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TONER CARTRIDGE AND IMAGE FORMING APPARATUS

BACKGROUND

Technical Field

[0001]

The present invention relates to a toner cartridge and an image forming apparatus using the toner cartridge.

Related Art

[0002]

There is known a toner cartridge for supplying toner to an image forming apparatus. The toner cartridge is attached to and is detached from the image forming apparatus. When toner in the image forming apparatus is insufficient, the toner cartridge is replaced.

SUMMARY OF THE INVENTION

[1][1] According to an aspect of the present invention, a toner cartridge comprising:

a container body that contains toner and that has an opening portion provided on an outer face of the container body and a guide piece provided on the outer face;

a first cover that opens and closes the opening portion;

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[1] This number corresponds to claim number in this specification.

and

a second cover that is supported by the guide piece and that is movable in an noncontact state with a bottom portion of the first cover to cover the first cover when the container body is pulled out from an image forming apparatus.

[2] According to another aspect of the present invention, a toner cartridge comprising:

a container body that contains toner and that has an opening portion provided on an outer face of the container body and a guide piece provided on the outer face;

a first cover that opens and closes the opening portion; and

a second cover that is supported by the guide piece and that is movable while having space between the second cover and a bottom portion of the first cover to cover the first cover when the container body is pulled out from an image forming apparatus.

[3] In the toner cartridge of [1] or [2], wherein the second cover includes a pressed mechanism that inclines a the second cover so that a front end portion of the second cover faces downward by being pressed when the container body is inserted into the image forming apparatus.

[4] In the toner cartridge of [3], wherein the pressed mechanism is pressed a given distance that is equal to or greater than a distance between a bottom face of the first

cover and a bottom portion of the container body.

[5] In the toner cartridge of [3], wherein the second cover is movable between an original position and an inclined position, and

a position of the second cover is moved toward the original position by the guide piece when the container body is pulled out from the image forming apparatus during the second cover is inclined by the pressed mechanism.

[6] In the toner cartridge of [1] or [2], wherein the first cover includes a first protrusion that is provided on a side portion of the first cover and that protrudes toward an upper side of the container body,

the second cover includes a second protrusion that is provided on an inner side of a side portion of the second cover, and

the second protrusion comes in contact with the first protrusion when the container body is pulled out from the image forming apparatus so that the first cover slides in an insertion direction of the container body.

[7] In the toner cartridge of [1] or [2], wherein a pressing force of the second cover exerted on the container body is weaker than a pressing force of the first cover exerted on the opening portion.

[8] According to another aspect of the present invention, an image forming apparatus comprising:

a toner cartridge that includes:

a container body that contains toner and that has an opening portion provided on an outer face of the container body and a guide piece provided on the outer face;

a first cover that opens and closes the opening portion; and

a second cover that is supported by the guide piece and that is movable in an noncontact state with a bottom portion of the first cover to cover the first cover when the container body is pulled out from an image forming apparatus; and

a toner cartridge receiving portion that receives the toner cartridge,

wherein the toner cartridge receiving portion includes a pressing mechanism that is configured to press the pressed mechanism.

[9] According to another aspect of the present invention, an image forming apparatus comprising:

a toner cartridge that includes:

a container body that contains toner and that has an opening portion provided on an outer face of the container body and a guide piece provided on the outer face;

a first cover that opens and closes the opening

portion; and

a second cover that is supported by the guide piece and that is movable while having space between the second cover and a bottom portion of the first cover to cover the first cover when the container body is pulled out from an image forming apparatus; and

a toner cartridge receiving portion that receives the toner cartridge,

wherein the toner cartridge receiving portion includes a pressing mechanism that is configured to press the pressed mechanism.

[10] In the image forming apparatus of [8] or [9], wherein a front end portion of a first bottom surface of the second cover is formed to be inclined so that an angle between the first bottom surface and a second bottom surface of the toner cartridge receiving portion is reduced when the first bottom surface is inclined as the pressed mechanism is pressed by the pressing mechanism.

[11] In the image forming apparatus of [8] or [9], wherein the second cover includes a pressed mechanism that inclines a the second cover so that a front end portion of the second cover faces downward by being pressed when the container body is inserted into the image forming apparatus.

[12] In the image forming apparatus of [11], wherein the pressed mechanism is pressed a given distance that is equal to

or greater than a distance between a bottom face of the first cover and a bottom portion of the container body.

[13] In the image forming apparatus of [11], wherein the second cover is movable between an original position and an inclined position, and

a position of the second cover is moved toward the original position by the guide piece when the container body is pulled out from the image forming apparatus during the second cover is inclined by the pressed mechanism.

[14] In the image forming apparatus of [8] or [9], wherein the first cover includes a first protrusion that is provided on a side portion of the first cover and that protrudes toward an upper side of the container body,

the second cover includes a second protrusion that is provided on an inner side of a side portion of the second cover, and

the second protrusion comes in contact with the first protrusion when the container body is pulled out from the image forming apparatus so that the first cover slides in an insertion direction of the container body.

