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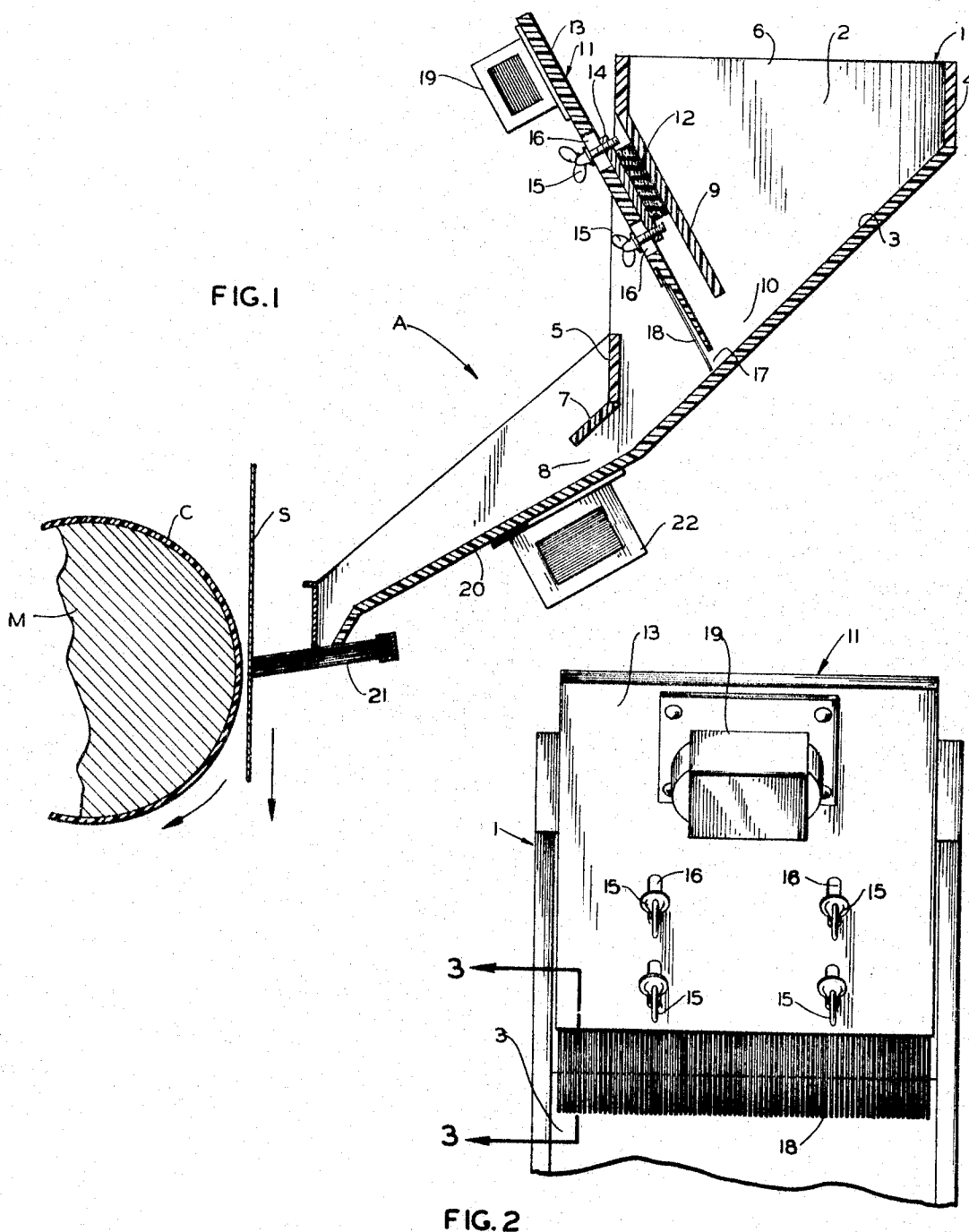
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3,320,879

