TONER CARTRIDGE

Background of the Invention

The present invention relates to a toner cartridge. More specifically, it relates to a toner cartridge for use in a developing unit of an image forming apparatus such as an electrostatic copying machine.

Removing a Seal Member

A developing unit of an electrostatic copying machine consists mainly of a developing device and a toner hopper (referred to as a hopper below) supplying toner to the developer. To supply toner to the hopper, for example, a toner cartridge containing toner is mounted on the hopper, and a seal member covering an opening at the bottom of the toner cartridge if removed.

The seal member adheres to the peripheral portion of the opening of the toner cartridge, for example with adhesive. According to a conventional method for removing the seal member from the toner cartridge, as shown in Figs. 1 and 2, a folded seal member 91 closes a toner supply opening 93 of a cartridge body 92, wherein its portion between the folded part and an end 91a is pulled by hand at the end for removal. Moreover, Japanese Utility Model Laying-Open No. 117170/1986 discloses that a roller rolls up a seal member. Figs. 3 and 4 are bottom views of toner cartridges showing the seal member 91 of Figs. 1 and 2 not removed. In terms of the contact surface area of a portion of the seal member 91 adherent to the cartridge body 92, portions A, A' as removed first and portions B and B' as removed last are greater than mid-portions C, C', D and D', in both Figs. 3

and 4. Therefore, during removal of the seal member 91, the adherent portions A, A', B and B' require a relatively large force, thereby making it difficult to handle the toner cartridge. Particularly, in the case shown in Fig. 4, more force is required to remove the seal member 91 in the direction Y than in the case shown in Fig. 3 in the direction X.

Meanwhile, U.S. Pat. No. 4,827,307, Japanese Utility Model Laying-Open No. 115752/1983, Japanese Patent Laying-Open No. 53868/1984 and Japanese Patent Laying-Open No. 14865/1983, disclose that adherent portions of a seal member to a cartridge body are formed at an angle, which is not a right angle, to a direction of removing the seal member.

If the structure disclosed in the above documents is applied to the toner cartridge in Fig. 4, the structure shown in Fig. 5 is obtained. That is, an adherent portion 94 of a seal member 91 on a toner cartridge body 92 for closing a toner supply opening 93 is thereby mountain-shaped.

In this structure, however, the angle of the adherent portion 94 to the direction of removing cannot be too sharp or acute, because the toner supply opening 93 must be kept sufficiently large relative to the cartridge body 92, which moreover must be as compact as possible in terms of occupied space. Therefore, even if the above conventional technology, such as it is, is applied directly to the toner cartridge shown in Figs. 4 and 5, it still cannot be sufficiently effective whereby the seal member may be most easily removed at the onset of removal.

In order to obtain improvement in the removing of a seal member, Japanese Utility Model Laying-Open No. 117170/1986

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discloses a toner cartridge which incorporates a roller to roll up a seal member. However, if a seal member made of a material having a strong restoring tendency, or a strong tendency of being flat, is used in the toner cartridge incorporating the roller, the rolled seal member bulges due to its restoring tendency, thereby enlarging its diameter. This means that the rolled seal member cannot be stored in a compact space. Furthermore, toner carried on the seal member may be scattered due to the restoring tendency of the seal member. Accordingly, the material of the seal member must be less restoring to diminish its tendency toward flatness. This means the variability of material is narrowed.

The toner cartridge should have a one-way mechanism or the like to fix the direction of rolling. Otherwise, the surface of the seal member with adsorbed toner may be outside the roller, wherein the toner contaminates the atmosphere.

Summary of the Invention

It is an object of the present invention to provide a toner cartridge in which a seal member can easily be removed from a cartridge body with minimal force.

It is another object of the present invention to provide a toner cartridge in which a seal member can be removed from a cartridge body with minimal force and which can easily be set in an image forming apparatus.

It is yet another object of the present invention to provide a toner cartridge, whereby the diameter of the rolled seal member is reduced and toner is minimally scattered.

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The toner cartridge according to the present invention comprises a cartridge body having a toner supply opening, a seal member for closing the toner supply opening, a roller for rolling up the seal member placed on the cartridge body, and a pressing member for pressing the outer surface of the seal member rolled up by the roller.

The seal member is rolled up with the roller after the toner cartridge has been fixed. Since the outer surface of the rolled seal member is pressed by the pressing member, bulging of the rolled seal member due to its restoring tendency is minimized.

In one embodiment the pressing member extends laterally between the side ends of the seal member. It can also clean the toner-adsorbed surface of the seal member in order not to contaminate the atmosphere, even if the seal member is rolled up with the toner-adsorbed surface being on the outside.

These and other objects and advantages of the present invention will be more fully apparent from the following detailed description.

