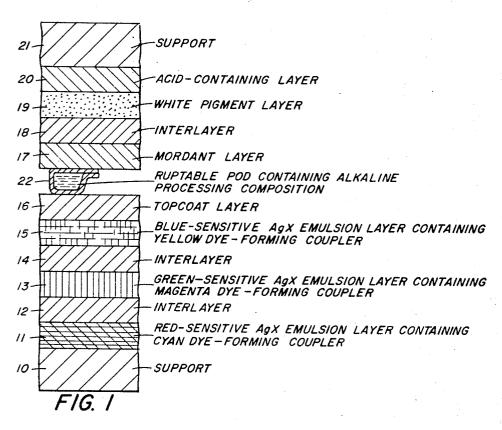
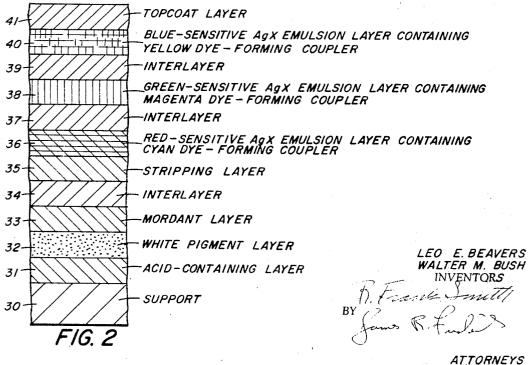
DYE DIFFUSION TRANSFER PROCESS AND ELEMENT

Filed June 14, 1966





3,445,228 Patented May 20, 1969

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3,445,228 DYE DIFFUSION TRANSFER PROCESS AND ELEMENT Leo E. Beavers and Walter M. Bush, Rochester, N.Y., as-

signors to Eastman Kodak Company, Rochester, N.Y., 5 a corporation of New Jersey Filed June 14, 1966, Ser. No. 557,511 Int. Cl. G03c 7/00

U.S. Cl. 96-3

13 Claims

ABSTRACT OF THE DISCLOSURE

In dye diffusion transfer processes utilizing aromatic primary amino color developing agent, the dyes are transferred to a receiving sheet including a support having 15 coated thereon, in the order given, a layer containing non-diffusible acid material; an interlayer containing finely divided white pigment; and, a mordant layer.

This invention relates to color photography, and more particularly, to photographic color diffusion transfer processes utilizing dye image receiving elements particularly adapted for use in such processes.

In photographic color diffusion transfer processes, image reproduction can be effected by developing an exposed silver halide emulsion layer having associated therewith a nondiffusible color-forming coupler that forms a diffusible dye when reacted with oxidized color develop- 30 receiving element for dye images. ing agent, reacting oxidized aromatic primary amino color developing agent with such coupler, and allowing the resulting dye to diffuse to a reception layer for such dyes. Such a color diffusion transfer system typically employs a photosensitive element comprised of three differentially 35 spectrally sensitized silver halide emulsion layers, each of which layers having associated therewith a nondiffusible coupler compound capable of yielding the appropriate diffusible complementary color dye upon development with oxidized aromatic primary amino color 40 developing agent.

When conventional silver halide negative emulsions are used in the above described coupler-containing photographic elements, negative transfer images can be produced. Photographic elements containing such conventional silver halide emulsions can also be utilized to prepare positive transfer images by subjecting the element to an initial black-and-white development to develop the exposed areas of the emulsion and thereafter rendering the resulting unexposed and undevelopd areas of the 50 smulsion developable by flash exposure or chemical fogging in the usual manner prior to the color development, or by utilizing certain black-and-white developers in nucleated silver halide emulsions that develop faster than color developers, or by utilizing certain development in- 55 hibitor-releasing couplers to obtain a reversal effect. Also, color diffusion transfer processes whereby positive transfer images are obtained directly with a single development in a color developer by utilizing direct-positive silver halide emulsions are described in the art. Such processes 60 are described in Whitmore et al. U.S. 3,227,550, Barr et al. U.S. 3,227,551 and Barr U.S. 3,243,294.

In such diffusion transfer processes involving the formation of a diffusible dye by reacting a photographic color coupler with oxidized aromatic primary amino color 65 developing agent, the transfer of the color dye images to mordanted reception layers is accompanied by small amounts of development reaction products and unused color developing agent. Such materials transferred with the dye image to the reception element are objectionable 70 because of the tendency of these transferred materials to form stain, particularly in the highlight or D_{min} areas.

