

[54] **APPARATUS FOR DISPENSING XEROGRAPHIC TONER PARTICLES**

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[58] Field of Search **222/367, 406, 407, 410, 222/414, DIG. 1; 74/22, 23, 24**

References Cited

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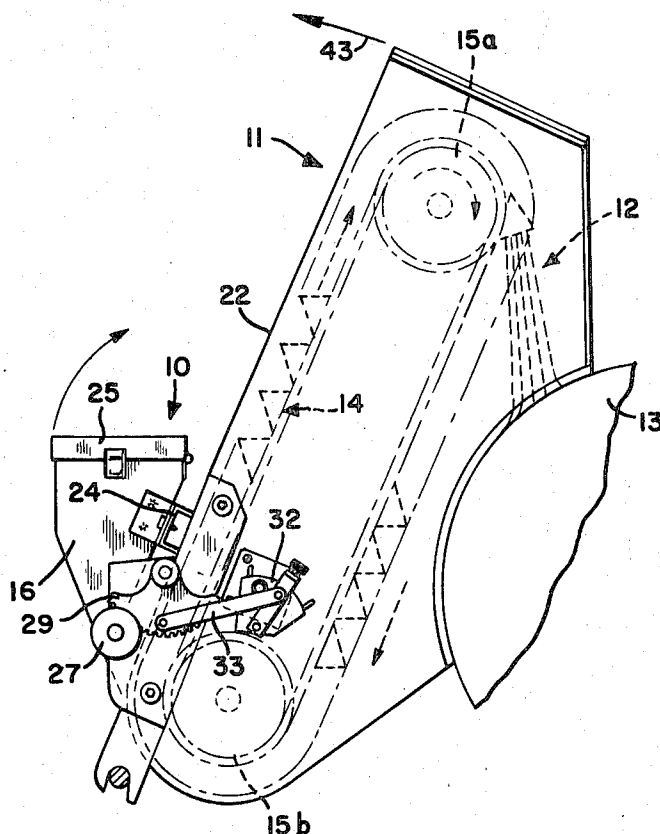
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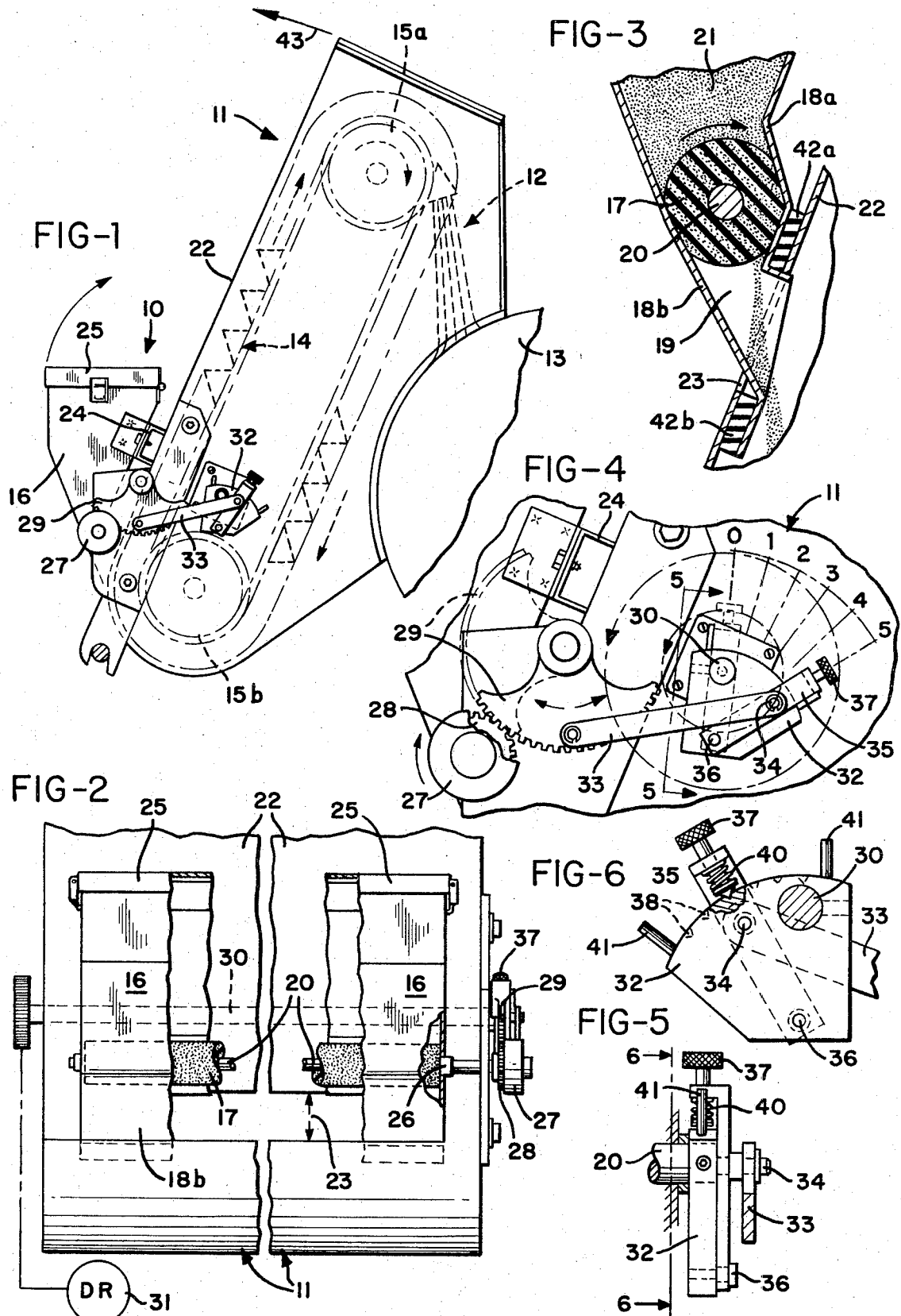
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ABSTRACT

