United States Patent Office

3,211,686

Patented Oct. 12, 1965

3,211,686

AQUEOUS COMPOSITION FOR PREWETTING A MASTER CARRYING AN IMAGE PREPARED BY ELECTROPHOTOGRAPHIC REPRODUCTION CONTAINING POLYACRYLIC ACID

Jay J. Uber, South Hadley, and Shwang Hsia, Holyoke, Mass., assignors to The Plastic Coating Corporation

No Drawing. Filed June 18, 1959, Ser. No. 821,106

3 Claims. (Cl. 260—29.6)

This invention relates to a composition for prewetting a master carrying an image which has been prepared by electrophotographic reproduction, to produce a printing plate therefrom.

Masters which are adapted by their form and dimensions for attachment to the cylinder of a lithographic printing press of either the office duplicating machine type or the commercial printing type have heretofore been prepared by electrophotographic reproduction. Such a master may be either a paper sheet or a plastic sheet carrying on its surface a light-sensitizable coating which may consist of a photosensitive zinc oxide pigment dispersed in an insulating matrix of a synthetic resin. The master is made into either a positive or a negative print by a four-step procedure. The sheet is first made sensitive to light by giving it a blanket, negative, electrostatic charge on the coated side of the paper in the dark. A convenient way of doing this is by ion transfer from a corona discharge. The sheet, while carrying the electrostatic charge, is exposed by any of the conventional photographic procedures, such as, by either contact or projection. The electrostatic charge is lost or reduced in the exposed areas and retained in the masked areas, to form a latent electrostatic image on the coated surface of the paper. The latent image on the paper is then developed by applying to the exposed surface a suitably pigmented resin powder, hereinafter referred to as a "toner," carrying an electrostatic charge. The powder image is fixed by melting the resin powder so that it fuses to the coated paper surface to produce a durable image.

During the sensitization of the coating on the paper by the application of a blanket, negative, electrostatic charge to its exposed surface, its reverse surface must be electrically grounded. It is grounded by placing the sheet on a grounded electrical conductor. For this reason, it is necessary for the sheet to be an electrical conductor to ground the lower surface of its coating to the electrically grounded conductor on which it rests.

The toner is retained by the image areas to form a direct image or by the background areas to form a reversed image depending upon its polarity with respect to the surface area to be developed. When the toner is charged positively with respect to the image area to be developed, a direct image is obtained. When the toner is charged negatively with respect to the image area, a reversal image is obtained.

The toner which is used in the production of lithographic printing plates, should, after fusion, produce a surface which is wetted by lithographic ink. Resins such as copal, sandarac, "Vinsol" and rosin as well as hard waxes can be used as the toner for this purpose. The toner need not carry pigment, although pigment may be included to facilitate the inspection of the image during its development.

In lithographic printing, the plate is treated with water to make the background areas hydrophilic and the ink adheres to the hydrophobic letters or image on the plate, but not to the background areas. This ink is then transferred to another sheet of paper by the use of an off-set printing press. For this reason, the final step in the production of a printing plate of this type is to render the

background areas of the plate hydrophilic, so that they are not receptive to a lithographic ink when wet with water.

Lithographic printing plates of this type can be prepared from an electrographic master by the foregoing procedure in a very short period of time. They may be prepared for either direct or off-set lithographic printing. The paperbase plates are satisfactory for the production of a limited number of copies, while the plastic-base plates are capable of reproducing a considerably greater number of copies.

It will be understood that the term "electrophotographic master" is used herein to mean a sheet of paper or of a plastic base, carrying a coating which is adapted to receive an image by electrophotographic reproduction but which does not carry such an image, and which is adapted by form and dimensions for attachment to the roll of a lithographic printing press or of a lithographic office duplicating machine.

The term "lithographic printing plate" is used in the commonly accepted sense to mean a printing plate having hydrophobic image areas which are receptive to lithographic ink and hydrophilic background areas which, when wet with water, will not accept a lithographic ink. This term is used to designate plates which carry images adapted either for off-set lithography or direct lithographic printing.

It is an object of this invention to provide an aqueous solution for use in the final step of the production of an electrophotographic printing plate from an electrophotographic master to render its non-image or background areas hydrophilic, while leaving its image areas formed by the fused toner hydrophobic in character and wettable by a lithographic printing ink.

Other objects of this invention and its various advantageous features will become apparent from the description which follows.