INK DELIVERY SYSTEM EMPLOYING VIBRATING WIRES

Filed Oct. 8, 1965

2 Sheets-Sheet 1



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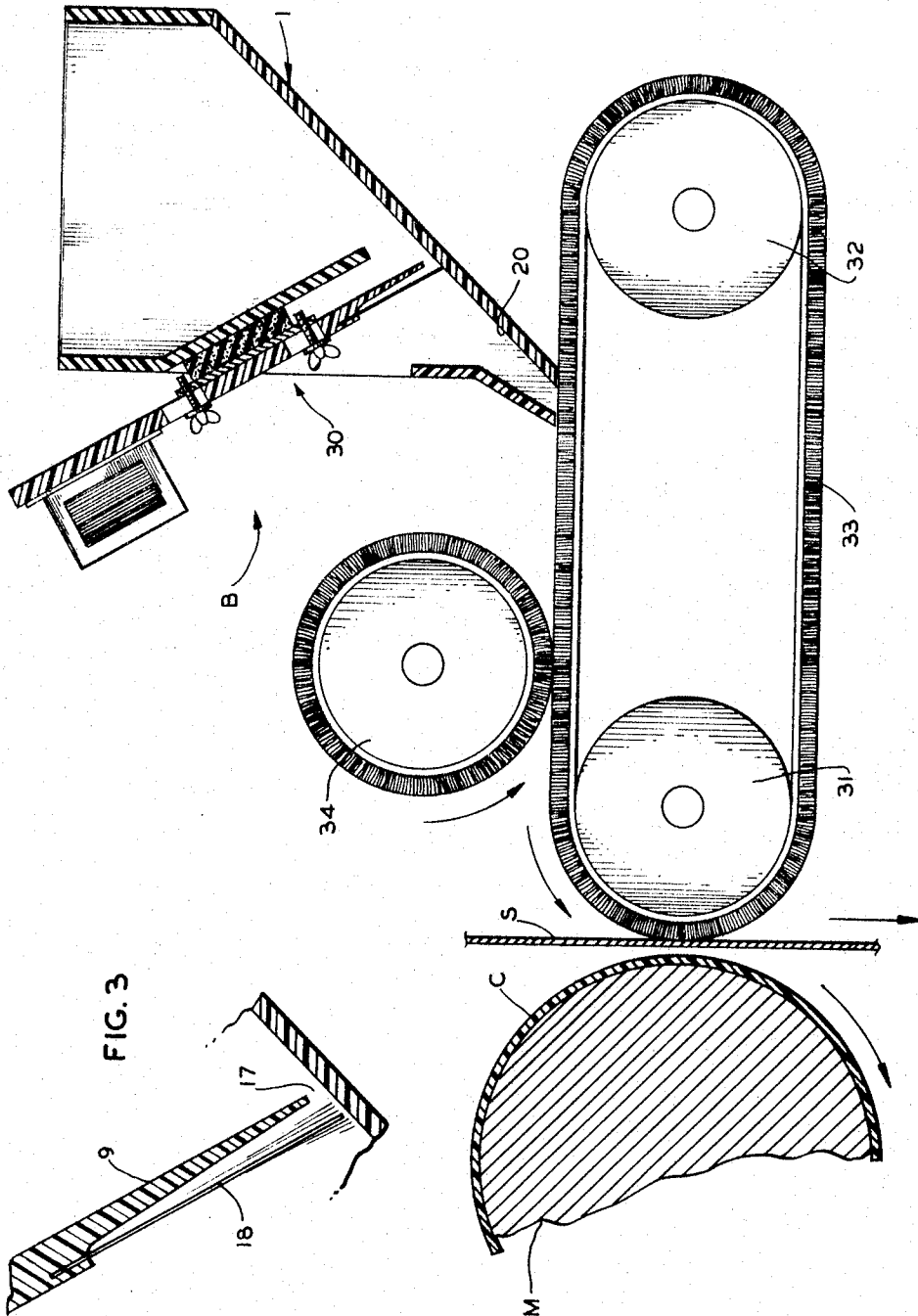


FIG. 4

FIG. 3

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INK DELIVERY SYSTEM EMPLOYING VIBRATING WIRES

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This invention relates in general to certain new and useful improvements in electrostatic printing and more particularly, to a mechanism for selective metering of electroscopic ink to an electrostatic printing screen.

In the presently available electrostatic printing devices, particularly in electrostatic screen process printing apparatus and in electrostatic coating apparatus, the article which is to be printed or coated is supported in spaced relationship to a discharge electrode and a receiving electrode. A substantial potential difference is maintained between these electrodes in order to create an electrostatic field. In most of the commercially available electrostatic printing devices, the inks which are employed are generally formed of a resinous base material such as natural rosin or various synthetic polymers and are designed to carry a suitable coloring material. These types of particles are extremely small, in the area of 2 to 20 microns and are capable of triboelectric charging.