[15] In the image forming apparatus of [8] or [9], wherein a pressing force of the second cover exerted on the container body is weaker than a pressing force of the first cover exerted on the opening portion.

[0015]

With the configuration of [1] and [2], it is possible to suppress the possibility that the user is stained by the toner due to toner that is adhered to the cover provided in the toner cartridge which is being pulled out when the user replaces the toner cartridge.

[0016]

With the configuration of [3] and [11], the front end portion of the second cover is prevented from coming in contact with the first cover when the toner cartridge is inserted.

[0017]

With the configuration of [4] and [12], the front end portion of the second cover is reliably prevented from coming in contact with the first cover when the toner cartridge is inserted.

[0018]

With the configuration of [5] and [13], the second cover which is inclined returns to its original positioning as the toner cartridge is pulled out.

[0019]

With the configuration of [6] and [14], even in a state where a part of the opening portion is opened, the state is prevented.

[0020]

With the configuration of [7] and [15], when the second

cover is slid, the sliding is achieved without power sufficient enough to slide the first cover.

[0021]

In the aspect according to claim [8] and [9], when the toner cartridge is inserted into the toner cartridge receiving portion, positioning of the second cover is inclined so that its front end portion faces downward as the toner cartridge is inserted.

[0022]

In the aspect according to claim [10], a space in the image forming apparatus occupied by the toner cartridge and the toner cartridge receiving unit is reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the invention will be described in detail based on the following figures, wherein:

[0023]

Fig. 1 is a diagram illustrating an example of a configuration of an image forming apparatus;

Fig. 2 is a perspective view illustrating an example of a toner cartridge;

Fig. 3 is a perspective view illustrating the toner cartridge in a state in which a shutter is enclosed by a cover;

Fig. 4 is a perspective view illustrating the toner

cartridge in a state in which the shutter is not enclosed by the cover;

Fig. 5 is a perspective view illustrating the cover;

Fig. 6 is a perspective view illustrating a toner cartridge receiving portion;

Fig. 7 is a perspective view illustrating the toner cartridge when it is mounted in the toner cartridge receiving portion;

Fig. 8 is a cross-sectional view illustrating the toner cartridge at the time of starting insertion;

Fig. 9 is a cross-sectional view illustrating the toner cartridge during the insertion;

Fig. 10 is a cross-sectional view illustrating the toner cartridge during the insertion;

Fig. 11 is a cross-sectional view illustrating the toner cartridge when the insertion has been completed;

Fig. 12 is a side view illustrating the cover of the toner cartridge at the time of starting the insertion;

Fig. 13 is a side view illustrating the cover of the toner cartridge during the insertion;

Fig. 14 is a side view illustrating the cover of the toner cartridge during the insertion; and

Fig. 15 is a side view illustrating the cover of the toner cartridge during the insertion.

DETAILED DESCRIPTION

[0024]

Hereinafter, exemplary embodiments of the invention will be described with reference to the accompanying drawings.

[0025]

Fig. 1 is a diagram illustrating an example of a configuration of an image forming apparatus 100. The image forming apparatus 100 includes at least a controller 10, an image forming unit 20, a toner cartridge 35, a toner cartridge receiving unit 36, an intermediate transferring member 40, a secondary transferring device 50, and an input unit 70. In Fig. 1, the tandem type image forming apparatus 100 is illustrated. However, a rotary type image forming apparatus 100 may also be employed.

[0026]

The controller 10 has a hardware configuration in which, for example, a CPU, a RAM such as an SRAM (Static Random Access Memory), a DRAM (Dynamic RAM), an SDRAM (Synchronous DRAM), or an NVRAM (Non Volatile RAM), a ROM (Read Only Memory) such as a flash memory, and an input/output I/F (interface) are connected via buses. The control unit 10 controls operations of each component of the image forming unit 20, the intermediate transferring member (for example, a transfer belt having a belt shape) 40, and the secondary transferring device 50 on the basis of signals input through

the input unit 70. The control operation is implemented by the CPU reading programs stored in a storage device such as the ROM and performing operations according to the corresponding programs.

[0027]

The image forming unit 20 includes an LPH (LED Printing Head) 21 in which LEDs are arrayed as an example of an exposure unit, a cleaning blade 22 as an example of a cleaning unit, a charging device 23 as an example of a charging unit, a photosensitive drum 25 as an example of an image carrying member, a transferring roller 26 as an example of a primary transferring unit, a developing device 27 as an example of a developing unit, and a dispenser 29 having a unit for carrying toner (not shown) therein as an example of a unit for supplying toner to the developing device 27.

