Description

FIELD OF THE INVENTION

The present invention relates to a toner development device and a method for mounting a toner cartridge for toner replenishment on a development device main body in such a manner that it can be freely attached to and detached from the development device main body for supplying toner to a photosensitive member of an electrophotographic recording apparatus, a copier and the like.

BACKGROUND OF THE INVENTION

In electrophotographic recording apparatus, an electrostatic latent image formed on a surface of a photosensitive member by the electrophotography process is developed by toner supplied from a development device, and is then transferred to a recording medium In the development device of the electrophotographic recording apparatus, a toner cartridge (hereinafter referred to as a cartridge) is removably mounted to a development device main body, and toner is replenished by exchanging the cartridge, as known, for example, from JP-A-60-147 768 and US-A-3 356 248.

Fig. 1 is a perspective view showing an other example of prior art development device of the above described type. Fig. 2 is a sectional view along line II-II in Fig. 1. Fig. 3 is a perspective view of a main body. Fig. 4 is a perspective view of a cartridge.

As shown in Fig. 1, the development device 1 comprises a main body 2 and a cartridge 3. As shown in Fig. 3, the main body 2 comprises a cartridge mounting part (hereinafter referred to as mounting part) 4, a toner supply roller 5 and a housing 6. In the mounting part 4, rotating members 8 and 9 which rotate in directions indicated by arrows B-C are provided, having an axis 7 of rotation with respect to the housing 6 and facing each other. The rotating members 8 and 9 are provided with levers 8a and 9a and joint grooves 8b and 9b, respectively. A shutter member 10 formed of polyethylene film or the like is provided to span across the rotating members 8 and 9 and is fixed to parts (positioned at the bottom in the state shown in Fig. 1) of the circumferential edges of the members 8 and 9, to block an opening 11 at the bottom of the mounting part 4, as shown in Fig. 2. As shown in Fig. 4, the cartridge 3 comprises a cylinder 12 and revolving members 13, 14 provided at opposite end openings of the cylinder 12, a stopper 15 fixed to the center of the cylinder 12, and toner 16 shown in Fig. 2. The cylinder 12 comprises an outer cylinder 17, and an inner cylinder 18 which is coaxial with the outer cylinder 17, has its outer surface slidably abutting against the inner surface of the outer cylinder 17, and is therefore slidable relative to the outer cylinder 17. The outer and inner cylinders 17 and 18 are provided with openings 17a and 18a along part only of their circumference. The revolving members 13 and 14 are fixed to the opposite end openings of the inner cylinder 18 so as to close them. Provided integrally with the revolving members 13 and 14 are linear joint projections 13a and 14a which engage with the joint grooves 8a and 9a on the rotating members 8 and 9. The stopper 15 extending semicircularly along the outer side of the outer cylinder 17 is fixed to the central part of the outer cylinder, and its opposite ends 15a and 15b are in abutment with edges 6a and 6b of the casing 6 of the mounting part 4.

Operation will now be described. First, as shown in Fig. 3, the levers of the rotating members 8 and 9 are rotated in the direction of arrow C. The rotating members 8 and 9 stop when they abut stoppers, not shown. At this moment, the joint grooves 8b and 9b are vertical. The cartridge 3 is placed such that its axis is parallel with the axis of the mounting part 4, and is pressed in, with the joint projections 13a and 14a being engaged with the joint grooves 8b and 9b. The cartridge 3 is thus set in the main body 2, as shown in Fig. 1. The bottom part of the cartridge 3 is in contact with the shutter member 10, as shown in Fig. 2, and the ends 15a and 15b of the stopper 15 abut against the edges 6a and 6b of the casing 6. Then, with the outer cylinder 17 being pressed, the levers 8a and 9a of the rotating members 8 and 9 are rotated in the direction of arrow B shown in Fig. 3. Since the joint projections 13a and 14a of the cartridge 3 are engaged with the joint grooves 8b and 9b of the rotating members 8 and 9, the revolving members 13 and 14 are rotated in the direction of arrow B. The inner cylinder 18 fixed to the revolving members 13 and 14 is therefore rotated in the direction of arrow B. The shutter member 10 fixed to the rotating members 8 and 9 is also rotated in the direction of arrow B. On the other hand, since the end 15a of the stopper 15 fixed to the outer cylinder 17 is in abutment with the edge 6a of the casing 6 as shown in Fig. 2, the outer cylinder 17 is not rotated.

When the opening 18a of the inner cylinder 18 comes to the position at which it overlaps or aligns with the opening 17a of the outer cylinder 17, the levers 8a and 9a abut against stoppers, not shown, and stop. The shutter member 10 also rotates, together with the rotating members 8 and 9, in the direction of arrow B and the opening 11 at the bottom of the mount part 4 is unblocked. The toner 16 that is contained in the inner cylinder 18 passes through a toner opening comprising the openings 18a, 17a and 11 and is supplied to the main body 2.