Due to the fact that the ink particles are relatively small and extremely light in weight, they are readily compressible and moreover, very difficult to control. These small ink particles also have a tendency to cling together in agglomerates and, due to the resinous nature of the particles, become permanently bonded together when subjected to moderate compression. Inasmuch as they are capable of being triboelectrically charged, they are always affected by static charges. In the actual electrostatic printing operation, it is often difficult to maintain a substantially uniform field strength. Consequently, the field strength is always relatively higher over and above partially defined edge portions and isolated prominences rather than over the relatively broad expansive connecting surfaces of the article. The influences of the field strength has substantial effects on these lightweight ink particles and thereby tends to deposit heavier coatings on such edge portions than on the body portions due to this lack of balance in distribution. Moreover, due to the fact that agglomerates of various sizes exist, the individual ink particles and masses acquire widely different amounts of charge during the triboelectric charging process, which also is a cause of irregular print coverage during the screen printing operation.

It is known that the even distribution and flow of ink particles materially affects the efficiency of the printing operation and of the line definition obtained. Problems of metering a selected quantity of ink particles, spreading the ink particles on a carrier, creating triboelectric charges on the particles and transporting the charged particles to an electrically charged screen are all interconnected and affect the quality of the electrostatic image produced.

In the devices of the prior art, distribution of ink particles on an ink carrier was uneven due to the fact that there was no effective device for simultaneously metering and delivering a charge of ink. Subsequent print from these devices suffered areas of reduced color density, as a result of uneven ink distribution on the ink carrier. These areas of reduced color density have the outline of the previously printed pattern, often referred to as "ghosting" or "memory" effects and materially reduces the aesthetic appearance of the print.

The prior art has attempted to solve the problem of even distribution of coating particles by promoting a more

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uniform field strength over all of the surface portions of the article to be coated. One moderately effective method of obtaining a more uniform field strength is described in U.S. Letters Patent No. 2,428,991, through the use of specially biased electrodes. However, devices of this last named type are expensive, and are not capable of being modified so that the printing devices of this type are limited in their degree of utility.

It is, therefore, the primary object of the present invention to provide an apparatus for use with an electrostatic printing system which is capable of metering a uniform supply of electroscopic ink to the screen of such electrostatic printing system.

It is another object of the present invention to provide an apparatus of the type stated which is capable of maintaining uniform distribution and continuous delivery of ink particles to the screen of an electrostatic printing system.

It is also an object of the present invention to provide an apparatus of the type stated which does not produce "memory" or "ghosting" effects during electrostatic printing operations.

It is a further object of the present invention to provide an apparatus of the type stated which is capable of simultaneously creating even distribution of ink particles and triboelectrically charging such particles.

It is another salient object of the present invention to provide an apparatus of the type stated which is adaptable for use in mass-production methods of electrostatic printing and which does not require the employment of specially designed electrodes or devices for continually altering the electrostatic field.

It is an additional object of the present invention to provide an apparatus of the type stated which is capable of accommodating a wide variety of types, colors and sizes of inks to be used in the electrostatic printing system.

With the above and other objects in view, our invention resides in the novel features of form, construction, arrangement and combination of parts presently described and pointed out in the claims.

In the accompanying drawing (2 sheets):

FIGURE 1 is a side elevational view, partially broken away and in section of an ink delivery apparatus constructed in accordance with and embodying the present invention;

FIGURE 2 is a front elevational view of the ink delivery apparatus of FIGURE 1;

FIGURE 3 is a fragmentary sectional view taken along line 3-3 of FIGURE 2; and

FIGURE 4 is a schematic illustration, partially broken away and in section of a modified form of ink delivery system constructed in accordance with and embodying the present invention.

General description

Generally speaking, the present invention comprises an apparatus which is designed for use in mass-production electrostatic printing systems of the type described in co-pending application Ser. No. 463,109, filed June 11, 1965.

An electrostatic printing system of the type with which the present apparatus is used contains an electrically charged mandrel and an electrically charged screen, the latter having a suitably imprinted pattern for creating a desired printed image. The normal screen or stencil generally comprises a fine mesh element of conductive material having masked non-printing areas. The ink particles are sized to pass through the interstices of the non-masked areas.

