June 21, 1966 P. F. KING 3,257,223

ELECTROSTATIC POWDER CLOUD XEROGRAPHIC DEVELOPMENT METHOD AND APPARATUS

Filed Nov. 1, 1962 2 Sheets-Sheet 1

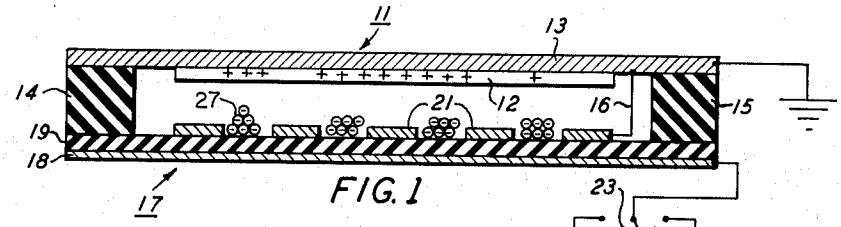
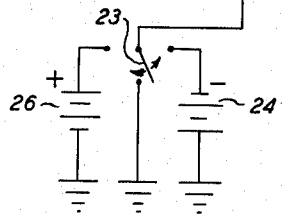


FIG. 1



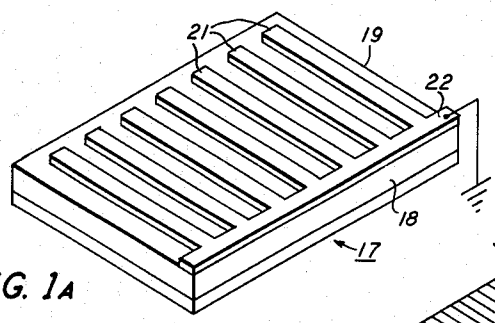


FIG. 1A

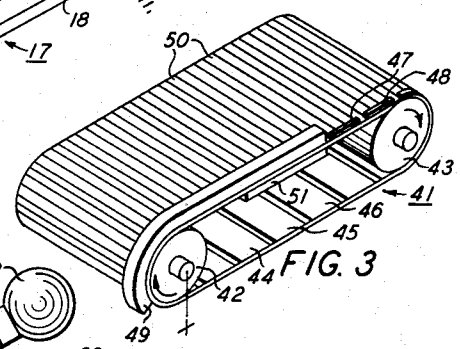


FIG. 3

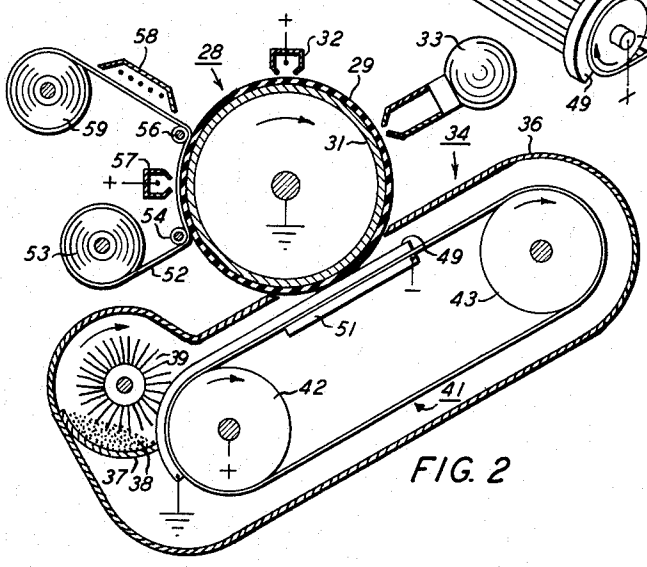


FIG. 2

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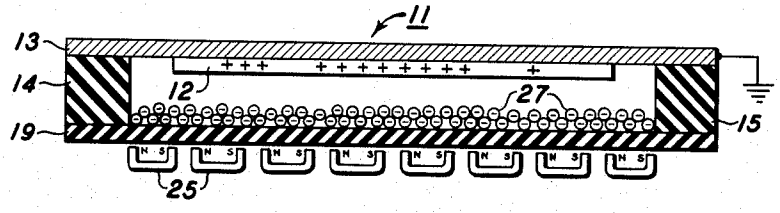