Receiving elements comprising a mordant layer with an underlying acid layer have been described in the art to reduce the alkalinity of the image on the receiving sheet. Spacer or timing layers between the acid layer and the image receiving layer have also been proposed to control the effective release of the acid material. Such receiving elements are described in Ford U.S. 2,584,030 and German 1,380,778. However, while such receiving sheets are effective when used in dye developer diffusion transfer processes of the type described in Rogers U.S. 2,983,606 (which is basically a black-and-white development process using a compound containing a hydroquinone developing moiety and a dye moiety), such multi-layer receiving elements have not alleviated the stain accompanying color diffusion transfer processes utilizing aromatic primary amino color developing agents.

It is an object of this invention to provide a new dye diffusion transfer process wherein the dye is produced by reacting a photographic coupler with an oxidized aromatic primary amino color developing agent and which process is characterized as providing transferred dye images of reduced stain.

It is also an object of this invention to provide a new dye diffusion transfer process utilizing an aromatic pri-25 mary amino color development and the transfer of the resulting dye image to a receiving element particularly characterized as producing dye images having clear highlight areas, high contrast and sharpness.

It is another object of the invention to provide a novel

The process of the invention comprises treating an imagewise exposed photographic element containing at least one silver halide emulsion having contiguous to the silver halide a nondiffusible photographic color coupler that reacts with oxidized aromatic primary amino color developing agent to form a diffusible dye with an aromatic primary amino color developing agent in an alkaline media and transferring the resulting dye image to a particular type of receiving element for such dye image which can be superposed on said photographic element or integral therewith in the form of sublayers positioned between the light-sensitive layers and the support. The receiving element used in the process of the invention comprises a support with: (1) an alkali-permeable layer containing a mordant for dye images, (2) an alkali-permeable layer containing a nondiffusible acid material positioned between the mordant-containing layer and the support, and (3) an alkali-permeable light-reflective layer containing a nondiffusible finely divided white pigment positioned between the acid-containing layer and the mordant-containing layer.

The white pigment contained in the interlayer of the dye image receiving elements used in our process not only hides the stain formed in the acid sublayer of such receving elements, but, in addition, confines the formation of stain to the underlying acid sublayer. The observation of this phenomenon is suprising, for the white pigment would be expected to have an affinity for unused alkaline developer and development reaction products and thereby adsorb a good portion of such within the interlayer. As is illustrated hereinafter, in processed receiving elements not containing the pigment, stain is present throughout both the acid sublayer and an interlayer not containing a white pigment, while in the receiving elements used in our invention, no stain is visible in the pigmented interlayer. It appears that the finely divided white pigment repels stainforming substances, thereby effectively keeping the white hiding layer untarnished from development reaction prodnets.

The interlayer of the receiving elements used in our invention as well as functioning as a stain-hiding layer and a stain-diminishing layer, also functions as a timing layer

in reducing the alkalinity of the process and as a lightreflecting layer. Thus, the pigmented middle layer of such image-receiving elements facilitates the preparation of photographic color diffusion transfer reproductions of improved quality.

A wide variety of color photographic elements can be processed in accordance with the invention. Such photographic elements should contain at least one light-sensitive silver halide emulsion having contiguous to the silver halide a photographic color coupler, the coupler suitably being in the silver halide emulsion or in a layer adjacent to the silver halide. Preferably, the photographic element is a multi-color system containing superposed red, green and blue light-sensitive silver halide emulsion layers containing a cyan-forming coupler (e.g. a phenolic compound), a magenta-forming coupler (e.g. a 5-pyrazolone compound) and a yellow-forming coupler (e.g., an open chain ketomethylene compound), respectively. Such couplers should be nondiffusible but which produce diffusible dyes when reacted with oxidized aromatic primary amino color developing agents such as p-phenylenediamines.

In the present process, the imagewise exposed photographic elements is wetted with alkaline processing compositon by imbibing the photographic element with the processing composition, by bringing the photographic element in contact with a dye image receiving element imbibed with the processing composition, or by rupturing a pod or container containing the processing composition positioned between the photographic element and a receiving element. The aromatic primary amino color developing agent is preferably present in the alkaline processing composition, although it also can be present in a layer in the photographic element or in a separate dye image receiving element. Typical photographic elements and alkaline processing compositions suitable in the present process are described in Whitmore and Mader U.S. 3,227,550 and in Barr et al. U.S. 3,227,551. Those photographic elements described in Barr U.S. 3,243,294 containing nondiffusible couplers that form diffusible dyes when reacted with oxidized aromatic primary amino color developing agents can also be utilized in the present process.