The apparatus of the present invention generally includes a hopper containing the desired electroscopic ink. The ink hopper is somewhat funnel-shaped and has a discharge slot formed in one of the end walls thereof. A

shiftable plate is movable in the discharge slot thereby regulating the size of the opening and is provided with a series of longitudinally spaced, relatively heavy and rigid spring wires which are capable of being vibrated. The spring wires are mounted on the plate in such manner so that the desired degree of vibration can be obtained by simple adjustment. The wires terminate very closely to the bottom wall of the discharge slot thereby forming a very narrow feeding slot or discharge aperture through which the ink particles are permitted to pass. A vibrating mechanism is designed to create a vibratory condition on the hopper and the degree of vibration of the spring wires regulates the amount of electroscopic ink which is capable of passing therethrough.

A discharge trough is connected to the ink hopper in proximate relation to the discharge slot. The electroscopic ink which passes through the discharge slot is then deposited in the trough. The trough is inclined and carries the ink particles from the discharge hopper to a vibrating plate which is, in turn, mounted in close proximity to an electrostatic printing screen. A vibrating mechanism is mounted on the underside of the trough to provide the desired degree of vibration in the trough for moving the electroscopic ink particles toward the vibrating plate. The plate is connected to the trough so that it is vibrated therewith and terminates at a point in very slight contact with the surface of the electrostatic printing screen so that the electroscopic ink particles are caught in the electrostatic field maintained between the screen and a substrate which is to be printed.

The present invention also provides a modified form of ink delivery system which similarly employs a somewhat wedge-shaped ink containing hopper and a vibratory mechanism consisting of a plurality of spring-wires for regulating the amount of ink passing through a discharge slot formed in the hopper. The ink particles which pass through the discharge slot are then deposited in a trough and carried to a rotating ink delivery belt. The belt is rotated on a pair of spaced rollers and the ink particles contained thereon are delivered to the surface of an electrostatic printing screen. One end of the belt maintains very light surface contact with the surface of the screen so that the ink particles contained on the belt are caught in the electrostatic field maintained between the electrostatic printing screen and a substrate which is to be printed. A charging roller is also disposed in rotating contact with the surface of the belt for providing rotational friction and thereby creating triboelectric charges on the ink particles.

The art of electrostatic printing is still a recent technological innovation, and the terminology peculiar to this technology has not yet achieved a commonly acceptable and understood usage and definition. Accordingly, the term "printing" as used herein, is employed to describe the operation of delivering ink from the ink member to the element being printed, although it is to be understood that the word "printing" as used herein does not connote any mechanical pressure. The word "printing" is used in its much broader sense of the word merely to mean transfer of a design from one element to another in analogous form to the use of the term "printing" in photography, where mechanical pressure is not the cause of transference of the design. The ink feeding mechanism of the present invention is designed for use in electrostatic printing systems of the type where mechanical pressure is not employed to cause a transference of the design. Therefore, in the interpretation of the specification and the following claims, all terminology borrowed from the conventional printing art must, therefore, be given a broad meaning appropriate to this specialized field of electrostatic printing.

Detailed description

Referring now in more detail and by reference characters to the drawings which illustrate a practical embodi-

ment of the present invention, A designates an ink delivery mechanism which is adapted for use with electrostatic printing systems of the type described and illustrated in copending application Ser. No. 463,109, filed June 11, 1965.

The ink delivery mechanism A generally comprises a hopper 1 which may be molded or formed by any synthetic resin or plastic material which is inert with respect to the electroscopic ink to be contained therein. The hopper 1 is provided with an internal chamber 2 which constitutes a fluidized ink reservoir for retaining a desired electroscopic ink and is formed by an inclined bottom wall 3, a relatively short back wall 4 and a relatively large front wall 5. Thus, it can be seen that the hopper 1 is provided with an upper open end 6 and may be suitably provided with a cover plate (not shown). The electroscopic ink is maintained in a fluidized state or so-called "fluid state" and may be fluidized by any conventional process such as passing low pressure air through a porous membrane in which the ink particles are maintained, in combination with a vibratory action. In order to avoid compression of the ink while in the ink hopper 1, a conventional agitator (not shown) may be employed for maintaining the ink particles in the fluidized state. The front wall 5 of the ink hopper 1 is integrally formed with a forwardly projecting inclined wall 7 which angularly approaches the inclined bottom wall 3, in the manner as shown in FIGURE 1 and thereby forms a tapered discharge aperture 8.

