

United States Patent

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[72] Inventors John W. Weigl, West Webster;
Richard J. Komp, Webster, N.Y.
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[73] Assignee Xerox Corporation
Rochester, N.Y.

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250/49.5 (60), 49.5 (61), 49.5 (62); 355/17;
317/262, 3

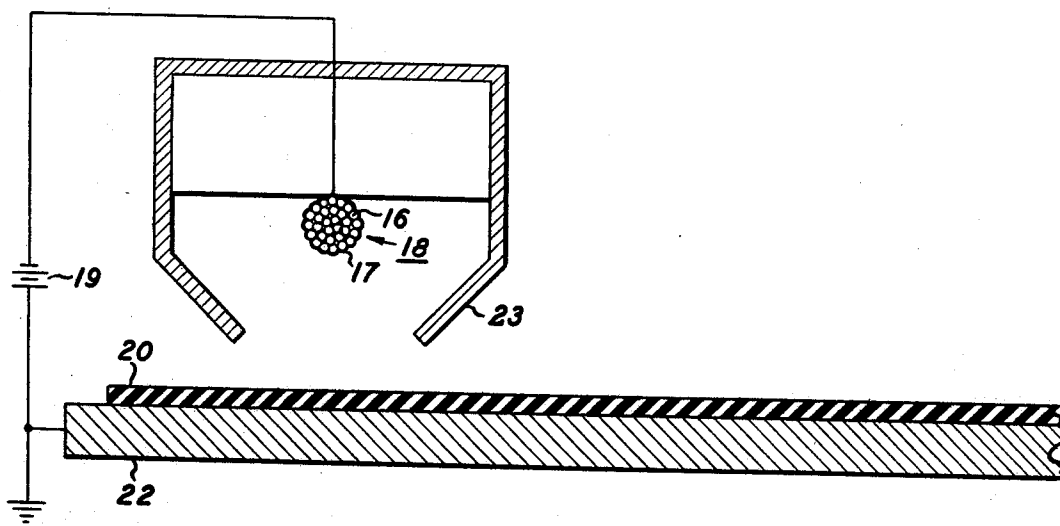
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Primary Examiner—James W. Lawrence
Assistant Examiner—A. L. Birch
Attorneys—Stanley Z. Cole and James J. Ralabate

[54] CORONA GENERATING ELECTRODE
STRUCTURE FOR USE IN A XEROGRAPHIC
CHARGING METHOD
5 Claims, 3 Drawing Figs.

[52] U.S. Cl..... 250/49.5,
313/354, 317/262, 355/17
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ABSTRACT: A corona generating article is provided by over-
coating a strand or bundle of strands with a material which is
at least partially conductive.



