

Dec. 20, 1960

J. RUTKUS, JR., ET AL
XEROGRAPHIC TONER DISPENSER

2,965,266

Filed April 30, 1958

3 Sheets-Sheet 1

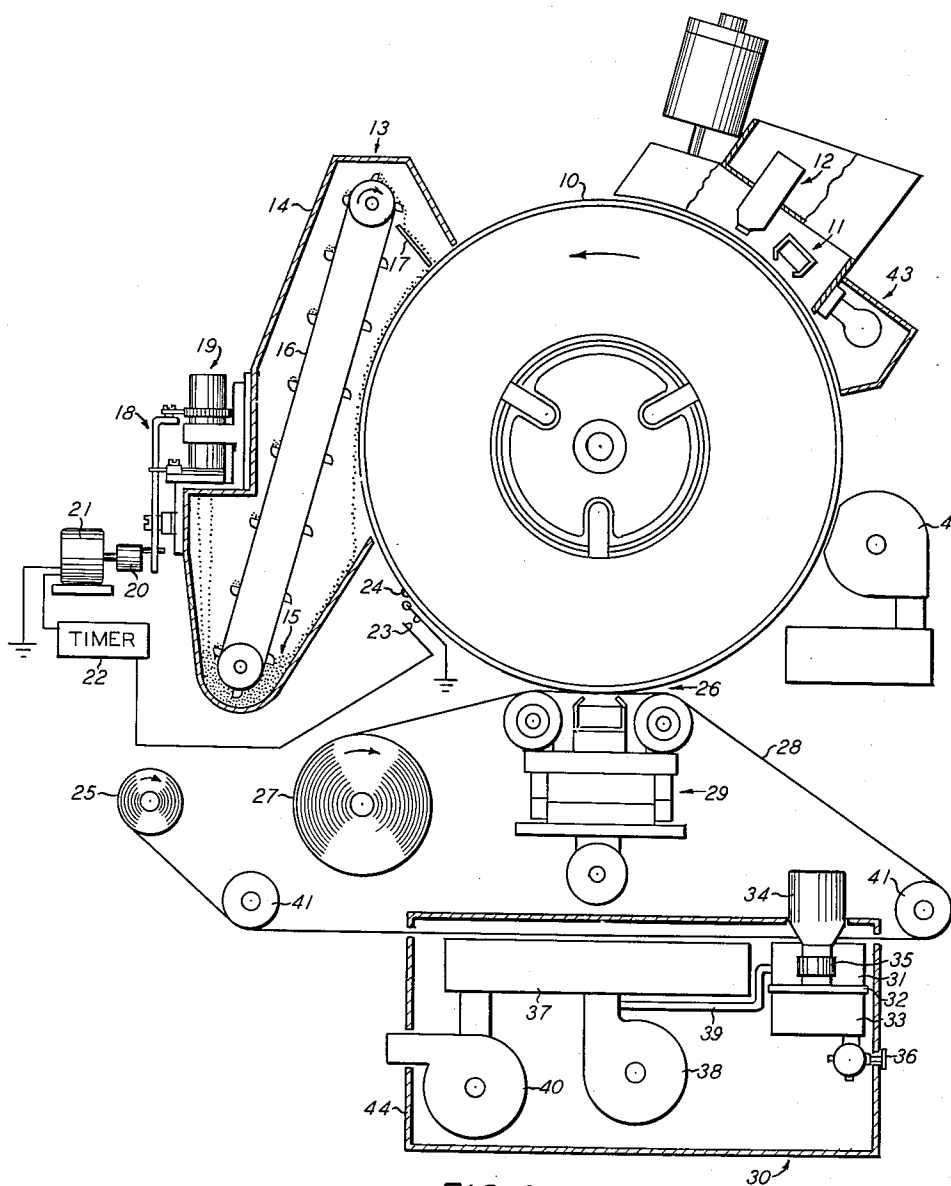


FIG. 1

INVENTOR.

John Rutkus, Jr.