The mordant-containing dye image receiving layers of the receiving sheets used in the process of the invention are alkali permeable and can contain any of the conventional mordant materials for dyes The mordant layer can contain such mordants as polymers of amino guanidine derivatives of vinyl methyl ketone such as described in the Minsk U.S. Patent 2,882,156 granted Apr. 14, 1959. Other suitable mordants include the 2-vinyl pyridine polymer metho-p-toluene sulfonate and similar compounds described in Sprague et al. U.S. Patent 2,484,430, granted Oct. 11, 1949, and cetyl trimethylammonium bromide, etc. Particularly effective mordanting compositions are described in copending applications of Whitmore U.S. Ser. No. 211,095 filed July 19, 1962 now U.S. Patent No. 55 3,271,148 and Bush U.S. Ser. No. 211,094 filed July 19, 1962, and now U.S. Patent No. 3,271,147. The mordanting compositions described in the Whimore application comprise at least one hydrophilic organic colloid containing a finely-divided uniform dispersion of droplets or globules of a high-boiling, water-immiscible organic solvent in which is dissolved a high concentration of a cationic, nonpolymeric, organic dye-mordanting compound for acid dyes. The mordanting compositions described in the Bush application comprise at least one hydrophilic organic colloid containing a finely-divided, uniform dispersion of particles of a salt of an organic acidic composition containing free acid moieties and a cationic, nonpolymeric, organic dye-mordanting compound for acid dyes. Useful cationic or basic organic dye-mordanting compounds for dyes include quaternary ammonium and phosphonium, and ternary sulfonium compounds in which there is linked to the N, P, or S onium atom at least one hydrophobic ballast group such as long-chain alkyl or substituted alkyl groups.

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The receiving element or layers for the dye images in the present process can be either an element separate from the light-sensitive element or integral therewith. When the light-sensitive element and the dye receiving element are integral, a stripping layer is utilized therebetween so that the light-sensitive silver halide emulsion layers can be readily removed after the dye image has been transferred to the mordant layer. Such stripping layers are hydrophilic materials that can be easily washed off or dissolved off such as water soluble hydrophilic organic colloids or emulsions containing polyvinyl alcohol, phthalated gelatin, alkali-soluble cellulose ether-phthalates, methyl celluloses, or the like vehicles. Such carboxylated cellulose compounds are described in Molm et al. U.S. 2,093,463 and Talbot et al. U.S. 2,725,293 are useful.

The acid-containing sublayer contains nondiffusible or immobilized acid-substituted or acid-yielding ballasted monomeric acid or polymeric acid compounds capable of reacting with alkaline materials or polymeric bases, or it can contain compounds having substituents capable of trapping basic reactants. Suitable monomeric acids are carboxylic acids typically containing at least 16 carbon atoms such as stearic acid and palmitic acid. Polymeric acidic compounds are preferred in the acid layer of the image receiving elements used in the invention. Among the suitable polymers are water-soluble carboxylated polymers whose sodium and/or potassium salts are watersoluble. Alternatively, polymers can be used which initially contain acid anhydride groups which are transformed, during processing, to free carboxyl groups. Polymeric acids used in the acid sublayer can be derivatives of cellulose or vinyl polymers, as well as acids of other polymeric compounds. Examples of typical polymeric acids are: dibasic half esters of derivatives of cellulose containing free carboxyl groups, e.g., cellulose acetatehydrogen phthalate, cellulose acetate-hydrogen glutarate, cellulose acetate-hydrogen succinate, ethyl cellulose-hydrogen succinate, ethyl cellulose acetate-hydrogen succinate, hydrogen phthalate, ether- and ester-derivatives of cellulose which are modified with sulfoanhydrides, e.g., with o-sulfobenzoic acid anhydride, polystyrylsulfonic acid, carboxymethyl cellulose, polyvinyl-hydrogen phthalate, polyvinyl-acetate-hydrogen phthalate, polyacrylic acid, acetals of polyvinylalcohol and carboxy or sulfo-substituted aldehydes, e.g., o-, m-, or p-benzaldehyde-sulfonic acid or -carbonic acid, partial ester of ethylene-maleic acid anhydride mixed polymers, partial ester of methylvinylether-maleic acid anhydride mixed polymers.

