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[54] **TONER SUPPLY MEANS FOR ELECTROSTATIC REPRODUCING MACHINE**

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[51] **Int. Cl.** **B67d 5/64**

[58] **Field of Search** ..... 222/199, 221, DIG. 1, 222/196, 160, 161, 167, 222, 223, 414, 199, 168, 169, 350, 202, 203, 228, 226, 233, 333; 221/201, 204; 118/637

[56] **References Cited**

UNITED STATES PATENTS

3,596,807	8/1971	Hudson	222/DIG. 1
3,448,724	6/1969	Chawda et al.	118/637

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Assistant Examiner—James M. Slattery
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[57] **ABSTRACT**

A means for supplying toner to a developer tank by giving an impulsive change to the air pressure in a disposable toner container which impulsive changes generated by striking a side surface of the container with a hammering member, said container being usually provided with a discharge mouth consisting of a plurality of small exit holes.

3 Claims, 3 Drawing Figures

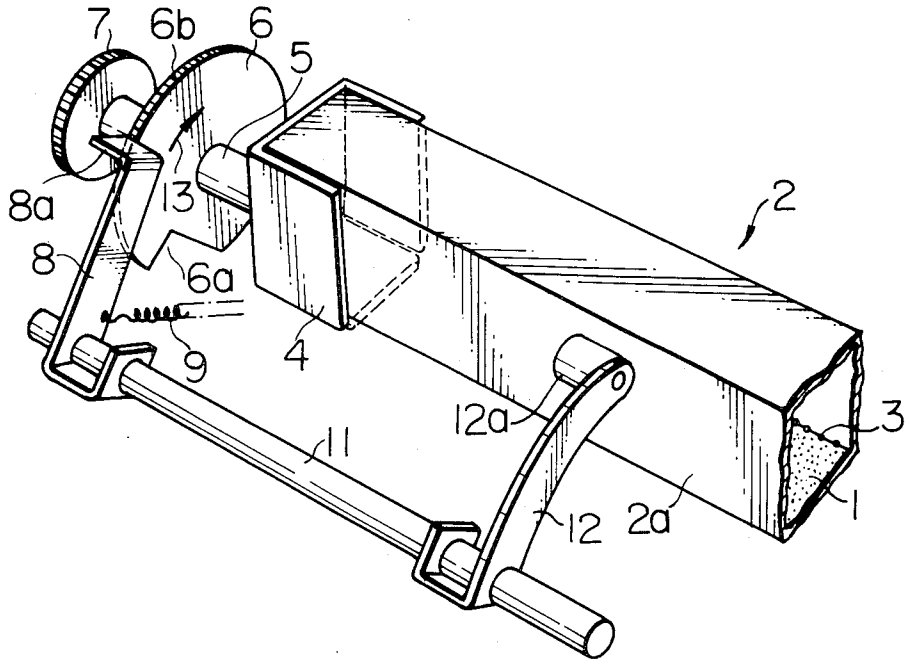


Fig. 1

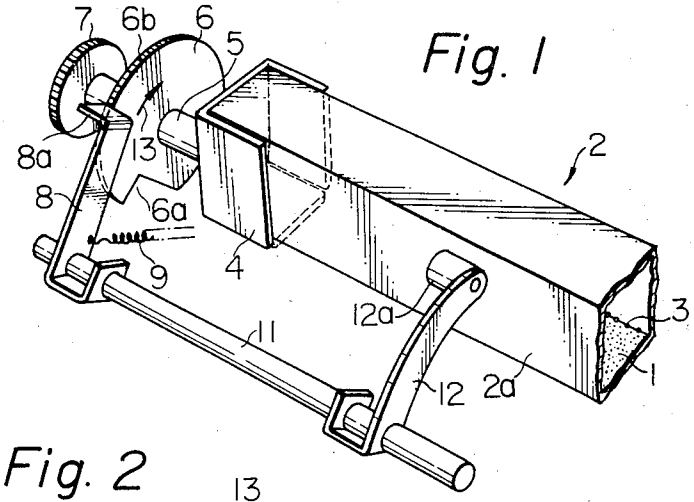


Fig. 2

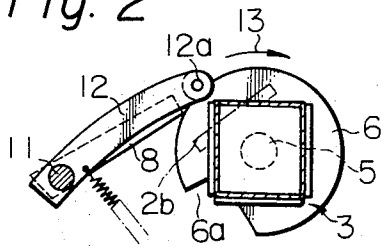
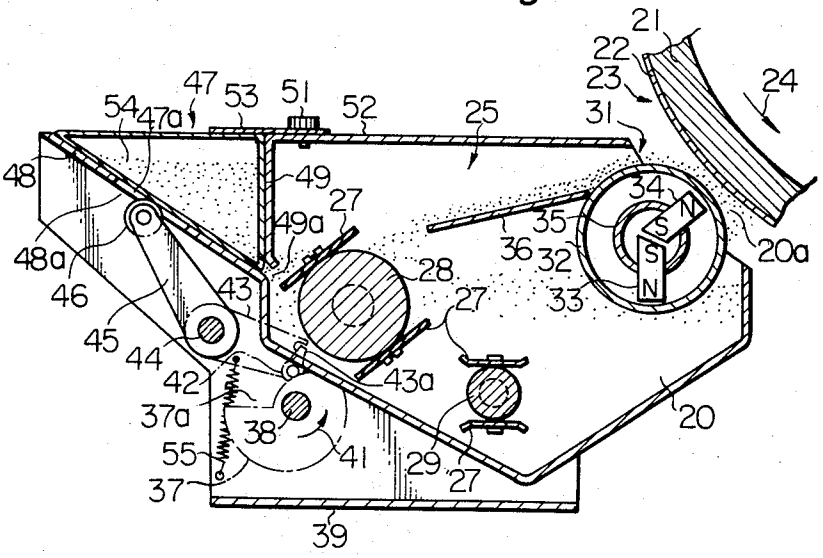


Fig. 3



TONER SUPPLY MEANS FOR ELECTROSTATIC REPRODUCING MACHINE

The present invention relates to a toner supply means for an electrostatic reproducing machine.

Dry type developer consists of so-called toner particles and proper carrier particles. The toner particles are prepared by uniformly dispersing a pigment such as carbon black, and a dispersoid and the like into a low melting point thermoplastic resin and pulverising the particles to the order of 1 to 10 microns. The proper carrier is iron particles in the case of the magnetic brush method, glass beads in the case of the cascade developing method and fur brush in the case of the fur brush developing method. Such developer particles are usually supplied upon the electrostatic latent image of a photosensitive member repeatedly and adhered to the latent image to form particle images. Therefore, the density of toner particles is gradually decreased and so a means for supplying toner particles becomes necessary.

