TONER SUPPLY APPARATUS AND TONER CARTRIDGE THEREFOR

FIELD OF THE INVENTION AND RELATED ART

The present invention relates to a toner supply apparatus or a toner cartridge usable therefor in an image forming apparatus such as an electrophotographic apparatus in which an electrostatic latent image formed on an electrostatic latent image bearing member is developed with toner powder.

In either of apparatus using one component developer and an apparatus usable with two component developer, when the amount of the toner in a developing unit decreases beyond a predetermined level as a result of developing electrostatic latent images, the toner is supplied from a toner hopper containing toner into a developing unit. When the amount of the toner in the hopper decreases beyond a predetermined, the operator manually supplies the toner to the hopper as a toner storage. Usually, a toner cartridge is used for the supply.

The toner cartridge is mounted on a cartridge mounting portion of an image forming apparatus, and a toner discharge opening of the toner cartridge is opened to let the toner fall into the hopper. Thereafter, the toner cartridge is removed from the mount.

Among such toner cartridge, there is a type having a shutter for closing and opening the toner discharge opening, manually. In such a toner cartridge, after the toner supply to the hopper, the toner discharge opening is closed by the shutter, and the cartridge may be removed from the mount, and therefore, it is convenient because the toner remaining in the cartridge does not scatter.

However, if the cartridge is removed from the mount before completely closing the toner discharge opening with the shutter, there is a liability that the toner remaining in the cartridge scatters from the toner discharge opening.

In addition, if the cartridge is not securedly mounted to the mount, the toner may scatter from the discharge opening.

SUMMARY OF THE INVENTION

Accordingly, it is a concern of the present invention to provide a toner cartridge and a toner supply apparatus for receiving toner using the toner cartridge, in which the cartridge can be securedly mounted.

An embodiment of the present invention provides a toner cartridge and a toner supply apparatus in which when the shutter does not in the closed state, the toner cartridge is prevented from

being removed from the mount.

Another embodiment of the present invention provides a toner cartridge and a toner supply apparatus in which operativity is improved when the toner is supplied to a toner storage.

A further embodiment of the present invention provides a toner cartridge and a toner supply apparatus in which the toner leakage is prevented when the toner is supplied into a toner storage.

Other features and advantages of the present invention will become more apparent upon a consideration of the following description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a top plan view illustrating a toner cartridge mounted on the mount and takes a removable position.

Figure 2 is a top plan view of the same when the toner cartridge takes a toner discharge position.

Figure 3 is a top plan view in which the shutter takes the completely open position while the toner cartridge takes the toner discharge position.

Figure 4 is a sectional view of a toner

cartridge.

Figure 5 is a sectional view taken along a line X-X in Figure 2.

Figure 6 is a sectional view taken along a line Y-Y in Figure 3.

Figure 7 is a sectional view taken along a line Z-Z in Figure 2.

Figure 8 is a top plan view of a shutter plate.

Figure 9 is a top plan view of a toner cartridge according to another embodiment of the present invention which is in a removable position.

Figure 10 is a top plan view of the same while the toner cartridge takes a toner discharge position.

Figure 11 is a top plan view of the same in which a shutter of the toner cartridge is completely opened, while the toner cartridge is placed in the toner discharging position.

Figure 12 is a sectional view taken along a line G-G' of Figure 10.

Figure 13 is a sectional view of a toner cartridge in a removable position.

Figure 14 is the same view when the toner cartridge is at the discharge position.

Figure 15 is a top plan view of the toner cartridge of FIgure 14.

Figure 16 is a top plan view of the toner cartridge in which the shutter is fully opened.

Figure 17 is a front view of the cartridge of Figure 14.

Figure 18 shows an example of an image forming apparatus usable with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 18 shows an electrophotographic apparatus usable with the present invention.

In Figure 18, an electrophotographic image forming apparatus 50 comprises an electrophotographic photosensitive member 51 rotatable in a direction indicated by an arrow. The photosensitive member 51 is first charged by a charger 52, and is exposed to image light by exposure device 53, so that an electrostatic latent image is formed.

