from the outside is transmitted to the driving force receiver **250**, the driving force receiver **250** and the shutter member **230** may rotate together. The driving shaft **260** may be fixed to the shutter member **230** and rotate together with the shutter member **230**. Accordingly, the rotational force input to the driving force receiver **250** may be transmitted to the agitating member **220** through the shutter member **230** and the driving shaft **260**, and may rotate such that the agitating member **220** agitates the toner.

(54) FIG. **8** is an assembled perspective view illustrating the toner filling portion **10** in which the toner refilling cartridge **9** is installed, according to an example, and FIG. **9** is an exploded view of

the toner filling portion **10** of FIG. **8**, according to an example. FIG. **10** is a cross-sectional view of the toner filling portion **10** of FIG. **8**, with a second shutter member **160** of the toner filling portion **10** in a second blocked position **1602**. FIG. **11** is a cross-sectional view of the toner filling portion **10** with the second shutter member **160** of FIG. **10** in a second open position **1601**.

(55) Referring to FIGS. **8** to **11**, the toner filling portion **10** includes a filling cover **110**, a toner conveying tube **120**, a driving force transmitter **150**, a rotation conveying portion **140**, the second shutter member **160**, and a second pressing member **170**.

(56) The filling cover **110** provides an insertion hole **111** into which the toner refilling cartridge **9** is inserted. The insertion hole **111** gradually decreases in width from top to bottom along the direction of gravity. Therefore, the toner refilling cartridge **9** may be easily inserted into the insertion hole **111** of the toner filling portion **10**. In addition, the filling cover **110** protects the toner conveying tube **120**, the driving force transmitter **150**, the rotation conveying portion **140**, the second shutter member **160**, and the second pressing member **170** from protruding to the outside.

(57) At least a portion of the toner conveying tube **120** is arranged in the insertion hole **111**. The toner conveying tube **120** provides a conveying path through which toner is conveyed. For example, the toner conveying tube **120** has a cylindrical structure extending along the direction of gravity. A toner inlet **121** through which the toner is introduced is formed in the toner conveying tube **120**. The toner inlet **121** is formed on an upper side of the toner conveying tube **120**. Through the toner inlet **121**, the toner may be introduced in a direction perpendicular to the direction of gravity. A third sealing member **130** is arranged around the toner inlet **121** in the toner conveying tube **120**. An opening **131** is formed in the third sealing member **130** to allow the toner to flow into the toner inlet **121**. Through the toner inlet **121** and the opening **131** of the third sealing member **130**, the toner flows in a direction perpendicular to the direction of gravity. A toner outlet **123** through which the toner is discharged is formed at a lower portion of the toner conveying tube **120**. The toner is delivered to the developing cartridge **2** of an image forming apparatus through the toner outlet **123**.

(58) The rotation conveying portion **140** is arranged in the toner conveying tube **120** to be rotatable. While the rotation conveying portion **140** rotates, the toner in the toner conveying tube **120** may be conveyed in the direction of gravity. For example, the rotation conveying portion **140** may include a spiral blade **142** arranged on the rotation shaft **141**, and may be an auger that conveys the toner in the gravity direction by rotating. Because of the rotation conveying portion **140**, the toner does not aggregate in the toner conveying tube **120**, and may be conveyed rapidly in the direction of gravity.

(59) The driving force transmitter **150** is arranged at one end portion of the toner conveying tube **120**. The driving force transmitter **150** is arranged at an upper portion of the toner conveying tube **120**. A rotation shaft of the driving force transmitter **150** is arranged coaxially with the rotation shaft **141** of the rotation conveying portion **140**. The driving force transmitter **150** is connected to one end portion of the rotation conveying portion **140**. Accordingly, in a case where the rotation conveying portion **140** rotates, a rotational force of the rotation conveying portion **140** is transmitted to the driving force transmitter **150** so that the driving force transmitter **150** rotates together. A rotation direction and rotation speed of the rotation conveying portion **140** may be the same as a rotation direction and rotation speed of the driving force transmitter **150**.