The composition in accordance with this invention comprises essentially an aqueous solution of a water-soluble organic film-forming material having free carboxyl groups and of an alkali metal ferrocyanide or an alkali metal ferricyanide, which has a pH below about 7.25 and preferably within the range of about 3.0 to about 7.25. Organic film-forming materials which are suitable for use in the production of this composition are polyacrylic acid, alginic acid, sodium polymethacrylate, ammonium polymethacrylate, sodium carboxymethylcellulose, and sodium alginate. Alkali metal ferrocyanides which are suitable for use in this solution are, for example, sodium ferrocyanide, potassium ferrocyanide, sodium ferricyanide and potassium ferricyanide.

In addition to the organic film-forming material and the complex inorganic salt, the aqueous composition in accordance with this invention will desirably contain a buffering agent to adjust the pH to a value below about 7.25 and preferably within the range of about 3.0 to about 7.25. The nature of the buffering agent included in this composition will depend upon whether or not the carboxyl group of the organic film-forming material used is initially in free or neutralized form. We have found that when using an organic film-forming material which has free carboxyl groups, such as, for example, polyacrylic acid or alginic acid, that trisodium phosphate, sodium carbonate, or sodium acetate is a suitable buffer for adjusting the pH of the solution. On the other hand, when sodium polymethacrylate, ammonium polymethacrylate, sodium carboxymethylcellulose, or sodium alginate is used as the organic film-forming material, it is necessary to use an acid, such as, for example, phosphoric acid or acetic acid to reduce the pH of the solution below 7.25.

In view of the fact that we have found that the pH of

this aqueous solution must be on the acid side for it to be fully effective in rendering the background areas of a developed electrophotographic master wettable by water, when using sodium polymethacrylate, ammonium polymethacrylate sodium carboxymethylcellulose or sodium alginate to form the solution, the carboxyl groups of the particular material used are in free, rather than in neutralized form in the solution.

We have been unable to determine the exact mechanism by which this aqueous solution renders the non-image or background areas of an electrophotographic master wettable by water. However, it is clear that both the organic film-forming material and the complex inorganic salt become chemically bonded to the surfaces of the background areas. It is our belief that the free carboxyl groups of the organic film-forming material are chemically bonded by a neutralization reaction with the partially exposed surfaces of the photo-conductive inorganic pigment embedded in the matrix of the organic film-forming material in the surfaces of the background areas. Also, it is our belief that the complex inorganic salt is bonded by a metathesis reaction with the exposed surfaces of the photo-conductive pigment. Regardless of the mechanism involved, the material react chemically with the background areas of the electrophotographic master in converting it into a printing plate since they are retained thereon during the use of the plate in off-set printing with a tenacity which would not be expected in view of the original water-soluble character of the materials.

Aqueous solutions of organic film-forming materials which have free carboxyl groups, which do not contain a complex inorganic salt are effective in rendering the background areas of an electrophotographic master wettable by water. However, we prefer to include a complex inorganic salt in the solution, since these inorganic materials enhance the wetting ability of the composition in a synergistic manner. The combination of a complex inorganic salt and of a film-forming material carrying free carboxyl groups is more effective than either alone in aqueous solution.

The aqueous compositions in accordance with this invention may contain about 0.5%, by weight, to about 2.5%, by weight, of an organic film-forming material carrying free carboxyl groups and about 0.5% to about 2.5%, by weight, of a water-soluble complex inorganic salt. They are desirably buffered at a pH below 7.25 and preferably to a pH within the range of about 3.0 to about 7.25 by the addition of an effective amount of a suitable buffer. When using an organic film-forming material which initially has free carboxy groups, an amount of trisodium phosphate, sodium carbonate, or sodium acetate, within the range of about 0.5%, by weight, to about 2.5%, by weight, is suitable for this purpose. The remainder of the composition is water.

The preferred aqueous composition in accordance with this invention may contain about 0.5%, by weight, to about 2.5%, by weight, of polyacrylic acid and about 0.5%, by weight, to about 2.5%, by weight, of potassium ferrocyanide with an amount of trisodium phosphate which adjusts the pH of the solution to a value within the range of about 3.0 to about 7.25.

A preferred embodiment of this composition is specifically illustrated by the following example:

Example I

	Parts by weight
Polyacrylic acid [1]	1.67
Potassium ferrocyanide	1.67
Trisodium phosphate	1.67
Water	94.99
	100.00

[1] Polyacrylic acid sold in the form of an aqueous solution under the tradename "Acrysol A-3."