There is disclosed dispensing apparatus for xerographic toner particles wherein the toner is stored in a hopper having a pair of converging walls which define a dispensing aperture along the lower extent thereof. A resilient dispensing roll having a porous surface is fitted snugly between the converging walls and is rotated by a gear and clutch arrangement. As the dispensing roll rotates, toner particles are picked up in the interstices thereof and metered out through the dispensing aperture. Thereafter the toner particles are picked up by a conventional belt and bucket assembly and cascaded over a xerographic drum. The drive for the dispensing roll is provided by a rotating shaft upon which a drive plate is fastened. Rotary motion of the drive plate moves one end of a link which is pivotally mounted thereon, and the link in turn provides an oscillating drive for a segment gear. The segment gear drives a one directional clutch which provides a stepped unidirectional drive for the dispensing roll. the step size for the dispensing roll drive may be adjusted by adjusting the pivotal attachment point of the link relative to the drive plate.

5 Claims, 6 Drawing Figures





APPARATUS FOR DISPENSING XEROGRAPHIC TONER PARTICLES

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation of Ser. No. 345,732, filed Mar. 28, 1973 now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to dispensing apparatus for xerographic toner particles. Such dispensing apparatus is used to meter toner particles into the developer chassis of a xerographic copier. Inside the developer chassis are provided means for mixing the metered toner particles with developer beads and cascading this mixture over a xerographic drum upon which is carried an image in the form of a distributed electrostatic charge. For proper operation of the copier it is important that the toner particles be uniformly and accurately metered, and this metering or dispensing of the toner particles is a common cause of operating problems.

A typical prior art dispenser comprises a hopper which supplies toner particles to an oscillating grid structure for gravity feeding into the region wherein mixing with the developer beads is accomplished. Such prior art dispensers are able to dispense toner particles automatically at a preselected rate, but the actual delivery rate of the particles may vary considerably about the selected rate thereby resulting in poor print reproduction.

Another problem with such prior art dispensers is encountered during the refilling thereof. The hopper has a bottom opening which may be blocked by a sliding slat. For refilling, this opening is blocked, and the hopper is removed from the developer chassis and refilled. Thereafter the hopper is replaced in the developer chassis and the bottom slat is withdrawn to dump toner particles from the hopper to the grid structure. During slat withdrawal toner particles migrate to the outside, thereby dirtying the working area and the operator as well.

SUMMARY OF THE INVENTION

This invention provides improved dispensing of xerographic toner particles by using a resilient porous dispensing roll. The dispensing roll is fitted inside a supply hopper against a longitudinally extending aperture therein. A supply of toner particles is maintained within the hopper, and some of the particles enter into the interstices of the dispensing roll. Such particles are thereupon dispensed outside the hopper by rotating the dispensing roll.