FIG. 4

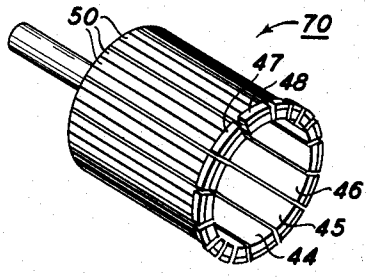


FIG. 5

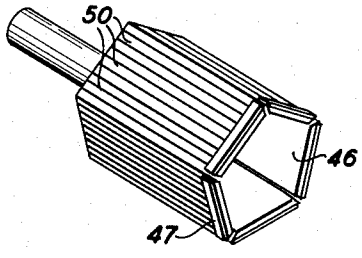


FIG. 6

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3,257,223

ELECTROSTATIC POWDER CLOUD XEROGRAPHIC DEVELOPMENT METHOD AND APPARATUS

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Filed Nov. 1, 1962, Ser. No. 234,611
8 Claims. (Cl. 117—17.5)

This invention relates in general to xerography and in particular to an improved method for the development of latent electrostatic images in xerography.

In the art of xerography as originally disclosed by Carlson in U.S. Patent 2,297,691 and as further amplified by many related patents in the field, an electrostatic latent image is formed on a photoconductive insulating layer with a relatively conductive backing and is then developed or made visible by the selective deposition thereon of finely-divided, electroscopic, marking material which is generally referred to in the art as toner. This toner image is then either fixed on the surface of the photoconductive insulating layer or transferred to an additional copy sheet where it is then fixed depending upon whether or not the photoconductive insulating layer is reuseable. The photoconductive insulating layer with its relatively conductive backing, which is referred to in the art as a plate, regardless of its shape, is in most instances first charged to sensitize it and then exposed to a visible light image or other pattern of activating electromagnetic radiation which serves to dissipate the charge in radiation struck areas, leaving a charge pattern on the plate which conforms to the electromagnetic radiation pattern applied to it. This exposure step is followed by the development and transfer steps described above.

As might be imagined from this brief description of the operation of the xerographic process the way in which the development of the invisible latent electrostatic image is carried out has a very significant effect upon the quality of the final copy produced by the process. Thus, even if a latent electrostatic image of excellent quality is formed on the xerographic plate, good quality copy will not be produced unless an effective developing technique is utilized. In the process of attempting to find good xerographic developing techniques many different methods have been evolved all of which include the essential step of bringing finely-divided toner particles into proximity with the latent electrostatic image on the xerographic plate. One of the most successful methods and one which is most widely used commercially today is termed cascade development and is described in U.S. Patents 2,618,551 to Walkup, 2,618,552 to Wise, and 2,638,416 to Walkup and Wise. Other techniques include brush development as described in U.S. Patents 2,975,758 to Bird and 2,880,-699 to Simmonds; liquid spray development as described in U.S. Patent 2,551,582 to Carlson; loop development as described in U.S. Patent 2,761,416 to Carlson; and, donor development as described in U.S. Patent 2,895,847 to Mayo.

One xerographic development technique first described by Carlson in U.S. Patent 2,217,776, and known as powder cloud development, has been found to be an excellent developing technique especially for continuous tone reproduction and other work requiring high resolution. In the powder cloud development technique the finely-divided marking particles or toner is uniformly suspended or dispersed in a gaseous carrier in the form of an aerosol. These particles are given a substantially uniform electrostatic charge either before, during, or after the formation of the aerosol and then this aerosol or "powder cloud" is presented to the surface of an electrostatic image-bearing member such as xerographic plate thus allowing the electric fields set up by the latent electrostatic image to

attract toner particles out of the aerosol and onto its own surface to thereby render the image visible.

