

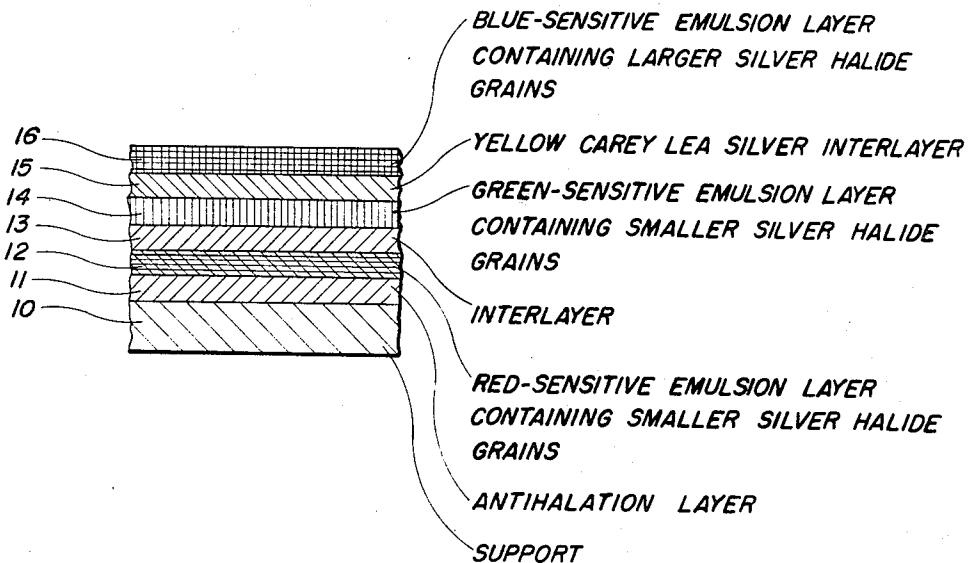
Sept. 17, 1968

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3,402,046

MULTILAYER COLOR PHOTOGRAPHIC ELEMENTS

Filed Sept. 23, 1963



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MULTILAYER COLOR PHOTOGRAPHIC ELEMENTS

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Filed Sept. 23, 1963, Ser. No. 310,824

7 Claims. (Cl. 96—74)

ABSTRACT OF THE DISCLOSURE

This invention relates to multicolor photographic elements having lower emulsion layers containing color couplers and fine grain silver halide of .3 micron and a top emulsion layer containing a color coupler and coarse grain silver halide of .7 to 1.5 microns for the purpose of improving image sharpness and sensitivity.

This invention relates to color photography, and in particular, to multilayer color photographic elements having improved sensitivity and image sharpness.

In conventional subtractive photographic systems employing three differentially sensitized silver halide emulsion layers for formation of dye images corresponding to the blue, green, and red light images, the more common arrangement of layers on the support comprises a top blue-sensitive silver halide emulsion layer to record the blue image overlying a yellow filter layer such as a Carey Lea silver layer to filter blue light from the light image passing therethrough, then a blue- and green-sensitive silver halide emulsion layer to record the green light image, and closest to the support, a blue- and red-sensitive silver halide emulsion layer to record the red image. It is known that the crispness or sharpness of a photographic image, which is important to high quality reproduction, depends to a high degree on the effective resolution of the green-sensitive silver halide emulsion layer. The human eye is particularly sensitive to differences in brightness modulated by magenta dyes, and substantially less sensitive to differences in brightness modulated by yellow dyes, for example. Effective resolution of the green-sensitive silver halide emulsion producing magenta dye depends not only upon the resolving power characteristics of the green-sensitive silver halide emulsion, but also on the distorting influences of the several media through which the light image passes between the subject and the green-sensitive silver halide emulsion, namely, the atmosphere, the camera lens, and in particular, the overlying photographic layers.

One approach to reducing the light distorting influence of emulsion layers superposed on green-sensitive silver halide emulsion layers is to coat the green-sensitive silver halide emulsion layer as the top layer and position the blue-sensitive silver halide emulsion layer more proximate to the support. However, such a physical disposition of light-sensitive layers presents a problem as photographic silver halide is inherently sensitive to blue light. Hence, the uppermost green-sensitive layer would undesirably record light that would normally be recorded only in the blue-sensitive silver halide emulsion layer.

It is also well known that reducing the thickness of the top silver halide emulsion layer by decreasing the ratio of gelatin to silver halide, or reducing the average grain size of the silver halide in the top layer, or modifying the binder colloid of the emulsions, or the like, can be useful in improving the effective resolution of the green-sensitive layer. Such approaches can have serious disadvantages. For example, a reduction in grain size decreases sensitivity, and a substantial reduction in binder colloid

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in the emulsions reduces the amount of color coupler that can be incorporated therein.

