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ELECTROPHOTOGRAPHIC MATERIALS AND PROCESS OF PRODUCING SAME

Frederick W. Sanders, Chillicothe, Ohio, assignor to The Mead Corporation, Dayton, Ohio, a corporation of Ohio

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ABSTRACT OF THE DISCLOSURE

The present invention relates to compositions for obtaining image reversal in electrophotographic printing processes by incorporating resin acids in wood rosin in conventional electrophotographic coating compositions comprising a photoconductive pigment and an electrically insulating binder.

This application is a continuation-in-part of United States patent application Ser. No. 459,923 filed May 28, 1965.

The present invention relates to electrophotographic materials and process of producing same. More particularly, it relates to compositions for obtaining image reversal of an electrophotographic surface and to methods of producing same.

An electrostatic printing process is a process in which a visible record, reproduction or copy is produced and which includes the conversion of a light image into an electrostatic charge pattern. Examples of such electrostatic printing process includes the xerographic process generally known in the trade as Xerox and a modification generally known in the trade as Electrofax.

The Xerox may be described generally as one where a base plate of relatively low electrical resistance such as metal, paper, etc. having a photoconductive insulating surface thereon is electrostatically charged in the dark. The charged coating is then exposed to a light image. The charges leak off rapidly to a base plate in any given area that is so exposed, after such exposure the coating is contacted with electrostatic marking particles in the dark. These particles adhere to the areas where the electrostatic charges remain, forming a powder image corresponding to the electrostatic image. The powder image is then transferred to a sheet of transfer material resulting in a positive or a negative print, as the case may be. A detailed description of the steps of such a process is found in United States Patent No. 2,297,691 issued Oct. 6, 1942, to C. P. Carlson.

Alternatively, where the base plate is relatively inexpensive, as of paper, it may be desirable to fix the powder image directly to the plate itself. In such cases, the process is generally known as Electrofax whereby direct electrophotographic printing is effected on paper. The Electrofax process may be described generally as including the following steps for making a direct print. The paper is first made sensitive to light by giving it a blanket negative electrostatic charge on the coating side in the dark. One way of doing this is by the ion transfer from a corona discharge. The sheet now sensitive to light, is exposed by any of the conventional photographic procedures. The electrostatic charge is lost or reduced in the exposed area and retained in the masked areas to form a latent electrostatic image on the surface of the paper. The latent image is developed by spraying, or otherwise suitably contacting it with a pigmented resin powder carrying a positive electrostatic charge. Finally, the powder image is fixed by melting the resin powder so it fuses to the paper surface to produce a durable light-fast image. A detailed description of the steps of such a process is described by H. G. Greig in U.S. Patent No. 3,052,539 issued Oct. 4, 1963.

The latter process eliminates the intermediate step of transferring the powder image and enables production of the image directly upon a desired surface. A photoconductive paper suitable for use in connection with such a process usually comprises a backing sheet, coated with a photoconductive agent such as zinc oxide, zinc sulfide, cadmium sulfide, titanium dioxide or the like particles suspended in an electrically-insulating film-forming binder.

The electrically insulating film-forming material may be one of a number of substances such as various synthetic resinous materials having high dielectric strength. Previously used materials of this type include polyvinyl acetate, copolymers of vinyl chloride-vinyl acetate, polystyrene, silicone resins, etc., as well as resin-like materials such as methyl or ethyl cellulose and cellulose acetate, natural resins and waxes.

Various types of photoconductive powders may be incorporated into the selected binder or film-forming material. Photoconductive zinc oxide powder, for example, is very commonly used for this purpose and may be incorporated into the binder in various ways. The resulting dispersion is then coated on paper or other suitable backing. After formation of the latent image on this coated base by conventional photographic means, the latent image is next developed by toners or developers in the form of charged powders which adhere to the charged areas of the latent image.

Using certain toners or developers and charging the surface negatively, the normal developed image is an exact duplicate of the image being copied. It is, however, sometimes desirable to produce reversals of the original image.