Although much effort has been invested in the improvement of powder cloud development as is evidenced by U.S. Patents 2,725,304 to Landrigan, 2,862,646 to Hayford, 2,918,900 to Carlson, and 2,943,950 to Ricker, which is only an exemplary sample of the patents relating to this development technique, the technique is not widely used in commercial machines, one of the reasons apparently being its relative complexity and cost. Generally these devices include a source of powder or toner, and means to suspend it in a gas in the form of an aerosol which is accomplished by agitating the powder in a gaseous atmosphere and allowing the gas to expand. Depending upon the particular powder cloud generator utilized, the creation of the aerosol may require the utilization of vanes or beaters to stir up the powder, sources of high pressure gas such as compressors, regulating valves, and the like, and means to handle and convey the aerosol after its creation while it is being transmitted for presentation to the latent electrostatic image to be developed.

It is an objective of this invention to describe a novel powder cloud developing apparatus utilizing a minimum number of parts which eliminates or substantially reduces the necessity for moving parts.

A further object of this invention is to describe a novel powder cloud developing apparatus which forms the developing cloud in situ thus eliminating the problem of conveying the powder cloud from the generator to the developing station.

It is also an object of this invention to describe a novel powder cloud developing method.

The above and still further objects, features, and advantages of the present invention will become apparent upon consideration of the following detailed disclosure with specific embodiments of the invention, especially when taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a cross-sectional view of apparatus for developing a latent electrostatic image according to the method of this invention.

FIGURE 1–A is a top isometric view of the aerosol generator of FIGURE 2.

FIGURE 2 is a cross-sectional view of a continuous automatic xerographic copying machine utilizing the developing technique of this invention.

FIGURE 3 is an isometric view of the developer-carrying belt of FIGURE 2.

FIGURE 4 is a cross-sectional view of modified apparatus for developing a latent electrostatic image according to the method of this invention.

FIGURE 5 is an isometric view of a cylindrical form of the invention and,

FIGURE 6 is an isometric view of a polygonal form of the invention.

Referring now to FIGURE 1 of the drawings there is illustrated a xerographic plate **11** bearing a latent electrostatic image in position for development according to the technique of this invention. It should be noted that the invention is not restricted to the development of xerographic plates and that any latent electrostatic image-bearing member might therefore be substituted for xerographic plate **11** and be developed according to this invention. Thus, for example, a dielectric sheet bearing a latent electrostatic image placed upon it by tesiprinting as described in U.S. Patent 2,919,967 to Schwertz, might be substituted for xerographic plate **11**. As is well known to those skilled in the art of xerography, the xerographic plate **11** is made up of a photoconductive insulating layer **12** such as amorphous selenium, anthracene, cadmium sulfide, zinc oxide in an insulating film-forming binder, or