[0028]

In Fig. 1, yellow (Y), magenta (M), cyan (C), and black (K) image forming units 20 have the same configuration. Therefore, although the dispenser 29 is allocated to each of the magenta, cyan, and black image forming units, the dispensers 29 of the image forming units excluding the yellow image forming unit are not illustrated. In addition, the toner cartridge receiving portion 36 and the toner cartridge 35 connected to the dispenser 29 of the image forming units excluding the yellow image forming unit are not illustrated.

In the following description, as an example, the yellow image forming unit 20 is described.

[0029]

The LPH 21 includes an LED array, a driving IC, and a rod lens array. The LPH 21 performs exposure by allowing a number of LEDs to emit light toward the photosensitive drum 25 according to the control of exposure intensity by the controller 10.

[0030]

The charging device 23 is configured of, for example, a conductive elastic roller. The charging device 23 charges the photosensitive drum 25 according to the potential control by the controller 10. Specifically, when a voltage is applied by allowing the charging device 23 to come in contact with the photosensitive drum 25, the photosensitive drum 25 is charged to have a positive polarity.

[0031]

The photosensitive drum 25 is configured as a round column of aluminum having a photoconductor (for example, a-Si (amorphous silicon)) layer on its surface. The photosensitive drum 25 rotates with a center of its upper surface (or bottom surface) as its axis according to the control by the controller 10 (rotates to the left in Fig. 1). As described above, the photosensitive drum 25 is charged by the charging device 23, and when the LPH 21 emits light, the charge is

removed from a portion which is scanned. Then, toner supplied from the developing device 27 described later is adhered to the photosensitive drum 25. As a result, the photosensitive drum 25 carries a toner image generated on the basis of image information.

[0032]

The transferring roller 26 primarily transfers the toner image adhered to the photosensitive drum 25 to the intermediate transferring member 40. The transferring roller 26 charges the intermediate transferring member 40 to be positive charge according to the control of transfer potential by the controller 10. As a result, toner adhered to the photosensitive drum 25 with a negative potential is transferred to the intermediate transferring member 40. As the transferring roller 26 rotates in the same direction as the photosensitive drum 25 (in Fig. 1, rotates to the right), the intermediate transferring member 40 is transferred so as to be pushed out in an arrow direction. However, when the toner remains on the photosensitive drum 25 after the primary transfer, the toner is scraped off by the cleaning blade 22 that comes in contact with the photosensitive drum 25.

[0033]

The developing device 27 includes a cylinder of aluminum (hereinafter, referred to as a developing roll) having a magnet (magnet roll) therein. The developing device 27 is

supplied with the toner from the toner cartridge 35 through the dispenser 29. The toner cartridge 35 is mounted so as to be able to be attached to or detached from the toner cartridge receiving portion 36. The supplied toner is agitated with a carrier and is negatively charged. A powder supplied for development like the toner and the carrier is called a developer. The developer is made into a magnetic brush shape on the developing roll by magnetic force of the magnet roll and brought into contact with the photosensitive drum 25. In addition, the toner on the developing roll is developed onto the photosensitive drum 25 according to the potential control by the controller 10 of the developing device 27. Accordingly, a toner image is formed on the photosensitive drum 25 and the toner image is primarily transferred to the intermediate transferring member 40.

[0034]

As described above, as well as a yellow toner image, magenta, cyan, and black toner images are primarily transferred to the intermediate transferring member 40. Individually or in an overlapped state, the color toner images form an image. When the toner images are overlapped, the intermediate transferring member 40 is driven, and for example, on a part where the yellow toner image is primarily transferred, magenta and cyan toner images are primarily transferred and a color image is formed.

[0035]

The intermediate transferring member 40 is continuously driven after the toner images are primarily transferred, and the primarily transferred part reaches the secondary transferring device 50. The secondary transferring device 50 secondary transfers the toner image primarily transferred to the intermediate transferring member 40 to a recording medium 60. The recording medium 60 includes film containing polyester as well as recording paper.

[0036]

The secondary transferring device 50 charges the recording medium 60 to be positive charge according to the control of the transfer potential by the controller 10. As a result, the toner image with the negative potential which is adhered to the intermediate transferring member 40 is absorbed into the recording medium 60. The toner image absorbed into the recording medium 60 is fixed to the recording medium 60 by a fixing device (not shown).

[0037]

The input unit 70 is configured of, for example, an operation panel or an operation button. When a user of the image forming apparatus 100 inputs content to the input unit 70, the input unit 70 outputs a signal to the controller 10 according to the input content.

[0038]

Next, the toner cartridge 35 will be described in detail with reference to Figs. 2 to 4. Fig. 2 is a perspective view illustrating an example of the toner cartridge 35. A forward side of the toner cartridge is defined as the same side where the toner cartridge is inserted into the image forming apparatus 100.