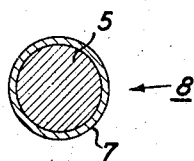


FIG. 1

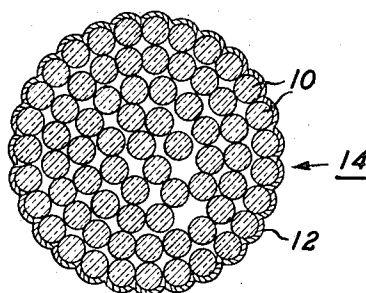


FIG. 2

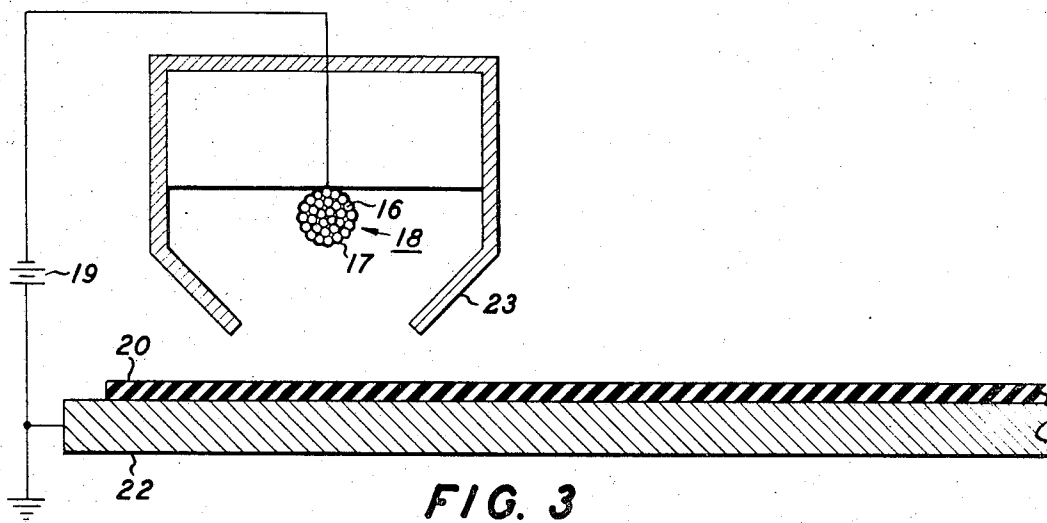


FIG. 3

INVENTORS
JOHN W. WEIGL
RICHARD J. KOMP

BY

James J. Ralston
ATTORNEY

CORONA GENERATING ELECTRODE STRUCTURE FOR USE IN A XEROGRAPHIC CHARGING METHOD

This invention relates in general to imaging and in particular to a xerographic system.

In the art of xerography, according to Carlson U.S. Pat. No. 2,297,691, it is usual to employ the simultaneous application of electric field and a pattern of activating radiation on a photoconductive insulating member to form an electrostatic charge pattern otherwise known as an electrostatic latent image. This electrostatic latent image then is capable of being utilized such as, for example, by the deposition of electroscopic material thereon to form a visible image.

Usually the order of procedure is to sensitize the xerographic plate by applying a uniform charge to the surface of the photoconductive member after which exposure is made. The art of sensitizing the photoconductive insulating member as employed in that Carlson patent has been a difficult and complex one. Normally sensitization may be accomplished by any of various means, such as, for example, frictional means as disclosed in that Carlson patent or ion charging means as shown in U.S. Pat. No. 2,777,957 to Walkup. Frictional charging, however, was found to be difficult in operation and generally resulted in an uneven or irregular charge across the surface of the photoconductor. The charge was also found to be too weak and insufficiently reproducible for use in xerography. Ion charging on the other hand, has been found to produce uniform and reproducible charges on the surface of the insulating member. Thus, ion charging, generally, comprises the application of charge to the photoconductive insulating surface by mechanically passing across the photosensitive surface a corona generating electrode maintained at a potential of several thousand volts, normally in the order of about 7000 volts with respect to ground potential. However, conventional corona generating devices have been known to fail in service for various reasons. For example, the potentials required for corona generation produce an ozone rich atmosphere which corrosively attacks the corona generating device. In addition, it has heretofore been necessary to use very thin wires to provide intense corona at reasonable electrical potentials. For example, corona wires customarily measure 0.002 inches in diameter. The wires are, therefore, also subject to neckdown failures caused by vibration. (U.S. Pat. No. 3,233,156 to Jarvis and Robinson shows other possible corona discharge devices, however, these are unnecessarily complex.) The requirements for a corona wire, therefore, are that it be corrosion resistant and mechanically strong. Although corona generating devices made of platinum alloys, for example, are comparatively resistant to an ozone rich atmosphere, they lack the tensile strength required of corona wires.

It is, therefore, an object of this invention to provide a system for charging an insulating or photoconductive insulating member which overcomes the above noted disadvantages.

It is another object of this invention to provide a system for charging an insulating or photoconductive insulating member which does not require the corrosion resistant component to be comparatively mechanically strong.

It is another object of this invention to provide a system for charging an insulating or photoconductive insulating member which does not require comparatively thin corona discharge wires.

It is another object of this invention to provide a comparatively mechanically strong, corrosion resistant corona discharge article.

It is another object of this invention to provide a corona discharge article which is comparatively useful for either positive or negative corona application.