The electrostatic latent image is developed by a developing limit 54, which comprises a developing roller 55 rotatable in a direction indicated by an arrow. The developing roller 55 carries a developer D to supply it to the electrostatic latent image. The developer may be one component developer, or two component developer. In any event, the toner on the developing roller is deposited onto the electrostatic latent image to form a toner image.

The toner image thus formed is transferred

onto a transfer sheet 57 by a transfer charger 56, and the transferred image is fixed on the sheet 57 by a fixing device 58. After the image transfer operation, the photosensitive member 51 is cleaned by a cleaning device.

In order to supply the toner consumed by the developing unit 54, the toner T is supplied from a toner storage container (hopper) 1 to the developing unit 54 by a feeding device 63 such as a screw conveyer or the like.

When the remaining amount of the toner T in the container 1 becomes lower than a predetermined level, the operator supplies the toner into the container 1 from a toner cartridge.

The toner cartridge is mounted to a cartridge mount 2 provided at a top part of a hopper (toner storage container) 1. The toner cartridge mount 2 is usually covered with a cover 61. The cover 61 is rotatably supported on a shaft 62. When the cartridge is to be mounted to the mount 2, it is rotated to a position indicated by 61 manually by the operator to expose the mount 2.

Figure 4 is a sectional view of a toner cartridge.

The toner cartridge 3 comprises a container body 4 having a toner accommodation chamber 5 for accommodating toner to be supplied to the hopper 1, a

shutter plate 7 for closing and opening the toner discharge opening 6, a shutter support 8 for slidably supporting the shutter plate 7.

The shutter support 8 is securedly fixed to the container body 4 by screws 9. The shutter support 8, as shown in Figure 7, is provided with a shutter guide 10. The shutter plate 7 slides on the guide 10, and is rectilinearly reciprocable in a direction perpendicular to the toner discharge direction (downward) from the toner discharge opening 6.

In this specification, the movement of the shutter plate 7 in the direction to open the opening 6 (arrow A in Figure 4) is pulling movement of the shutter plate 7, and the movement of the shutter plate 7 in the direction to close the opening 6 (B in Figure 4) is called "pushing movement".

Designated by reference numerals 14 and 15 are elastic sealing member made of rubber, felt or the like to prevent the leakage of the toner between the shutter plate 7 and the shutter support 8, and between the container body 4 and the shutter support 8, respectively.

A grip 11 is provided adjacent an end of the shutter plate 7 in the pulling direction, the operator grips the grip 11 to move the shutter plate 7 in directions A and B.

To the rear end of the shutter plate 7 in the

pulling direction, there is provided a stopper projection 12. When the shutter plate 7 is completely pulled out to completely open the toner discharge opening 6, the stopper projection 18 abuts a front wall 13 of the shutter support 8 to prevent further motion of the shutter plate 7, thus preventing the shutter plate 7 from being pulled out of the support 8 (Figure 6).

As shown in Figure 5 which is a cross-section taken along a line X-X of Figure 2, the cartridge mount 2 comprises a base plate 16 fixed on the top of the hopper 1, and an elastic sealing member 17 of rubber, felt, synthetic resin material or the like, fixed on the base plate 16. The shutter support 8 of the cartridge 3 is slidably mounted on the top surface 18 of the elastic sealing member 17.

The base plate 18 is provided with a toner receiving opening 19 through which the toner discharged through the toner discharging opening 3 of the toner cartridge 3 falls into the hopper 1.

A wall plate 20 is fixed on and perpendicularly extended from the base plate 16. The wall plate 20, as shown in Figure 1, is provided with a guiding surface 21 for guiding the mounting and demounting of the toner cartridge relative to the cartridge mounting position of the cartridge mount 2. By the sliding motion of the shutter support 8 of the

toner cartridge 3 on the guiding surface 21, the motion of the toner cartridge 3 is guided in a direction substantially perpendicular to the cartridge mounting surface 18.