Hitherto, as means to supply toners to a developer of a decreased density, a slit type opening was provided at the bottom of a toner housing hopper, and a rotatable roller provided at the opening portion in order to prevent the dropping of toner said roller being properly rotated, when necessary, to discharge toner to the outside of the hopper.

When the toners in the hopper are decreased, toner must be supplied to the hopper through the hand of an operator. In that case, toner consisting of small particles is often splashed thereabouts to spoil the surroundings. So, its handling must be effected carefully and it is very troublesome. As the particle size of the toner is in the order of 1 to 10 microns, toner particles are liable to coagulate or they are unremovably deposited upon the roller **13** to black the toner discharge mouth. As a result, the coagulated particles become hard to drop into the developer tank.

A major object of the present invention is to provide a means for supplying toner to a developer tank by giving an impulsive change to the air pressure in a disposable container which is generated by striking a side surface of the container with a hammering member, said container is usually provided with a discharge mouth consisting of a plurality of small holes and in the case of using said container, it is mounted to a developer tank with its discharge mouth opened.

The present invention will be explained hereunder with reference to the embodiments shown in the figures.

FIG. **1** denotes a perspective view of a toner supply means illustrating an embodiment of the present invention.

FIG. **2** denotes a side view illustrating the working condition of the means shown in FIG. **1.**

FIG. **3** denotes a cross sectional view of a toner supply means illustrating another embodiment of the present invention.