For removing the cartridge 3 from the mounting part 4, the levers 8a and 9a of the rotating members 8 and 9 are rotated in the direction of arrow C as shown in Fig. 3 until abutment with stoppers, not

shown. The inner cylinder 18 rotates with the rotating members 8 and 9 in the direction of arrow C, and the opening 18a of the inner cylinder 18 completely ceases to overlap the opening 17a of the outer cylinder 17. The shutter member 10 blocks the opening 11, and the toner opening is blocked. Then, the joint grooves 8b and 9b of the rotating members 8 and 9 are vertically aligned, so the cartridge 3 can be removed from the mounting part 4.

In this prior art cartridge mounting/removal mechanism the inner cylinder 18 slides in contact with the outer cylinder 17, so a frictional force is created in the direction of the tangent of the abutting circumferential surfaces. For instance, for supplying the toner in the cartridge to the main body, the inner cylinder 18 is made to slide, as shown in Fig. 5, in the direction of arrow B while in contact with the inner surface of the outer cylinder 17. At the points of sliding D and E between the outer cylinder 17 and the inner cylinder 18, a frictional forces F act on the inner cylinder 18 in the direction of tangents as indicated by the solid line arrows, whereas reactive forces F' which are equal to but opposite to the frictional force F act on the outer cylinder 17, as indicated by broken line arrows. As a result, a moment acts on the cartridge at the sliding points D and E, about an abutment point G between the end 15a of the stopper fixed to the outer cylinder 17 and the edge 6a of the casing 6. If the distances from the abutment point G to the sliding points D and E are denoted by L1 and L2, at the sliding points D and E, the outer cylinder 17 receives moments F' x L1, and F' x L2, respectively. The difference M in the moment:

$$M = F' \times L1 - F' \times L2$$

acts on the cartridge as a rotary moment, tending to rotate the cartridge in the direction of arrow H. Actually, the sum of all the rotary moments over the entire sliding surfaces determines the net effect.

When the cartridge 3 is removed from the mounting part 4, the inner cylinder 18 is rotated in the direction of arrow C, so for a reason similar to that described above, a moment in the direction of arrow J acts on the cartridge about an abutment point I between the end 15b of the stopper 15 and the edge 6b of the casing 6.

Since the rotating members 8 and 9 of the main body 2 and the revolving members 13 and 14 of the cartridge 3 are engaged by linear grooves and projections, when a rotary moment acts, the cartridge not only rotates in the direction of arrow H or the arrow J, but also is lifted. When the cartridge 3 is lifted, toner is scattered, and the main body 2 is soiled. In order to prevent the lifting of the cartridge 3, the operator must press the cartridge 3 when he rotates the lever of the main body. This is achieved for instance by pressing the cylinder 12 with his thumb and simultaneously rotating the lever with his forefinger. If the cylinder of the cartridge 3 is pressed with the thumb, since the cylinder is thin, it is deformed, and the inner cylinder becomes difficult to rotate.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a development device in which, even when the rotary moment acts on the cartridge about abutment point G or I at the time of mounting and removal of the cartridge on and from the mounting part, the cartridge is prevented from being lifted.

In accordance with the invention, cooperating cross-shaped projections and grooves are provided on releasable rotary means at opposite ends of the cartridge and the mounting part.

In a method for mounting and removing the toner cartridge, the projection and the groove are loosely engaged at a set position, the rotary means is rotated in one direction to open the toner cartridge opening and is subsequently returned to the set position to have the projections and the grooves disengaged from each other, for removal. At the time of setting the cartridge to a position for supplying toner to the main body, lifting of the cartridge is prevented even when a lifting force acts due to the rotary moment created when the rotating members are rotated. It is therefore not necessary to press the the cartridge. Moreover, as the lifting is prevented, the scattering of the toner is prevented.

For automatic engagement and disengagement of the projection and the groove, there may further be provided a biasing member which, when the rotary means is rotated in one direction from the set position, applies a biasing force.

With this arrangement, the engagement and disengagement between the cross-shaped groove on the revolving member and the cross-shaped projection on the rotating member can be automatically achieved and can be visually confirmed. The cartridge mounting/removing mechanism is therefore easy to manipulate.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a prior art example of a mechanism for mounting and removing a cartridge.

Fig. 2 is a sectional view along line II-II in Fig. 1.

Fig. 3 is a perspective view of the main body.

Fig. 4 is a perspective view of the cartridge.

Fig. 5 is a schematic diagram for explaining the lifting.

Fig. 6A and Fig. 6B are perspective views of the main part of a first embodiment of the invention, with Fig. 6A showing the main body, and Fig. 6B showing the cartridge.

Fig. 7A to Fig. 7F are explanatory diagrams showing the process for mounting and removing the car-

tridge according to the first embodiment of the invention.

Fig. 8A and Fig. 8B are perspective views of the main part of a second embodiment of the invention, with Fig. 8A showing the main body, and Fig. 8B showing the cartridge.