[0039]

The toner cartridge 35 includes a container body 35a, covers 35b and 35c, and a guide piece 35e. The cover 35b (hereinafter, referred to as a shutter 35b) is provided on an outer surface of the cylindrical container body 35a. More specifically, the shutter 35b is provided on a bottom surface of a front part of the container body 35a. The shutter 35b is mounted to the guide piece 35b2 and thus is able to slide in an axial direction along an outer surface thereof. The shutter 35b slides along the guide piece 35b2 to open or close an opening portion (not shown) provided on the outer surface of the container body 35a. In Fig. 2, a state where the shutter 35b closes the opening portion is illustrated.

[0040]

A side portion of the shutter 35b is provided with a protrusion 35b1 protruding toward an upper side of the container body 35a. The protrusion 35b1 may be provided on both sides instead of on only one side as illustrated in Fig. 2. The protrusion 35b1 comes in contact with a suspension

protrusion 35c2 (see Fig. 5) which is provided on an inner surface of the side portion of the cover 35c and will be described later.

[0041]

A shape of the side portion of the shutter 35b is a right-angled trapezoid, and a length of a lower bottom thereof is greater than that of an upper bottom thereof. Since the shape of the side portion of the shutter 35b is the right-angled trapezoid, a part connecting one end of the upper bottom to one end of the lower bottom forms right angles with the upper bottom and the lower bottom. However, a part connecting the other end of the upper bottom to the other end of the lower bottom has an inclination and does not form a right angle. The suspension protrusion 35c2 described above slides on the inclined portion and the part of the upper bottom connected from the inclined portion and stops by coming in contact with the protrusion 35b1 when the toner cartridge 35 is inserted into the image forming apparatus 100.

[0042]

The cover 35c is suspended by the guide piece 35e provided on the outer surface of the container body 35a. The cover 35c slides and encloses the shutter 35b, while not coming in contact with a bottom portion of the shutter 35b and having space between the cover 35c and the bottom portion of the shutter 35b, when the container body 35a is pulled out

from the image forming apparatus 100.

[0043]

The guide piece 35e is provided on both sides of the bottom surface of the container body 35a and extends rearward from a center thereof. Suspension protrusions 35c3 and 35c4 (see Fig. 5), which are provided on an inner surface of the cover 35c and will be described later, slide along the guide piece 35e. Accordingly, the cover 35c moves toward a front side or a rear side of the container body 35a.

[0044]

Center portions of both sides of the cover 35c are provided with pressed mechanisms 35c1. As the pressed mechanism 35c1 is pressed downward, the cover 35c is inclined so that its front end portion faces downward. The pressed mechanism 35c1 is bent downward when pressed and will return to its original state by a restoring force.

[0045]

A bottom surface of the cover 35c is not horizontal and a front end portion thereof is inclined. More specifically, a height of the front end portion of the cover 35c is lower than height of the center portion and of the rear end portion of the cover 35c. Although this will be described later in detail, when the bottom surface of the cover 35c is horizontal, in order to prevent a bottom surface of the toner cartridge receiving portion 36 from coming in contact with the bottom

surface of the cover 35c, a distance from the toner cartridge 35 to the toner cartridge receiving portion 36 needs to be increased. However, by providing the inclined front end portion of the cover 35c, the distance between the toner cartridge 35 and the toner cartridge receiving portion 36 is reduced while preventing the contacting as mentioned above, and a large installation space for the toner cartridge 35 and the toner cartridge receiving portion 36 is not required in the image forming apparatus 100.

[0046]

Fig. 3 is a perspective view illustrating the toner cartridge 35 in a state in which the shutter 35b is enclosed by the cover 35c.

[0047]

When the user disengages the toner cartridge 35 from the image forming apparatus 100, a state illustrated in Fig. 3 is shown. As illustrated in Fig. 3, the cover 35c is positioned on the front side of the container body 35a. In addition, the front end portion of the cover 35c is aligned at substantially the same position as a front end portion of the container body 35a.

[0048]

The shutter 35b is enclosed by the cover 35c. As a result, even when toner is adhered to the shutter 35b, the toner is enclosed by the cover 35c, and the possibility that

the toner adheres to the user is reduced. Moreover, when a color of the cover 35c is opaque, the shutter 35b is not visible to the user. As a result, even if yellow, cyan, and magenta toner is adhered to the shutter 35b, an unsightly appearance of the shutter 35b stained by the color toners is prevented.

[0049]

Fig. 4 is a perspective view illustrating the toner cartridge 35 in a state in which the shutter 35b is not enclosed by the cover 35c. When the user inserts the toner cartridge 35 into the image forming apparatus 100 and the mounting of the toner cartridge 35 to the toner cartridge receiving portion 36 is completed, a state illustrated in Fig. 4 is shown. As illustrated in Fig. 4, the cover 35c is positioned on a rear side of the center portion of the container body 35a. In addition, the shutter 35b slides toward the rear side of the container body 35a to open an opening portion 35d. As a result, the toner contained in the container body 35a is supplied to the image forming apparatus 100.