More particularly, the operator holds the container body 4 of the cartridge 3 by his hand, and lowers it in a direction C shown in Figure 5 along the guiding surface 21, by which the cartridge 3 is placed on the surface 18. On the other hand, by raising the cartridge 3 in a direction D along the guiding surface 21, the cartridge 3 is removed from the mount 2.

Figures 1, 2 and 3 are top plan views of the toner cartridge mounted on the cartridge mount 2.

For the sake of simplicity of explanation, the container body is omitted from the Figure.

In Figure 1, the toner cartridge has been mounted to the mount 2 and takes a cartridge mounting or demounting position. In Figure 1, the toner discharge opening 6 of the cartridge 3 is completely closed by the shutter plate 11.

When the cartridge 3 is mounted to the position shown in Figure 1, the operator holds the container body 4, for example, and rotates it about an axis substantially perpendicular to the cartridge mounting surface 18, as indicated by an arrow a. At this time, the bottom surface of the shutter support 8 slides on the mounting surface 18.

A projection 23 of the shutter support 8 is engaged into a recess 22 formed in the wall plate 20, by the above rotation (Figure 2, and Figure 7 which is a sectional view taken along a line Z-Z of Figure 2).

As shown in Figure 7, the top surface 24 of the projection 23 of the toner cartridge 3 is press-contacted to the top sealing surface 25 of the recess 22, by which the toner cartridge 3 is prevented from being removed upwardly from the cartridge mount 2. Figure 2 shows the state in which the toner cartridge 3 takes a toner discharge position for discharging the toner into the hopper by opening the toner discharge opening of the toner cartridge 3. By the engagement of the projection 23 of the cartridge into the recess 22 of the mount 2, removal of the toner cartridge 3 from the mount 2 is prevented when the toner cartridge takes the toner discharge position.

By the press-contact between the projection 23 and the sealing 25 of the recess 22, the bottom surface of the shutter support 8 of the cartridge elastically compresses the sealing member 17 to improve the press-contact therebetween, so that the toner leakage from the contact portion between the cartridge 3 and the mount 2 can be further prevented.

In this embodiment, the projection 23 is formed in the toner cartridge 3, and the recess 22 is formed in the cartridge mount. However, the recess

may be formed in the toner cartridge 3, and the projection may be formed in the toner cartridge, wherein they are engaged by rotation of the cartridge 3 in a direction a.

Thus, the toner cartridge 3 is slidingly rotated in a direction a on the mount surface 18, by which the projection 23 is engaged into the recess 22, so that the cartridge 3 takes the toner discharge position as shown in Figure 2. At this time, three side surfaces of the shutter support 8 of the cartridge 3 are abutted to three stopping surfaces 26 formed on the wall plate 20, respectively. In this manner, further rotation of the toner cartridge in the direction a beyond the toner discharge position, is prohibited.

A second portion of the side surface of the shutter support 8, contactable to the stopper surfaces 26, are different from a first position slidable relative to the guiding surface 21, and as will be understood from Figures 1 and 2, when the first portion is in contact with the guiding surface 21, the second portion is disengaged from the stop surfaces 26. On the other hand, when the second portion is in contact with the stopping surface 26, the first portion is out of contact with the guiding surface 21.

When the cartridge 3 is brought into the state shown in Figure 2, that is, the toner

discharging position by the recess 22 and the stopper surface 26, the operator grips the grip 11 of the shutter plate 7, and pulls the shutter plate 7 in a direction A. As will be understood from Figures 1 and 2, the shutter plate 7 pulling direction crosses with the rotational direction a of the toner cartridge 3.

The shutter plate 7 comprises a narrow portion 7a and a wide portion 7b having a width larger than that of the narrow portion 7a.

The narrow portion 7a is disposed at a front side with respect to the pulling direction of the shutter plate 7. Therefore, an end of a front part of the shutter plate 7a is cut-away, as shown in Figure 8.

In Figure 8, the toner discharge opening 6 of the toner cartridge 3 is completely closed by the wide portion 7b of the shutter plate 7. The wide portion 7b is slidable engagement with the shutter support 8, and even when the wide portion 8b completely closes the shutter discharge opening 6, the narrow portion 7a projects out from the shutter support 8.