Any of a variety of electroscopic inks can be employed in the present invention. Generally, the electroscopic inks comprise a finely dispersed powder which is capable of being triboelectrically charged. The powder generally carries a desired pigment. A number of satisfactory powders can be employed in the present invention and each must be in a finely divided state. Suitable powders are dyed thermoadhesive resins such as rosin, gum copal, gum sandarac, ethyl cellulose, Egyptian asphalt and the like. A very satisfactory thermoadhesive powder can be produced by dissolving equal parts of ethyl cellulose and Vinsol resin in acetone together with a small amount of spirit soluble aniline dye such as Nigrosine or aniline blue and spray drying the solution to produce an extremely fine powder having substantially spherical particles. Dyed Lycopodium powder is suitable where thermoadhesive properties are not required of the powder as is also starch, cellulose flour, powdered metal and copper powder.

Whether fusible, thermoadhesive or non-fusible powders or others are used, the particle size is preferably near the limit of definition of the eye under ordinary reading conditions. Excessive powder size contributes to graininess in appearance of the image. On the other hand, extremely fine powder may be undesirable in many instances due to its tendency to "ball up" or cling together in clusters. It is, therefore, desirable to use a powder in which substantially all the particles are within the size range from 2 to 10 microns. If spherical powders are used, this refers to their diameters, otherwise to the largest dimension. For most purposes, it is preferred to use an equidimensional powder particle, the sphere being the preferred form.

The front wall 5 is cut away in the provision of an inwardly struck support flange 9 forming an aperture 10 in the front wall 5. A gate mechanism 11 is secured to the exterior surface of the inwardly struck support flange 9 through a rubber block 12. The gate mechanism 11 generally comprises a shiftable plate 13 which is adjustably secured to a support plate 14 by means of wing nuts 15, the support plate 14, in turn, being bonded to the rubber block 12 by any suitable adhesive such as an epoxy resin. The wing nuts 15 are generally shiftable in slots 16 formed within the shiftable plate 13 so that the relative position of the plate 13 may be adjusted with respect to the support flange 9.

The lower end of the shiftable plate 13 is reduced in thickness and is tapered in the manner as shown in FIGURE 3. Moreover, it is spaced slightly from the interior of the bottom wall 3 to form a discharge slot 17. The discharge plate 13 is also slotted longitudinally in order to accommodate a plurality of longitudinally spaced relatively heavy and moderately rigid spring wires 18 which are capable of being vibrated. The spacing between each of the wires 18 is sufficiently small so that unauthorized ink from between each of the wires will not occur. The spacing is designed so that the ink will pass only when vibrated. It should be understood that the wires 18 are sufficiently rigid to retain their shape when disposed in a cantilever position, but are sufficiently flexible to be vibrated. The rubber block 12 which provides the securement of the gate mechanism 11 to the hopper 1 permits the desired degree of vibration of each of the wires 18. Secured to the forwardly presented surface of the shiftable plate 13 is a conventional vibrating mechanism 19 which is suitably connected to a source of electrical current (not shown).

By further reference to FIGURE 1, it can be seen that the wires 18 terminate very closely to the interior surface of the wall 1 and moreover, are spaced sufficiently so that when vibrated, electroscopic ink contained within the hopper 1 can pass through the spaces between each of the spring wires 18. The conventional vibrator mechanism 19 is provided with means for adjusting the amount of current thereto so that the desired degree of vibration on the gate mechanism 16 can be applied. The mechanisms for regulating the voltage and the vibration itself are not described in further detail herein inasmuch as these elements are conventional in their construction. Furthermore, it can be seen that the desired degree of vibration of each of the spring wires 18 may be regulated by adjusting the position of the shiftable plate 13. This can be performed through the employment of the wing nuts 15. The length of the wires 18 is, of course, proportional to the degree of vibration attained and the degree of vibration is proportional to the amount of feed which is permitted to pass through the wires 18 and through the discharge slot 17 and the discharge aperture 8.