[0050]

A vicinity of an edge of the opening portion 35d is provided with a rubber plate (not shown). Accordingly, the shutter 35b comes in close contact with the opening portion 35d when the opening portion 35d is closed and exerts a strong pressing force on the opening portion 35d. In addition, since

the shutter 35b comes in close contact with the rubber plate, when the shutter 35b slides, a force greater than friction between the rubber plate and the shutter 35b is needed. On the other hand, a pressing force of the cover 35c on the container body 35a is weaker than the pressing force of the shutter 35b on the opening portion 35d. Accordingly, when the cover 35c slides, a force sufficient enough to slide the shutter 35b is not needed.

[0051]

Next, the cover 35c will be described in detail with reference to Fig. 5.

[0052]

Fig. 5 is a perspective view illustrating the cover 35c. Both side portions of the cover 35c are provided with the suspension protrusions 35c2, 35c3, and 35c4. The suspension protrusion 35c2 is provided in front of the pressed mechanism 35c1. The suspension protrusion 35c4 is provided in the rear of the pressed mechanism 35c1. The suspension protrusion 35c3 is provided between the suspension protrusion 35c4 and the pressed mechanism 35c1. The suspension protrusions 35c2, 35c3, and 35c4 protrude toward an inside of the cover 35c.

[0053]

The suspension protrusions 35c3 and 35c4 are connected to the guide piece 35e of the container body 35a described above. The suspension protrusion 35c2 is connected to both

side portions of the shutter 35b described above. The cover 35c is suspended in the container body 35a by the suspension protrusions 35c2 and 35c4 or the suspension protrusions 35c3 and 35c4.

[0054]

A vicinity of the center portions of the both sides of the cover 35c is provided with the pressed mechanism 35c1. A rear side of the pressed mechanism 35c1 is provided with a protrusion 35c5 protruding toward an outside of the cover 35c. A space exists between the pressed mechanism 35c1 and the cover 35c. Therefore, when the protrusion 35c5 is pressed downward, the pressed mechanism 35c1 is bent downward. The bent pressed mechanism 35c1 has a restoring force to return it to its original state. When the pressed mechanism 35c1 is bent downward, the cover 35c is inclined so that its front portion faces downward.

[0055]

The opening portion 35d and the shutter 35b are accommodated in a space formed by side surfaces, the bottom surface, and a front surface of the cover 35c. The opening portion 35d and the shutter 35b are enclosed by the side surfaces, the bottom surface, and the front surface of the cover 35c. In addition, visibility of the opening portion 35d and the shutter 35b is blocked by the side surfaces, the bottom surface, and the front surface of the cover 35c.

[0056]

Subsequently, the toner cartridge receiving portion 36 will be described in detail with reference to Figs. 6 and 7.

[0057]

Fig. 6 is a perspective view illustrating the toner cartridge receiving portion 36. Fig. 7 is a perspective view illustrating the toner cartridge 35 when it is mounted in the toner cartridge receiving portion 36. As illustrated in Fig. 6, the toner cartridge receiving portion 36 includes bottom surfaces 36a, 36c, and 36d and both side portions 36f.

[0058]

The bottom surface 36a is interposed between the bottom surfaces 36c and 36d. The bottom surface 36a is formed at a position lower than that of the bottom surface 36c. The bottom surface 36d is formed at a position higher than that of the bottom surface 36c. Therefore, there are height differences between the bottom surfaces 36a, 36c, and 36d. In a space formed by the bottom surface 36a and side portions 36f, the cover 35c is accommodated when the toner cartridge 35 is mounted.

[0059]

On the bottom surface 36c, a stopper 36c1 is formed so as to be able to slide. As illustrated in Fig. 7, when the toner cartridge 35 is pulled out from the toner cartridge receiving portion 36, the stopper 36c1 comes in contact with

the rear end portion of the cover 35c to stop a movement of the cover 35c movable along with the container body 35a. In this state, when the toner cartridge 35 is further pulled out, the cover 35c is moved to a relatively forward side of the container body 35a. Accordingly, the cover 35c encloses the shutter 35b and the opening portion 35d.

[0060]

A pressing mechanism 36b is formed on an inner side of the side portion 36f with the bottom surface 36a interposed therebetween. The pressing mechanisms 36b are formed on the both side portions 36f. The pressing mechanism 36b has a V shape in which an apex faces the bottom surface 35a. The pressing mechanism 36b presses the protrusion 35c5 provided in the pressed mechanism 35c1 of the cover 35c. As illustrated in Fig. 7, when the toner cartridge 35 is inserted, the protrusion 35c5 of the cover 35c is pressed by a predetermined pressing force at an inlet of the pressing mechanism 36b. The pressing force is increased as the protrusion 35c5 descends along an inclined surface of the pressing mechanism 36b such that the pressing force is greatest at the apex of the pressing mechanism 36b. When the protrusion 35c5 is pressed, the cover 35c is inclined.