(60) The driving force transmitter **150** may be configured to be coupled to the driving force receiver **250** of the toner refilling cartridge **9**. For example, the driving force transmitter **150** of the toner filling portion **10** and the driving force receiver **250** of the toner refilling cartridge **9** may be in the form of a coupler. The driving force receiver **250** and the driving force transmitter **150** include protrusions and grooves having shapes corresponding to each other. Accordingly, the driving force transmitter **150** is coupled to the driving force receiver **250**, and a driving force of the driving force transmitter **150** is transmitted to the driving force receiver **250**. A rotational force of the rotation conveying portion **140** may be transmitted to the driving force transmitter **150** to rotate

the driving force receiver **250** of the toner refilling cartridge **9**.

(61) At least a portion of the second shutter member **160** is arranged in the insertion hole **111** and movable in the direction of gravity or a direction opposite to the direction of gravity. The second shutter member **160** may have a second blocked position **1602** to block the toner inlet **121** and the second open position **1601** to open the toner inlet **121**. When the toner refilling cartridge **9** is installed in the toner filling portion **10**, the second shutter member **160** is pressed in the gravity direction by the body **210** of the toner refilling cartridge **9** to move from the second blocked position **1602** to the second open position **1601**. For example, the second shutter member **160** may be pressed by at least one of one end portion of the body **210** and the coupling portion **214** to move to the second open position **1601**.

(62) The second shutter member **160** includes a shutter region **161** to surround a circumference of the toner conveying tube **120** and a contact region **162** in contact with the body **210** and pressed against the body **210**. A length **L1** of the shutter region **161** in the gravitational direction may be less than a length **L2** between the toner inlet **121** and the toner outlet **123** in the gravitational direction. The contact region **162** may include a first groove **163** into which the coupling portion **214** is inserted.

(63) The second pressing member **170** presses the second shutter member **160** to move the second shutter member **160** from the second open position **1601** to the second blocked position **1602**. For example, the second pressing member **170** may provide an elastic force to press the second shutter member **160** upward, opposite to the direction of gravity. When an external force applied while installing the toner refilling cartridge **9** is released, the second pressing member **170** may press the second shutter member **160** upward with an elastic force to move the second shutter member **160** from the second open position **1601** to the second blocked position **1602**. Accordingly, when the toner refilling cartridge **9** is separated from the toner filling portion **10**, the toner inlet **121** is blocked by the second shutter member **160**. The second shutter member **160** includes a locking protrusion **164** to maintain the second blocked position **1602** and not to fall out of the toner filling portion **10**.

(64) A driving force supplier **190** to supply a rotational force is arranged at another end portion of the rotation conveying portion **140**. The driving force supplier **190** transmits the rotational force to the driving force transmitter **150** through the rotation conveying portion **140**. The rotational force transmitted to the driving force transmitter **150** may be transmitted to the toner refilling cartridge **9** to rotate the agitating member **220**. Accordingly, the rotation conveying portion **140** of the toner filling portion **10** and the agitating member **220** of the toner refilling cartridge **9** may be rotated together by the single driving force supplier **190**.

(65) A controller **15** controls rotation of the driving force supplier **190**. When the toner refilling cartridge **9** is installed in the toner filling portion **10**, the controller **15** may rotate the driving force supplier **190**. For example, if the toner refilling cartridge **9** is electrically connected to the image forming apparatus by a communication portion, when the toner refilling cartridge **9** is installed in the toner filling portion **10**, the controller **15** may determine that the toner refilling cartridge **9** has been installed, and may accordingly rotate the driving force supplier **190**. As the driving force supplier **190** is automatically rotated by the controller **15**, the toner contained in the toner refilling cartridge **9** may be automatically supplied to the image forming apparatus.

(66) The toner filling portion **10** further includes a fixing portion **180** to fix a location of the toner refilling cartridge **9**. The fixing portion **180** includes a second groove **182** into which the coupling portion **214** of the toner refilling cartridge **9** may be inserted, and a locking protrusion **181** in the second groove **182** to limit movement of the coupling portion **214**. The locking protrusion **181** may have an inclined surface **1810** (FIG. 14A) inclined in the direction of gravity. A force in the direction of gravity may be converted into a force in a direction perpendicular to the direction of gravity by the coupling portion **214** through the inclined surface **1810**, and accordingly, the fixing portion **180** may rotate during an installing process of the toner refilling cartridge **9**. However, the

inclined surface **1810** may be omitted in other examples.