It is an object of this invention to provide novel multilayer color photographic elements having improved resolution without loss of sensitivity.

It is another object of this invention to provide novel multilayer photographic elements useful in color photography that are capable of providing multicolor images of improved sharpness without modifying the binder colloid or reducing the thickness of the blue-sensitive silver halide emulsion layer.

These and other objects of the invention are accomplished with multilayer color photographic elements containing a blue-sensitive silver halide emulsion layer coated over green- and red-sensitive silver halide emulsion layers wherein the average grain diameter of the silver halide in the over-coated blue record silver halide emulsion layer is substantially larger than the average grain diameter of the silver halide in the remaining silver halide emulsion layers as described below. Color images of improved properties, such as improved sharpness, can be prepared with such photographic elements. Photographic color films having improved sharpness or resolution are particularly useful when such films are to be enlarged many times as in the case with 8 mm. movies, aerial photographs, astronomical photographs, and the like.

In the present multilayer color photographic elements I utilize larger silver halide grains in the top-coated blue record layer than those used in undercoated green and red record layers. As larger grains would be expected to cause more graininess, it was unexpected when I obtained improved image sharpness of the color images prepared with the photographic elements of the invention without apparent degradation in the overall graininess, sensitivity, or other sensitometric properties responsible for photographic color quality.

In accordance with the invention, the silver halide grains utilized in the silver halide emulsion comprising the uppermost emulsion layer used for the blue record of the photographic elements of the invention have an average diameter of at least about .7 micron and more generally in the range of about .7 to 1.5 microns. The other silver halide emulsion layers, namely, the silver halide emulsion layers spectrally sensitized to green or red light, have silver halide grains that have an average diameter of at least .3 micron and are at least 20 percent smaller in diameter than those of the blue record emulsion layer. Reference is made to Loveland et al., Journal of the Franklin Institute, vol. 246, No. 6, pages 459—481, December 1958, for a description of a method for determining grain size of photographic silver halide.

In the silver halide emulsions comprising the subject photographic elements, various silver salts can be used as the sensitive salt including silver bromide, silver iodide, silver chloride, silver chlorobromide, silver bromoiodide and silver chlorobromoiodide. Negative-type, developing-out emulsions are more usually utilized, although direct positive emulsions of the type described in Davey et al., U.S. Patent 2,592,250, for example, are suitable.

In the preparation of the silver halide dispersions employed for preparing silver halide emulsions used in the photographic elements of the invention, there can be employed as the dispersing agent for the silver halide, gelatin or some other hydrophilic colloidal material, such as colloidal albumin, a cellulose derivative, or a synthetic resin, for instance, a polyvinyl compound, although gelatin is preferred.

The photographic elements of the invention have silver halide emulsion color-forming units for three color records, the unit coated farthest from the support being

for the blue record, the unit coated beneath being for the green record, and the unit coated nearest the support being for the red record. Each of such color-forming units can comprise one or more silver halide emulsions or blends of emulsions. The silver halide emulsions of the color-forming units or layers for recording green and red light are spectrally sensitized with sensitizing dyes in accordance with usual practice. Typical suitable sensitizing dyes include the cyanine and merocyanine dyes described in Brooker U.S. Patents 1,846,301, 1,846,302 and 1,942,854; White U.S. Patent 1,990,507; Brooker and White U.S. Patents 2,112,140, 2,165,338, 2,493,747 and 2,739,964; Brooker and Keyes U.S. Patent 2,493,748, Sprague U.S. Patents 2,503,776 and 2,519,001; Heseltine and Brooker U.S. Patent 2,666,761; Heseltine U.S. Patent 2,734,900; Van Lare U.S. Patent 2,739,149; and British Patent 450,958.

The silver halide emulsion layers of the photographic elements of the invention utilized to record blue, green and red light respectively are prepared to have substantially the same speed sensitivity when exposed from the emulsion side. The silver halide emulsion layer used to make the blue record in the present instance is prepared with silver halide having substantially larger grains, and thus inherently of a higher speed sensitivity, than those in the other silver halide emulsion layers. Such speed differentials can be compensated for by appropriate finishing techniques or, advantageously by utilizing a bleachable yellow dye in the silver halide emulsion layer used to make the blue record, or a bleachable or removable yellow filter coated over such silver halide emulsion layer containing a yellow dye or a yellow material such as yellow Carey Lea silver. Such yellow filters absorb a portion of the blue light and thus reduce the effective speed of the blue record layer. Suitable bleachable yellow filters are well known in the art and include such yellow dyes as tartrazine and those described by Silberstein and Carroll in U.S. Patent 2,527,583. As used herein, "bleachable" refers to yellow filter materials or compounds capable of being solubilized and thus readily removable from the photographic element, or compounds capable of being made colorless during color processing utilizing an alkaline bleach or a bleach composition containing an alkali metal ferricyanide.