[0061]

The bottom surface 36d is provided with a discharge port 36d1 and a stopper 36d2. A position of the discharge port 36d1

is closer to the rear end portion of the toner cartridge receiving portion 36 than a position of the stopper 36d2.

[0062]

The discharge port 36d1 is positioned to be aligned with the position of the opening portion 35d of the container body 35a when the mounting of the toner cartridge 35 is completed. Therefore, the toner accommodated in the container body 35a is supplied to the image forming apparatus 100 through the opening portion 35d and the discharge port 36d1.

[0063]

The stopper 36d2 comes in contact with the rear end portion of the shutter 35b when the toner cartridge 35 is pulled out and stops a movement of the shutter 35b which corresponds with that of the container body 35a. In this state, when the toner cartridge 35 is further pulled out, the shutter 35b moves to a relatively forward side of the container body 35a. Accordingly, the shutter 35b closes the opening portion 35d.

[0064]

Next, an insertion operation of the toner cartridge 35 will be described with reference to Figs. 8 to 11.

[0065]

Fig. 8 is a cross-sectional view illustrating the toner cartridge 35 at the time of starting insertion. Figs. 9 and 10 are cross-sectional views illustrating the toner cartridge 35

during the insertion. Fig. 11 is a cross-sectional view illustrating the toner cartridge 35 when the insertion has been completed.

[0066]

As illustrated in Fig. 8, the toner cartridge 35 is inserted while staying horizontal. When the insertion is started, the center portion and the rear end portion of the bottom surface of the cover 35c move forward while maintaining a state of substantially being parallel to the bottom surface 36c of the toner cartridge receiving portion 36.

[0067]

When the toner cartridge 35 is further inserted from the state illustrated in Fig. 8, as illustrated in Fig. 9, the protrusion 35c5 comes in contact with the pressing mechanism 36b. When the toner cartridge 35 is still further inserted, as illustrated in Fig. 10, the protrusion 35c5 is pressed downward, and the pressed mechanism 35a1 is bent. Accordingly, the cover 35c is inclined so that its front end portion faces downward and starts to be accommodated in a space which includes the bottom surface 36a. Here, the bottom surface of the front end portion of the cover 35c is formed so that an angle between the bottom surface of the front end portion thereof and the bottom surface 36a of the toner cartridge receiving portion 36 is reduced when the bottom surface of the front end portion of the cover 35c is inclined as the

protrusion 35c5 is pressed downward by the pressing mechanism 36b. Therefore, the height difference between the bottom surfaces 36a and 36c or the height difference between the bottom surfaces 36a and 36d may be smaller as compared with a case where the bottom surface of the cover 35c is horizontal.

[0068]

When the toner cartridge 35 is further inserted from the state illustrated in Fig. 10, the suspension protrusion 35c4 provided in the cover 35c comes in contact with the protrusion 35f (see Fig. 4) provided in the container body 35a and the forward movement of the toner cartridge receiving portion 36 is stopped. The container body 35a and the shutter 35b provided therein move toward the front side of the toner cartridge receiving portion 36 as illustrated in Fig. 11. As described above, since the shutter 35b moves along with the movement of the container body 35a while the front end portion of the cover 35c is facing downward, a collusion of the shutter 35b with the cover 35c is prevented.

[0069]

The shutter 35b opens the opening portion 35d as the toner cartridge 35 is inserted. This is because the shutter 35b comes in contact with an embankment 36d3 (see Figs. 7 and 8) provided between the stopper 36d2 and the discharge port 36d1 and the movement of the shutter 35b in the insertion direction is stopped. When the toner cartridge 35 is inserted

and the shutter 35b is to be opened, slight vibration may occur. Therefore, the toner accommodated in the vicinity of the opening portion 35d falls to the bottom surface 36d of the toner cartridge receiving portion 36. Accordingly, there is a concern that the toner may adhere to the front end portion of the shutter 35b or the front end portion of the rubber plate. The toner may still be adhered when the toner cartridge 35 is pulled out, and there is a possibility that the toner adheres to the clothes or the body of a user. However, when the toner cartridge 35 is pulled out, the shutter 35b is enclosed by the cover 35c. Therefore, the possibility that the toner adheres to the clothes or the body of the user is suppressed, and the toner is not visible to the user. In addition, the pulling out of the toner cartridge 35 is performed by reversing the order illustrated in Figs. 8 to 11.

[0070]

Operations of the cover 35c shown when the toner cartridge 35 is further inserted are described with reference to Figs. 12 to 15.

[0071]

Fig. 12 is a side view illustrating the cover 35c of the toner cartridge 35 at the time of starting the insertion. Figs. 13 to 15 are side views illustrating the cover 35c of the toner cartridge 35 during the insertion.