In FIG. **1,** along one edge of a toner **1** containing container **2,** there is provided a dishcharge mouth **3** consisting shaft are a plurality of members holes. Both ends of the container are removably mounted to a holder **4.** Each side surface **2***a* of the container **2** is made of an elastic member such as a sheet of paper, plastics or a thin metal plate so that when when an side surface is struck by a hammer, the side surface is deformed to a certain degree and recovers its original state when the hammer has left the surface.

On a shaft **5** to which a holder **4** is fixedly mounted, there are mounted a working cam **6** provided with a notched protion **6**a and a gear **7.** Against the peripheral surface **6**b of the working cam **6,** a bent piece **8**a which is provided at the free end of a follower lever **8** is pressed. This pressing force is given by an elastic spring **9,** one end of which is mounted to the follower lever **8** and the other end is mounted to a fixed member not shown in the drawings.

To the bottom of the follower lever **8,** there is fixed a shaft **11,** both ends of the shaft journaled in fixed member not shown in the drawings. To the shaft **11,** there is mounted a hammering member **12** which is provided with a hammer **12***a* at its free end. The gear **7** is connected to a drive means not shown in the drawings and when approriate order for supplying toner to the drive means is given, the gear **7** and the working cam **6** rotate in the direction shown by an arrow **13.**

When the density of the toner in developer tank **2** which supplies toner upon an electrostatic latent image is decreased, a start switch is operated for a drive means in order to rotate the working cam **6** and the container **2** in the direction of arrow **13** for a proper period. While the free end **8***a* of the follower lever **8** is pressed against the peripheral surface **6***b* of the working cam **6** as seen in FIG. **1,** the free end **12***a* of the hammering member **12** is in a condition separated from the adjacent side surface and edge of the container **2** as seen in FIG. **2.** When the working cam **6** is rotated in the direction of arrow **13** and the bent piece **8***a* of the follower lever **8** is suddenly dropped into the notched portion **6***a* of the working cam **6** through elastic force of the spring **9,** the hammering member **12** which operates substantially integrally with the follower lever **8** rotates in the clockwise direction in FIG. **2.** In FIG. **2,** just before the free end **8***a* of the follower lever **8** drops into the notched portion of the working cam, the toner discharge mouth **3** of the container **2** is positioned low the shaft **5** and a side surface or side plate **2***a* is positioned in a position shown by a phantom line **2**b, facing to the hammer **12***b* of the hammering **12.** As a result, the hammer **12***a* strikes a side plate **2**of the container upon the bent piece **8***a* of the follower lever **8** dropping into notched portion **6***a* of the working cam **6.**

When the container **2** is struck by the hammering member. **12** and its side surface **2***a* is deformed to a certain degree, the internal capacity of the container **2** is decreased mementarily and the air pressure in the container **2** is changed. As the change is generated impulsively, a certain amount of air in the container is discharged with pressure through the discharge mouth **3.** At the discharge time of the air, a portion of toner **3** consisting of small particles is discharged from the container and supplied to the developer tank.

As the bent piece **8***a* of the follower lever **8** drops into the notched portion **6***a* of the working cam **6** whenever the cam **6** rotates one revolution, the container **2** is struck by the hammering member **12** to discharge toner to the outside of the container whenever the discharge mouth **3** comes below the shaft **5.** When a desired quantity of toner **3** is supplied to a developer tank, it is sufficed to suddenly stop the drive means for driving the working cam **7.** Further, the drive means for rotating the working cam **6** may be controlled properly by an operator by examining the densiIy of an image upon

a copy sheet or the start and stop of the drive means may be controlled by sensing the descrease of toner density in the developer by a density detector.

FIG. 3 is a side sectional view of a toner supply means which shows another embodiment of the present invention, wherein a photosensitive drum 23 consisting of a photosensitive plate 22 made of a thin layer of an amorphous selenium overcoated on the surface of a metal base 21 (for example, an aluminum plate) is mounted so as to rotate in the direction of an arrow 24. When the photosensitive plate is previously positively charged and is exposed to light corresponding to an original, the resistivity of the selenium is decreades corresponding to the received quantity of light to discharge the electric charge and an electrostatic latent image corresponding to the light image is formed upon the selenium surface. When developer 20 consisting of negatively charged toner or iron particles is caused with a positively charged electrostatic latent image, toner is adhered to the electrostatic latent image to visualize the image. When this visible image is transferred to a copy sheet and fixed thereon by heating, a copy corresponding to an original is obtained.