BY

Donald W. Shepardson

Bernard J. Wolfe

Donald W. Shepardson
ATTORNEY

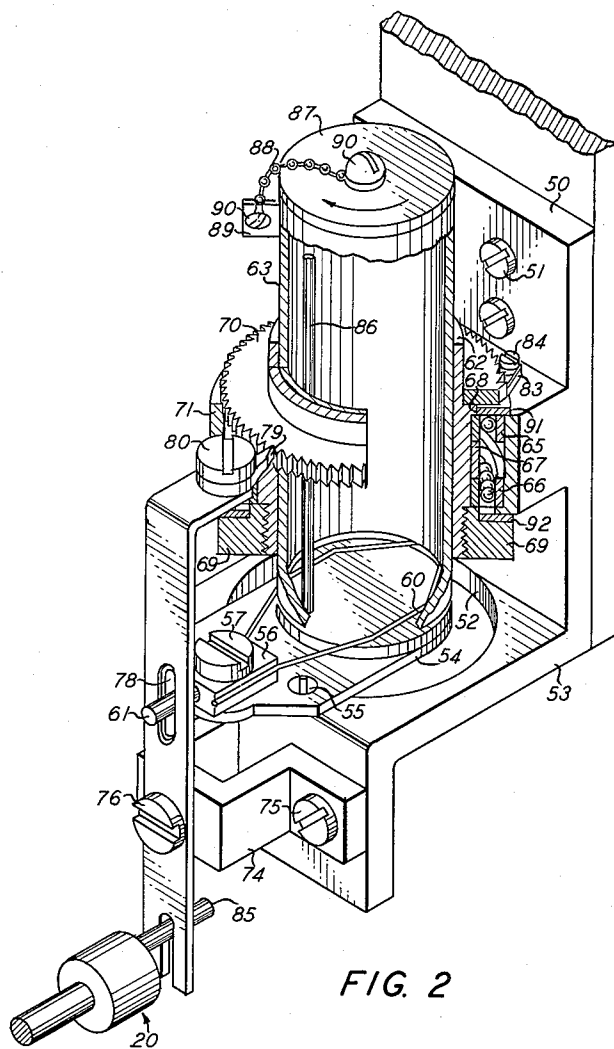
Dec. 20, 1960

J. RUTKUS, JR., ET AL
XEROGRAPHIC TONER DISPENSER

2,965,266

Filed April 30, 1958

3 Sheets-Sheet 2



INVENTOR.
John Rutkus, Jr
Donald W. Shepardson
Bernard J. Wolfe
BY *Donald W. Shepardson*
ATTORNEY

Dec. 20, 1960

J. RUTKUS, JR., ET AL
XEROGRAPHIC TONER DISPENSER

2,965,266

Filed April 30, 1958

3 Sheets-Sheet 3

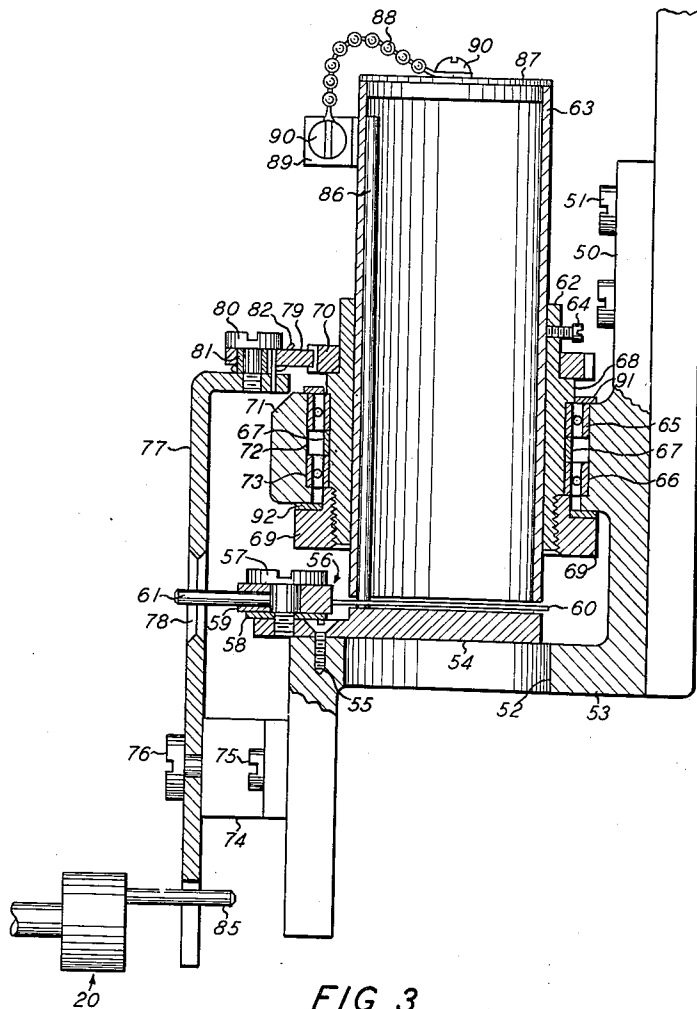


FIG. 3

INVENTOR.
John Rutkus, Jr.
BY Donald W. Shepardson
Bernard J. Wolfe
Donald W. Shepardson
ATTORNEY