In preferred embodiment the dispensing aperture is defined by a pair of converging walls along the lower extent of the hopper, and the dispensing roll is snugly fitted between these walls. Furthermore, the roll is unidirectionally rotated in small steps, and a gear and clutch arrangement are provided for this purpose.

Accordingly it is an object of this invention to provide improved apparatus for dispensing xerographic toner particles into a region from which they may be mixed with developer and thereafter cascaded over a rotating xerographic drum. Other and further objects of the invention will be apparent from the following description the accompanying drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side elevation view of a developer chassis with toner dispensing apparatus attached thereto;

FIG. 2 is a partially cut away front elevation view of the apparatus of FIG. 1;

FIG. 3 is an enlarged side elevation section of a dispensing roll in its operating position within a hopper;

FIG. 4 illustrates driving apparatus for a dispensing roll;

FIG. 5 is an enlarged view taken along lines 5—5 of FIG. 4 and illustrates a portion of the driving apparatus as adjusted to the number 0 position; and

FIG. 6 is a view taken along lines 6—6 of FIG. 5, but with the illustrated apparatus in the number 3 position.

DESCRIPTION OF PREFERRED EMBODIMENTS

A preferred embodiment of the invention is illustrated in FIG. 1 as comprising dispensing apparatus 10 removably attached to a developer chassis 11. As further shown in FIG. 1, apparatus within developer chassis 11 dispenses a mixture of toner particles and developer beads as at 12 for cascading flow over the surface of a xerographic drum 13. The toner particles are first dispensed by dispensing apparatus 10 into the lower portion of chassis 11 where they are mixed with developer beads. The mixture then is scooped up by a belt and bucket assembly 14. Belt and bucket assembly 14 carries the mixture upwardly over wheel 15a at which point it is dumped out to form the cloud 12. The emptied buckets then continue downwardly around wheel 15b at which point they pick up a new supply of the developing mixture. The developer chassis and the belt and bucket assembly as above described may be of the type utilized in copiers sold by Xerox Corporation of Rochester, New York under the trademark 1824.

The toner particles are stored in a hopper 16 and dispensed by a dispensing roll 17 as shown in detail in FIG. 3. Along its lower extent hopper 16 comprises an upper wall 18a and a lower wall 18b which converge to define a dispensing aperture 19. Dispensing roll 17 is made of a resilient porous material such as urethane sponge, and is mounted on a shaft 20 for snug fitting against aperture 19. The diameter of roll 17 is larger than the width of aperture 19 so that roll 17 is in a state of continuous compression. The upper surface of dispensing roll 17 is in contact with a supply of toner particles 21, and some of these particles enter the interstices of the roll 17. As roll 17 rotates, these particles are dispensed into aperture 19 for accurately metered delivery into chassis 11.

Front wall 22 of chassis 11 is provided with a slot 23 into which dispensing apparatus 10 is inserted. The dispensing apparatus is removably mounted in place as by a bracket assembly 24, and hopper walls 18a and 18b rest against a pair of rubber pads 42a and 42b so as to prevent leakage of toner particles outside the dispensing apparatus. Further, hopper 15 has a sealed cover 25, and dispensing roll 17 extends the full length of aperture 19 as shown in FIG. 2. This simplifies toner replenishment and eliminates toner loss when chassis 11 is pivotally opened (in direction of the arrow 33) for routine maintenance or the like.

Dispensing roll shaft 20 is journaled into nylon bearings 26 at the end walls of hopper 16. Shaft 20 is driven stepwise by a one-way clutch 27, and clutch 27 is

driven by a gear 28. Gear 28 provides clutch 27 with an oscillating two-directional rotary drive, and clutch 27 converts this to a stepped one directional rotational drive for dispensing roll 17.

The main input drive member for the dispensing apparatus of this invention is a drive shaft 30. Drive shaft 30 is driven by the drive for the belt and bucket assembly 14 or other convenient drive means as shown generally at 31.

There is a plate 32 mounted fast on shaft 30 for rotation therewith (see FIG. 4). A drive link 33 is pivotally mounted with respect to plate 32 so that the one end of the link moves in a circular path about the axis of shaft 30. The other end of link 33 is pivotally attached to sector gear 29 as illustrated. Thus when shaft 30 rotates, an oscillating two-directional rotary motion is applied to sector gear 29. Sector gear 29 transmits this motion to the clutch drive gear 28.