In FIG. 3 there are provided mising rollers 28, 29 having mixing plates 27 for mixing the developer 20 from container 47 in the interior of a developer tank 25 and the tank is further provided with a cylindrical body ruler 32 which supplies the developer for development at opening portion 31 of the developer tank 25. These rollers are connected by a chain not shown in the drawings so as to rotate in the counter clockwise direction. The peripheral surface of the cylindrical body 32 is close to the photosensitive plate 22 as shown in the drawing, and in the interior of the cylindrical body roller 32, there are positioned magnets 33 and 34. Both end portions of shaft 35 which is fixed to the bottom of both magnets are fixed to both side plates of the developer tank 25.

In the peripheral surface of the cylindrical body roller 32, channels are cut parallel to its axis. When developer 20 adhered to said channels by magnets 33 comes to the vicinity of magnet 34 through the counter clockwise rotation of the cylindrical body roller 32, developer 20*a* including iron particles contact with photosensitive plate 22 as shown in the drawing. However, the iron particles are held on the surface of roller 32 by magnet 34. As a result, only toner is supplied to an electrostatic latent image on the photosensitive plate 22 and the latent image is visualized. The iron particles from developer 20a which has supplied toner to the photosensitive plate are fed to a mixing roller 28 by a guide plate 36 arranged with its side edge at the peripheral surface of the cylindrical body 32 to be mixed with more toner from container 47.

A working cam 37 for supplying toner to the interior of the developer tank 25 is fixed to a shaft 38, with both end portions journaled to side plates 39 of the developer tank 25 so as to rotate in the direction of an arrow 41. A roller 42 is pressed against the peripheral surface of the working cam 37 and the shaft of the roller 42 is set in one of the comb shaped channels provided at the free end of a follower lever 43. A shaft 44 to which the follower lever 43 is fixed is journalled to side plates 39 and a hammering member 45 is fixed to this shaft 44. A roller 46 provided at the free end of the hammering member 45 contacts a side plate 47a of the container 47. The container 47 is set in a compartment made of a slant plate 48 and a wall plate 49, with its upper surface is pressed by a fixed plate 53 which is mounted upon an upper plate 52 of compartment 25 by a fixed screw 51. A notch 48*a* is provided at a portion of the slant plate 48 to expose a portion of side plate 47*a* of the container 47 and a toner supply mouth 49*a* is provided at the bottom of wall plate 49. At the lower edge of the container, there is provided a discharge mouth for discharging toner 54 to the outside of the container. This discharge mouth corresponds to the discharge mouth 3 of the container 2 shown in the embodiment of FIG. 1.

The follower member 43 is given a rotational bias in the clockwise direction around the shaft 44 by the elasticity of an elastic spring 55 which is engaged at one end with side plate 39 and at another end with a follower member 43.

When the toner density of the developer in the developer tank 25 is decreased, the working cam 37 may be rotated in the direction of arrow 41 by giving a working order to a drive means not shown in the drawings. By this rotation, the roller 42 will be raised gradually, the follower member 43 rotates in the counter clockwise direction and charges the spring 55. When the roller 42 comes close to the notched portion 37*a* of the working cam 37, the roller 46 of the hammering member 45 is in a position which is considerably remote from the side plate 47*a* of the container 47. Then the follower member 43 and the hammering member 45 are rotated rapidly in the clockwise direction by the spring 55 upon the roller 42 dropping into the notched portion, so that the roller 47a of the hammering member strikes the side plate 47a of the container 47. By this hammering action, the toner 45 in the container 47 is discharged through the discharge mouth not shown in the drawings into the developer tank 25 as in the case of the embodiment shown in FIG. 1. This hammering action is effected once whenever the working cam 37 rotates one revolution and discharges the toner to the outside of the container. When the toner 54 in the container 47 is exhausted, the emptied container 47 is taken out and a new container filled with toner is replaced.