The function of the acid sublayer in the receiving element is to terminate development and to stabilize the final print by reacting with, and lowering the pH of, the alkaline developer composition used for processing the light-sensitive photographic element from which the dyes diffuse as a function of exposure and development.

The white pigmented interlayer of the present dye image receiving element is permeable to the alkaline processing composition used in processing the photographic element. Finely divided white pigment material such as titanium dioxide, barium sulfate, calcium sulfate, colloidal silica and the like inert inorganic white pigment materials can be utilized in this receiving sheet interlayer. Titanium dioxide is preferred. Sufficient white pigment is utilized to render the pigment layer opaque and mask stain trapped or "mopped up" in the underlying acidic layer, the pigment being the reflecting or background material for the image in the mordant layer. The amount of pigment utilized is in excess of that used to reduce "light piping" in photographic element layers. Typically, the white pigment 70 is utilized at a coverage of from about .1 to $\hat{2}$ grams per square foot, and preferably from about .5 to 1.3 grams per square foot. An alkali-permeable binder or vehicle is used for the white pigment. Typical binders include gelatin, polyvinyl alcohol, hydroxypropyl-polyvinyl 75 alcohol, poly(vinylmethyl ether), polyethylene oxide, par-

tial acetals of polyvinyl alcohol such as partial polyvinyl butyral, partial polyvinyl formal, partial polyvinyl acetal, partial polyvinyl propional and the like. The proportions of white pigment and binder material can be widely varied in preparing the receiving sheet pigmented interlayer, although the weight ratio of white pigment to binder typically varies from about 1/5 to 5/1, and preferably from about 1/1 to 3/1. The white pigmented interlayer is typically about 3 to 25 microns, and preferably about 8 to 15 microns, in thickness.

The diffused dye image prepared in accordance with the present process is mordanted in the mordant-containing layer of the receiving element. The dye image is viewed against the white background provided by the white pigment in the underlying interlayer of the receiving element. Staining materials which characterize processes utilizing aromatic primary amino color developing agents are contained and masked from view in the acid-containing layer positioned between the white pigmented interlayer and the support of the image receiving element. 20

In addition to functioning as a stain mask, the pigmented interlayer of the receiving element also serves as a timing layer to control the rate of diffusion of components of the alkaline developing composition into the acid sublayer. The white pigment appears to also facilitate this latter function. Thus can be provided a sufficient duration of time for the complete development of the exposed photosensitive element, as well as for the complete transfer of dye from the photosensitive element onto the dye-receiving element and for an adequate formation of the color image in the dye receptive mordanted layer of the receiving element.

The dye image receiving element can also contain other layers in addition to the mordant-containing layer, the white pigment-containing layer and the acid-containing layer, such as subbing layers, overcoat layers containing ultraviolet absorbers and the like layers, in accordance with usual practice.

The dye image receiving elements, as well as the various layers comprising the photographic elements processed in accordance with the invention can be coated on a wide variety of supports in accordance with usual practice. Typical suitable supports include paper, polyethylene-coated paper, polypropylene-coated paper, cellulose nitrate film, cellulose acetate film, polyvinyl acetal film, polystyrene film, polycarbonate film, polyethylene-terephthalate film and related films of resinous materials and others

The drawing illustrates in section and in elevation typical photographic systems processed in accordance with the invention, including light-sensitive photographic elements as well as separate and integral dye image receiving elements.

FIG. 1 of the drawing illustrates a typical multicolor photographic element that can be processed in accordance with the invention in combination with a suitable typical separate dye image receiving element and a rupturable pod containing an alkaline processing composition. Coated over support 10 is red-sensitive silver halide emulsion layer 11 which contains a nondiffusible coupler that forms a diffusible cyan dye when reacted with oxidized aromatic primary amino color developing agent. Over red-sensitive silver halide emulsion layer 11 is coated interlayer 12 that serves to separate green-sensitive silver halide emulsion layer 13 and red-sensitive silver halide emulsion layer 11. Interlayer 12 can contain such addendum as antioxidants, nondiffusible couplers that form nondiffusible dyes with oxidized color developing agents from adjacent layers, filter dyes such as a magenta filter dye, or the like. Greensensitive silver halide emulsion layer 13 contains a nondiffusible coupler that forms a diffusible magenta dye when reacted with oxidized aromatic primary amino developing agents. Over green-sensitive silver halide emulsion layer 13 is coated interlayer 14 that serves to separate green-sensitive silver halide emulsion layer 13 and 75