Fig. 9A to Fig. 9F are explanatory diagrams for showing the process for mounting and removing the cartridge according to the second embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the invention will now be described with reference to the drawings.

First Embodiment

Fig. 6A and Fig. 6B are perspective views of elements of a first embodiment according to the invention. Fig. 6A shows the characterizing part of the main body with the right half omitted, whereas Fig. 6B shows the characterizing part of the cartridge with the right half omitted. The remaining part of the mechanism is similar to that shown in and described with reference to Fig. 1 to Fig. 5.

As in the case of the prior art, provided on each opposite end of a mounting part 4 of a main body 20 is a rotating member 21 having a pivot axis between it and a casing 6. Provided integrally with the rotating member 21 is a cross-shaped joint projection 23 projecting toward the space in which the cartridge is to be positioned when mounted.

The projection 23 comprises a longitudinal main projection 23a and a lateral auxiliary projection 23b extending at right angles with the main projection 23a and intersecting the main projection 23a at about the center of the main projection 23a.

The main projection 23a is tapered toward opposite ends thereof and has a maximum width Wmax at a position slightly ove the center in the longitudinal direction of the main projection 23a. A distance Wcg between a first pair of side walls 23c and 23g which are parallel to each other, and the distance Wdh between a second pair of side walls 23d and 23h which are parallel to each other are both equal to the maximum width Wmax of the main projection 23a.

The auxiliary projection 23b comprises a first auxiliary projection 23e and a second auxiliary projection 23f on the respective sides of the main projection 23a.

As in the case of the prior art, the cylinder 12 of the cartridge 24 comprises an outer cylinder 17 and an inner cylinder 18. Fixed to each opposite end of the inner cylinder 18 is a revolving member 25. The revolving member 25 is provided with a cross-shaped groove 26 which engages, with play, with the projection 23 on the rotating member 21 on the mounting part 4. The groove 26 comprises a main groove 26a having one open end i.e. lower end where the opening 17a is provided, and an auxiliary groove 26b extending at right angles with the main groove 26a and intersecting the main groove 26a at about the center thereof. The main groove 26a includes side walls 26c, 26d, 26g and 26h which are parallel with each other. The side walls 26c and 26g align with each other. The side walls 26d and 26h align with each other. The auxiliary groove 26b has a first auxiliary groove 26e and a second auxiliary groove 26f wider than the first auxiliary groove 26e, with its upper edge positioned above the upper edge of the first auxiliary groove 26e.

The operation will now be described with reference to Fig. 7A to Fig. 7F. Fig. 7A to Fig. 7F are diagrams showing mounting and removal of the cartridge according to the first embodiment. The solid lines illustrate the rotating member 21, while chain lines illustrate the revolving member 25.

First, the lever 22 of the rotating member 21 is rotated in the direction of arrow C as shown in Fig. 7A until it abuts against a stopper, not shown, and subsequently is returned slightly. The position of the rotating member 21 at this time is the cartridge set position. The cartridge 24 is inserted in the mounting part 4, with the axis of the cartridge 24 being held parallel with the axis of the mounting part 4, and at the same time the grooves 26 of the revolving members 25 on both ends are engaged, through their lower openings, with the projections 23 on the rotating members 21. When the cartridge 24 is substantially completely mounted in the mounting part 4, the cartridge 24 is pressed in, while rotating the lever 22 of the rotating member 21 slightly relative to the revolving member 25 in the direction of arrow C, as shown in Fig 7B. The lever 22 is returned a little in the direction of arrow B, and then the force for pressing the cartridge 24 is removed. The projection 23 on the rotating member 21 is inclined a little relative to the revolving member 25, as shown in Fig. 7C, and the first pair of the side walls 23c and 23g of the main projection 23a abut against the side walls 26g and 26d of the main groove 26a, and the first auxiliary projection 23e enters the first auxiliary groove 26e. Then, the bottom part of the outer cylinder 17 which is in contact with the shutter member 10 of the mounting part 4 receives an upward force from the bottom part of the mounting part 4, and the projection 23 and the groove 26 are therefore kept engaged (cartridge set).

Further, the rotating member 21 is rotated in the direction of arrow B as shown in Fig. 7D until it abuts against a stopper, not shown. The rotating force of the rotating member 21 causes the revolving member 25 to rotate in the direction of arrow B, via the projection 23 and the groove 26. The inner cylinder 18 which is fixed to the revolving member 25 slides while in con-

tact with the inner surface of the outer cylinder 17. The cartridge 24 tends to be lifted from the mounting part 4 by a rotary moment. However, since the first auxiliary projection 23e and the first auxiliary groove 26e are engaged, the cartridge 24 is prevented from being lifted.