(67) While rotating during the installing process of the toner refilling cartridge **9**, the fixing portion **180** may have resilience to restore itself back to its original location. As an example, the fixing portion **180** may include a fixed blade **183** on an outer circumferential surface. The fixed blade **183** may have a helical structure capable of elastic deformation, and may be supported by a blade support groove **113** of the filling cover **110**.

(68) Hereinafter, a process in which the toner refilling cartridge **9** is installed in the image forming apparatus, a process in which toner is supplied by the toner refilling cartridge **9**, and a process in which the toner refilling cartridge **9** is separated from the image forming apparatus are described.

(69) FIGS. **12A** to **12C** are perspective views illustrating a process in which the toner refilling cartridge **9** is installed in the toner filling portion **10** of an image forming apparatus, according to an example, and FIGS. **13A** to **13C** are cross-sectional views illustrating a process in which the toner refilling cartridge **9** of FIGS. **12A** to **12C** is installed in the toner filling portion **10** of an image forming apparatus. FIGS. **14A** to **14C** are diagrams illustrating a process in which the coupling portion **214** is fixed by the locking protrusion **181**, when the toner refilling cartridge **9** of FIGS. **12A** to **12C** is installed in the toner filling portion **10** of an image forming apparatus. FIG. **15** is a cross-sectional view illustrating a state in which toner is supplied to an image forming apparatus from the toner refilling cartridge **9** installed in the image forming apparatus, according to an example.

(70) Referring to FIGS. **12A** and **13A**, first, the toner refilling cartridge **9** filled with toner is prepared. The shutter member **230** of the toner refilling cartridge **9** is in the blocked position **2302**, and accordingly, because of the first shutter **231** and the second shutter **232**, the toner contained in the toner refilling cartridge **9** does not leak out. In the arrangement of FIGS. **12A** and **13A**, the second shutter member **160** of the toner filling portion **10** is located at the second blocked position **1602**, and the toner inlet **121** of the toner conveying tube **120** is blocked by the second shutter member **160**. While the second shutter member **160** is movable in the direction of gravity, the remaining components of the toner filling portion **10**, apart from the second shutter member **160**, for example, the driving force transmitter **150**, the toner conveying tube **120**, etc. do not move in the direction of gravity. A user inserts the toner refilling cartridge **9** into the toner filling portion **10** in the direction of gravity such that the toner outlet **212** faces the insertion hole **111** of the toner filling portion **10**.

(71) Referring to FIGS. **12B** and **13B**, when the toner refilling cartridge **9** is inserted into the insertion hole **111** of the filling cover **110**, the coupling portion **214** of the toner refilling cartridge **9** is inserted into a positioning groove **112** provided in the filling cover **110**. While the coupling portion **214** is inserted into the positioning groove **112**, the driving force receiver **250** of the toner refilling cartridge **9** comes into contact with the driving force transmitter **150** of the image forming apparatus, and the body **210** of the toner refilling cartridge **9** comes into contact with the second shutter member **160** of the image forming apparatus. In a state in which the driving force receiver **250** and the body **210** of the toner refilling cartridge **9** are in contact with the driving force transmitter **150** and the second shutter member **160** of the image forming apparatus, the toner refilling cartridge **9** is pressed in the direction of gravity.

(72) Referring to FIGS. **12C** and **13C**, the body **210** of the toner refilling cartridge **9** moves in the direction of gravity due to the user's applied pressure. In that case, the driving force receiver **250** in contact with the driving force transmitter **150** and the shutter member **230** on which the driving force receiver **250** is arranged do not move in the direction of gravity. Accordingly, the shutter member **230** moves relative to the body **210** in a direction opposite to the direction of gravity. The shutter member **230** relatively moves from the blocked position **2302** to the open position **2301**, and the pressing member **240** between the shutter member **230** and the agitating member **220** is compressed. As the shutter member **230** moves to the open position **2301**, the toner may be conveyed between the toner outlet **212** and the first shutter **231**, and the toner may also be

conveyed between an inner circumferential surface of the body **210** and the second shutter **232**.