[0072]

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As illustrated in Fig. 12, the suspension protrusion 35c2 of the cover 35c comes in contact with an upper side of the side portion of the shutter 35b at the time of starting the insertion of the toner cartridge 35, and the suspension protrusion 35c4 thereof comes in contact with the guide piece 35e. That is, the cover 35c is suspended at two points of the suspension protrusions 35c2 and 35c4. Here, the shutter 35b closes the opening portion 35d.

[0073]

When the toner cartridge 35 is inserted, as illustrated in Fig. 13, the suspension protrusion 35c2 moves the side portion of the shutter 35b toward a relatively rearward side of the container body 35a, and the suspension protrusion 35c4 moves the guide piece 35e toward a relatively rearward side of the container body 35a. In addition, the suspension protrusion 35c3 moves toward a relatively rearward side of the container body 35a on a trapezoidal convex portion provided on the guide piece 35e. Therefore, the cover 35c is suspended at three points of the suspension protrusions 35c2, 35c3, and 35c4. Due to the suspended state, the cover 35c is inclined. Here, the shutter 35b slightly opens the opening portion 35d.

[0074]

When the toner cartridge 35 is further inserted, as illustrated in Fig. 14, the suspension protrusion 35c2 slides and falls from the side portion of the shutter 35b and is

suspended. The suspension protrusion 35c4 moves toward a relatively rearward side of the container body 35a along the guide piece 35e. In addition, the suspension protrusion 35c3 moves toward a relatively rearward side of the container body 35a on the trapezoidal convex portion provided on the guide piece 35e. Therefore, the cover 35c is suspended at two points of the suspension protrusions 35c3 and 35c4. In this suspended state, the cover 35c is inclined. Here, the shutter 35b further opens the opening portion 35d as compared with the state illustrated in Fig. 13.

[0075]

In this state, a distance d1 between the upper side of the front end portion of the cover 35c and the bottom portion of the container body 35a is greater than a distance d2 between the bottom portion of the container body 35a and the bottom surface of the shutter 35b. Accordingly, the front surface of the cover 35c is prevented from coming in contact with the bottom surface of the shutter 35b or the opening portion 35d even though the cover 35e moves toward a relatively rearward side of the container body 35a. Therefore, the pressed mechanism 35c1 needs to be pressed at least to an extent equal to or greater than the distance between the bottom surface of the shutter 35b and the bottom portion of the container body 35a.

[0076]

When the toner cartridge 35 is further inserted, as illustrated in Fig. 15, the suspension protrusion 35c4 moves along the guide piece 35e toward the relatively rearward side of the container body 35a. In addition, the suspension protrusion 35c3 moves toward the relatively rearward side of the container body 35a on the trapezoidal convex portion provided in the guide piece 35e. In this suspended state, the cover 35c is inclined. Here, the shutter 35b opens the opening portion 35d. In addition, the cover 35c is not under the opening portion 35d. Therefore, when the insertion of the toner cartridge 35 is completed, the toner is supplied to the image forming apparatus 100 through the opening portion 35d.

[0077]

In addition, the pulling out of the toner cartridge 35 is performed by reversing the order illustrated in Figs. 12 to 15 described above. Here, the shutter 35b is gradually closed as the toner cartridge 35 is pulled out. Here, when the shutter 35b is stopped in the course of the movement for any reason, a part of the opening portion 35d is opened. However, as the toner cartridge 35 is pulled out, the suspension protrusion 35c2 of the cover 35c ascends while being in contact with the inclined surface of the side portion of the shutter 35b and comes in contact with the protrusion 35b1 (see Fig. 2) provided in the upper part of the side portion thereof. In this state, when the toner cartridge 35 is further pulled

out, the movement of the rear end portion of the cover 35c is stopped by the stopper 36c1, and the shutter 35b moves toward the relatively forward side of the container body 35a due to the suspension protrusion 35c2. As a result, the shutter 35b is closed completely, and completing the pulling out of the toner cartridge 35 when the opening portion 35d is opened is prevented.

[0078]

While the invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments, and various modifications can be made without departing from the spirit and scope of the invention disclosed in the following claims.

The foregoing description of the exemplary embodiment of the present invention has been provided for the purpose of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and various will be apparent to practitioners skilled in the art. The embodiments were chosen and described in order to best explain the principles of the invention and its practical application, thereby enabling other skilled in the art to understand the invention for various embodiments and with the various modifications as are suited to the particular use contemplated.

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It is intended that the scope of the invention be defined by the following claims and their equivalents.