The shutter member 10 fixed to the rotating member 21 shown in Fig. 6A and Fig. 6B, rotates together with the rotating member 21 in the direction of arrow B, and the opening 11 provided in the bottom part of the mounting part 4, the opening 17a of the outer cylinder 17, and the opening 18a of the inner cylinder 18 overlap each other so that a toner opening comprising the openings 11, 17a and 18a is opened, and toner in the cartridge 24 is supplied to the main body 2 (cartridge open).

For removing the cartridge 24 from the mounting part 4, the lever 22 of the rotating member 21 is rotated in the direction of arrow C as shown in Fig. 7E. First, the rotating member 21 rotates without being accompanied by the rotation of the revolving member 25. When the second pair of side surfaces 23d and 23h of the main projection 23a abut against the side walls 26h and 26c of the main groove 26a, the second auxiliary projection 23f engages with the second auxiliary groove 26f. The rotating member 21 is further rotated in the direction of arrow C, as shown in Fig. 7F, until it abuts against a stopper, not shown. The cartridge 24 tends to be lifted from the mounting part 4 because of a rotary moment. However, since the second auxiliary projection 23f and the second auxiliary groove 26f are engaged, the cartridge 24 is prevented from being lifted.

The shutter member 10 shown in Fig. 6A rotates together with the rotating member 21 in the direction of arrow C, and closes the opening 11 provided in the bottom part of the mounting part 4. The inner cylinder 18 is rotated relative to the outer cylinder 17 in the direction of arrow C, and the openings 17a and 18a are shifted relative to each other, so that there will be no overlapping, and the toner opening of the cartridge 24 is closed (cartridge close).

Finally, the lever 22 of the rotating, member 21 is rotated slightly in the direction of arrow B while pressing the cartridge 24 to the mounting part 4, to remove the force from the cartridge 24. The rotating member 21 rotates in the direction of arrow B, without being accompanied by the rotation of the revolving member 25, and the second auxiliary projection 23f is disengaged from the second auxiliary groove 26f. The projection 23 becomes parallel with the groove 26, and the cartridge 24 is pushed up by the force pushing up from the bottom part of the mounting part 4, as shown in Fig. 7A.

As a result, the cross part of the projection 23 and the cross part of the groove 26 are disengaged, and the cartridge 24 can be removed from the mounting part 4.

For removing the cartridge immediately after it is set (i.e., without bringing the cartridge to the position where the toner is supplied to the main body), the lever 22 is rotated a little in the direction of arrow C from the state shown in Fig. 7C while pressing the cartridge 24. The state shown in Fig. 7B is then achieved, and the cartridge 24 can be easily removed.

Second Embodiment

Fig. 8A and Fig. 8B are perspective views of the second embodiment according to the invention. Fig. 8A shows the characterizing part of the main body with the right half omitted, and Fig. 8B shows the characterizing part of the cartridge with the right half omitted.

The difference from the first embodiment is the structure of the rotating member 31 provided in the mounting part 4 in main body 30, and the revolving member 37 provided on opposite ends of cartridge 36. Specifically, the rotating member 31 comprises a lever 32, a cross-shaped joint projection 23 projecting toward the space where the cartridge 36 is positioned when mounted in the mounting part 4, and a spring member 33 which are formed integrally with each other. The shape of the projection 23 is identical to that of the first embodiment. The lever 32 has an inclined surface 32a, and a V-shaped recess 32b opened in the circumferential direction is provided on the inclined surface 32a. The spring member 33 comprises a longitudinal flexible part 33a and a lateral hook part 33b. The hook part 33b is in abutment with and slidable along the upper edge of a rectangular hole 35. A chamfered part 35a is provided on a lower edge of the rectangular hole 35.

The revolving member 37 of the cartridge 36 comprises a joint groove 26 engaging, with play, with the projection 23 of the rotating member 31 and a V-shaped protrusion 38 protruding from a longitudinal extension 37a extending from the outer circumference of the revolving member 37. The V-shaped protrusion 37 extends and tapers in the circumferential direction. The shape of the groove 26 is identical to that of the first embodiment.

The inclined surface 32a provided on the lever 32 of the rotating member 31 abuts against the V-shaped protrusion 38 when the cartridge 36 is mounted on the mounting part 4 and the rotating member 31 is rotated in the direction of arrow C. At this time, the spring member 33 is energized.

The operation will now be described with reference to Fig. 9A to Fig. 9F as well. Fig. 9A to Fig. 9F are explanatory diagrams showing mounting and removal of the cartridge according to the second embodiment. The solid line shows the rotating member 31, and the chain lines show the revolving member 37. As shown in Fig. 9A, the rotating member 31 is at a standstill at a position where the spring member 33