Accordingly, the toner contained in the accommodation space **2101** is movable in the direction of gravity.

(73) As the body **210** of the toner refilling cartridge **9** moves in the gravity direction, the second shutter member **160** contacted and pressed by the body **210** moves in the gravity direction from the second blocked position **1602** to the second open position **1601**. As the second shutter member **160** moves to the second open position **1601**, the toner inlet **121** of the toner conveying tube **120** is opened, and the second pressing member **170** is compressed. Accordingly, the toner moving between the inner circumferential surface of the body **210** and the second shutter **232** may flow into the toner inlet **121** of the toner conveying tube **120**.

(74) An example of a process of fixing a location of the body **210** of the toner refilling cartridge **9** while installing the toner refilling cartridge **9** in the toner filling portion **10** is described below.

(75) Referring to FIGS. **14A** and **14B**, while the toner refilling cartridge **9** is inserted into the insertion hole **111** of the filling cover **110**, the coupling portion **214** on the outer circumferential surface of the body **210** of the toner refilling cartridge **9** moves in the direction of gravity. While the coupling portion **214** of the body **210** moves in the direction of gravity, the coupling portion **214** may be inserted into the first groove **163** of the second shutter member **160** and the second groove **182** of the fixing portion **180**. While the coupling portion **214** is inserted into the second groove **182**, an inclined surface **2140** of the coupling portion **214** contacts and presses the inclined surface **1810** of the locking protrusion **181**. At least a portion of a pressing force in the direction of gravity of the coupling portion **214** is converted into a pressing force in a direction perpendicular to the direction of gravity by the inclined surface **2140** of the coupling portion **214** and the inclined surface **1810** of the locking protrusion **181**. Accordingly, the locking protrusion **181** moves in the direction perpendicular to the direction of gravity, for example, in a left direction. In that case, the fixing portion **180** on which the locking protrusion **181** is formed rotates, and a shape of the fixing blade **183** of the fixing portion **180** is temporarily modified.

(76) Referring to FIG. **14C**, when the coupling portion **214** moves lower than the locking protrusion **181** while the coupling portion **214** moves in the direction of gravity, a force applied to locking protrusion **181** by the coupling portion **214** is released. When the force applied to the locking protrusion **181** is released, the fixing portion **180** rotates in an opposite direction due to shape resilience of the fixing blade **183**, and the locking protrusion **181** also moves in the right direction to return to its original location. Therefore, the locking protrusion **181** is located above the coupling portion **214** to restrict movement of the coupling portion **214** upward. Thus, the location of the body **210** of the toner refilling cartridge **9** may be fixed, and the toner refilling cartridge **9** may be prevented from falling out of the toner filling portion **10** inadvertently.

(77) Hereinafter, while the toner refilling cartridge **9** is installed, a process in which toner is refilled into the toner filling portion **10** by the toner refilling cartridge **9** is described.

(78) Referring to FIG. **15**, as the user presses the toner refilling cartridge **9** until the toner filling portion **10** is completely installed, the driving force transmitter **150** of the toner filling portion **10** is coupled to the driving force receiver **250** of the toner refilling cartridge **9**, and the shutter member **230** and the second shutter member **160** are located at the open position **2301** and the second open position **1601**, respectively.

(79) The controller **15** may rotate the driving force supplier **190**, when the toner refilling cartridge **9** is installed in the toner filling portion **10**. The controller **15** may determine whether the toner refilling cartridge **9** is installed in the image forming apparatus through a communication portion, and may rotate the driving force supplier **190** in a certain direction, in a case where it is determined that the toner refilling cartridge **9** is installed. As the controller **15** rotates the driving force supplier **190** in a certain direction, the rotation conveying portion **140** connected to the driving force supplier **190** may rotate, and the toner in the toner conveying tube **120** may be rapidly conveyed in the direction of gravity. In that case, the driving force transmitter **150** arranged at one end portion