the like, on a relatively conductive backing **13** such as aluminum, brass, a conductive plastic conductively coated glass, a paper layer and the like which is of adequate strength to act as a support for the plate as a whole. In this instance plus marks are shown on the photoconductive insulating layer **12** to represent the invisible latent electrostatic image on the plate. The xerographic plate **11** is supported with its photoconductive insulating surface facing downwardly on two insulting support blocks **14** and **15** so that the plate is spaced on the order of about ⅛" above the surface of impermeable development member **17**. The member is made up of a conductive base plate **18** supporting a dielectric interlayer **19** which in turn underlies a conductive grid **21**. Conductive base **18** may generally be fabricated of any good conductive material such as aluminum, copper, or the like, while dielectric interlayer **19** may be fabricated of any good dielectric material and its thickness may be varied according to its dielectric strength, the voltage applied across it, and the spacing desired between conductive base layer **18** and grid **21**. Generally, a thin interlayer **19** having a high dielectric strength would be most desirable for this layer so as to maximize the electric field extending up through the dielectric between adjacent portions of grid **21** when a voltage is applied across the conductive layer and grid. In actual practice a sheet of two mil thick Teflon (a trademark of E. I. du Pont & Co. for polytetrafluorethylene) was found to be quite satisfactory. Grid **21** as shown in FIGURES 1 and 1–A is made up of a number of parallel conductive lines which are interconnected at their ends by a transverse conductive line **22**. Since this grid is maintained at a grounded reference potential by wire **16** during operation of the system, it may be connected to the conductive backing **13** of plate **11** which may also be grounded and is shown in FIGURE 1. It has been found that the spacing of the parallel conductive lines which make up grid **21** is not critical to the operation of the process. Thus, for example, grids having 25 lines per inch and grids having 50 lines per inch have been found to produce good results and grids of other densities or shapes may also be used. Conductive base layer **18** is connected to a double-throw switch **23** so that this base layer may be connected to either of two potential sources **24** and **26** which are of opposite polarity. In operation, the xerographic plate **11** is unformly charged and exposed to an image of activating electromagnetic radiation to form a charge pattern of the type illustrated in FIGURE 1. The polarity of the initial charge utilized on the photoconductor is dependent upon the nature of the particular photoconductor selected for use in the plate **11**. Thus, for example, it has been found that it is preferable to use a positive charge with amorphous selenium photoconductive insulators while it is preferable to use a negative charge with zinc oxide binder type photoconductive insulators. In the event that it is desired to develop the charged areas of plate **11** development member **17** is loaded with developing material having a polarity opposite to that of the charged areas. In this instance, then, developing will be carried out with negatively charged developing particles which will be referred to hereinafter as negative toner. These toner particles are generally less than about 20 microns in diameter on an average and are fabricated of insulating thermoplastic resins of the types described in U.S. Patents 2,788,288, 2,891,011, 2,659,670, and Reissue Patent 25,136 Carlson and also include some type of pigment such as carbon black. It should be noted, however, that any particle capable of acquiring and holding a charge may be utilized in this invention.

It is axiomatic in electrostatics that charges of like polarity repel each other while charges of opposite polarity attract each other. Thus, it is difficult to deposit a great number of toner particles **27**, all charged to the same polarity between the parallel lines of conductive grid **21** as shown in FIGURE 1 since the particles tend to repel each other. In order to overcome this difficulty the bottom conductive plate **18** of member **17** is held at a potential above ground which is opposite in polarity to the charge on the particles being deposited on the upper surface of dielectric layer **19** between the parallel conductive lines of grid **21** during loading of particles on the generator. Since the particles being utilized to develop the positive image on xerographic plate **11** are negative a positive potential is applied to conductive layer **18** thus serving to attract these particles and overcoming their tendency to repel each other away from the surface of the dielectric layer **19**, and allowing a relatively heavy layer of particles to be deposited. Any one of a number of well known techniques may be utilized for uniformly charging the toner particles to one polarity and depositing them on the member **17** while conductive backing layer **18** is connected to its potential source. For example, the cascade technique as more fully described in U.S. Patents 2,618,551 to Walkup, U.S. 2,618,552 to Wise, and 2,638,416 to Walkup and Wise which is ordinarily utilized to develop a latent electrostatic image may be used in this instance to load aerosol development member **17**. In this loading process grossly larger granular carrier beads are mixed in with the finely-divided electroscopic toner particles. The rubbing together of the granular carrier material with the toner particles in this developing mixture serves to charge the carrier particles and the toner particles to opposite polarities by triboelectrification causing the toner particles to attach themselves to the outer periphery of the carrier beads. The carrier beads are fabricated of a material which is selected from a position in the triboelectric series which is either above or below the toner material depending upon the polarity of charge desired on the toner particles. When the developing mixture is dropped on or cascaded over member **17** the developing particles are pulled off the surface of the carrier beads by virtue of the stronger attractive electric fields emanating from conductive plate **18** which, during the loading step, is connected to a potential source of opposite polarity to the charged toner particles.

In addition to the cascade loading technique described above, the toner may be deposited upon member **17** using a fur brush. In the fur brush technique the bristles of the brush are analogous to the carrier beads of the cascade technique, since the toner particles are also triboelectrically charged to a polarity determined by the relative position of the toner particles and the fur fibers in the triboelectric series. The brush is run through a supply of toner particles which form a coating on the bristles of the fur clinging thereto by reason of the electrostatic attraction between the toner and the fur just as the toner clings to the surface of the granular carrier particles. The brush is then rubbed against the generator which pulls toner particles off of the bristles with the stronger electric field emanating from conductive plate **18**. Other loading techniques may also be utilized.