is in abutment with the upper edge of the rectangular hole 35. This position is the waiting position of the cartridge 36. With the groove 26 of the revolving member 37 being engaged with the projection 23 of the rotating member 31, the cartridge is pressed into the mounting part 4. When the cartridge 36 approaches the bottom of the mounting part 4, the V-shaped protrusion 38 of the revolving member 37 is brought to abutment with the inclined surface 32a of the lever 32 of the rotating member 31. With the insertion of the cartridge 36, the V-shaped protrusion 38 rotates the rotating member 31 in the direction of arrow C. With the hook part 33b sliding along the upper edge of the rectangular hole 35, and the flexible part 33a bending as illustrated in Fig. 9B, the spring member 33 imparts to the rotating member 31 a restoring force tending to rotate member 31 in the direction of arrow B. The V-shaped protrusion 38 of the revolving member 37 is brought to engagement with the V-shaped recess 32b of the lever 32 as shown in Fig. 9B. When the pressing force is removed from the cartridge 36, the rotating member rotates in the direction of arrow B due to the restoring force of the spring member 33. The bottom part of the outer cylinder 17 is in contact with the mounting part 4, and receives an upward force from the bottom part of the mounting part 4 thereby to be pushed up. During such a process, as described in connection with the first embodiment, and as shown in Fig. 9C, the first auxiliary projection 23e of the projection 23 is engaged with the first side groove 26e, and the first pair of the side surfaces 23c and 23g of the main projection 23a abut against the first pair of the side walls 26g and 26d of the groove 26. Concurrently therewith, the V-shaped recess 32b of the lever 32 is engaged with the V-shaped protrusion 38 of the revolving member 37, so the operator can visually confirm the completion of the setting of the cartridge 36.

Thus, by pressing the cartridge 36 into the mounting part 4 as described above, the cartridge 36 can be automatically set by the restoring force of the spring member 33.

Further, the rotating member 31 is rotated in the direction of arrow B as shown in Fig. 9D. The hook part 33b of the spring member 33 is moved along the chamfered edge 35a of the rectangular hole 35, and is separated from the rectangular hole 35, and rotates together with the rotating member 31 In the direction of arrow B. Then, the cartridge 36 tends to be pushed up (being lifted) from the mounting part 4 because of the rotary moment, but as the projection 23 and the groove 26 are engaged with each other, the pushing-up of the cartridge 36 is prevented (cartridge open). The toner in the cartridge 36 is supplied as in the first embodiment.

For removing the cartridge 36 from the mounting part 4, the rotating member 31 is first rotated in the direction of arrow C as shown in Fig. 9E. First, the rotating member 31 is rotated in the direction of arrow C without being accompanied by the rotation of the revolving member 37, and the V-shaped recess 32b of the rotating member 31 is separated from the V-shaped protrusion 38 of the revolving member 37. The second pair of the side surfaces 23d and 23h of the main projection 23a and the second pair of the side walls 26h and 26c of the main groove 26a are in abutment with each other, and the second auxiliary projection 23f is engaged with the second auxiliary groove 26f. Further, as shown in Fig. 9F, the rotating member 31 is rotated until it abuts against a stopper, not shown (cartridge closed). Then, the hook part 33b of the spring member 33 again abuts against the upper edge of the rectangular hole 35, and the flexible part 33a bends, imparting the rotating member 31 with a restoring force tending to rotate member 31 in the direction of arrow B. When the force on the lever 32 is removed, the rotating member 31 is rotated in the direction of arrow B, without being accompanied by the rotation of the revolving member 37, because of the restoring force of the spring member 33. The revolving member 37 is pushed up by the upward force from the mounting part 4, so the auxiliary projection 23f of the projection 23 is separated from the auxiliary groove 26f of the groove 26, as shown in Fig. 9A.

In addition, the cartridge 36 is automatically lifted and the operator can visually confirm that the cartridge setting is released, and removal of the cartridge 36 from the mount part 4 is facilitated.

Moreover, when it is desired to remove the cartridge 36 immediately after the cartridge setting, the lever 32 is rotated in the direction of arrow C from the cartridge set state shown in Fig. 9C, and the lever 32 is released (from the hand). Then the operation is as shown in Fig. 9C to Fig. 9B and to Fig. 9A, so that the cartridge 36 is automatically lifted. Thus, removal is facilitated.

In this embodiment, the spring and the revolving member are integral. However, a coil spring, a torsion spring or any other spring mechanism may be separately provided.

In the present embodiment, with regard to the engagement and disengagement of the cross-shaped parts of the projection and the groove, a spring is provided. Accordingly, for the cartridge setting, the cartridge is simply pressed in, and then the cartridge is automatically set. By the action of the combination of the inclined part and the V-shaped protrusion, and the confronting protrusion of the revolving member, the setting of the cartridge is further facilitated, and the completion of setting can be visually confirmed by the operator. Furthermore, during removal of the cartridge, because of the restoring force of the spring, the cartridge is lifted, so the release of the setting can be visually confirmed by the operator, and removal is facilitated. Compared with the first embodiment, the second embodiment is easier to oper-

ate.

As has been described, the mechanism for mounting and removing the toner cartridge according to the invention are suitable for use with a development device supplying toner to a photosensitive member in an electrophotographic recording apparatus, photocopiers and the like.