The foregoing objects and others are accomplished in accordance with this invention by utilizing a corona discharge article comprising a core made of one or more thin wires, filaments, or fibers, hereafter referred to as strands, overcoated with a conductive corrosion resistant material. The core provides mechanical strength and the coating provides the corrosion resistance required for corona discharge purposes. The

individual strands in the multistrand core may be placed parallel to one another but preferably are woven or twisted together to aid handling. Since the corona intensity is a function of the surface curvature of the corona discharge device, the multistrand corona discharge core may be larger than the usual 0.002 inch corona wire because the surface curvature of the strands control the intensity of the corona generated, that is, the smaller the surface curvature of the corona discharge device is the less voltage is required to establish a usable corona. For example, a bundle of about 0.008 inches in diameter made up of about 200 individual strands, each strand measuring about 0.0004 inches in diameter may be used in place of a conventional 0.002 inch corona discharge wire. That is, the 0.008 inch bundle operating at the same potential as a 0.002 inch wire under similar conditions charges the surface of an insulator to about the same potential. The multistrand core corona generating article is useful for either positive or negative charging as is disclosed in U.S. Pat. No. 3,075,078 to Olden.

The preferred corona discharge device, therefore, comprises a multistrand core of quartz fibers twisted together and overcoated with a thin electrically continuous film of platinum. The quartz provides the tensile strength required of corona discharge devices and the platinum provides inertness to an ozone rich atmosphere and good conductivity. In addition, the heterogeneous system provides increased working strength due to even distribution of stress among the quartz fibers resulting from the use of a comparatively soft matrix.

It should be understood that for the purposes of this disclosure that the term insulating surface is intended to include insulating and photoconductive insulating surface materials and materials such as electrographic recording dielectrics.

Any suitable conductive, semiconductive, or insulating material may be used as the strand material. Typical materials include strands of quartz, tungsten, platinum, platinum alloys, such as platinum-iridium, platinum-rhodium, etc., stainless steel, ceramics, glass, silicon carbide, boron nitride, and mixtures thereof. Quartz is preferred because of its high tensile strength and chemical resistivity.

The coating material may be of any suitable conductive material. Typical conductive metals are: aluminum, brass, cadmium, copper, gold, magnesium, nickel, noble metals and their alloys such as, platinum, platinum alloys such as platinum-iridium, platinum-rhodium, palladium, iridium, rhodium, etc., silver, stainless steel, tin, tungsten, and mixtures thereof. Corrosion resistant semiconductive materials may be used. Typical semiconductive coatings include tin oxide, indium oxide, and silicon carbide. Platinum is preferred because of its inertness to an ozone rich atmosphere and its relatively high conductivity.

The advantages of this improved method of imaging will become apparent upon consideration of the detailed disclosure of the invention especially when taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a cross-sectional end view of an embodiment of the corona discharge source of this invention.

FIG. 2 is a cross-sectional end view of a preferred embodiment of the corona discharge source of this invention.

FIG. 3 is an end sectional view schematically illustrating the operation of this invention.

Referring now to FIG. 1 a single strand core 5 is overcoated with conductive material 7 to form corona discharge device 8. The coating may be applied to the core by any conventional method such as painting, spraying, dipping, plating, by chemical reaction, or by vacuum deposition. Preferably coated core 8 will not exceed in diameter conventional corona discharge devices which conventionally measure about 0.002 inches in diameter. Core 5 may be either insulating or conducting.

Referring now to FIG. 2 a core comprising a plurality of fine strands 10 are overcoated with conductive material 12. Alternatively, the strands 10 may be overcoated after they are twisted, woven, or placed together. Preferably strands 10 are twisted together to aid handling. Corona discharge device 14

may be larger than conventional corona discharge wires. The coating may be applied to the strands by any conventional method such as painting, spraying, dipping, plating, by chemical reaction, or by vacuum deposition. The allowable thickness of coating 12 depends on the number of strands 10 in the core and on the diameter of strands 10. For example, if a very large number of small diameter strands 10 are used, a very thin coating 12 is preferred because a thick coat would fill the spaces between the outer strands 10 of the bundle resulting in loss of the small diameter surface curvature. By way of example, a core comprising 200 strands of 0.0004 inch diameter quartz should have a coating thickness in the range of 0.00001 inches to 0.00005 inches.