When the hammering force of the hammering member 45 striking the container 47 is too strong and the quantity of the discharged toner is too much, the roller 42 may be set in a channel at the upper portion. Now, supposing that the roller 42 is moved from the position shown in the drawing to the upper channel 43*a* of the follower member, then the roller 42 will be set in the direction of leaving from the peripheral surface of the working cam. Therefore, when the working cam 37 rotates in the direction of arrow 41 and the roller 42 comes close to the notched portion, the distance between the roller 46 of the hammering member 45 and the side plate 47*a* becomes small. As a consequence, the charged quantity of the spring becomes small, and the hammering force of the hammering member is decreased. Therefore, the amount of the discharged toner is also decreased. Further, when the container 47 is fixed as shown in FIG. 3, the toner in the vicinity of the discharge mouth is easily discharged to the outside of the container, while the toner remote from the discharge mouth is liable to be coagulated since the toner consists of small particles. Therefore, a cavity is often formed in the vicinity of the discharge mouth. After a portion of air is discharged from the discharge mouth by striking a side plate of the container, air flows into

the container through the discharge mouth. Therefore, the occurence of the above mentioned coagulation of toner is prevented.

In accordance with the present invention, toner is housed in a disposable container which is removably mounted in the vicinity of a developer tank and the toner is supplied to the developer from a discharge mouth of the container by striking the side surface of the container, if necessary. The supply of toner to a reproducing machine may be effected simply and swiftly, the toner contamination of the surroundings of a reproducing machine is prevented.

What is claimed is:

1. Toner supply means for supplying toner to the developer tank of an electrostatic reproducing machine comprising:

a. a removable container containing toner and having a discharge mouth defined by a plurality of small discharge holes for discharging toner;

a pivotable hammering member positioned adjacent a side surface of the container;

c. means for biasing said hammering member for pivoting in the direction of said side surface;

d. control means for pivoting said hammering member agsinst the action of said biasing means and releasing it to permit the hammering member to be pivoted by said biasing means to strike said surface of the container discharging toner therefrom;

e. follower means connected to said hammering member for pivoting therewith;

f. rotatable cam means having a surface which pivots said follower means against the action of said biasing means and with a notched portion permitting the follower means to be pivoted by said biasing means causing said hammering member to strike said container;

g. a rotatable shaft having said container and said cam means mounted thereon for rotation therewith.

2. Toner supply means for supplying toner to the developer tank of an electrostatic reproducing machine comprising:

a. a removable container containing toner and having a discharge mouth defined by a plurality of small discharge holes for discharging toner;

a pivotable hammering member positioned adjacent a side surface of the container;

c. means for biasing said hammering member for pivoting in the direction of said side surface;

d. control means for pivoting said hammering member against the action of said biasing means and releasing it to permit the hammering member to be pivoted by said biasing means to strike said surface of the container discharging toner therefrom;

e. follower means connected to said hammering member for pivoting therewith;

f. rotatable cam means having a surface which pivots said follower means against the action of said biasing means and with a notched portion permitting the follower means to be pivoted by said biasing means causing said hammering member to strike said container; and

g. a pivotable shaft having said hammering member and said follower means mounted thereon for pivoting therewith.

3. Toner supply means for supplying toner to the developer tank of an electrostatic reproducing machine comprising:

a. a removable container containing toner and having a discharge mouth defined by a plurality of small discharge holes for discharging toner;

b. a pivotable hammering member positioned adjacent a side surface of the container;

c. means for biasing said hammering member for pivoting in the direction of said side surface;

d. control means for pivoting said hammering member against the action of said biasing means and releasing it to permit the hammering member to be pivoted by said biasing means to strike said surface of the container discharging toner therefrom;

e. follower means connected to said hammering member for pivoting therewith and adjustable in position with respect to said hammering member to vary the striking force of said hammering member against said side surface of the container;

f. rotatable cam means having a surface which pivots said follower means agsinst the action of said biasing means and with a notched portion permitting the follower means to be pivoted by said biasing means causing said hammering member to strike said container.

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