of the rotation conveying portion **140** rotates along with the rotation conveying portion **140**. As the driving force transmitter **150** rotates, the driving force receiver **250** coupled to the driving force transmitter **150** rotates, and a rotational force of the driving force receiver **250** is transmitted to the agitating member **220** through the driving shaft **260** to rotate the agitating member **220**. The toner stored in the accommodation space **2101** is agitated by the rotation of the agitating member **220**, and the agitated toner passes between the body **210** and the first and second shutters **231** and **232** to be supplied to the toner inlet **121** of the toner conveying tube **120**. The toner supplied to the toner conveying tube **120** moves in the direction of gravity due to the rotation conveying portion **140** to be delivered into a body of the image forming apparatus through the toner outlet **123**.

(80) The controller **15** may operate the driving force supplier **190** until the toner contained in the toner refilling cartridge **9** is completely discharged to the toner filling portion **10**. For example, the controller **15** may control an operation of the driving force supplier **190** by taking account of a rotation time of the driving force supplier **190** or a printing medium used after the toner refilling cartridge **9** is installed.

(81) Hereinafter, a process of removing the toner refilling cartridge **9** is described.

(82) As an example, the toner refilling cartridge **9** may be automatically removed after toner refilling is completed. For example, the controller **15** may automatically release locking of the toner refilling cartridge **9** after toner discharge of the toner refilling cartridge **9** is completed.

(83) FIGS. **16A** to **16C** are diagrams illustrating a process in which a toner discharge cartridge is separated by the controller **15**. Referring to FIG. **16A**, the coupling portion **214** is locked on the locking protrusion **181** until supply of toner is completed. In that state, when the toner supply is completed, the controller **15** may change an operation direction of the driving force supplier **190**. For example, the controller **15** may determine whether the toner supply is completed, by taking account of a rotation time of the driving force supplier **190** or a printing medium used after the toner refilling cartridge **9** is installed. After determining that the toner supply is completed, the controller **15** may change a rotation direction of the driving force supplier **190**. For example, the controller **15** may switch the rotation direction of the driving force supplier **190** from a forward rotation in which the toner is conveyed in the direction of gravity to a reverse rotation.

(84) A rotational force of the driving force supplier **190** may be transmitted to the fixing portion **180**. For example, the forward rotation of the driving force supplier **190** may not be transmitted to the fixing portion **180**, and the reverse rotation of the driving force supplier **190** may be transmitted to the fixing portion **180**. As an example, the driving force supplier **190** may be connected to the fixing portion **180** by a one-way clutch **16**. The one-way clutch **16** does not transmit power to the fixing portion **180**, when the driving force supplier **190** rotates in a forward direction, and transmits power to the fixing portion **180**, when the driving force supplier **190** rotates in a reverse direction.

(85) Referring to FIG. **16B**, the controller **15** rotates the driving force supplier **190** in the reverse direction. By the one-way clutch **16**, the reverse rotational force of the driving force supplier **190** is transmitted to the fixing portion **180**, thereby rotating the fixing portion **180** clockwise. Therefore, the locking protrusion **181** on the fixing portion **180** moves in a left direction. As the locking protrusion **181** moves, the coupling portion **214** may move upward.

(86) Referring to FIGS. **13C** and **16C**, the second shutter member **160** is pressed upward by the second pressing member **170**. Therefore, as the locking protrusion **181** moves in the left direction, locking of the coupling portion **214** is released, and the second shutter member **160** is pressed by the second pressing member **170** so as to rise in a direction opposite to the direction of gravity. The body **210** of the toner refilling cartridge **9** that contacts the second shutter member **160** rises.

Accordingly, the toner refilling cartridge **9** moves more upward than in a case where the toner filling portion **10** is completely installed, and is detachable from the toner filling portion **10**. A user may recognize that toner refilling has been completed by the toner refilling cartridge **9**, by checking that the toner refilling cartridge **9** has moved upward.

(87) According to the above-described example, the toner refilling cartridge **9** is automatically

switched to a detachable state by the controller **15**. In other examples, the toner refilling cartridge **9** may be manually removed by the user's force. For example, although not shown, the user may turn the body **210** of the toner refilling cartridge **9** to separate the coupling portion **214** of the toner refilling cartridge **9** from the locking protrusion **181**.