Brief Description of the Drawings

Figs. 1 and 2 are perspective views showing seal members removed from cartridge bodies;

Figs. 3 and 4 are bottom views showing conventional toner cartridges;

Fig. 5 is a bottom view of a toner cartridge for explaining problems of the prior art;

Fig. 6 is a sectional view, showing decomposed parts of a developing unit of the copying machine;

Fig. 7 is a sectional view taken along the line X-X of Fig. 6;

Fig. 8 is a perspective view showing the outer appearance of a toner cartridge;

Fig. 9 is a bottom view showing the toner cartridge with a seal member unfixed to a roller;

Fig. 10 is a sectional view showing a rolling mechanism for rolling up the seal member;

Fig. 11A-11C and 12 are views for explaining the function of the mechanism of rolling up the seal member;

Fig. 13 is a perspective view showing a toner cartridge according to another embodiment;

Fig. 14-18 are bottom views showing toner cartridges according to other embodiments, respectively;

Fig. 19 is a perspective view showing a toner cartridge according to another embodiment;

Fig. 20 is a bottom view showing the toner cartridge of Fig. 19.

Description of the Preferred Embodiments

Referring to Fig. 6, the developing unit 10 of a conventional electrostatic copying machine consists mainly of a developing device 20 and a hopper 21 for supplying toner to the developing device 20. The developing device 20 is placed between a front plate 22 and a back plate (not shown), where the side of the copying machine closer to an operator is referred to as the front side and the opposite side is referred to as the rear side.

Referring again to Fig. 6, the hopper 21 is disposed in the front of the developing device 20, and fixed to the front plate 22 with supporting plates 35 and 36. The hopper 21 consists mainly of a hopper body 37 and a cartridge 42.

Hopper Body

The hopper body 37 has a toner container 38 for containing toner. The toner container 38 has a pair of inside walls at both ends in the widthwise direction, which slope to make a "V", as in the sectional side view, and another pair of inside walls at both ends in the direction perpendicular to the widthwise direction, which slope as well. Accordingly, the container 38 opens out at its upper end. The toner container 38 has holders 40 and 41, whereof the sectional shape is similar to a "C", at the upper left and right ends. The holders 40 and 41 hold a flange 43 surrounding the opening of the toner cartridge 42, as described below. Referring to Fig. 7, another holder 44 is formed in the rear portion of the toner container 38. The holder 44 holds the flange 43 of the toner cartridge 42 similarly to the holders 40 and 41.

Referring to Figs. 6 and 7, a toner supply opening 38a for allowing toner to drop is formed at the bottom of the toner container 38. The toner supply opening 38a is formed slightly on the right (in Fig. 6) of the middle in the lengthwise direction of the toner container 38 to correspond to the connecting opening 20a of the developing device 20, as in the view in Fig. 6. In the bottom portion of the toner container 38, a transfer means 39 is disposed to transfer the toner in the container 38 to the opening 38a.

The toner cartridge 42 is for storing toner and supplying the toner to the toner container 38. Referring to Figs. 8 - 10; the toner cartridge 42 consists of a cartridge body 42a, a seal member 62 and a rolling-up mechanism.

The cartridge body 42a is box-shaped and has an opening 66 at the bottom end. There are sloping walls in the lower part of the cartridge body 42a whereof the lower ends are closer to each other than the upper ends. The flange 43 is formed at the bottom end, as described above, and is slid into the holders 40 and 41 of the hopper body 37 when the cartridge 42 is to be attached to or detached from the hopper body. As shown in Fig. 7, there is a hole 43a for locking, into which a locking projection 38b of the toner container 38 is engaged to fix the toner cartridge 42 when the cartridge body 42a is set onto the hopper body 37.

Referring to Fig. 19, the cartridge 42 has the opening 66 closed by the folded seal member 62 before use. On the flange 43, there is a mechanism with which the seal member 62 is rolled up when the cartridge body 42a is set onto the hopper body 37. The mechanism consists of a supporter 63, a roller 64 and a pressing member 65. The supporter 63 is formed integrally on the operator-side part of the flange 43.

The supporter 63 has a U-shaped notch 63a into which the roller 64 is received rotatably. The folded seal member 62 is adhered to the roller 64 at the free end. The roller 64 has a crank-shaped end portion 64a for handling, referred to as a roll-up handle. The pressing member 65, made of resin having a sponge-like elasticity, extends in the lateral direction of the seal member 62 along the roller 64. The pressing member 65 presses on the outer surface of the seal member 62 when it is rolled by the roller 64.