The narrow portion 7a is provided with inclined stepped portion in the illustrated example, it may be a stepped portion perpendicular to a side surface 27b of the wide portion 7b.

The grip 21 is fixed to an end of the narrow portion 7a.

Figure 3 shows a state in which the shutter plate is pulled to a position at which the stopper projection 12 is abutted to the wall surface 13 of the shutter support. Figure 6 is a sectional view taken along a line Y-Y of Figure 3.

In this state, the toner discharge opening 6 of the container body 4 of the toner cartridge is completely opened. The toner contained in the container body 4 falls by the gravity into the hopper 1 with the opening action of the opening 6. When the opening 6 is completely opened, the toner in the container body 4 smoothly and quickly falls into the hopper 1.

When the toner supply from the toner cartridge 3 into the hopper 1 is completed. The operator pushes the grip 11 to push the shutter 7 as shown in Figure. When the shutter plate 7 completely closes the toner discharge opening 6 (original position), the leading end 30 of the shutter plate 7 in the pushing direction B is contacted to the rear wall surface 31 of the shutter support 8, by which the further pushing of the shutter 7a is prohibited (Figure 4).

When the shutter plate completely closes the toner discharge opening 6, the operator holds the container body 4 or the like by his hands, and rotates the toner cartridge slidingly on the mount surface 18

in a direction opposite from the direction a as shown in Figure 2, (B), by which the original position is restored. By the rotation of the cartridge 3 in the direction b, the projection 23 of the cartridge 3 is disengaged from the mount 2, by which the operator can remove the toner cartridge 3 from the mount 2.

When the shutter plate 7 is in the process of pulling from Figure 2 position, or when it is in the process of pushing from Figure 3 position to Figure 2 position, the toner cartridge 3 can not be removed from the mount, even if the operator erroneously tries to raise it. This is because the projection 23 of the toner cartridge is engaged into the recess 22 of the mount 2.

When the shutter plate 7 is in the process of drawing from Figure 2 position to Figure 3 position, or when it is in the process of pushing from Figure 3 position to Figure 2 position, in other words, when the toner discharge opening 6 of the container body 4 is not completely closed by the shutter plate 7, rotation of the toner cartridge 3 in the direction b is prohibited in this embodiment, even if the operator tries to rotate it in this direction.

This will be described in detail. The wall plate 20 of the cartridge mount 2 is provided with a limiting surface 28 faced to the pulling or pushing path of the shutter plate 7. When the shutter plate 7

is pulled out of the support 8 so that the toner discharge opening 6 is opened even slightly, the side surface 27b of the wide portion 7b of the shutter plate is opposed to the limiting surface 28 with or without small gap therebetween (Figure 3).

If the operator tries to rotate the toner cartridge 3 in a direction b, erroneously, the side surface 27b of the wide portion 7b of the shutter plates is abutted to the limiting surface 28, so that the rotation is stopped. Therefore, the projection 23 of the cartridge 3 does not disengage from the recess 22 of the mount 2. For this reason, the toner cartridge 3 is not removed from the mount 2.

When the shutter plate 7 takes the completely closing position for the toner discharge opening 6, the side surface 27b of the wide portion 7b of the shutter plate is not opposed to the limiting surface 28, but the side surface 27a of the narrow portion 7a of the shutter plate is faced to the regulating surface 28 (Figure 2).

Therefore, with this state, even if the toner cartridge 3 is rotated in the direction b, the side surface 27a of the narrow portion 7a is not abutted to the limiting surface 28, and therefore, a projection 23 of the toner cartridge 3 can be disengaged from the recess of the mount 2, and therefore, the toner cartridge 3 can be returned to the mounting and

demounting position shown in Figure 1.

When the cartridge 3 returns to the Figure 1 position by rotation in the direction b, three parts of the side surface of the shutter support 8 of the cartridge are abutted to three parts of the guiding surface 21 of the cartridge mount, by which further rotation of the cartridge 3 in the direction b is prohibited, and therefore, the narrow portion 27a of the shutter plate 7 is not abutted to the limiting portion 28.

