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3,576,744

ELECTROSTATIC DEVELOPING COMPOSITION CONTAINING TWO DIFFERENT NEGATIVE DIRECTING RESINS

Robert F. Sharrock and Joseph W. Castillo, Parsippany,
N.J., assignors to Clopay Corporation

No Drawing. Filed Sept. 21, 1967, Ser. No. 669,376

Int. Cl. G03g 9/04

U.S. Cl. 252—62.1

2 Claims

ABSTRACT OF THE DISCLOSURE

A liquid developer composition for developing latent electrostatic images to visible images. The composition contains two different negative directing resins, pigment, a negative charge control agent and a carrier liquid.

This invention relates to electrophotography. More particularly it relates to compositions useful for converting latent electrostatic images to visible images.

In one electrophotographic technique, a photo-conductive layer coated on a relatively conducting support, such as paper, is charged electrostatically as by a corona discharge device. The charged photoconductive surface is then exposed to a radiation pattern which causes the charged surface to discharge, the extent of discharge being proportional to the amount of intensity of the radiation. Thus a charge pattern, or latent electrostatic image, is produced.

One method of converting the latent electrostatic image to a visible image is by contacting the latent image with a liquid developer that contains finely divided toner or developer powder dispersed in a carrier liquid which is relatively non-conducting. The liquid developer is so formulated that the dispersed toner particles are charged and, due to such charge they will deposit on the latent image to produce a visible image. If the toner particles are positively charged they tend to deposit on the more negative parts of the charge pattern on photoconductive surface, and if the particles are negative, they tend to deposit on the more positive portions of the surface.

The present invention provides an improved liquid developer for electrophotography wherein the toner particles are negatively charged. Since the most commonly used liquid developer contains positively charged toner particles, and are used to transform negatively charged latent images to visible images, the developers that contain negatively charged particles are commonly referred to as "reversal developers" or "reversal toners."

It is known in the art that reversal toners can be made by dispersing colorants that can develop a negative charge, when properly dispersed, in a carrier liquid. Negative charge control agents can be used to facilitate development of a negative charge on the colorant particles. U.S. Pat. 2,907,674, for instance, discloses boiled linseed oil as a negative charge control agent. Certain resins are also known to act as negative charge control additives, or negative directing fixing agents, e.g. U.S. Pat. 3,244,633 discloses resins that act in this manner.

The improved reversal developers of the present invention are made possible by our discovery that the negative charge on a toner particle is enhanced by use of a combination of two different negative directing resins, together with a negative charge control agent which is an ionic surfactant or wetting agent. One of the negative directing resins must be soluble and the other must be insoluble in the carrier liquid.

Combinations of negative directing resins that we have found to be suitable in our invention include: pentaerythritol ester of rosin-maleic anhydride adduct (e.g. Pentalyn

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G) with a polyacrylate ester polymer (e.g., Acryloid 917); β -pinene polymer (e.g. Piccolyte S-115, M.P. 115° C.) with a hydrocarbon fossil resin; pentaerythritol ester of rosin-maleic anhydride adduct with glycerol ester of polymerized rosin (e.g. Polypale Esters); and maleic alkyl modified rosin ester (e.g. Lewisol 28) with pentaerythritol ester of rosin maleic adduct.

The preferred pigment is carbon black, especially carbon black that is available commercially in the form of a dispersion in hydrocarbon resin; examples of such dispersions are Covarnish Blak-BK (Columbia Carbon) and Costyrene Black 921 (Columbia Carbon).

Ionic surfactants and wetting agents that act as negative charge control agents include: petroleum sulfonates, cationic quaternary organosilicone surfactants, tetraisoamyl-ammoniumpicrate, and alkyl amine salts. Petroleum sulfonates are most effective and are preferred.

Solvents that are operable include the hydrocarbon solvents of low KB (Kauri-Butanol) value, e.g. below about 28, with only a very minor amount of a strong solvent, such as xylene, to originally dissolve the soluble resin component if desired or necessary. The low KB value solvent should have a boiling range on the order of 315 to 360° F.

Examples of negative toners made in accordance with the invention are:

EXAMPLE 1

A concentrate dispersion is made from:

Covarnish Blak-BK (a dispersion of carbon black and hydrocarbon fossil resin containing 30% carbon black) -----	5.2
Mineral spirits (KB value 26, boiling range 350 to 400° F.) -----	5.2
Piccolyte S-115 (65% solution in mineral spirits) --	69.6
Petroleum sulfonate (wetting agent) -----	1.4
Isopar O (hydrocarbon solvent of KB value 25.1, and boiling range 504 to 540° F.) -----	9.3
Isopar G (hydrocarbon solvent having KB of 27.4 and boiling range of 318 to 350° F.) -----	9.3

To make a liquid developer from the above concentrate, it was diluted with Isopar G at the ratio of 1 gal. of Isopar G to 8 grams of the concentrate. The developer gives excellent dark images with the little background color, when used to develop positive electrostatic images.

EXAMPLE 2

A concentrate dispersion is made from:

	Grams
Costyrene Black 921 (35% dispersion of carbon black in extended polystyrene) -----	4
Pentalyn G (60% in xylene) -----	60
Isopar G -----	10
Petronate CR, 10% solution in Isopar G (described by the supplier as high molecular weight petroleum sulfonate) -----	1

A developer is made by diluting two grams of the above concentrate with one quart of Isopar G. The developer produced excellent dark images when used to develop positives from electrostatic images.

We claim:

1. A liquid developer for developing electrostatic image consisting of a carbon black pigment dispersed in a vehicle consisting of (a) hydrocarbon carrier liquid having a specific resistivity of at least 10^{10} ohm centimeters, (b) a soluble negative directing resin of β -pinene polymer, (c) an insoluble negative directing resin of hydrocarbon fossil resin, and (d) a negative charge control agent of petroleum sulfonate, the said developer being further characterized by containing 10-30 parts of soluble resin per part of pigment, 1.0 to 4.0 parts of insoluble resin

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per part of pigment, and .1 to 1 part of charge control agent per part of pigment.

2. A liquid developer for developing electrostatic image consisting of a carbon black pigment dispersed in a vehicle consisting of (a) hydrocarbon carrier liquid having a specific resistivity of at least 10^{10} ohm centimeters, (b) a soluble negative directing resin of pentaerythritol ester of rosin maleic anhydride adduct, (c) an insoluble negative directing resin of polystyrene, nad (d) a negative charge control agent of petroleum sulfonate, the said developer being further characterized by containing 10-30 parts of soluble resin per part of pigment, 1.0 to 4.0

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parts of insoluble resin per part of pigment, and .1 to 1 part of charge control agent per part of pigment.

References Cited

UNITED STATES PATENTS

2,907,674	10/1959	Metcalf et al.	252—62.1
3,032,432	5/1962	Metcalf et al.	252—62.1

GEORGE F. LESMES, Primary Examiner

J. P. BRAMMER, Assistant Examiner