Once member **17** has been loaded with toner particles **27** as shown in FIGURE 1, it is brought adjacent to the latent electrostatic image to be developed so that the spacing between the generator and the plate is on the order of about ⅛". The positive potential is then removed from backing plate **18** by disconnecting it from potential source **26** with switch **23** thus creating an unstable condition on the surface of the generator because of the great number of closely adjacent toner particles all having the same charge polarity. Owing to the mutual repulsion of these particles, many of the particles are rapidly forced away or "blown off" from the surface of the generator thus forming an aerosol in the space between the generator and the xerographic plate **11** being developed. Charged particles in this aerosol are picked up by the electric fields set up by the charge pattern on the photoconductive insulating portion of plate **11** thus serving to develop or make visible the charge pattern with these toner particles.

The plate is then removed from the developing system and the now visible image is utilized as desired. For example, the toner image may be transferred to a sheet of copy paper to which it is then permanently affixed by the action of heat or a solvent vapor, or if the photoconductor is of the non-reuseable type, the powder image may be fixed directly on the surface of the photoconductive insulating member. Alternatively, the image may merely be viewed in situ on the photoconductive insulator and then removed by brushing, blowing, or the like, to condition it for reuse.

It has also been found that repulsion of the toner particles from the surface of member **17** may be improved by connecting conductive base **18** of the member to a potential source opposite in polarity to that utilized during the loading step rather than merely grounding this base. In this manner the repulsive force of a field emanating from conductive plate **18** is added to the force of mutual repulsion between the toner particles thereby propelling them into the aerosol with greater velocity and uniformity. This may be accomplished by merely moving switch **23** from potential source **24** to potential source **26** at the time of development rather than merely connecting it to ground. It has been found that widely varying voltages may be utilized with this technique of powder cloud generation both during the loading step and during the creation of the powder cloud hereinafter referred to as the blowoff step. Thus, for example, from 200 to 1,000 volts have been found adequate for loading and these voltages could be much higher if for some reason a much thicker layer of toner were needed on the generator. As stated above, a shorting or grounding of the plate base has been found adequate for the blowoff step but voltages running up from ground to 1,000 volts and more have been found to improve blowoff. Obviously, much higher voltages could be used during both the loading and blowoff steps; however, good images have been formed within these voltage ranges and practical considerations of cost and safety militate against the use of much higher voltages than these.

Since toner particles are held on the generator after loading by the force of attraction of the electrical field emanating from the generator the orientation of the loaded generator with respect to the plate to be developed is not critical and it may be above, beneath, or beside the plate. It is to be noted however that the preferred positions of the loaded generator are beneath or beside the plate so that no developing particles fall on the plate being developed during or after the blowoff merely by virtue of gravitational forces. These preferred positions thus reduce or eliminate the deposition of toner particles in background or non-image areas.

As should be apparent from the explanation of the invention given above the basic objective of the developing techniques of the instant invention is to gather a plurality of similarly charged developing particles closely together in groups which cover the surface of an aerosol generator by applying a holding or attracting force to the particles and then releasing the attractive force on the particles when the generator is opposite the plate to be developed so that mutual repulsion of the particles forms a powder developing cloud or aerosol. If in addition to being electroscopic in nature the particles also contain a magnetic component the attracting or holding force applied to load or keep the similarly charged particles on the generator prior to development may take the form of a magnetic field from magnets **25** as shown in FIGURE 4. It should be noted however that electric field attraction is generally preferable since the field may be reversed to aid the forces of mutual particle repulsion during the aerosol formation as described above. In this preferred embodiment the overlying grid **21** is generally used to break up the electric field lines of force emanating from the biased generator backing **18** during loading and blowoff so as to create the characteristically strong fringing fields which exist at any point of high potential contrast in a field source. The grid also serves to concentrate the developing particles more effectively because they are attracted to areas between the grid lines by the fields from the backing **18** rather than to the ground grid. Clearly a simpler, cheaper and less effective generator operating on the electric field attraction principle may be fabricated by eliminating the grid.