blue-sensitive silver halide emulsion layer 15. Interlayer 14, like interlayer 12, can contain antioxidants, nondiffusible couplers that react to form nondiffusible dyes with oxidized aromatic primary amino color developing agents from adjacent layers, filter dyes, and the like. Interlayer 14 typically contains yellow Carey-Lea silver to serve as a filter for blue light. Blue-sensitive emulsion layer 15 contains a nondiffusible coupler that forms a diffusible yellow dye on reaction with oxidized color developing agent. Over blue-sensitive silver halide emulsion layer 15 is coated top coat layer 16 that typically contains such addenda as antioxidants, ultraviolet absorbers, color developing agents, and the like addenda. FIG. 1 also illustrates a typical dye image receiving element that can be used to receive dye images in accordance with the process of the invention. The receiving element comprises support 21 having coated thereon acid-containing layer 20. Over acid-containing layer 20 is coated white pigment layer 19, and which is separated from mordant layer 17 by interlayer 18. FIG. 1 further illustrates rupturable pod 22 containing an alkaline processing composition, such composition preferably containing the aromatic primary amino color developing agent utilized in the process of the invention. The receiving element is superposed on the light-sensitive element during processing. On color development, cyan dyes diffuse from layer 11, magenta dyes diffuse from layer 13 and yellow dyes diffuse from layer 15 in areas of color development imagewise in register to mordant layer 17. After the diffusion transfer of the dye images from the photographic element (layers 10-16 of FIG. 1) to mordant layer 17 of the receiving element (layers 17-21), the alkalinity of the processing composition is substantially reduced by the acid material of acid-containing layer 20 of the receiving element. On stripping apart the dye image receiving element and the light-sensitive photographic element, the alkalinity of residual processing composition on the dye image receiving element is further reduced, obviating the necessity of further post treatment of such element. Further, stain-forming materials which typically accompany color processing utilizing aromatic primary amino color developing agents are located in acid-containing layer 20 of the receiving element masked or hidden from view by white pigment layer 19.

FIG. 2 of the drawing illustrates a light-sensitive element that can be utilized in accordance with the invention to prepare color images wherein the dye image receiving element is initially integral with the light-sensitive portion of the photographic element. The light-sensitive portion of the photographic element can be removed during processing to leave the dye image with the sublayers described below. In FIG. 2 coated on support 30 is acid-containing layer 31. Coated over acid-containing layer 31 is white pigment layer 32. Over white pigment layer 32 is coated mordant layer 33. Over mordant layer 33 is coated interlayer 34 and then stripping layer 35 that serves to facilitate the separation of the dye image reception portion of the photographic element from the lightsensitive portion of the photographic element after the transfer of the dye image. Layers 36-41 of FIG. 2 correspond in substance and function to layers 11-16 of FIG. 1 described above, respectively. After an imagewise exposure and having been wetted with an alkaline processing composition containing an aromatic primary amino color developing agent, cyan, magenta and yellow dyes diffuse from layers 36, 38 and 40 respectively in areas of color development in register to mordant layer 33. Thereafter stripping layer 35 facilitates the removal of layers 35-41 leaving mordant layer 33 containing the dye image, white pigment layer 32 masking from view stain materials in acid-containing layer 31.

The present invention is further described with reference to preferred embodiments thereof in the following examples.

EXAMPLE 1

Three separate dye image receiving elements were pre-

Mr. /f+ 2

N/ ~ /f+ 2

pared and each processed with a multicolor light-sensitive element as described.