The seal member 62, as shown in Fig. 10, has a folded part 62a and closes the toner supply opening 66 with the part between the folded part 62a and the adhered end 62b. In Fig. 9, the area shown with oblique lines is an adhered part 71 between the seal member 62 and the peripheral portion of the opening 66. At the adhered part 71, the seal member 62 is fixed to the cartridge body 42a with adhesive to be removed by a proper force.

As shown in Fig. 9, the seal member 62 is trapezoid-shaped, so that the measures between the folded part 62a and the rolling end 62c on the opposite sides of the seal member 62 are different. Namely, the line of the rolling end 62c meets the direction of the roller 64 at an angle θ, so that the side of the seal member 62 nearer to the roll-up handle 64a is longer than the opposite side. As the angle θ is increased, less force is required to remove the seal member 62 at the adhered part 71, but therefor the distance is longer thereby. Therefore, the angle θ is set such that the roller 64 is not too long to handle. If due to a greater angle θ, the seal member cannot be suitably rolled by the roller 64, to thereby make a roll like a spiral shell, a roller may be used which has different diameters between both ends thereof.

The rolling end 62c of the seal member 62 is fixed to the roller 64 with a proper adhesive material, wherein the line of the rolling end 62c is extended in parallel with the roller 64. This fixing work is usual performed in a manufacturing process. Since the side of the seal member 62 near the handle 64a is longer than the other side in terms of the length between the folded part 62a and the rolling end 62c, the side near the handle 64a has more slack than

the other side due to the difference in length, as shown in Fig. 8.

Setting for Use

When the developing unit 10 is set in the machine body 1, as shown in Fig. 7, the hopper 21 is fixed to the developing device 20 and then the front cover 19 is closed. Thus, the end portion of the toner supply pipe 50 is inserted into the connecting opening 20a of the developing device 20, because the inside surface of the front cover 19 pushes the rod 51a toward the right (in Fig. 7).

The rotor 39a of the transfer means 39 permits only the predetermined amount of toner to fall through the opening 38a, and this rotor 39a closes the opening 38a with its wings 45 when the rotor 39a stops. Therefore, the toner cannot be supplied overly, and thereby neither an excessive-toner problem nor a spreading-toner problem can occur.

Installing Toner Cartridge

Before a new toner cartridge 42 can be installed in the developing unit, an empty toner cartridge 42 must be drawn out in the horizontal direction, therein pressing down the projection 38b, and then thrown away. Subsequently, the new toner cartridge 42 is slid in the horizontal direction, with its flange 43 inserted into the holders 40 and 41 of the toner container 38. As a result, the projection 38b is engaged with the hole 43a, formed in the flange 43, to lock the new toner cartridge 42.

Next, the roller 64 is rotated clockwise (in Fig. 10) in order to roll up the folded seal member 62 as shown in Figs. 11A and 11B. Since every rolled part of the seal mem-

ber 62 has the same length on every part of the roller 64, as shown in Fig. 12, the slackened part of the seal member 62 near the handle 64a maintains its slack when removal of the seal member 62 starts. When the seal member 62 is removed by rolling, part of the side shortest in the length between the folded part 62a and the rolling end 62c, specifically the part of the seal member 62 farthest from the handle 64a, is the first to start leaving the container 38. Fig. 12 shows the condition, in which the seal member 62 is removed diagonally with respect to its folded part, so that the toner in the cartridge body 42 drops little by little whereby it is supplied.

In this embodiment, the greatest area of the adherent part to be removed at any given moment is always less than that in the conventional example, so that the maximum force required in removing the seal member 62 is reduced. Particularly, at the beginning of removal of the seal member 62, the required force is reduced over that of a conventional device, whereby the facility of operation is improved.

As the seal member 62 is rolled up by the roller 64, its outer surface is pressed by the pressing member 65, as shown in Fig. 11C. Since the rolled-up seal member 62 is pressed by the pressing member 65, expansion of the diameter of the rolled seal member 62 due to its elasticity does not occur. Furthermore, the pressing member 65 can clean the seal member 62 of toner adsorbed on its surface, as the seal member 62 is rolled up. Therefore, the rolling-up mechanism in this embodiment does not require any one-way mechanism to fix the direction of rolling, whereas a conventional rolling mechanism needs a one-way mechanism to ensure that the surface of the seal member with toner is always placed inside. Moreover, since the pressing member 65 keeps the rolled seal member 62 from expanding, as des-

cribed above, the variety of the material which may constitute the seal member 62 is less limited; thereby the degree of freedom of its material is increased.

Modifications

(a) As shown in Fig. 13 and 14, a first seal member 67 and a second seal member 68 having different lengths can be used on one roller 64 wherein the second seal member 68 has more slack than the first seal member 67, whereas one seat comprises one seal member 62 in the above example.