1

2,965,266

XEROGRAPHIC TONER DISPENSER

John Rutkus, Jr., Penfield, and Donald W. Shepardson and Bernard J. Wolfe, Rochester, N.Y., assignors to Haloid Xerox Inc., Rochester, N.Y., a corporation of New York

Filed Apr. 30, 1958, Ser. No. 731,980

6 Claims. (Cl. 222—70)

This invention relates to improvements in apparatus for dispensing powder or granulated material and, particularly, to improvements in xerographic toner dispensing apparatus.

More specifically, the invention relates to an improved toner dispenser that is particularly adapted for use in a xerographic developing apparatus wherein, in order to develop the electrostatic latent image formed on a xerographic plate, it is required to dust the image with a developer powder, whereby the powder particles are selectively attracted to the charged areas of the plate to form a visible powder particle image of the electrostatic latent image.

In the process of xerography, for example, as disclosed in Carlson Patent 2,297,691, issued October 6, 1942, a xerographic plate, comprising a layer of photoconductive insulating material on a conductive backing, is given a uniform electric charge over its surface and is then exposed to the subject matter to be reproduced, usually by conventional projection techniques. This exposure discharges the plate areas in accordance with the light intensity which reaches them and thereby creates an electrostatic latent image on or in the plate coating.

Development of the image is effected with developers which comprise, in general, a mixture of a suitable pigmented or dyed electrostatic powder, hereinafter referred to as toner, and a granular carrier material, which latter functions to carry and to generate triboelectric charges on the toner. In the development of the image, the toner powder is brought into surface contact with the coating and is held thereon electrostatically in a pattern corresponding to the electrostatic latent image. Thereafter, the developed xerographic image is usually transferred to a support material to which it may be fixed by any suitable means.

In the mixture of toner particles and carrier material, the toner particles, which are many times smaller than the carrier particles, adhere to and coat the surface of the carrier particles due to the electrostatic attraction between them. During development, as the powder coated carrier particles roll or tumble over the xerographic plate carrying an electrostatic image of opposite polarity to the charge on the toner, toner particles are pulled away from the carrier by the charged image and deposited on the plate to form a powder image, while the partially denuded carrier particles pass off the plate. As toner powder images are formed, additional toner particles must be supplied to the developer mixture in proportion to the amount of toner deposited on the plate.

If prints, made by the xerographic process, have heavy deposits of toner in image areas of good contrast and non-image areas have a grey veiling, the toner concentration in the developer mixture is too great. If the prints have low contrast images, the quantity of toner particles in the developer mixture is insufficient.

In order to continually obtain prints of good quality, the quantity of toner powder in the developer mixture must be held reasonably constant by the addition of toner

2

to the developer mixture in proportion to the amount of toner deposited on the plate.

It is therefore an object of this invention to provide a toner dispensing system whereby accurately metered amounts of toner are added to the developer mixture in a xerographic machine in proportion to the amount of toner used by the machine to make xerographic copy.

A further object of the invention is to provide a toner dispenser which will accurately dispense a given amount of toner powder.

The present invention contemplates an improvement in dispensing devices wherein an automatic metering arrangement is provided to control the rate of discharge from the dispenser.

These and other objects of the invention are attained by means of a toner dispenser system which includes a toner dispenser, having a constant metered output, driven by a constant speed motor, the length of time during which the toner dispenser is operated being correlated to the drum speed by means of a timer controlling the operation of the motor, the timer being in turn controlled by a microswitch operated by a cam on the drum. The toner dispenser includes a rotatable powder container, a wire grid wiper arm to dispense powder from the powder container, an offset stationary post positioned inside the rotatable powder container to prevent bridging of powder, and means for moving the wiper arm and for rotating the powder container to permit controlled dispensing of the powder.

For a better understanding of the invention as well as other objects and further features thereof, reference is had to the following detailed description of the invention to be read in connection with the accompanying drawings, wherein:

Fig. 1 illustrates schematically a preferred embodiment of an electrophotographic apparatus adapted for continuous and automatic operation, and incorporating a toner dispenser in accordance with the invention;

Fig. 2 is a perspective view of the toner dispenser, partially broken away to illustrate the various elements of the device; and

Fig. 3 is a detail vertical sectional view of the toner dispenser.