Secured to the underside of the hopper 1 is a discharge trough or chute 20, which receives the electroscopic ink particles passing through the discharge aperture 8 and carries the ink particles to a vibrating plate 21. Also mounted on the underside of the trough or chute 20 is a conventional vibrating mechanism 22 which is suitably connected to the source of electrical current (not shown) for creating a vibratory condition on the trough 20. A conventional mechanism (not shown) for regulating the amount of the voltage to the vibrator 22 may also be provided in order to regulate the amount of vibration maintained on the trough 20. In this manner, a constant flow of electroscopic ink can be maintained from the hopper 1 to the vibrating plate 21. By reference to FIGURE 1, it can be seen that the trough 20 and the vibrating plate 21 are inclined so that ink is moved toward an electrostatic printing screen S when the trough 20 and the plate 21 are vibrated. The vibrating plate 21, however, is located at less of an acute angle with respect to the horizontal than the trough 20. The plate preferably is connected to the discharge end of the trough 20 through a fairly rigid structure so that it is similarly vibrated with the trough 20 through the action of the vibrator 22. However, it should be understood that a vibrator similar to the vibrator 22 may be mounted on the underside of the plate 21 thereby creating an independent vibratory action. The vibrating plate 21 terminates at a point in very slight contact with the electrostatic printing screen S so that the electroscopic ink particles contained on the plate 21 are deposited on the screen S and carried by an electrostatic field to a substrate C, which is preferably mounted on a mandrel M.

The plate 21 is preferably insulated from the remainder of the hopper 1 and the terminal ends of the wires 18 may be connected to a source of high voltage electrical current (not shown). Thus, current is supplied to the wires 18 to provide a corona discharge so that the ink particles passing between the wires 18 are electrically charged. By this process, it is possible to eliminate the necessity of triboelectrically charging the ink particles before they are admitted to the electrostatic field maintained below the screen S and the mandrel M.

The screen S is of the type described in copending application Ser. No. 463,109, filed June 11, 1965, and is, therefore, not described in detail herein. However, it is pointed out that the screen S oscillates and shifts a distance which is at least equal to the length of the screen S during each printing cycle. It has been found in connection with the present invention that a very effective type of screen which can be employed in electrostatic printing operations of this type is an electroformed nickel screen with 250 wires to the inch. The screen or so-called "stencil" is coated with a photosensitive material or so-called "resist." This coating is applied so that it spans all of the interstices in the screen. The sensitized screen is then exposed to an ultraviolet light through an interposed positive image of the desired copy for a proper length of time to harden the area where the interposed image transmits light. Thereafter, this coated screen is then developed and the development will dissolve away the areas of the material which were protected from light by the opaque areas of the film image, thereby leaving a solid mask in the areas affected by the light.

Various methods of preparing the stencil can be used. It is only necessary that the non-printing area be effectively masked to prevent the movement of pigment there-through in subsequent electrostatic printing operations. This is accomplished very well by various known methods as well as the use of photosensitive coatings on the open mesh. Techniques familiar in the silk screen process printing may also be employed in the production of stencils for electrostatic printing operations. It is not necessary to have the regularity of openings of a fine mesh screen or sensitized net. The regular openings in fibrous material and the like can be satisfactory as long as the openings and the particle size of the pigment are compatible for movement therethrough.

In use, the ink hopper 1 is filled with the desired electroscopic ink which is fluidized in a manner as previously described. The proper amount of electrical current is supplied to the vibrator 19 so that the desired degree of vibration is maintained on the shiftable plate 13 and hence on the spring wires 18. Moreover, the position of the plate 13 is adjusted so that the desired size of the discharge slot 17 is maintained. Thereafter, a substrate C is deposited on the mandrel M in any suitable electrostatic screen process printing apparatus and ink is supplied from the hopper 1 so that it is deposited in the trough 20. A continuing flow of electroscopic ink can be maintained by maintaining the vibratory action on the wires 18. Moreover, since the trough 20 is maintained in a vibratory state, ink will be continually moved toward the vibrating plate 21 where it is again moved toward the electrostatic printing screen S. The ink will pass through the interstices of the screen and to the substrate C contained on the mandrel M.

It is possible to provide another modified form of ink delivery mechanism B, substantially as shown in FIGURE 4, which is similar to the previously described ink delivery mechanism A. The ink delivery mechanism B generally comprises a metering mechanism 30 which is substantially similar to the combined ink hopper 1 and trough 20. In general, the metering mechanism 30 is similar to the previously described apparatus A except that the vibratory plate 21 is not employed.