It will be appreciated that in the course of operating a xerographic copying machine, different rates of toner particle dispensing may be required. In accordance with the practice of this invention, the rate of toner particle dispensing is adjusted or altered by changing the size of the rotary steps taken by the dispensing roll 17. Thus there are provided means for adjusting the pivotal mounting point of link 33 with respect to plate 32. As shown in detail in FIG. 6, link 33 is pivotally attached to a bracket 35 as at 34. Bracket 35 is pivotally mounted on plate 32 as at 36 and is adjustably secured in place by means of a locking pin 37 configured for engagement with any of several detents 38 along the arc shaped edge of plate 32. A compression spring 40 locks pin 37 in place, and stop pins 41 limit the adjusting movement of bracket 35. As shown in FIG. 6, bracket 35 is secured at position number 3.

During normal operation of the copy machine, bracket 35 is secured in place at any selected one of the different illustrated locking positions, and this setting controls the distance between the pivot point 34 and the axis of shaft 30. For instance, when locking pin 37 locks bracket 35 into position 0 as shown in FIG. 5 and in phantom lines on FIG. 4, pivot point 34 is directly in line with the axes of shaft 30. In this position rotation of shaft 30 produces no movement of the link 33. Thus there is no oscillation of the sector gear 29, and the step size for dispensing roll 17 is zero degrees.

For adjustment of bracket 35 to position 5 as shown in FIG. 4, the distance between pivot point 34 and the axis of shaft 30 is maximum, so that rotation of shaft 30 imparts maximum movement to the link 33 and maximum oscillation to the sector gear 29. Under these conditions the step size for dispensing roll 17 is maximum and may be in the order of one complete revolution. Adjustment of the bracket 35 to other intermediate positions will produce other step sizes and other rates of delivery of toner particles into developer chassis 11. Thus the toner dispenser meters the toner particles accurately over the complete dispensing speed range from OFF to maximum. This eliminates under toned and over toned copies and greatly reduces toner waste.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be

made therein without departing from the scope of the invention.

What is claimed is:

1. Dispensing apparatus for xerographic toner particles comprising:
 - a supply hopper for said toner particles, said hopper being provided along the lower portion thereof with a longitudinally extending dispensing aperture,
 - a resilient dispensing roll fitted inside said hopper to cover said aperture, said dispensing roll having a porous surface and a diameter greater than the width of said aperture, and
 - drive means for rotating said dispensing roll to carry said particles through said aperture; said drive means comprising an input drive shaft, a drive plate mounted fast on said shaft, a drive link pivotally mounted with respect to said drive plate, a gear mounted for driving by pivotal connection to said link whereby rotary motion of said drive shaft produces oscillating two directional rotation of said gear, and a clutch driven by said gear and connected for stepwise one directional rotational of said dispensing roll.
2. Apparatus according to claim 1 further comprising means for adjusting the pivotal mounting point of said link with respect to said plate and thereby altering the size of the steps comprising said stepwise drive.
3. Apparatus according to claim 1 said dispensing aperture being defined by a pair of converging walls and said dispensing roll being fitted against both of said walls.
4. Apparatus according to claim 3, the length of said dispensing roll being equal to the length of said hopper for covering said aperture along the entire extent thereof.
5. Dispensing apparatus for xerographic toner particles comprising:
 - a supply hopper for said toner particles, said hopper having a pair of converging walls for defining a longitudinally extending dispensing aperture along the lower portion thereof,
 - a resilient dispensing roll mounted inside said hopper for blocking said aperture, said dispensing roll having a porous structure for receiving particles of toner stored within said hopper,
 - a drive shaft,
 - a drive plate mounted fast on said shaft,
 - a drive link pivotally mounted with respect to said drive plate,
 - means for adjusting the pivotal mounting point of said link with respect to said plate,
 - a gear mounted for driving by pivotal connection to said link whereby rotary motion of said drive shaft produces oscillating two directional rotation of said gear, and the magnitude of said oscillation is determined by aforesaid adjustment of said pivotal mounting point, and
 - a clutch driven by said gear and connected for one directional rotation of said dispensing roll in stepwise fashion with steps of magnitude related to the magnitude of aforesaid two directional oscillation of said gear.

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