The method of this invention may also be applied to an automatic continuous xerographic copying machine as illustrated in FIGURE 2. In this embodiment a cylindrical xerographic plate **28** which may alternatively be a flexible endless belt, made up of a photoconductive insulating layer **29** on a cylindrical backing **31** is utilized and this drum is rotated in the direction indicated by the arrow in the illustration. As the drum rotates it passes a charging corotron **32** which is connected to a source of high potential so as to uniformly charge the photoconductive insulating layer **29** of drum **28** by corona discharge as more fully described in U.S. Patents 2,836,725 to Vyverberg, and 2,777,957 to Walkup. The drum then passes a projector **33** which exposes the charged photoconductor to a light image of the original to be reproduced thus discharging portions of the charged photoconductor which are struck by light. The drum then continues to rotate, moving past the developing unit **34** which utilizes the developing technique of this invention. The developing unit consists of an enclosure **36** which surrounds the entire unit except for that portion adjacent the drum. Within enclosure **36** is a trough **37** containing a quantity of toner particles or developer **38**. This trough **37** is placed directly beneath a rotating brush **39** which picks up toner from the trough, charges it, and deposits it on an endless belt **41** which is entrained about two rollers **42** and **43**, at least one of which is driven in the direction indicated by the arrows. As illustrated, most clearly in FIGURE 3, impermeable endless belt **41** is made up of a plurality of powder cloud generators of the type described in connection with FIGURES 1 and 1–A, with each generating unit being electrically separated from all others. Thus, the conductive plate on the back or inside of the generator which is analogous to conductive plate **18** in FIGURE 1 is broken up into a number of conductive plates **44, 45, 46**, etc., and only those conductive parallel grid lines on the opposite side of the endless belt dielectric layer which are above one of the plates **44, 45**, or **46** are connected together. The interconnection of the parallel conductors **50** making up the grids on the outside of endless belt **41** is shown at **47** and **48**. Each of these transverse conductors **47** and **48** connect together a group of parallel conductors **50** corresponding to one portion of the conductive backing such as **44, 45**, or **46**.

In operation rollers **42** and **43** move in the direction indicated by the arrows in FIGURE 2, at least one of them being driven so as to move endless belt **41** around their peripheries. During rotation, portions of the belt are also in sliding contact with contacts **49** and **51**. If brush **39** is being used to deposit negatively charged toner on the belt to develop a positive image on photoconductive insulator **29**, conductive roller **42** is connected to a source of potential of positive polarity while contact **49** is connected to ground. Since roller **42** is connected to a positive source of potential it attracts this negative toner through its connection with the backing plates **44, 45, 46**, etc., with which it may be in contact at that particular time, while grounding of contact **49** serves to ground all grid sections above these conductive backing portions by contacting transverse conductors similar to **47** and **48** as shown in FIGURE 3. This gives the endless generator belt a uniform and dense coating of toner particles which are held to its outer surface by electric field attraction. Upon continued rotation of rollers **42** and **43** endless belt **41** passes