In the ink delivery mechanism B, a belt system is disposed in close proximity to the discharge end of the trough 20 and is used to move the ink particles to the electrostatic printing screen S. The ink delivery mechanism B provides a pair of spaced rollers 31, 32, one or both of which may be driven through a suitable electrical motor (not shown). Trained around the rollers 31, 32 is an ink transporting belt 33. The belt 33 is preferably formed of a relatively thick mohair pile fabric having a relatively thick bristle brush surface. It is important, however, that the belt 33 be constructed of a material which has a sufficient number of cavities or interstices into which ink powder can be deposited and subsequently transferred to the screen S. Moreover, the fabric of which the belt 33 is formed must have a different triboelectric charging potential than the ink which is to be delivered to the electrostatic printing screen S. By reference to FIGURE 4, it can be seen that the belt terminates in very slight tangential contact with the surface of the screen S so that the ink particles contained on the belt 33 are caught in the electrostatic field maintained between the screen S and the mandrel M and transferred through the screen S. Furthermore, a triboelectric charging roller 34 is mounted in contact with the upper surface of the belt 33 and is designed to rotate at a different rate of speed than the surface movement of the belt 33 so that a frictional effect is produced. This condition produces a triboelectric charge on the ink particles contained on the belt 33. Moreover, the belt 33 and the triboelectric charging roller 34 both rotate in a counter-clockwise direction so that the surface movement of the belt is in an opposite direction to the surface movement of the charging roller 34 at the point of contact between these two elements. The electrostatic printing apparatus B functions in a manner similar to the operation of the electrostatic printing apparatus A except that in the electrostatic printing apparatus B, the electroscopic ink from the hopper 1 is charged on the continuously rotating belt 33. This type of delivery has been proved to be very effective in certain cases where uniformity of distribution of the ink particles is critical.

The ink delivery systems of the present invention are particularly adaptable for use in the printing method for printing on curved surfaces and described in copending application Ser. No. 472,829, filed July 19, 1965, and which relates to electrostatic screen process printing. In the printing on curvilinear surfaces such as conically shaped cups, the cup is positioned in an axis of rotation so that the exterior wall tangentially approaches and departs from the screen. Thus, the printing will occur along an elemental line of closest approach between the cup and screen. The substrate or container is rotated at approximately the same rate of speed of the movement or rotation of the screen so that a continuing line of tangency occurs between the surface of the container and the surface of the screen. Simultaneously with the rotation of the screen and the container, electroscopic ink particles are moved toward and through the screen to the substrate by the electrostatic field. The ink particles are passed through the screen along this line or band of tangency. In this manner, it is possible to provide electrostatically printed images on the surface of a curvilinearly shaped article, such as a conically shaped container.

The delivery mechanisms of the present invention have found unique application in this type of printing since they are capable of providing a continual supply of ink along a flat thin line. These ink feeding mechanisms are so located that ink can be supplied to the screen along this continuing line of tangency.

It should be understood that changes and modifications in the form, construction, arrangement and combination of parts presently described and pointed out may be made and substituted for those herein shown without departing from the nature and principle of our invention.

Having thus described our invention, what we desire to claim and secure by Letters Patent is:

1. A feeding mechanism for electrostatic printing systems and the like which include a counter-electrode and an electrostatic printing screen with an electrostatic field established therebetween; said feeding mechanism comprising a container having a lower wall and a side wall, said container also having an interior chamber for housing electroscopic ink, said side wall being spaced from said lower wall thereby forming a discharge slot therebetween, a plate operatively mounted on said side wall and extending toward said lower wall, resilient means operatively interposed between said side wall and said plate, a plurality of wires having one end rigidly mounted on said plate and extending toward said lower wall, said wires being disposed across the entire length of said discharge slot and terminating at their lower ends in close proximity to said lower wall for selective metering of electroscopic ink, the spacing between each of said wires being sufficiently small to prevent flow of ink particles therethrough when said wires are in a static state, and vibratory means operatively mounted on said plate for vibrating said wires to an extent sufficient to permit ink particles to pass through the spacings between each of the wires.

2. The feeding mechanism of claim 1 further characterized in that means is operatively mounted on said plate for adjustably positioning said plate and said wires with respect to said lower wall.

3. The feeding mechanism of claim 1 further characterized in that said lower wall is inclined downwardly.

4. The feeding mechanism of claim 1 further characterized in that an inclined supporting element is operatively associated with the discharge slot of said container for transporting the ink to said screen, and means for vibrating said supporting element when electroscopic ink is deposited thereon.