Receiving sheet No. 1

A dye-receiving sheet was prepared by coating on an opaque white paper support a layer of the following composition:

	$Mg./ft.^2$
Gelatin	500
Octadecyltributylammonium bromide	200
Receiving sheet No.	2

A dye-receiving sheet was prepared by coating on an opaque white paper support the following four superposed layers numbered in sequence from the support:

8	./IL.4	
Layer 1: Copoly(methylvinyl ether-maleic acid) 3	3000	
Layer 2:		
Polyvinyl alcohol	670	2
Polyvinyl acetate	1180	
Layer 3:		
Gelatin	50	
Layer 4:		
Gelatin	500	2
Octadecyltributylammonium bromide	200	
Receiving sheet No. 3		

A dye-receiving sheet similar to coating No. 2, except that Layer 2 was composed of the following composition: 30

1415	5./ II
Polyvinyl alcohol	450
Polyvinyl acetate	750
Finely divided TiO ₂ ("Titanox TL" titanium dioxide,	
Titanium Pigment Corp. N.Y.C.)	1000

A multicolor photographic element of the type described in Example 1, columns 30 and 31, of Whitmore and Mader U.S. 3,227,550 and illustrated in FIG. 1 of the drawing (layers 10-16) was prepared, the silver 40 halide emulsions being direct positive gelatino silver bromoiodide emulsions containing a 1-hydroxy-4-(3octadecylcarbamylphenylthio) - N - ethyl - 3',5' - dicarboxy-2-naphthanilide coupler, a 1-phenyl-3-(3,5-disulfobenzamido) - 4 - (2 - hydroxy - 4 - pentadecylphenylazo)-5-pyrazolone coupler and a α -pivalyl- α -(3-octadecylcarbamylphenylthio)-4-sulfoacetanilide potassium salt coupler in the red, green and blue light recording emulsions respectively. Separate samples of the photographic element were identically exposed to a variable neutral density test chart and processed for 3 minutes at a temperature of 72° F. by spreading an aqueous liquid processing composition comprising:

Benzyl alcoholml_	. 5
6-nitrobenzimidazolegm	0.25
Hydroxyethylcellulose (high viscosity)gm	. 20
Sodium hydroxidegm	
p-Aminoethyl-β-hydroxyethylanilinegm	. 1.25
In 1 liter water.	

between each of the exposed photographic elements and each of the dye image receiving elements Nos. 1. 2 and 3, respectively. After completion of development, the dye image receiving elements were separated from the photosensitive elements. Receiving Sheet No. 1 was divided into two samples one of which was washed for 3 minutes in water at 75° C. and dried. Each of these two samples and each of Receiving Sheets Nos. 2 and 3 were then divided into three separate strips, designated a, b, and c, respectively. All strips a were subjected to an oven test for 24 hours at a temperature of 140° F. and a relative humidity of 70%. All strips b were subjected to an oven test for 1 week at a temperature of 140° F. and a relative humidity of 70%. All strips c were exposed for 48 hours to a xenon arc light. The following 75

table shows the increase in visible strain which had occurred in the highlight area of each sample as measured with blue light at 450 m μ .

	Receiving Sheet	Strip	Orig. Dens.	Density after Treatment	Change in Dens.
10	No. 1 Unwashed Do	b	. 57 . 50 . 63	1. 47 1. 52 1. 70	. 90 1. 02 1. 07
	No. 1 Washed Do Do	<i>a</i>	. 36 . 40 . 37	. 42 . 50 . 27	. 06 . 10 10
15	No. 2 Unwashed Do	b	. 39 . 56 . 41	. 93 1. 18 . 44	. 54 . 62 . 03
15	No. 3 Unwashed Do Do	b	. 45 . 59 . 54	. 50 . 54 . 49	. 05 05 05

A comparison of the stain levels in the above table for each of the dye image receiving elements shows the improvement obtained with the receiving element containing the pigment. Removal of the pigment interlayer in the highlight areas of strips a, b, and c of Receiving Sheet No. 3 following incubation and light exposure, revealed the polymeric acid sublayer which had a stain level similar to that of the corresponding strips of Receiving Sheet No. 2.

EXAMPLE 2

Dye image receiving elements corresponding to the following structures were prepared using an opaque white paper support numbered in sequence from the support:

Coating I

Ma /ft 2

		5./IL."
	Layer 1: Gelatin	600
	Layer 2: Copoly (methylvinyl-ether-maleic acid)	3000
	Layer 3:	
)	Polyvinyl acetate	1050
	Polyvinyl alcohol	525
	Layer 4:	
	Polyvinyl alcohol	500
	Octadecyl tri-n-butylammonium bromide	200
_		

Coating II

Like Coating I except that Layer 3 was of the following composition:

			g./ft.²
0	Polyvinyl	acetate	 1050
	Polyvinyl	alcohol	 1575

Coating III

Like Coating I except that Layer 3 was of the follow-55 ing composition.