It is an object of the present invention to produce reversals of the original image when reproducing same electrophotographically.

It is a further object of the present invention to effect the reversal of electrophotographically produced images by the use of wood rosin acid.

Other objects will be evident from the description which follows.

It has been found according to the present invention that by using a zinc oxide or other photoconductive agent surface coating containing an ammoniacal solution of resin acids in wood rosin, the image is reversed. The black areas of the original image appear as white areas, and the white areas appear as black areas. Effectively, a negative image will print positive, or vice versa. Apparently, this change in the normal printing procedure is due to the effect of the resin acids in wood rosin in radically changing the position of the zinc oxide or other photoconductive agent, in the triboelectric series.

The following specific examples are given to illustrate the invention. It will be obvious to one skilled in the art, however, that numerous variations from the specific examples are possible. Any such variation, however, which does not depart from the basic concept of the invention disclosed herein is intended to come within the scope of the appended claims.

Example I

50 grams of photoconductive zinc oxide were dispersed in 70 ml. of a stock solution prepared by dissolving 100 grams of a vinyl acetate-crotonic acid copolymer containing 3–7% crotonic acid, dissolved in 600 ml. of water containing 10 ml. of 28% ammonium hydroxide solu-

tion. The resulting dispersion was coated on untubsized 40# (per 3000 square feet) coating rawstock paper at the rate of 18 pounds (dry) per 3000 square feet, and dried. The surface of the dried sheet was then charged, exposed to light through a negative, and developed with a positive toner which gave an image identical with that on the negative in that black on the negative gave a black image.

Example II

In this experiment, 40 grams of the same photoconductive zinc oxide used in Example I were dispersed in 35 ml. of the same resin stock of vinyl acetate-crotonic acid copolymer in dilute ammonium hydroxide solution. To this was then added 35 ml. of a solution obtained by dissolving 20 grams of resin acids in wood rosin dissolved in 120 ml. of water containing 10 ml. of 28% ammonium hydroxide solution. The resulting solution was then applied to a paper base of the same character as in Example I, and the coated paper processed as described in Example I. In this case, however, the developed image was the reverse of that in Example I, that is, the blacks of the negative appeared white, and vice versa.

Similar results were obtained using other photoconductive agents and other binders in place of the zinc oxide and the vinyl acetate-crotonic acid copolymer, and other proportions of photoconductive zinc oxide and binder, within the ranges customarily used. It is generally desirable to use amounts of wood rosin acids ranging from ⅓ to 1/10 parts per part of the photoconductive agent used.

What is claimed is:

1. An electrophotographic coating composition comprising an inorganic photoconductive pigment, an electrically insulating film-forming copolymer binder material and an ammoniacal solution of resin acids of wood rosin.

2. The electrophotographic composition of claim 1 wherein the resin acids of wood rosin are present in amounts ranging from ⅓ to 1/10 parts by weight of said acids per one part of said photoconductive pigment.

3. The electrophotographic composition of claim 1 wherein said photoconductive pigment is zinc oxide.

4. The electrophotographic composition of claim 1 wherein said binder is vinyl acetate-crotonic acid copolymer containing 3%, by weight, of crotonic acid.

5. In a method for obtaining image reversal on an electrophotographic surface, the step which comprises coating said surface with an electrophotographic coating composition comprising an inorganic photoconductive pigment, an electrically insulating binder therefor, and ⅓ to 1/10 part by weight of resin acids of wood rosin per one part of said photoconductive pigment, said acids being in the form of an ammoniacal solution.

6. Electrophotographic recording element comprising a base coated with an electrophotographic coating composition comprising an inorganic photoconductive pigment, an electrically insulating binder therefor and ⅓ to 1/10 part, by weight, of ammonium salt of resin acids of wood rosin per one part of photoconductive pigment.

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NORMAN G. TORCHIN, *Primary Examiner.*

C. E. VAN HORN, *Assistant Examiner.*

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