Claims

1. A toner development device comprising
   (a) a generally cylindrical toner cartridge (3) having a toner opening (17a, 18a) that is openable to release toner,
   (b) a body (2) including a mounting part (4) to receive the toner cartridge (3), and
   (c) releasable rotary means (13a, 14a, 8a, 8b, 9a, 9b) at opposite ends of the toner cartridge (3) and the mounting part (4) releasably to receive the toner cartridge, the releasable rotary means being rotatable to cause the toner opening of the cartridge to be opened to release toner therefrom, **characterised in that** said releasable rotary means includes cooperating cross-shaped projections and grooves (23, 26) at the opposite ends of the cartridge (3) and the mounting part (4) for positively releasably holding said cartridge (3) in axial alignment with the mounting part (4) upon said rotation of said releasable rotary means such as to inhibit the cartridge from lifting out of the mounting part upon said toner opening of the cartridge being opened to release toner.

2. A device according to claim 1 wherein the grooves (26) are disposed on revolving members (25) disposed at opposite ends of the toner cartridge and the projections (23) are diposed on rotating members (21) disposed at opposite ends of the mounting part (4).

3. A device according to claim 2 wherein the toner cartridge (3) comprises first and second coaxial cylinders (17, 18) including openings (17a, 18a), the revolving members (25) being fixed to one of the cylinders whereby upon rotation thereof the openings can be aligned to release toner from the cartridge.

4. A device according to any prceding claim including biassing means (33) for tending to cause rotation of said releasable rotary means in response to insertion of the cartridge (3) into the mounting part (4).

5. A device according to claim 4 wherein said biassing means (33) comprises spring members on said rotating members (21).

6. A device according to claim 4, further comprising means (32a, 32b, 38) responsive to insertion of the cartridge (3) for rotating the releasable rotary means in a first direction and then in a second direction opposite to the first direction, so that the releasable rotary means is brought to a predefined set position.

7. A method of mounting and removing a toner cartridge (3) of a development device (1) in which cross-shaped grooves (26) on revolving members (25) provided on opposite ends of the toner cartridge and cross-shaped projections (23) on rotating members (21) provided in opposition to each other in a toner cartridge mounting part (4) of a main body (2) are loosely engaged at a set position of the toner cartridge, the rotating members are then rotated in one direction such that the cross-portions of the grooves and cross-portions of the projections become firmly engaged with each other and such that a toner opening in the cartridge is opened to supply toner to the main body, and thereafter said rotating members are rotated in the other direction such that said rotating members are returned to said set position and the cross portions of said projections and the cross portions of said grooves can be disengaged from each other to permit removal of the cartridge.

Patentansprüche

1. Toner-Entwicklungsvorrichtung, enthaltend:
   (a) eine allgemein zylindrische Tonerpatrone (3) mit einer Toneröffnung (17a, 18a), die sich öffnen läßt, um Toner freizugeben,
   (b) einen Körper (2), der einen Befestigungsteil (4) zur Aufnahme der Tonerpatrone (3) enthält, und
   (c) eine lösbare Dreheinrichtung (13a, 14a, 8a, 8b, 9a, 9b) an einander gegenüberliegenden Enden der Tonerpatrone (3) und des Befestigungsteils (4), die lösbar ist, um die Tonerpatrone aufzunehmen, und die drehbar ist, um zu bewirken, daß die Toneröffnung der Patrone geöffnet wird, um Toner davon freizugeben, dadurch gekennzeichnet, daß die lösbare Dreheinrichtung zusammenwirkende kreuzförmige Vorsprünge und Nuten (23, 26) an den einander gegenüberliegenden Enden der Patrone (3) und des Befestigungsteils (4) enthält, zum genauen lösbaren Festhalten der Patrone (3) in axialer Ausrichtung auf den Befestigungsteil (4) auf die Drehung der lös-

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ate.

As has been described, the mechanism for mounting and removing the toner cartridge according to the invention are suitable for use with a development device supplying toner to a photosensitive member in an electrophotographic recording apparatus, photocopiers and the like.

Claims

1. A toner development device comprising
   (a) a generally cylindrical toner cartridge (3) having a toner opening (17a, 18a) that is openable to release toner,
   (b) a body (2) including a mounting part (4) to receive the toner cartridge (3), and
   (c) releasable rotary means (13a, 14a, 8a, 8b, 9a, 9b) at opposite ends of the toner cartridge (3) and the mounting part (4) releasably to receive the toner cartridge, the releasable rotary means being rotatable to cause the toner opening of the cartridge to be opened to release toner therefrom, **characterised in that** said releasable rotary means includes cooperating cross-shaped projections and grooves (23, 26) at the opposite ends of the cartridge (3) and the mounting part (4) for positively releasably holding said cartridge (3) in axial alignment with the mounting part (4) upon said rotation of said releasable rotary means such as to inhibit the cartridge from lifting out of the mounting part upon said toner opening of the cartridge being opened to release toner.