	./ft.²
Polyvinyl acetate	540
Polyvinyl alcohol	270
TiO ₂ powder	750

Coating IV

Like Coating I except that Layer 3 was of the following composition:

		g./ft²
5	Polyvinyl acetate	1050
	Polyvinyl alcohol	525
	TiO ₂ powder	1050

Coating V

Like Coating I except that Layer 3 was of the following composition:

M	g./ft. ²
Polyvinyl acetate	150
Polyvinyl alcohol	375
TiO ₂ powder	1050

Coating VI

Like Coating I	except	that	Layer	3	was	of	the	follov	₩-
ing composition:									

	/ft.2	
Polyvinyl alcohol	 525	i

Coating VII

Like Coating I except that Layer 3 was of the following composition:

m5 composition.			
	Mg.	/ft. ²	10
Polyvinyl acetate		150	

Each of the above coatings was processed with the multicolor photographic element and processing composition as described in Example 1 with the following results: The density of the neutral dye image (i.e., cyan, magenta and yellow dyes) in the areas of maximum density were essentially the same in Coatings I, II, III, 20 IV, and V, while the dye density in coatings VI and VII were unacceptably low. These results indicate that the TiO2 in Layer 3 of Coatings III, IV. and V is as effective a timing substance as are polymeric materials such as polyvinyl alcohol and/or polyvinylacetate. While the relatively low quantities of polymers in Coatings VI and VII are inadequate to perform the required timing function, they are effective as a binding medium for the TiO2, as is evidenced by Coating No. III. The TiO2, can be present in the interlayers of the dye image receiving element either in addition to, or as a replacement of, a part of the alkali-permeable polymeric material as in Coatings IV and V.

EXAMPLE 3

Other receiving sheet coatings of the type described in Example 2, Coating III, were prepared wherein the sole binder for the TiO₂ was polyvinyl alcohol. When processed with the multicolor photographic element as 40 described in Example 1, these receiving sheet coatings showed results similar to those obtained with dye image receiving elements wherein the TiO2 was dispersed in a mixture of vehicular polymers.

EXAMPLE 4

A strip of a multilayer photosensitive element referred to in Example 1 was exposed through a 0.3 neutral density step tablet and processed according to the procedure described in Example 1 by using a sample of Receiving Sheet 3 of Example 1. This sample was labeled a. Sample a was then subjected to an oven test for 24 hours at a temperature of 140° F. and a relative humidity of 70%. An unprocessed sample of Receiving Sheet 3 of Example 1 was labeled b and subjected to the same oven test. A visual examination of the two samples showed that the area of sample a corresponding to the maximum exposure in the photosensitive element was just as white as the entire face of sample b. This example illustrates that the white pigmented interlayer of a receiving element according to our invention has no affinity for the stainproducing materials resulting from the development with the aromatic primary amino developing agent.

EXAMPLE 5

A light-sensitive, multicolor photographic element having an integral dye image receiving element and the general configuration illustrated by FIG. 2 of the drawing 70 was prepared. With reference to FIG. 2 of the drawing, the light-sensitive portion of the element (layers 36-41) were the same as described in Example 1, except the silver halide emulsions were conventional negative developing-out emulsions, having coated immediately there- 75

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under the following layers numbered successively below from the support:

	Layer 1: Mg Copoly(methylvinyl ether-maleic acid) Layer 2:	g./ft. ² 3000
	Polyvinyl alcohol TiO ₂ powder	525 1050
)	Layer 3: Polyvinyl alcohol Octadecyl tri-n-butylammonium bromide Layer 4:	500 200
	Gelatin Laver 5:	40
•	A gelatin anhydride-gelatin derivative of 25% by weight of phthalic anhydrideCopoly(ethyl acrylate-acrylic acid) 80% ester_	100 100

Samples of the prepared photographic element were exposed through a three-color negative and processed as follows:

(1) Development for 30 seconds at a temperature of 125° F. in a solution having the following composition:

	Trisodium phosphate	_gm	75.0
	Diethylhydroxylamine sulfate	gm	0.5
	1-phenyl-3-pyrazolidone	_gm	0.2
	Potassium bromide	_gm	8.0
	p-aminoethyl-β-hydroxyethylaniline	_gm	10.0
	Sodium hydroxide	_gm	2.0
	2-aminoethanol	_ml	3.0
	6-nitrobenzimidazole	_gm	0.18
	Water to make 1 liter.	_	
`	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4		

- (2) Acid stop bath (2% acetic acid) for 15 seconds at
- (3) Spray water wash for 15 seconds at 72° F.
- (4) Dry.