Referring now to the drawing, the continuously operating xerographic apparatus shown in Fig. 1 comprises a xerographic plate including a photoconductive layer on a conductive backing and formed in the shape of a drum, generally designated by numeral 10, which is mounted to rotate through a plurality of xerographic processing stations. Positioned at a desired point adjacent to the path of rotation of drum 10 is a charging station 11 which may desirably be a corona discharge electrode or the like. Next subsequent thereto in the path of motion of the xerographic drum is an exposure station 12. This exposure station may be one of a number of types of mechanisms or members such as desirably an optical projection system or the like whereby an optical image is projected onto the surface of the photosensitive xerographic drum. This is desirably done by a slit projection lens arrangement designed to project a line copy image onto the surface of the photoconductive xerographic drum.

Adjacent to the exposure station 12 is a development station generally designated 13. The development station comprises generally a developer reservoir or enclosure 14 containing a source of development material 15 and a suitable conveyor 16 to carry the development material to the upper part of the development station from where the material is cascaded down a hopper chute 17 and then over the drum 10 to develop the electrostatic latent image formed thereon.

An automatic toner dispenser system, generally designated by numeral 18 is used to supply additional toner

3

powder to the development material 15. In the particular embodiment illustrated, the automatic toner dispenser system includes a toner dispenser 19, which will be described in greater detail in connection with Figs. 2 and 3, driven by an eccentric 20 mounted on a constant speed motor 21. The operation of the motor 21 is controlled by a conventional timer 22 which in turn is controlled by a microswitch 23 activated by cam 24 on drum 10.

At the area generally designated by numeral 26, electrostatic transfer of the developed image from the drum 10 occurs. A roller 27 supplies a continuously fed web of film 28 or other transfer material over the rollers of transfer mechanism 29 and into contact with drum 10. Immediately below the web and drum contacting area is a corona discharge electrode that is suitably energized to attract the xerographic powder image from the drum surface and cause it to adhere electrostatically to the web surface, whereby transfer of the powder image is effected. The web is then fed, carrying the transferred image, over an image fixing apparatus 30 whereby the copy is made permanent, and finally on to take-up roller 25. The fixing apparatus 30 includes a vapor fuser 31 mounted on the plate 32 of a solvent reservoir tank 33 supplied with solvent from a solvent supply bottle 34 attached to the tank by a bottle adapter 35. A drain cock 36 is mounted to the bottom of reservoir tank 33 for draining liquid from the tank. Although any one of a number of different types of vapor fusers may be used, the vapor fuser shown is of the type described in more detail in copending Huber et al. application Serial No. 718,178, filed February 28, 1958, in which a compressed aeriform fluid is used to carry resin solvent vapors into contact with the powder images on the support material to thereby liquefy or tackify the powder images. The support material with the tackified images thereon is then passed over an opening (not shown) in the dryer 37 to permit the resin solvent to evaporate therefrom, thereby leaving the pigmented resin of the xerographic powder image permanently bonded to the support material. Air is supplied to the dryer 37 from air compressor 38 which also supplies air through conduit 39 to the vapor fuser 31. Air is exhausted from the dryer by means of exhaust blower 40 which, in a permanent installation of the xerographic machine in a building, would preferably be connected to the building's exhaust facilities (not shown). Although any one of a number of different types of dryers may be used, the dryer shown is of the type disclosed in more detail in copending Lot application Serial No. 718,179, filed February 28, 1958.

Rollers 41 act as guide rolls for the web. The movement of web 28 is synchronized with the turning of drum 10, which in this embodiment is rotated in a counter-clockwise direction, as indicated by the arrow in Fig. 1. The drum 10 and the web 28 may be driven by a suitable motor (not shown) or by other conventional means.

Positioned next adjacent to the transfer area 26 is a cleaning device 42 to clean the drum surface of any residual powder.

The next and final station in the device described in Fig. 1 is a floodlight station 43 where the xerographic drum 10 is flooded with light to cause dissipation of any residual electrical charge on the drum 10.

Normally, the various movable mechanisms of the xerographic device are enclosed in a suitable housing or housings similar to the enclosure 44 around the fixing apparatus 30.

Referring now to Figs. 2 and 3, it will be seen that the toner dispenser 19 includes a support element 50 which can be fastened to the developer reservoir 14 by machine screws 51.