(88) According to the above-described examples, the shutter member **230** and the driving force receiver **250** are a single body in the toner refilling cartridge **9**. However, in other examples, the shutter member **230** and the driving force receiver **250** may be modified into various structures.

(89) FIG. **17** is a perspective view of a toner refilling cartridge **9A**, according to another example, FIG. **18** is an exploded perspective view of the toner refilling cartridge **9A** of FIG. **17**, according to an example, and FIGS. **19** and **20** are diagrams illustrating an operation of the toner refilling cartridge **9A** of FIG. **17**.

(90) Referring to FIGS. **17** to **20**, the toner refilling cartridge **9A** according to further examples includes a body **210A**, the agitating member **220**, a shutter member **230A**, the pressing member **240**, a driving force receiver **250A**, and a driving shaft **260A**. Hereinafter, descriptions of the same configuration as in the above-described example are omitted, and only differences are described.

(91) The body **210A** supports one end portion of the pressing member **240**, and may further include a support portion **215** through which the driving shaft **260A** passes. For example, the body **210A** may include a first body portion **210-1** and a second body portion **210-2**, where the coupling portion **214** and the toner outlet **212** are formed in the first body portion **210-1**, and the support portion **215** is formed in the second body portion **210-2**, which is arranged inside the first body portion **210-1**. The support portion **215** may be fixed onto the second body portion **210-2** by a plurality of arms **2151**. The driving shaft **260A** passes through the support portion **215** to be connected to the agitating member **220**.

(92) The driving shaft **260A** has one end portion connected to the agitating member **220** and another end portion fixed to the driving force receiver **250A**. The driving force receiver **250A** is arranged inside the shutter member **230A** and supported by the shutter member **230A** to be rotatable. Between the driving force receiver **250A** and the shutter member **230A** is included a rotation support portion **270**, which supports the driving force receiver **250A** to be rotatable with respect to the shutter member **230A**. A third sealing member **236** may be arranged between the driving shaft **260A** and the driving force receiver **250A**. The shutter member **230A** may be fitted with the first shutter **231** and the second shutter **232**, and the driving force receiver **250A**, the rotation support portion **270**, and the third sealing member **236** are arranged therebetween.

(93) One end portion of the pressing member **240** is supported by the support portion **215** and another end portion of the pressing member **240** is supported by the shutter member **230A**. Since the pressing member **240** is supported by the support portion **215**, instead of the agitating member **220**, a pressing force of the pressing member **240** may be prevented from acting on the agitating member **220**.

(94) If the pressing force of the pressing member **240** acts on the agitating member **220**, the agitating member **220** may be pressed upward, and accordingly, a frictional force due to rotation may increase between the agitating member **220** and the lid **211**. In that case, a driving force to rotate the agitating member **220** may increase, and in severe cases, noise due to friction may occur when the agitating member **220** rotates.

(95) However, in the toner refilling cartridge **9A** according to the present example, since another end portion of the pressing member **240** is supported by the support portion **215**, instead of the agitating member **220**, the pressing force of the pressing member **240** does not act on the agitating member **220**. Therefore, an increase in driving force to rotate the agitating member **220** may be prevented, and noise of the agitating member **220** may be prevented.

(96) It should be understood that examples described herein should be considered in a descriptive sense only and not for purposes of limitation. Descriptions of features or aspects within each example should typically be considered as available for other similar features or aspects in other

examples. While one or more examples have been described with reference to the figures, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope as defined by the following claims.