During the development step of the above element, the image dyes formed in the photosensitive component diffused into the integral mordant receiving layer (i.e. Layer 3) wherein they formed a three-color image. During the washing step of the process, the photosensitive layers were removed from the receiving element due to the dissolving of the wash-off or stripping interlayer (i.e. Layer 5). A similar coating as described above was prepared without the TiO₂-containing layer beneath the mordant layer, and processed as described above. A comparison of the results showed that the element containing TiO2 had less visible stain and provided better color reproduction than the element not containing the TiO2.

Although the invention has been described in considerable detail with reference to certain preferred embodiments thereof, it will be understood that variations and modifications can be effected without departing from the spirit and scope of the invention as described hereinabove and as defined in the appended claims.

We claim:

1. In a process for treating with an alkaline processing composition in the presence of an aromatic primary amino color developing agent an imagewise exposed photographic element containing at least one silver halide emulsion having contiguous to the silver halide a nondiffusible photographic color coupler that reacts with oxidized aromatic primary amino color developing agent to form a diffusible dye, color developing the exposed 65 photographic element with said color developing agent and transferring the resulting diffusible dye image to a receiving element, the improvement wherein said receiving element comprises a support with:

- (1) an alkali-permeable layer comprising a mordant for said dye image,
- (2) an alkali-permeable layer comprising a nondiffusible acid material positioned between the said mordant-containing layer and said support, and
- (3) an alkali-permeable light-reflective layer comprising a nondiffusible, finely divided white pigment

positioned between the said acid-containing layer and the said mordant-containing layer.

2. The process as described in claim 1 wherein the white pigment in the receiving element is titanium dioxide.

- 3. The process as described in claim 1 wherein the receiving element for the dye image is separate from and superposed on the silver halide emulsion layers during the color processing.
- 4. The process as described in claim 1 wherein the mordant-containing layer, the acid-containing layer and the white pigment-containing layer are coated between the silver halide emulsion layers and the support and are separable after the color developing from the silver halide emulsion layers by means of an interposed stripping layer.
- 5. The process as described in claim 1 wherein the silver halide emulsions are direct positive silver halide emulsions.
- 6. The process as described in claim 1 wherein the silver halide emulsions are negative-forming developing-out silver halide emulsions.
- 7. The process as described in claim 1 wherein the alkaline processing composition is an aqueous alkaline composition containing a p-phenylenediamine color developing agent.

8. The process as described in claim 1 wherein the 25 acid material in the acid-containing layer is a polymer.

9. In a color diffusion transfer process for treating an image exposed photographic element having a support with superposed red, green and blue light-sensitive gelatino silver halide emulsion layers containing a cyan dye-forming coupler, a magenta dye-forming coupler and a yellow dye-forming coupler respectively, said couplers being nondiffusible and forming diffusible dyes when reacted with oxidized aromatic primary amino color developing agents, color developing the exposed photographic element by activating with an aqueous alkaline composition containing an aromatic primary amino color developing agent and transferring the resulting diffusible dye images to a separate receiving element juxtaposed on

said photographic element, the improvement wherein said receiving element comprises a second support with:

(1) an alkali-permeable layer comprising a mordant for said dye images,

(2) an alkali-permeable layer comprising a nondiffusible polymeric acid material positioned between the said mordant-containing layer and said second support, and

(3) an alkali-permeable light-reflective layer comprisprising finely divided titanium dioxide in a sufficient amount to mask stain in the said polymeric acidcontaining layer positioned between the said polymeric acid-containing layer and the said mordant containing layer.

10. The process as described in claim 9 wherein the receiving element layer containing the titanium dioxide utilizes a binder for the titanium dioxide comprising polyvinyl alcohol.

11. The process as described in claim 9 wherein the receiving element layer containing the mordant contains octadecyltributylammonium bromide.

12. The process as described in claim 9 wherein the receiving element layer containing the polymeric acid contains copoly (methylvinyl ether-maleic acid).

13. The process as described in claim 10 wherein the weight ratio of titanium dioxide to binder is about 1/5 to 5/1 and the titanium dioxide is coated at a coverage of about .1 to 2 grams per square foot.

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U.S. Cl. X.R.

96-29,56