The opening 52 in the lower leg 53 of the support element is aligned with an aperture (not shown) in the developer reservoir 14 so that the toner powder metered

4

from the toner dispenser is fed into the developer reservoir.

A dispensing platform 54 is fixedly attached to the leg 53 by means of screws 55 or other suitable means, the dispensing platform extending over but not completely blocking the opening 52 in leg 53.

A wire grid wiper arm assembly 56 is pivotally mounted on the dispensing platform 54 by a wiper pivot shoulder screw 57 and washer 58. The wire grid wiper arm assembly 56 consists of a pivot block 59, a pair of wiper blades 60 fastened to block as by soldering, the wiper blades 60 extending from the pivot block 59 out over the dispensing platform 54, and a pin 61 fixedly attached to the pivot block 59. In assembly the wiper blades are adjusted to be flush with the top of the dispensing platform 54, but freely movable thereover.

A cylindrical bearing 62 receives a dispenser barrel or container 63 in the form of an open ended tubular element. The dispenser barrel or container 63 is adjustably held in place in the bearing mount 62 by set screws 64. The outer periphery of the bearing mount 62 is machined to receive the inner races of bearing 65 and 66 positioned in spaced relationship by means of a spacer 67. The bearings 65 and 66 and the spacer 67 are secured in place by means of the shoulder 68 of the bearing mount 62 and a bearing nut 69 threaded to the bottom of the bearing mount. Rigidly attached as by a force fit or other suitable means to the upper end of the bearing mount 62 and butted against the shoulder 68 thereon is a ratchet 70.

The upper leg 71 of the support element is counter-bored as at 71 to receive the outer races of the bearings 65 and 66, the outer race of the bearing 66 resting against the shelf 73 formed by the counterbore.

A bracket 74 is fixedly attached to the vertical extension of leg 53 of the support element by machine screws 75. Pivotably secured to the bracket by a pivot arm shoulder screw 76 is an inverted L-shaped pivot arm 77 having an elongated slot 78 therein to receive the pin 61. A pawl 79 is pivotally attached to the short leg of the pivot arm by a pawl stud 80 and pawl spaced 81, and as shown, the pawl is positioned by the pawl spring 82 to engage the teeth of the ratchet 70. A ratchet stop spring 83 is fastened by a stop spring support screw 84 to the leg 71 of the support element 50, this stop spring engaging the teeth of the ratchet to permit rotation of the ratchet only in a clockwise direction as shown by the arrow in Fig. 2.

The lower end of the pivot arm is bifurcated to receive a drive element such as the eccentric pin 85 of eccentric 20.

A wiper rod 86 is fastened to the stationary dispensing platform and extends vertically into the interior of the dispenser barrel 63.

A cover 87 is provided for the dispenser barrel, and for convenience the cover 87 is attached to dispenser barrel 63 by chain 88 fastened to the cover 87 and a cover bracket 89, respectively, by screws 90.

Seals 91 and 92 are used to prevent foreign material from entering the bearings 65 and 66, the seal 91 being supported on the upper leg 71 of the support element and seal 92 is carried by the shoulder of the bearing nut 69.

In the embodiment illustrated, the wiper blades 60 are made of .048 inch diameter wire, although other sized wire may be used. With the wiper blades 60 adjusted to be flush with but freely movable over the dispensing platform 54, the dispenser barrel or container 63 is adjusted by means of the set screws 64 so that there is just sufficient clearance between the dispenser barrel and the dispensing platform for free movement of the wiper blades therebetween. Thus the gap between the dispenser barrel and the dispensing platform limits or meters the amount of toner powder that can be forced out of the dispenser by the wiper blades.

5

In operation, when the pivot arm 77 is caused to oscillate about the pivot arm shoulder screw 76, the wire grid wiper arm assembly 56 is oscillated by the pin 61 engaged in slot 78 of the pivot arm 77, the wiper blades 60 forcing the toner powder, which has previously been placed in the dispenser barrel 63, across the top of the dispensing platform 54 and out through the gap between the dispenser barrel and the dispensing platform. As the pivot arm is actuated, the pawl 79 indexes the ratchet 70 fixed to the dispenser barrel 63 in the direction of the arrow in Fig. 2 so that the stationary wiper rod 86 agitates the toner powder to assure the presence of a sufficient quantity of toner powder on the dispensing platform.