over sliding contact **51** which is connected to a potential source opposite in polarity to that applied to roller **42**, the potential source in this instance being negative. The potential source applied to conductive backing portions similar to **44**, **45**, and **46**, is thus changed from positive to negative thereby eliminating the toner attracting positive electric field produced by the positive potential source and substituting in its place a repelling negative electric field which is produced by conductive portions **44–46**, which are in contact with element **51**. The combined effect of mutual repulsion between the toner particles of the same polarity and the repelling fields set up by the negative potential applied to the conductive backing portions serves to repel the toner particles into the space between electrostatic image-bearing drum **28** and belt **41**, as described more fully in connection with FIGURE 1. This results in the production of a powder aerosol which serves to develop the latent electrostatic image on electrostatic image-bearing member **28**, giving superior reproduction of continuous tone and solid dark original subjects. Drum **28** then continues its rotation with a developed particle image on its surface coming into contact with a web of copy paper **52** from a supply roll **53** which is held against the drum by two idle rollers **54** and **56**. Behind and spaced slightly from this copy sheet **52** between idle rollers **54** and **56** is a transfer unit **57**. This transfer unit is a corona generating filament or filament array similar to the charging corotron described above connected to a source of high potential opposite in polarity to the toner particles utilized to develop the image. As described more fully in U.S. Patent 2,576,047 to Schaffert, this corona generating unit deposits positive charge on the back of the copy web **52** thus serving to attract the toner particles and remove them from the surface of drum **28** transferring them to the copy sheet **52**. Copy sheet **52** then passes under a fixing unit **58** which serves to permanently affix the powder image to the copy web. In this instance a heat fixer of the type which fuses the thermoplastic developing particles to the copy web is illustrated, however, any of the well known fixing techniques such as solvent vapor spray, adhesive overcoating, or the like, may be used to fix this image on the copy sheet. The copy sheet is then rolled up on a take-up roll **59** for future use.

It should be recognized that many alternative materials and techniques may be utilized in carrying out the instant invention. For example, toner particles charged to the same polarity as the latent electrostatic image to be developed may be utilized so as to give a negative reproduction of the original. In this case the polarity of the voltage applied to the conductive backing of the generator is still the opposite in polarity to the charge on the toner particles for generator loading and of the same polarity as the charge on the toner particles for the blowoff step. Variations may also be made in the generator fabrication and configuration including changes in the grid such as varying the number of grid lines per inch, changing the shape of the grid to a screen mesh, a spiral mesh, or any one of many other shapes. The generator may also be fabricated in forms other than the plate of FIGURE 1 or the endless belt of FIGURE 2. For example, it might be made directly on a cylindrical drum **60**, as in FIGURE 5 which is continuously rotated during the process or on the surface of a polygonal support **70**, as in FIGURE 6, which is indexed around a central shaft for loading and blowoff.

While the specific embodiments shown and described in this specification and drawings are admirably adapted to fulfill the stated objects, it should be understood that it is not intended to confine the invention to these disclosed embodiments since the invention itself is susceptible of embodiment in many various forms all coming within the scope of the following claims.

What is claimed is:

1. A method of developing a latent electrostatic image comprising gathering a plurality of fine-divided electroscopic marking particles, substantially all of which are charged to the same polarity closely together on the surface of an aerosol generator by applying an attracting force to said particles, bringing the particle covered side of said aerosol generator into a closely spaced relationship with the latent electrostatic image to be developed and then releasing the applied attracting force on said particles whereby they are mutually repelled by the similarity of their charge into the space between said generator and said image to form an aerosol and develop said image.

2. A method according to claim **1** including the further step of applying a force repelling said particles from said generator in addition to their mutual repelling forces after releasing said attracting force.

3. A method according to claim **1** in which said attracting force is a magnetic field and said marking particles are magnetically attractable.

4. A xerographic powder aerosol development generator comprising in combination,

a unitary powder impermeable development member adapted to attract, hold and subsequently to release like charged toner particles comprising an electrically continuous conductive grid at a first surface thereof,

an electrically conductive backing member exclusively at the second surface thereof,

a thin solid insulating layer separating said grid and backing member and in contact therewith,

and reversible polarity electrical biasing means connected between said grid and said backing member to initially attract and hold like charged toner particles by a first polarity and subsequently to release said particles by a second polarity.

5. A xerographic powder aerosol development generator comprising in combination,

a unitary powder impermeable development member comprising an electrically continuous conductive grid separated from an electrically conductive backing member solely by a thin solid insulating layer,

means to deposit finely divided electroscopic marking particles substantially all of which are charged to the same polarity over said grid and onto said insulator where uncovered by said grid,

electrical bias means operably connected to said grid and backing member to electrically bias said backing member with respect to said grid while said particles are being deposited thereon whereby said marking particles are held against the surface of said insulating layer where uncovered by said grid,

and electrical bias means operably connected to said grid and backing member to thereafter electrically bias said backing member with respect to said grid whereby said particles are no longer held against the surface of said insulating layer and are mutually repelled by the similarity of their charge and by the like charge on the biased conductive backing layer thereby forming a powder aerosol adjacent the development member.

