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1

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TRANSFER FILM AND PROCESS OF USING SAME

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This invention relates to an electrophotographic copysheet which can be retouched with water soluble dyestuffs. In one aspect this invention relates to color retouchable electrolytic electrophotographic full color prints. In another aspect this invention relates to a transfer film for providing a retouchable surface on an electrophotographic print.

One electrophotographic method for providing full color reproductions of a light image utilizes electrolytic electrophotographic techniques. As described in U.S. 3,010,884 and 3,130,655 successive deposits of subtractive primary colors may be applied to the light exposed surface of an electrolytically developable photoconductive copysheet. Particularly suitable color developers include basic nitrogen containing organic compounds which are soluble in an aqueous acidic solution and which are insoluble in water at a pH above 7, as shown in U.S. 3,172,827. Another class of outstanding color developers are the water soluble onium cations which decompose electrolytically to form water insoluble compounds, as shown in U.S. 3,172,826. Although frequently it is desirable to retouch finished full color prints, as in conventional color photography, the print surfaces of most electrolytic electrophotographic copysheets are not generally sufficiently receptive to the water soluble dyestuffs preferred for color retouching. Although it is possible to provide a gelatin retouchable layer over the final color print, gelatin is susceptible to water spotting, becomes tacky when wet, embrittles at lower temperatures, is sensitive to actinic radiation, and tends to curl with changes in humidity.

It is an object of this invention to provide an electrophotographic copysheet with a surface which can be color retouched with aqueous solutions of water soluble dyestuffs.

Another object of this invention is to provide a transfer film suitable for application to the surface of an electrophotographic print to provide a retouchable surface.

A further object of this invention is to provide a method for rendering an electrophotographic print retouchable with water soluble dyestuffs.

Other objects and advantages will be apparent from the following description.

In accordance with this invention it has been found that an electrophotographic copysheet having a visible image thereon can be rendered readily retouchable with water soluble dyestuffs without loss of other desirable physical properties if a layer of an essentially colorless methanol soluble synthetic polyamide is bonded to the image bearing copysheet surface. A preferred class of methanol soluble polyamides is the nitrogen substituted polyamides, particularly the N-alkoxymethyl polyamides, as described in U.S. 2,412,993, 2,430,860, 2,430,907 and 2,441,057. Other suitable methanol soluble synthetic polyamides include polyamides prepared with the use of certain diamines, e.g. triglycoldiamine, and multicomponent systems, e.g. interpolyamides of hexamethylene diammonium adipate, hexamethylene diammonium sebacate and caprolactam ("Zytel 61," a product of E. I. du Pont de Nemours and Co.). By "methanol soluble polyamide" is meant a polyamide which can exist as at least a 5 percent

2

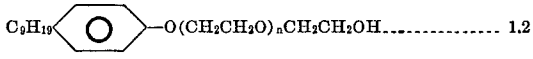
solution or gel in methanol at 25° C. The methanol soluble polyamides provide a retouchable surface for electrophotographic prints without the problems of curl and tackiness encountered in conventional prints. In the form of a retouchable layer having a thickness below about 5 mils they improve color saturation and appearance of the image and serve also to protect the print from abrasion, water spotting and degradation by actinic light.

The retouchable layer may be prepared by coating the electrophotographic print with a methanol-water solution of the methanol soluble polyamide. However, it is more convenient to provide a transfer film which comprises a transparent layer of methanol soluble polyamide on a releasable or strippable backing. Various backing materials with dry releasability from the polyamide may be used, such as a polypropylene film with or without a silica slip agent, polyethylene terephthalate, polypropylene coated paper, polyethylene coated paper, polyethylene film and poly-methyl methacrylate coated paper. To improve the adhesion of the methanol soluble polyamide retouchable layer to the print surface a suitable essentially colorless adhesive system, e.g. solvent and/or heat activatable adhesives and pressure sensitive adhesives, can be employed. If a heat activatable adhesive is used, it should generally be capable of activation at a temperature below about 120° C., preferably below 95° C., to avoid degradation of the print. The adhesive may be coated directly onto the print surface before application of the retouchable film or it may be carried on the surface of the retouchable film and form an integral component of the transfer film construction. Because of its relative ease in application the adhesive containing transfer film is preferred, generally with a releasable outer layer or liner to protect the adhesive prior to use if a pressure sensitive formulation is utilized. The surface of the retouchable film can be varied in texture from glossy to matte by selecting a release backing with the desired finish or by incorporating colloidal silica into the retouchable layer. Frequently it is desirable to include a surfactant into the retouchable layer or into the solution of retouching dyestuff to improve the rate and uniformity of dye absorption.

The following examples will illustrate the invention.

Example 1

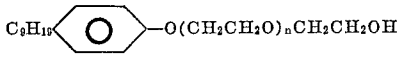
A methanol soluble polyamide (B.C.I. nylon 819, N-methoxymethyl polyhexamethylene adipamide, 500–600% ultimate elongation, 3400–3600 p.s.i. tensile strength, 12.4% water absorption, melting range 140–148° C., tack point 130° C.) was coated from the following solution onto a 5 mil polypropylene film to provide a dry film of one mil thickness.