5. The feeding mechanism of claim 1 further characterized in that belt means is operatively associated with the discharge slot of said container for transporting the electroscopic ink deposited thereon to said screen, and triboelectric charging means disposed in operative engagement with said belt means for triboelectrically charging the ink particles contained on said belt.

6. A feeding mechanism for electrostatic printing systems and the like which include a counter-electrode and an electrically charged screen with an electrostatic field established therebetween; said feeding mechanism comprising a container of electroscopic ink having a discharge end, a vibratory mechanism operatively mounted on said container, resilient means operatively interposed between said container and said vibratory mechanism, a plurality of wires having one end stationarily mounted on said vibratory mechanism so that said wires are capable of being vibrated with respect to said container, said wires being disposed across the discharge end of said container for selective metering of electroscopic ink, the spacing between each of said wires being sufficiently small to prevent flow of ink particles therethrough when said wires are in a static state, said vibratory mechanism being capable of vibrating said wires to an extent sufficient to permit ink particles to pass through the spacing between each of the wires, and an inclined supporting element associated with the discharge end of said container for transporting the ink to said screen.

7. A feeding mechanism for electrostatic printing systems and the like which include a counter-electrode and an electrically charged screen with an electrostatic field established therebetween; said feeding mechanism comprising a container of electroscopic ink having a discharge end, a vibratory mechanism operatively mounted on said container, resilient means operatively interposed between said container and said vibratory mechanism, a plurality of wires having one end stationarily mounted on said vibratory mechanism so that said wires are capable of

being vibrated with respect to said container, said wires being disposed across the discharge end of said container for selective metering of electroscopic ink, the spacing between each of said wires being sufficiently small to prevent flow of ink particles therethrough when said wires are in a static state, means for vibrating said wires to an extent sufficient to permit ink particles to pass through the spacing between each of the wires, an inclined supporting element associated with the discharge end of said container for transporting the ink to said screen, and means for vibrating said supporting element when electroscopic ink is deposited thereon.

8. A feeding mechanism for electrostatic printing systems and the like which include a counter-electrode and an electrically charged screen with an electrostatic field established therebetween; said feeding mechanism comprising a container of electroscopic ink having a discharge tube, a vibratory mechanism operatively mounted on said container, resilient means operatively interposed between said container and said vibratory mechanism, a plurality of wires having one end stationarily mounted on said vibratory mechanism so that said wires are capable of being vibrated with respect to said container, said wires being disposed across said tube for preventing flow of ink, the spacing between each of said wires being sufficiently small to prevent flow of ink particles therethrough when said wires are in a static state, said vibratory mechanism being capable of vibrating said wires to an extent sufficient to permit ink particles to pass through the spacings between each of the wires.

9. A feeding mechanism for electrostatic printing systems and the like which include a counter-electrode and an electrically charged screen with an electrostatic field established therebetween; said feeding mechanism comprising a container of electroscopic ink having a discharge tube, a vibratory mechanism operatively mounted on said container, resilient means operatively interposed between said container and said vibratory mechanism, a plurality of wires having one end stationarily mounted on said vibratory mechanism so that said wires are capable of being vibrated with respect to said container, said wires being disposed across said tube for preventing flow of ink, the spacing between each of said wires being sufficiently small to prevent flow of ink particles therethrough when said wires are in a static state, said vibratory mechanism being capable of vibrating said wires to an extent sufficient to permit ink particles to pass through the spacings between each of the wires, and means associated with said vibratory mechanism for adjusting the

degree of vibration of the wires to obtain the desired flow of ink from the container.

10. A feeding mechanism for electrostatic printing systems and the like which include a counter-electrode and an electrically charged screen with an electrostatic field established therebetween; said feeding mechanism comprising a container of electroscopic ink having a discharge end, a vibratory mechanism operatively mounted on said container, resilient means operatively interposed between said container and said vibratory mechanism, a plurality of wires having one end stationarily mounted on said vibrating mechanism so that said wires are capable of being vibrated with respect to said container, said wires being disposed across the discharge end of said container for selective metering of electroscopic ink, the spacing between each of said wires being sufficiently small to prevent flow of ink particles therethrough when said wires are in a static state, said vibratory mechanism being capable of vibrating said wires to an extent sufficient to permit ink particles to pass through the spacings between each of the wires, and belt means operatively associated with the discharge end of said container for transporting the electroscopic ink deposited thereon to said screen.

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