6. A xerographic powder aerosol development generator comprising in combination,

a unitary powder impermeable development member comprising an electrically continuous conductive grid separated from an electrically conductive backing member solely by a thin solid insulating layer,

means to deposit finely divided electroscopic marking particles substantially all of which are charged to the same polarity over said grid and onto said insulator where uncovered by said grid,

electrical bias means operably connected to said grid and backing member to electrically bias said backing member with respect to said grid while said particles are being deposited whereby said marking

particles are held against the surface of said insulating layer where uncovered by said grid,

means to bring said grid into a closely spaced apart facing relationship with an electrostatic latent image bearing member having thereon a latent electrostatic charge pattern distinct from said grid,

and bias means operably connected to said grid and backing member to thereafter electrically bias said backing member with respect to said grid whereby said particles are no longer held against the surface of said insulating layer and are mutually repelled by the similarity of their charge and by the like charge on the bias conductive backing layer into the space between said development member and said latent image bearing member and deposit on said latent image bearing member in accordance with the electrostatic latent image thereon.

7. A xerographic powder aerosol development generator comprising in combination,

a unitary powder impermeable development member comprising an electrically continuous conductive grid separated from an electrically conductive backing member solely by a thin solid insulating layer,

means to deposit finely divided electroscopic marking particles substantially all of which are charged to the same polarity over said grid and onto said insulator where uncovered by said grid,

electrical bias means operably connected to said grid and backing member to electrically bias said backing member to a first polarity with respect to said grid while said particles are being deposited whereby said marking particles are held against the surface of said insulating layer where uncovered by said grid,

means to bring said grid into a closely spaced apart upwardly facing relationship with an electrostatic latent image bearing member having thereon a latent electrostatic charge pattern distinct from said grid,

means to maintain said grid at a fixed potential with respect to said image bearing member,

and bias means operably connected to said grid and backing member to thereafter electrically bias said backing member to a second polarity with respect to said grid whereby said particles are no longer held against the surface of said insulating layer and are mutually repelled by the similarity of their charge and by the like charge on the bias conductive backing layer into the space between said development member and said latent image bearing member and deposit on said latent image bearing member in accordance with the electrostatic latent image thereon.

8. A xerographic powder aerosol development generator comprising in combination,

a unitary powder impermeable development member comprising an endless electrically insulating web bearing on its outer surface and in contact therewith a plurality of mutually insulated electrically continuous conductive grid patterns and bearing on its inner surface and in contact therewith a plurality of mutually insulated electrically conductive areas, each of said grid patterns being substantially coextensive with a conductive area,

deposition means to deposit finely divided electroscopic marking particles substantially all of which are charged to the same polarity over the outer surface of said web,

first electrical contact means to contact said grid patterns and said continuous areas where subject to said deposition means,

electrical bias means connected to said first contact means to electrically bias said continuous areas to a first polarity with respect to said grid patterns while said particles are being deposited whereby said marking particles are held against the outer surface of said web where uncovered by said grid patterns,

moving means to bring the outer surface of said web into a closely spaced-apart upwardly facing relationship with an electrostatic latent image bearing member having thereon an electrostatic charge pattern distinct from said grid,

second contact means to contact said grid patterns and said continuous areas where adjacent to said image bearing member,

means connected to said second contact means and to said image bearing member to maintain said grid patterns at a fixed potential with respect to said image bearing member when adjacent to said image bearing member,

and bias means connected to said second contact means to electrically bias said continuous areas to a second polarity with respect to said grid patterns whereby said particles are no longer held against the outer surface of said web and are mutually repelled by the similarity of their charge into the space between said web and said latent image bearing member and deposit on said latent image bearing member in accordance with the electrostatic latent image thereon.

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