The aqueous composition in accordance with this invention may be used in the final step in the preparation of a printing plate from any of the electrophotographic masters which have heretofore been developed. An electrophotographic image is imposed on the master in the usual manner, the image is developed by the application of a toner, and the toner on the image areas is fused to produce a resinous film on those areas. The resulting image areas are inherently hydrophobic in nature. The background areas are merely exposed areas of the electrophotographic coating of the original master. These background areas are then rendered hydrophilic and freely wettable by water by spreading the composition in accordance with this invention over the surface of the master as a uniform, thin film by the use of, for example, a cotton swab moistened with the composition. In this application, the image areas on the surface of the master are not wet by the composition due to their hydrophobic nature.

The aqueous composition in accordance with this invention is also quite suitable, when diluted by the addition of water, for use as a fountain solution in offset printing with a plate produced by electrophotographic reproduction. Such a solution is used during the printing operation to keep the background areas of the plate wet with water and non-receptive to the printing ink. For this purpose, one part by volume of the composition may, for example, be diluted with 25 parts by volume of water.

The printing plates which have heretofore been prepared by electrophotographic methods have offered definite advantages over printing plates prepared by other methods in the rapidity and ease with which they may be prepared. However, after a short period of use in a printing operation the background areas of these prior art printing plates tend to lose their hydrophilic character and to pick-up traces of printing ink which causes the background areas of the printed copies to have a dirty, unsightly appearance which is highly undesirable.

The printing plates produced by the use of the aqueous composition in accordance with this invention have all the advantageous features of the prior art printing plates produced by electrophotographic methods. In addition to these inherent advantages, they are definitely superior to the printing plates which have heretofore been produced by electrophotographic methods due to the fact that their background areas tenaciously retain their hydrophilic character of being non-wettable by printing ink and even after prolonged use produce printed copies with clean, ink-free background areas.

In the foregoing, details and specific illustrations of the aqueous compositions in accordance with this invention have been given for the purpose of fully explaining the nature of the invention. However, it will be understood that many variations can be made in the details which have been given without departing from the spirit of this invention or the scope of the following claims.

We claim:

1. A liquid prewetting composition capable of producing a lithographic printing plate from an electrophotographic master by rendering the background areas of the said master hydrophilic in nature without affecting the hydrophobic nature of its image areas, when it is applied to the image-bearing surface of the said master as a moistening film, and

is a dilute, aqueous solution which consists essentially of

polyacrylic acid,

a water-soluble, inorganic salt selected from the group consisting of sodium ferrocyanide, potassium ferrocyanide, sodium ferricyanide and potassium ferricyanide,

a buffer which adjusts the pH of the solution to a value within the range of about 3.0 to about 7.25.

and water.

2. A liquid prewetting composition capable of producing a lithographic printing plate from an electrophoto-

graphic master, by rendering the background areas of the said master hydrophilic in nature without affecting the hydrophobic nature of its image areas, when it is applied to the image-bearing surface of the said master as a moistening film, and

is a dilute solution which consists essentially of polyacrylic acid,

potassium ferrocyanide,

trisodium phosphate in an amount which adjusts the pH of the solution to a value within the range of about 3.0 to about 7.25,

and water.

3. A liquid prewetting composition capable of producing a lithographic printing plate from an electrophotographic master, by rendering the background areas of the said master hydrophilic in nature without affecting the hydrophobic nature of its image areas, when it is applied to the image-bearing surface of the said master as a moistening film, and

which is a dilute solution which consists essentially of about 0.5%, by weight, to about 2.5%, by weight, of polyacrylic acid, about 0.5%, by weight, to about 2.5%, by weight, of potassium ferrocyanide,

and water, which is buffered to a pH within the range of about 3.0 to about 7.25 by trisodium phosphate.

References Cited by the Examiner

UNITED STATES PATENTS

1,981,102	11/34	Hagedorn	260—29.6
2,045,080	6/36	Hagedorn	260—78.5
2,186,945	1/40	Wood	96—33 XR
2,231,045	2/41	Wood	106—2
2,582,347	1/52	Neuman	106—197
2,589,313	3/52	Wood	106—197
2,741,981	4/56	Frost	101—149.2
2,758,102	8/56	Grummitt	260—29.6
2,760,431	8/56	Beautty	101—149.2
2,806,424	9/57	Ensink	101—149.2
2,952,536	9/60	Kurz	96—1
2,957,765	10/60	Resetich	96—1
2,988,988	6/61	Kurz	101—149.2
3,001,872	9/61	Kurz	96—1

FOREIGN PATENTS

648,897	1/51	Great Britain.
678,187	8/52	Great Britain.
856,154	11/52	Germany.

MURRAY TILLMAN, *Primary Examiner.*

J. R. SPECK, D. ARNOLD, LEON J. BERCOVITZ, *Examiners.*