Claims

1. A toner refilling cartridge for installation in an image forming apparatus in a direction of gravity to refill toner, the toner refilling cartridge comprising: a body to contain toner, and comprising a toner outlet to discharge the toner to an outside of the toner refilling cartridge; an agitating member to rotate about a central axis of the body and agitate the toner in the body; a shutter member to move along the central axis with respect to the body, the shutter member comprising an open position to open the toner outlet and a blocked position to block the toner outlet; a driving force receiver exposed to the outside through the toner outlet when the shutter member is in the blocked position, the driving force receiver to rotate by receiving a driving force from the outside; and a driving shaft to transmit a rotational force of the driving force receiver to the agitating member, wherein the driving shaft is to move in a direction of the central axis to connect with the agitating member, while the shutter member moves from the blocked position to the open position.
2. The toner refilling cartridge of claim 1, wherein the driving force receiver is arranged inside the shutter member.
3. The toner refilling cartridge of claim 1, wherein, while the toner refilling cartridge is installed in the image forming apparatus, the driving force receiver moves relative to the body in the direction of the central axis, and the shutter member moves relative to the body from the blocked position to the open position.
4. The toner refilling cartridge of claim 1, wherein the driving shaft is movable in the direction of the central axis with respect to the agitating member, and when the shutter member moves from the blocked position to the open position, the driving shaft moves in the direction of the central axis, and a depth at which the driving shaft is inserted into the agitating member varies.
5. The toner refilling cartridge of claim 1, comprising a pressing member to press the shutter member such that the shutter member moves from the open position to the blocked position in the direction of the central axis.
6. The toner refilling cartridge of claim 5, wherein the pressing member is an elastic member to surround a circumference of the driving shaft, and is compressible and expandable in the direction of the central axis.
7. The toner refilling cartridge of claim 5, wherein one end portion of the pressing member is supported by the agitating member.
8. The toner refilling cartridge of claim 5, wherein the body comprises a support portion to support the one end portion of the pressing member, and the driving shaft passes through the support portion.
9. The toner refilling cartridge of claim 8, wherein the driving force receiver is fixed to the driving shaft and is supported by the shutter member to be rotatable.
10. The toner refilling cartridge of claim 1, wherein the body comprises an accommodation space and a discharge space, wherein the accommodation space contains the toner and the agitating member is rotatable in the accommodation space, and the toner outlet is formed in the discharge space and a width of the discharge space is less than a width of the accommodation space, and wherein the shutter member comprises: a first shutter to block the toner outlet, a second shutter to block a space between the accommodation space and the discharge space, or an inside of the discharge space, a first sealing member arranged around the first shutter, and a second sealing member arranged around the second shutter.
11. The toner refilling cartridge of claim 1, comprising a plurality of coupling portions provided on an outer circumferential surface of the body.

12. An image forming apparatus comprising a toner filling portion in which the toner refilling cartridge according to claim 1 is installed in the direction of gravity, the image forming apparatus comprising: the toner filling portion comprising a filling cover to provide an insertion hole into which the toner refilling cartridge is inserted; a toner conveying tube having a portion arranged in the insertion hole, extending in the direction of gravity, the toner conveying tube to provide a conveying path through which the toner is conveyed, and the toner conveying tube comprising a toner inlet through which the toner is introduced in a direction perpendicular to the direction of gravity; a driving force transmitter arranged at one end portion of the toner conveying tube, coupled to the driving force receiver, the driving force transmitter to transmit a driving force to the driving force receiver; a rotation conveying portion having one end portion connected to the driving force transmitter, and arranged in the toner conveying tube to be rotatable to convey the toner in the toner conveying tube in the direction of gravity; and a second shutter surrounding a circumference of the toner conveying tube, the second shutter movable in the direction of gravity and in a direction opposite to the direction of gravity, the second shutter comprising a second blocked position to block the toner inlet and a second open position to open the toner inlet.
13. The image forming apparatus of claim 12, comprising a driving force supplier to supply a driving force to the rotation conveying portion such that the rotation conveying portion rotates, wherein, while the driving force supplier rotates, the driving force of the driving force supplier is transmitted to the driving force transmitter through the rotation conveying portion, and the driving force transmitted to the driving force transmitter rotates the agitating member through the driving force receiver and the driving shaft of the toner refilling cartridge.
14. The image forming apparatus of claim 13, comprising a controller to rotate the driving force supplier when the toner refilling cartridge is installed in the toner filling portion.
15. The image forming apparatus of claim 12, comprising a fixing portion to fix a location of the body of the toner refilling cartridge.
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