In any case, as described above, the toner cartridge 3 can not be returned to the cartridge mounting and demounting position from the toner discharge position, as long as the toner discharge opening 6 is not completely closed by the shutter plate 7. Therefore, it can be avoided that the cartridge is removed before the toner discharge opening is not completely closed with the result that the toner powder remaining in the container body leaks out and scanners out.

In the foregoing example, the toner cartridge 3 is rotated slidingly in a direction a and b about an axis passing through a neighborhood of a center of the toner discharge opening 6, within an enclosure defined by wall 20 extended perpendicularly. With this structure, there is no need of provision of central rod, and therefore the structure is simple.

In the following example, a core rod is provided to improve the operativity in the rotation of the toner cartridge 3.

Referring to Figures 9, 10, 11 and 12, the same reference numerals as in the foregoing embodiment are assigned to the members and portions having the corresponding functions, and the detailed description thereof are omitted for simplicity.

As shown in Figure 12 which is a sectional view taken along a line G-G of Figure 10, the base plate 17 of the cartridge mount 2 is provided with a core rod 32 extended substantially perpendicularly therefrom. A hole 33 formed adjacent a corner of the shutter support 8 of the cartridge 3 receives the core rod 32.

The cartridge 3 rotates in a direction c about the core rod 32 from the position of Figure 9 (mounting and demounting position) on the mount surface 3. to Figure 10 position (toner discharge position). Subsequently, the shutter plate 7 is pulled as shown in Figure 11 to permit toner discharge. Then, the shutter plate 7 is pushed in, and the cartridge is rotated in a direction d which is opposite from the direction c about the core rod 32, sliding on the mount surface 3, by which it is returned from Figure 10 position to Figure 9 position. In the Figure 9 position, the cartridge 3 can be

demounted from the mount 2.

As long as the shutter plate 7 closes the toner discharge opening, the side surface 27b of the wide portion 7b of the shutter plate abuts the limiting surface 28 to prevent the rotation of the cartridge 3 from the toner discharging position to the cartridge mounting and demounting position, similarly to the foregoing embodiment.

In the foregoing examples, when the toner cartridge 3 is moved from the mounting and demounting position of Figure 1 or 9 to the toner discharging position of Figure 2 or 10, the toner discharging position of the toner cartridge 3 is assuredly maintained by the engagement between the projection 23 and the recess 22. Therefore, the operation is easy and stabilized at the start of pulling the shutter plate and at the end of pushing the shutter plate 7 in.

In the following embodiment, a pivot projection 34 is provided in the shutter support 8 of the toner cartridge 3 at an opposite side in the shutter plate pulling direction.

The operator holds the toner cartridge 3 and lowers it in an inclined direction. As shown in Figure 13, the pivot projection 34 is engaged into the recess 35 of the wall plate 20 of the cartridge mount 2.

Subsequently, the operator rotates the cartridge 3 in a direction e about the pivot projection 34. As shown in Figure 14, the bottom surface of the shutter support 8 is contacted to the top surface of the cartridge mount surface 18 (elastic sealing member 17) of the mount 2. The movement is guided by the sliding between the guiding surface 29 of the wall plate 20 and a side surface of the shutter support 8.

The cartridge position of Figure 13 is a cartridge mounting and demounting position, and the position shown in Figure 14 is a toner discharging position.

Figure 15 is a top plan view in the state shown in Figure 14, and Figure 17 is a front view in the same state.

As will be understood from Figures 15 and 17, a pair of channel like projections 36 are provided with a space therebetween slightly larger than a width of a narrow portion 7a of the shutter plate 7, in a front portion of the wall plate 20 of the cartridge mount 2.

When the cartridge 3 is rotated downwardly from Figure 13 position to Figure 14 position, in the narrow portion 7a of the shutter plate 7 passes between the projections 36, by which the cartridge 3 is closely contacted to the mount surface 18.