In this example, the cartridge body 42a has a first opening 69 and a second opening 70 for supplying toner in correspondence with the first seal member 67 and the second seal member 68, as shown in Fig. 23.

As the seal members 67 and 68 begin to be rolled, the first seal member 67 leaves the cartridge body 42a, first, then the second seal member 68 begins to leave. Thereby, the force required at the start of rolling is reduced. Furthermore, by changing the difference of the lengths between the folded parts 67a and 68a, and the roller 64, in seal members 67 and 68, the timing whereupon the seal members 67 and 68 begin to leave can be controlled.

(b) Seal members of more than two seats may be used, whereas seal members of two seats are used in the embodiment shown in Fig. 13.

(c) Fig. 14 shows another embodiment according to the present invention. A toner cartridge 42 has one toner supply opening 66, and first and second seal members

67 and 68 to close the opening 66. Provided between the first seal member 67 and the second seal member 68 is a stacked seal part 72 adhered similarly to the adhered part 71. At the adhered part 72, the second seal member 68 is located between the cartridge 42a and the first seal member 67.

In this embodiment, the first seal member 67 begins to leave first followed by the second seal member 68. On the roller 64, the second seal member 68 is stacked on the first seal member 67 in the area of the part 72.

(d) A roller 75 having a large diameter part 75a and a small diameter part 75b, as shown in Fig. 16, can be used instead of the roller 64 described above. In this modification, the seal members 87 and 88 may have different lengths.

According to this modification, the required force of removal is minimal, because the peripheral speeds of the seal members 87 and 88 are different.

(e) In the embodiments shown in Figs. 13-16, at least one of seal members may have a trapezoid shape similar to that in the embodiment shown in Fig. 9.

In Fig. 17, an embodiment includes two seal members 76 and 77 having trapezoid shapes. Fig. 17 shows the seal members 76 and 77 before these are attached to the roller 64.

(f) Fig. 18 shows an embodiment in which each of two seal members 78 has the same length and a trapezoid shape.

(g) Figs. 19-20 show another embodiment of the present invention.

In this embodiment, the cartridge body 42a has two openings 69 and 70 at the bottom. The opening 70 is closed by a first seal member 67, and the opening 69 is closed by a second seal member 68 longer than the first seal member 67. Contrary to the above embodiment, the first seal member 67 is located adjacent to the handle 64a of the roller 64. Adhered parts 73 and 74 of the seal members 67 and 68 have mountain-like shapes whereof the center projects outward along the removing direction.

(h) The roller 64 can be rotated counterclockwise when rolling up the seal member 62. By a counterclockwise rotation of the roller 64, the seal member 62 is formed into a roll wherein the surface having toner is inside, so that less amount of toner scatters.

(i) In the embodiment of Fig. 8, one pressing member 65 extends the length of the seal member 62. Furthermore, a plurality of pressing members 65 may instead be located therein with a spacing between the respective ones.

(j) A copying machine to which the present invention is applied is not limited to the clamshell type in which a copying machine body 1 consists of an upper portion 1a and a lower portion 1b for opening, although the present invention is applied to the clamshell type in the above embodiments. For example, the present invention may be applied to a copying machine having a slidable contact glass. In this type of copying machine, after the contact glass is slid out from its pos-

ition over the machine body to make an opening in the upper portion, the developing units can be exchanged through the opening.

(k) The present invention can be applied to other types of image forming apparatus, such as a printer and a facsimile, although the toner cartridge of the present invention is applied to a copying machine in the above embodiments.

The foregoing description of the embodiments according to the present invention is provided for the purpose of illustration only.

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CLAIMS

1. A toner cartridge (42) comprising:

- a cartridge body (42a) having a toner supply opening (66);
- a seal member (62) for closing the toner supply opening (66);
- rolling means (63, 64), provided on the cartridge body (42a), for rolling up the seal member (62); and
- a pressing member (65) for pressing against the outer surface of the seal member (62) while being rolled up by the rolling means (63, 64).

2. The toner cartridge according to claim 1,

wherein the rolling means (63, 64) comprises supporters (63) and a roller (64) having a handle (64a) at an end rotatably supported by the supporters (63).

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

- the cartridge body (42a) is box-shaped having the toner supply opening (66) at the bottom and a flange (43) surrounding the toner supply opening (66); and
- the supporters (63) and the pressing member (65) are located on the flange (43) of the cartridge body (42a).

4. The toner cartridge according to any of claims 1 to 3, wherein the pressing member (65) is made of elastic resin.

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5. The toner cartridge according to any of claims 1 to 4, wherein the pressing member (65) extends between both ends of the seal member (62).

6. The toner cartridge according to any of claims 1 to 5, wherein the pressing member (65) includes a plurality of pressing parts disposed in the transverse direction of the seal member (62).