2. A device according to claim 1 wherein the grooves (26) are disposed on revolving members (25) disposed at opposite ends of the toner cartridge and the projections (23) are diposed on rotating members (21) disposed at opposite ends of the mounting part (4).

3. A device according to claim 2 wherein the toner cartridge (3) comprises first and second coaxial cylinders (17, 18) including openings (17a, 18a), the revolving members (25) being fixed to one of the cylinders whereby upon rotation thereof the openings can be aligned to release toner from the cartridge.

4. A device according to any preceding claim including biassing means (33) for tending to cause rotation of said releasable rotary means in response to insertion of the cartridge (3) into the mounting part (4).

5. A device according to claim 4 wherein said biassing means (33) comprises spring members on said rotating members (21).

6. A device according to claim 4, further comprising means (32a, 32b, 38) responsive to insertion of the cartridge (3) for rotating the releasable rotary means in a first direction and then in a second direction opposite to the first direction, so that the releasable rotary means is brought to a predefined set position.

7. A method of mounting and removing a toner cartridge (3) of a development device (1) in which cross-shaped grooves (26) on revolving members (25) provided on opposite ends of the toner cartridge and cross-shaped projections (23) on rotating members (21) provided in opposition to each other in a toner cartridge mounting part (4) of a main body (2) are loosely engaged at a set position of the toner cartridge, the rotating members are then rotated in one direction such that the cross-portions of the grooves and cross-portions of the projections become firmly engaged with each other and such that a toner opening in the cartridge is opened to supply toner to the main body, and thereafter said rotating members are rotated in the other direction such that said rotating members are returned to said set position and the cross portions of said projections and the cross portions of said grooves can be disengaged from each other to permit removal of the cartridge.

Patentansprüche

1. Toner-Entwicklungsvorrichtung, enthaltend:
   (a) eine allgemein zylindrische Tonerpatrone (3) mit einer Toneröffnung (17a, 18a), die sich öffnen läßt, um Toner freizugeben,
   (b) einen Körper (2), der einen Befestigungsteil (4) zur Aufnahme der Tonerpatrone (3) enthält, und
   (c) eine lösbare Dreheinrichtung (13a, 14a, 8a, 8b, 9a, 9b) an einander gegenüberliegenden Enden der Tonerpatrone (3) und des Befestigungsteils (4), die lösbar ist, um die Tonerpatrone aufzunehmen, und die drehbar ist, um zu bewirken, daß die Toneröffnung der Patrone geöffnet wird, um Toner davon freizugeben, dadurch gekennzeichnet, daß die lösbare Dreheinrichtung zusammenwirkende kreuzförmige Vorsprünge und Nuten (23, 26) an den einander gegenüberliegenden Enden der Patrone (3) und des Befestigungsteils (4) enthält, zum genauen lösbaren Festhalten der Patrone (3) in axialer Ausrichtung auf den Befestigungsteil (4) auf die Drehung der lös-

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baren Dreheinrichtung hin, um zu verhindern, daß die Patrone aus dem Befestigungsteil angehoben wird, wenn die Toneröffnung der Patrone geöffnet wird, um Toner freizugeben.

2. Vorrichtung nach Anspruch 1, worin die Nuten (26) an Wendegliedern (25) angeordnet sind, die an einander gegenüberliegenden Enden der Tonerpatrone angeordnet sind, und worin die Vorsprünge (23) an Drehgliedern (21) angeordnet sind, die an einander gegenüberliegenden Enden des Befestigungsteils (4) angeordnet sind.

3. Vorrichtung nach Anspruch 2, worin die Tonerpatrone (3) einen ersten und einen zweiten koaxialen Zylinder (17, 18) aufweist, welche öffnungen (17a, 18a) enthalten, wobei die Wendeglieder (25) an einem der Zylinder befestigt sind, wodurch bei deren Drehung die Öffnungen ausgerichtet werden können, um Toner von der Patrone freizugeben.

4. Vorrichtung nach einem der vorstehenden Ansprüche, mit einer Vorspanneinrichtung (33), die auf das Einsetzen der Patrone (3) in den Befestigungsteil (4) hin eine Drehung der lösbaren Dreheinrichtung zu bewirken sucht.

5. Vorrichtung nach Anspruch 4, worin die Vorspanneinrichtung (33)Federelemente an den Drehgliedern (21) aufweist.

6. Vorrichtung nach Anspruch 4, die außerdem eine Einrichtung (32a, 32b, 38) aufweist, die auf das Einsetzen der Patrone (3) reagiert, um die lösbare Dreheinrichtung in einer ersten Richtung und dann in einer zweiten, der ersten Richtung entgegengesetzten Richtung zu drehen, so daß die lösbare Dreheinrichtung in eine vorbestimmte Einsetzstellung gebracht wird.