When the shutter plate is pulled in a direction A perpendicular to the direction of an arrow e to open the shutter discharge opening 6, side portion of the wide portion 7b of the shutter plate passes the gap of the recess at the lower part of the projection 36. Therefore, even if the toner cartridge 3 is attempted to be raised, the top surface 37b of the wide portion 7b is abutted to the bottom surface of the projection 36, and the pivot projection 34 is also engaged in the recess 35 of the mount 2, and therefore, the raising of the toner cartridge 3 is prohibited. Therefore, the toner cartridge 3 is not removed from the mount 2 (Figure 16 which is a top plan view in which the shutter plate 7 has been pulled out to a position for completely open the toner discharge opening 6).

In this manner, the removal of the toner cartridge from the cartridge mount 2 is prohibited, when the shutter plate 7 completely close the toner discharging opening 6.

After the shutter plate 7 is pushed into a position for completely closing the toner discharge opening 6, the operator rotates upwardly about the pivot projection 34 under the guide by the guiding surface 29 in a direction f in Figure 14 (opposite from the direction e), to Figure 13 position. Then, the cartridge 3 is raised upwardly in an inclined

direction, by which the pivot projection 34 is disengaged from the recess 35, thus permitting removal of the cartridge from the mount 2.

In the embodiment of Figures 13 - 17, the mounting and demounting direction of the toner cartridge at Figure 13 position, and the direction of the toner cartridge rotation between Figure 13 position and Figure 14 position, are not deviated much, and the operation can be smoothly continuously performed.

In this specification, width of shutter plate is a dimension of the shutter plate surface effective to close the toner discharge opening, measured in a direction perpendicular to the shutter plate pulling or pushing direction. A side surface of the shutter plate is an end surface of the shutter plate in the width direction. The top surface of the shutter plate is a surface of the shutter plate effective to close the shutter discharge opening.

As described in the foregoing, according to the present invention, an erroneous operation of removing the toner cartridge from the mount before the toner discharge opening is completely closed, with simple structure.

While the invention has been described with reference to the structures disclosed herein, it is not confined to the details set forth and this

application is intended to cover such modifications or changes as may come within the purposes of the improvements or the scope of the following claims.

WHAT IS CLAIMED IS:

1. A toner supply mechanism comprising:

a toner storage unit for storing toner;

a toner container for containing toner to be supplied to said toner storage unit, said toner container including a toner containing portion for containing the toner, said toner containing portion having a toner discharge opening and a shutter member for opening and closing the discharge opening;

a container mounting portion having a receiving opening for receiving toner from said toner container to supply toner into said toner storage unit, said container mounting portion receivably mounting said toner container with the discharging opening facing downward toward said receiving opening;

wherein when said toner container is mounted on said container mounting portion, said toner container is rotatable about an axis substantially perpendicular to a mounting surface of said container mounting portion between a first angular position for mounting and dismounting said toner container and a second angular position for supplying toner to said toner storage unit; and

wherein said shutter member includes preventing means for preventing said shutter member from being pulled out by contacting to said container mounting portion when said toner container is in the first angular position, and preventing means for preventing said toner container from rotating to the first angular position by contacting to said container mounting portion when said toner container is at the second angular position.

2. Wherein said container mounting portion has a dismounting preventing portion engageable with said toner container at the second angular position to prevent dismounting of said toner container.

3. A mechanism according to Claim 2, wherein said toner container includes a projection engageable with a recess of said dismounting preventing portion by rotation of said toner container to the second angular position, thereby to prevent dismounting of said toner container.

4. A mechanism according to Claim 3, wherein said closing means includes a shutter for opening and closing the discharge opening, and a supporting member for supporting said shutter member, and wherein said projection is mounted on said supporting member.

5. A mechanism according to Claim 4, wherein said supporting member is substantially rectangular, and the projection is provided adjacent a corner of said supporting member.

6. A mechanism according to Claim 5, wherein said projection is provided at each of two diametrically opposite positions of said supporting member.

7. A mechanism according to Claim 1, wherein said container mounting portion has a guiding surface for guiding movement of said toner container in a direction of the axis.