In the embodiment shown, the toner dispenser 19 is designed to operate continuously to supply an adequate amount of toner at the maximum drum speed of the xerographic machine. Overtoneing is controlled at any drum speed below the upper limit, defined below, by regulating the time that the dispenser operates during each drum revolution. The timer 22 can be adjusted to operate the motor 21 for an interval of time which is less than the time interval required for the drum 10 to make one revolution at the highest drum speed at which the machine operates. During each revolution of the drum, the cam 24 thereon closes the microswitch 23 starting a timed operating cycle of the motor and the toner dispenser driven thereby. As the number of drum revolutions per unit of time increases, the number of timed motor operating cycles increases until the drum speed reaches maximum at which time the operating cycles overlap resulting in the continuous operation of the motor driving the toner dispenser.

Although the invention has been described as applied to a xerographic toner dispensing apparatus, it is apparent that it is not limited to this particular use but can be applied equally well to the dispensing of any similar type of powder or granulated material. In addition, while there have been shown and described the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. A toner dispenser for a xerographic machine, said toner dispenser including a support element, a dispensing platform mounted on said support element, an upright wiper rod mounted on said dispensing platform, a tubular element rotatably mounted on said support element in spaced vertical relationship to said dispensing platform and encompassing said wiper rod, a wiper means mounted on said dispensing platform for oscillatory movement in the space between said dispensing platform and said tubular element, and power driven means connected to said tubular element and said wiper means to impart rotary movement to said tubular element and to effect oscillatory movement of said wiper means.

2. A toner dispenser for a xerographic machine, said toner dispenser including a support element, a dispensing platform mounted on said support element, an upright wiper rod mounted on said dispensing platform, a tubular element rotatably mounted on said support element in spaced vertical relationship to said dispensing platform and encompassing said wiper rod, a wiper means mounted on said dispensing platform for oscillatory movement in the space between said dispensing platform and said tubular element, and power driven means connected to

6

said tubular element and said wiper means to impart rotary movement to said tubular element and to effect oscillatory movement of said wiper means, said power driven means including a constant speed motor and timer means operatively connected to said constant speed motor for controlling the operation of the constant speed motor in timed cycles to control the quantity of toner metered by said wiper means.

3. A toner dispenser including a support element, a dispensing platform mounted on said support element, a tubular element rotatably mounted on said support element in spaced relationship to said dispensing platform, a wiper arm mounted on said dispensing platform for oscillatory movement between a first position and a second position in the space between said dispensing platform and said tubular element, said tubular element, said wiper arm and said dispensing platform forming a container for toner powder, and means connected to said tubular element and said wiper arm to impart rotary movement to said tubular element and to effect oscillatory movement of said wiper arm.

4. A toner dispenser for a xerographic machine, said toner dispenser including a support element, a tubular element mounted on said support element for rotary movement, a dispensing platform mounted on said support element below and in spaced relationship to said tubular element to define a discharge outlet around the bottom of said tubular element, wiper means mounted for oscillatory movement in the discharge outlet between said tubular element and said dispensing platform a wiper rod extending into said tubular element and mounted for movement relative to said tubular element, and power driven means operatively connected to said tubular element, said wiper rod and said wiper means to effect relative movement between said tubular element and said wiper rod, and to oscillate said wiper means.

5. A toner dispenser for a xerographic machine, said toner dispenser including a support element, a container for containing toner powder mounted on said support element, a dispensing platform mounted on said support element below and in spaced relationship to said container, a wiper arm mounted for oscillatory movement in the space between said container and said dispensing platform, a wiper rod positioned within said container and mounted for movement relative to said container, and means connected to said wiper arm for oscillating said wiper to dispense toner through the space between said container and said dispensing platform.

6. A toner dispenser for a xerographic machine, said toner dispenser including a support element, a dispensing platform rigidly mounted on said support element, a tubular element rotatably supported by said support element in spaced vertical relationship to said dispensing platform, a wiper arm having at least one wiper blade rotatably mounted on said dispensing platform with the wiper blade of said wiper arm projecting between said dispensing platform and said tubular element, and means connected to said tubular element and said wiper arm to impart rotary movement to said tubular element and to effect oscillatory movement of said wiper arm.

References Cited in the file of this patent

UNITED STATES PATENTS

65	1,484,298	Collins	Feb. 19, 1924
	1,768,723	Linde	July 1, 1930
	2,620,946	Auer	Dec. 9, 1952
	2,775,371	Isserlis	Dec. 25, 1956
	2,779,306	Dunn	Jan. 29, 1957
70	2,781,952	Mahoney	Feb. 19, 1957
	2,865,447	Kaufman	Dec. 23, 1958