	Grams
Trichloroethylene	23.3
Methanol	56.2
Polyamide	18.7
Water solution (30%) of:	
	1.2

(60% by weight of combined ethylene oxide)

Onto the dry polyamide surface a 24% solution of polyvinyl acetate (9% hydrolyzed) in toluene was coated to serve as a heat activatable adhesive, the dry coating thickness being one mil. The resulting transfer film was laminated by means of heated squeeze rolls at a temperature of about 80° C. to an electrophotographic full color print. After lamination the polypropylene release film was dry stripped from the print, exposing a semi-gloss polyamide surface. A 5 weight percent aqueous

solution of Genacryl Red 6B (Color Index No. 48020) containing 0.25 weight percent of



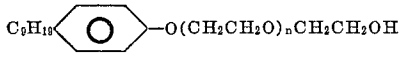
was applied to the white areas of the topcoated print for 15 seconds. After removal of excess dye the dyed areas had a green reflection optical density of 2.40 (Wratten filter No. 93).

Example 2

A polymethyl methacrylate coated paper was coated with the following solution to give a dry film thickness of one mil.

	Grams
Methylene chloride	25
Methanol	60
N - methoxymethyl polyhexamethylene adipamide (500–600% ultimate elongation, 3800–4000 p.s.i. tensile strength, 10.0% water absorption, melting range 145–153° C., tack point 135° C.)	20

A colorless polyester high strength adhesive (Du Pont 46950 polyester adhesive) was coated onto the polyamide surface (dry coating thickness of one mil). The resulting construction was laminated by means of heated squeeze rolls at a temperature of about 80° C. to an electrophotographic print. After lamination the methylmethacrylate coated paper was stripped from the print leaving a surface with a pleasing semigloss texture. A 5 weight percent aqueous solution of Pontamine Sky Blue 6BX (Color Index No. 24410) containing 0.25%



was applied to a white area of the print surface for 15 seconds. In the dyed area both the red and green reflection optical density was 1.74 (Wratten filter Nos. 92 and 93, respectively) after the excess dye was removed.

Example 3

A retouchable layer was prepared by coating an electrophotographic print with the following solution:

	Grams
Methanol	65
Water	15
Polyamide of Example 1	20

The dry thickness of the retouchable layer was 0.5 mil. A 5 weight percent aqueous solution of Calcocid Blue AX Double (Color Index No. 42080) was applied to a white area of the print for 15 seconds. The excess dye was washed off, and the dyed area had a reflection optical density of 1.33 measured through a Kodak Wratten filter No. 92.

Various other embodiments of the present invention will be apparent to those skilled in the art without departing from the scope thereof.

We claim:

1. A dimensionally stable, electrophotographic print having bonded to its image bearing surface an essentially colorless, methanol soluble, synthetic polyamide layer.

2. The electrophotographic print of claim **1** in which

said essentially colorless, methanol soluble, synthetic polyamide layer is adhesively bonded to said print surface.

3. The electrophotographic print of claim **1** in which said essentially colorless, methanol soluble, synthetic polyamide layer is bonded to said print surface with a heat activated, essentially colorless adhesive.

4. In an electrophotographic print the improvement which comprises an essentially colorless, methanol soluble, synthetic polyamide layer bonded to the surface of said print, said layer being retouchable with water soluble dyestuffs.

5. The electrophotographic print of claim **4** in which said methanol soluble, synthetic polyamide is an N-alkoxymethyl polyamide.

6. A transfer film for rendering an electrophotographic print retouchable with water soluble dyestuffs which comprises an essentially colorless, methanol soluble, synthetic polyamide film releasably bonded to a support sheet.

7. The transfer film of claim **6** in which said polyamide film contains a heat activatable adhesive on its exposed surface.

8. The transfer film of claim **6** in which said polyamide film contains on its exposed surface an adhesive capable of heat activation at a temperature below about 120° C.

9. The transfer film of claim **6** in which said polyamide film contains on the surface opposite said releasable support sheet an adhesive layer over which is superimposed a protective liner which can be stripped from said adhesive layer without removal of adhesive from the polyamide layer.

10. The transfer film of claim **6** in which said polyamide film contains on its exposed surface a solvent activatable adhesive.

11. The process for rendering an electrophotographic print retouchable with water soluble dyestuffs which comprises providing an essentially colorless, methanol soluble, synthetic polyamide layer on the print surface.

12. The process for rendering an electrophotographic print retouchable with water soluble dyestuffs which comprises coating the print surface with a solution of an essentially colorless, methanol soluble, synthetic polyamide and drying the resulting coating.

13. The process for rendering an electrophotographic print retouchable with water soluble dyestuffs which comprises (1) contacting the print surface with a transfer film comprising a layer of an essentially colorless, methanol soluble, synthetic polyamide releasably bonded to a support sheet, said support sheet being furthermost from said print surface, (2) bonding said polyamide layer to said print surface, and (3) removing said support sheet from said polyamide layer without breaking the bond between said print surface and said polyamide layer.

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