[Description of Reference Numerals and Signs]

[0079]

10: CONTROLLER

20: IMAGE FORMING UNIT

21: LPH

22: CLEANING BLADE

23: CHARGING DEVICE

25: PHOTOSENSITIVE DRUM

26: TRANSFERRING ROLLER

27: DEVELOPING DEVICE

29: DISPENSER

35: TONER CARTRIDGE

35b: SHUTTER

35b1: PROTRUSION

35c: COVER

35c1: PRESSED MECHANISM

35d: OPENING PORTION

35e: GUIDE PIECE

36: TONER CARTRIDGE RECEIVING PORTION

36b: PRESSING MECHANISM

40: INTERMEDIATE TRANSFERRING MEMBER

50: SECONDARY TRANSFERRING DEVICE

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60: RECORDING MEDIUM

70: INPUT UNIT

100: IMAGE FORMING APPARATUS

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WHAT IS CLAIMED IS:

1. A toner cartridge comprising:

a container body that contains toner and that has an opening portion provided on an outer face of the container body and a guide piece provided on the outer face;

a first cover that opens and closes the opening portion; and

a second cover that is supported by the guide piece and that is movable in an noncontact state with a bottom portion of the first cover to cover the first cover when the container body is pulled out from an image forming apparatus.

2. A toner cartridge comprising:

a container body that contains toner and that has an opening portion provided on an outer face of the container body and a guide piece provided on the outer face;

a first cover that opens and closes the opening portion; and

a second cover that is supported by the guide piece and that is movable while having space between the second cover and a bottom portion of the first cover to cover the first cover when the container body is pulled out from an image forming apparatus.

3. The toner cartridge according to claim 1 or 2, wherein

the second cover includes a pressed mechanism that inclines a the second cover so that a front end portion of the second cover faces downward by being pressed when the container body is inserted into the image forming apparatus.

4. The toner cartridge according to claim 3, wherein the pressed mechanism is pressed a given distance that is equal to or greater than a distance between a bottom face of the first cover and a bottom portion of the container body.

5. The toner cartridge according to claim 3, wherein the second cover is movable between an original position and an inclined position, and

a position of the second cover is moved toward the original position by the guide piece when the container body is pulled out from the image forming apparatus during the second cover is inclined by the pressed mechanism.

6. The toner cartridge according to claim 1 or 2, wherein the first cover includes a first protrusion that is provided on a side portion of the first cover and that protrudes toward an upper side of the container body,

the second cover includes a second protrusion that is provided on an inner side of a side portion of the second cover, and

the second protrusion comes in contact with the first protrusion when the container body is pulled out from the image forming apparatus so that the first cover slides in an insertion direction of the container body.

7. The toner cartridge according to claim 1 or 2, wherein a pressing force of the second cover exerted on the container body is weaker than a pressing force of the first cover exerted on the opening portion.

8. An image forming apparatus comprising:

a toner cartridge that includes:

a container body that contains toner and that has an opening portion provided on an outer face of the container body and a guide piece provided on the outer face;

a first cover that opens and closes the opening portion; and

a second cover that is supported by the guide piece and that is movable in an noncontact state with a bottom portion of the first cover to cover the first cover when the container body is pulled out from an image forming apparatus; and

a toner cartridge receiving portion that receives the toner cartridge,

wherein the toner cartridge receiving portion includes a pressing mechanism that is configured to press the pressed mechanism.

9. An image forming apparatus comprising:

a toner cartridge that includes:

a container body that contains toner and that has an opening portion provided on an outer face of the container body and a guide piece provided on the outer face;

a first cover that opens and closes the opening portion; and

a second cover that is supported by the guide piece and that is movable while having space between the second cover and a bottom portion of the first cover to cover the first cover when the container body is pulled out from an image forming apparatus; and

a toner cartridge receiving portion that receives the toner cartridge,

wherein the toner cartridge receiving portion includes a pressing mechanism that is configured to press the pressed mechanism.

10. The image forming apparatus according to claim 8 or 9, wherein a front end portion of a first bottom surface of the

second cover is formed to be inclined so that an angle between the first bottom surface and a second bottom surface of the toner cartridge receiving portion is reduced when the first bottom surface is inclined as the pressed mechanism is pressed by the pressing mechanism.

11. The image forming apparatus according to claim 8 or 9, wherein the second cover includes a pressed mechanism that inclines a the second cover so that a front end portion of the second cover faces downward by being pressed when the container body is inserted into the image forming apparatus.

12. The image forming apparatus according to claim 11, wherein the pressed mechanism is pressed a given distance that is equal to or greater than a distance between a bottom face of the first cover and a bottom portion of the container body.

13. The image forming apparatus according to claim 11, wherein the second cover is movable between an original position and an inclined position, and

a position of the second cover is moved toward the original position by the guide piece when the container body is pulled out from the image forming apparatus during the second cover is inclined by the pressed mechanism.

14. The image forming apparatus according to claim 8 or 9, wherein the first cover includes a first protrusion that is provided on a side portion of the first cover and that protrudes toward an upper side of the container body,

the second cover includes a second protrusion that is provided on an inner side of a side portion of the second cover, and

the second protrusion comes in contact with the first protrusion when the container body is pulled out from the image forming apparatus so that the first cover slides in an insertion direction of the container body.

15. The image forming apparatus according to claim 8 or 9, wherein a pressing force of the second cover exerted on the container body is weaker than a pressing force of the first cover exerted on the opening portion.