Although FIG 2 shows the overcoating to be a thin coating over the surface of the core, it is preferred to have the overcoating material penetrate to all parts of the core bundle. The degree to which the overcoating material penetrates the core depends on the process by which the core is overcoated.

Referring now to FIG 3 a core comprising a plurality of fine strands 16 are twisted together and overcoated with conductive material 17. The corona discharge device 18 is surrounded by insulating housing 23 and connected to a source of potential difference 19. Xerographic surface 20 which is to be charged is placed on conductive plate 22 which is connected to potential source 19 and grounded. Uniform charging is accomplished by moving xerographic surface 20 at about constant speed and at approximately a right angle to the axis of discharge device 18.

The following examples further specifically illustrate the present invention. The examples below are intended to illustrate the various preferred embodiments of the improved corona generating device. The parts and percentages are by weight unless otherwise indicated.

EXAMPLE I

A core comprising about 200 quartz fibers twisted together, each fiber measuring approximately 0.0004 inches in diameter (available from Lamp Glass Department, General Electric), is coated with Hanovia Liquid Bright Platinum 040 (available from the Hanovia Liquid Gold Division, Engelhard Industries) by brushing with a camel's hair brush dipped in the platinum solution. Sufficient solution is brushed onto the core to insure penetration of the solution into the core. The coated core is then placed in an oven and cured at a temperature of 400° C. for 1 hour. The platinum compounds decompose leaving behind a coating of pure platinum. The coated core is then recoated by brushing again with the camel's hair brush dipped in the platinum solution and again baked at 400° C. for 1 hour to insure electrical continuity of the coating. The coating measures approximately 0.00002 inches. The coated core is then used as a corona generating article as is shown in U.S. Pat. No. 2,777,957 to Walkup.

EXAMPLE II

A core comprising about 70 wound stainless steel wires each wire measuring approximately 4 microns in diameter (available from the Brunswick Corporation) is immersed in an

electroplating bath comprising 13.4 ounces of ammonium nitrate, 1.3 ounces of sodium nitrate, 2.2 ounces of platinum diammino nitrate and 6.7 ounces of 28 percent ammonium hydroxide in solution in 1 gallon of water. The electroplating bath is prepared as follows: The platinum diammino nitrate is separately dissolved by heating it in a 5 percent ammonium hydroxide solution. The diammino salt is thereby changed into the tetrammino salt which is then added to the solution of ammonium nitrate, sodium nitrate and ammonium hydroxide in water. Electroplating is accomplished by applying a potential difference of about 4.5 volts until the coating measures approximately 0.00004 inches. The coated core is then used as a corona generating article.

EXAMPLE III

The experiment of example I is repeated with the exception that after the coated core is cured for the first time it is electroplated as in example II. The resulting coating measures approximately 0.00004 inches.

EXAMPLE IV

A core comprising about 200 Pyrex fibers twisted together each fiber measuring approximately 0.0004 inches in diameter available from Corning Glass Works is coated with platinum as in example I.

EXAMPLE V

A core comprising about 200 Pyrex fibers twisted together each fiber measuring approximately 0.0004 inches in diameter available from Corning Glass Works is coated as in example III.

Although specific components and proportions have been stated in the above description of preferred embodiments of the invention, other typical materials, as listed above where suitable, may be used with similar results. In addition, other materials may be added to the mixture to synergize, enhance, or otherwise modify the properties of the strands and the overcoating. For example, a material to improve the adhesion of the overcoating to the core bundle may be incorporated within the bundle material or coated thereon.

Other modifications and ramifications of the present invention will occur to those skilled in the art upon a reading of the disclosure. These are intended to be included within the scope of this invention.

We claim:

1. The method of electrostatically charging a member which comprises placing said member in the corona discharge of a corona generating electrode comprising a core of at least two strands overcoated with an electrically continuous coating of a conductive material.

2. The method of claim 1 wherein said core comprises an insulating material.

3. The method of claim 2 wherein said core comprises quartz.

4. The method of claim 1 wherein said core comprises stainless steel.

5. The method of claim 1 wherein said overcoating comprises platinum.