7. Verfahren zum Befestigen und Entfernen einer Tonerpatrone (3) einer Entwicklungsvorrichtung (1), wobei kreuzförmige Nuten (26) an Wendegliedern (25), die an einander gegenüberliegenden Enden der Tonerpatrone vorgesehen sind, und kreuzförmige Vorsprünge (23) an Drehgliedern (21), die einander gegenüberliegend in einem Tonerpatronen-Befestigungsteil (4) eines Grundkörpers (2) vorgesehen sind, in einer Einsetzstellung der Tonerpatrone lose eingerückt werden, wobei die Drehglieder dann in einer Richtung gedreht werden, so daß die Kreuz-Teile der Nuten und die Kreuz-Teile der Vorsprünge fest ineinander eingerückt werden und so daß eine Toneröffnung in der Patrone geöffnet wird, um dem Grundkörper Toner zuzuführen, und wobei danach die Drehglieder in der anderen Richtung gedreht werden, so daß die Drehglieder in die Einsetzstellung zurückgedreht werden und die Kreuz-Teile der Vorsprünge und die Kreuz-Teile der Nuten auseinander ausgerückt werden können, um das Entfernen der Patrone zu ermöglichen.

Revendications

1. Dispositif de développement de toner comportant
   (a) une cartouche de toner globalement cylindrique (3) ayant une ouverture (17a, 18a) qui peut être ouverte afin de libérer du toner,
   (b) un corps (2) comprenant une partie de montage (4) afin de recevoir la cartouche (3), et
   (c) des moyens rotatifs libérables (13a, 14a, 8a, 8b, 9a, 9b) aux extrémités opposées de la cartouche de toner (3) et de la partie de montage (4) pouvant être libérés afin de recevoir la cartouche de toner, les moyens rotatifs libérables pouvant être entraînés en rotation afin d'amener l'ouverture de toner de la cartouche à être ouverte afin de libérer du toner, caractérisé en ce que lesdits moyens rotatifs libérables comprennent des saillies et des rainures de raccordement qui coopèrent (23, 26) aux extrémités opposées de la cartouche (3) et de la partie de montage (4) afin de maintenir de façon positive et libérable ladite cartouche (3) en alignement axial avec la partie de montage (4) lors de ladite rotation desdits moyens rotatifs libérables de façon à empêcher la cartouche de se soulever de la partie de montage lorsque l'ouverture de toner de la dite cartouche est ouverte afin de libérer le toner.

2. Dispositif selon la revendication 1, dans lequel les rainures (26) sont disposées sur des éléments rotatifs (25) disposés aux extrémités opposées de la cartouche de toner et les saillies (23) sont disposées sur des éléments rotatifs (21) disposés aux extrémités opposées de la partie de montage (4).

3. Dispositif selon la revendication 2, dans lequel la cartouche de toner (3) comporte des premier et deuxième cylindres coaxiaux (17, 18) comprenant des ouvertures (17a, 18a), les éléments rotatifs (25) étant fixés sur l'un des cylindres de sorte que, lors de la rotation de ceux-ci, les ouvertures peuvent être alignées afin de libérer du toner de la cartouche.

4. Dispositif selon l'une quelconque des revendica-

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tions précédentes, comprenant des éléments de rappel (33) destinés à provoquer la rotation desdits moyens rotatifs libérables en réponse à l'insertion de la cartouche (3) dans la partie de montage (4).

5. Dispositif selon la revendication 4, dans lequel lesdits moyens de rappel (33) comportent des éléments de ressort sur lesdits éléments rotatifs (21).

6. Dispositif selon la revendication 4, comportant en outre des moyens (32a, 32b, 38) qui répondent à l'insertion de la cartouche (3) afin d'entraîner en rotation les moyens rotatifs libérables dans une première direction et ensuite dans une deuxième direction opposée à la première direction, de sorte que les moyens rotatifs libérables sont amenés dans une position de mise en place prédéfinie.

7. Procédé de montage et d'enlèvement d'une cartouche de toner (3) d'un dispositif de développement (1) dans laquelle des rainures en forme de croix (26) sur des éléments rotatifs (25) prévus sur des extrémités opposées de la cartouche de toner et des saillies en forme de croix (23) sur des éléments rotatifs (21) prévus en opposition l'un à l'autre dans une partie de montage (4) de cartouche de toner d'un corps principal (2) sont engagées de façon libre dans une position déterminée de la cartouche de toner, les éléments rotatifs sont alors entraînés en rotation dans une direction de telle sorte que les parties en croix des rainures et les parties en croix des saillies sont fermement engagées l'une avec l'autre et de telle sorte qu'une ouverture de toner dans la cartouche est ouverte afin d'amener le toner vers le corps principal, et lesdits éléments rotatifs sont ensuite entraînés en rotation dans l'autre direction de telle sorte que lesdits éléments rotatifs sont ramenés vers ladite position déterminée et les parties en croix desdites saillies et les parties en croix desdites rainures peuvent être désengagées l'une de l'autre afin de permettre l'enlèvement de la cartouche.