The respective silver halide emulsion layers comprising the photographic elements of the invention can also be adjusted to proper speed by appropriate emulsion finishing techniques known to those skilled in the art.

A wide variety of chemical sensitizers or speed-increasing compounds can be utilized in the emulsions. The emulsions can be digested with naturally active gelatin, or sulfur compounds can be added, such as those described in Sheppard U.S. Patent 1,574,944, Sheppard et al. U.S. Patent 1,623,499 and Sheppard and Brigham U.S. Patent 2,410,689. The emulsions can also be treated with salts of the noble metals such as ruthenium, rhodium, palladium, iridium and platinum. Representative compounds are ammonium chloropalladate, potassium chloroplatinate, and sodium chloropalladate, which are used for sensitizing in amounts below that which produces any substantial fog inhibition, as described in Smith and Trivelli U.S. Patent 2,448,060 and as antifoggants in higher amounts, as described in Trivelli and Smith U.S. Patents 2,566,245 and 2,566,263. The emulsions can also contain sensitizing amounts of gold salts as described in Waller et al. U.S. Patent 2,399,083 or stabilizing amounts of gold salts as described in Damschroder U.S. Patent 2,597,856 and Yutzy and Leermakers U.S. Patent 2,597,915. Suitable compounds are potassium chloraurate, potassium aurithiocyanate, potassium chloraurate, auric trichloride and 2-aurosulfobenzothiazole methochloride. The emulsions can also contain sensitizing amounts of reducing agents disclosed in Carroll U.S. Patent 2,487,850. Other suitable sensitizers are disclosed in Lowe et al. U.S. Patents 2,518,698, 2,521,925, 2,521,926, Carroll U.S.

Patent 2,271,623 and Carroll et al. U.S. Patents 2,288,226 and 2,334,864.

The emulsions utilized in preparing the photographic elements of the invention can be coated on a wide variety of supports in accordance with usual practice. Typical supports for photographic elements of the invention include cellulose nitrate film, cellulose acetate film, polyvinyl acetal film, glass, paper, polyethylene-coated paper, polystyrene film, polyethylene terephthalate film and related supports.

The photographic elements of the invention are useful for producing multicolor images. I preferably incorporate contiguous to the silver halide of each of the color-recording emulsion layers of the subject elements (i.e., incorporate in the emulsion or in an adjacent layer), a photographic image color former. Examples of such color formers include color coupler compounds that form diffusible or nondiffusible dyes when reacted in aqueous alkaline processing compositions with oxidized primary amino color developing agents such as p-phenylenediamines, and diffusible dye developers that react with developable silver halide to form an insoluble deposit corresponding to the developed silver halide and a diffusible dye image corresponding to the undeveloped silver halide. Typical suitable color coupler compounds and methods for processing such are disclosed in McCrossen et al. U.S. Patent 2,875,057, Loria et al. U.S. Patent 2,600,788, Yutzy U.S. Patent 2,756,142, Weissberger et al. U.S. Patent 2,474,293, Spath U.S. Patent 2,956,876, Rogers U.S. Patent 3,087,817, and British Patents 840,731 and 904,364. Typical dye developers and diffusion transfer processes utilizing such are disclosed in Rogers U.S. Patent 2,983,606 and British Patent 804,972.

Typically, the color formers positioned contiguous to the silver halide emulsion layers are of the type that form, on color processing, dye images that are substantially complementary in color to the color recorded in the respective emulsion layers. For example, a yellow dye developer or an open-chain ketomethylene color coupler that forms a yellow dye on reaction with color developing agents is used with the blue-record layer, a magenta dye developer or a 5-pyrazolone color coupler that forms a magenta dye on reaction with color developing agents is used with the green-record layer, and a cyan dye developer or a phenolic color coupler, including α -naphthols, that forms a cyan dye on reaction with color developing agent is used with the red-record layer.

Also, the photographic elements of the invention can be prepared without incorporated image color formers and color processed, for example, with diffusible color couplers in the color developer that form nondiffusible dyes when reacted with oxidized color developing agent. Such multicolor processing and suitable couplers are disclosed in Mannes et al. U.S. Patent 2,252,718.

The term "nondiffusible" has the meaning commonly applied to color formers and dyes in color photography and denotes materials which for all practical purposes do not wander through organic colloid layers of the elements of the invention in the presence of aqueous alkaline processing solutions. The term "diffusible" has the opposite meaning.

The drawing illustrates a typical multilayer color photographic element of the invention. On support 10 is coated antihalation layer 11. Over layer 11 is coated red-sensitive silver halide emulsion layer 12 which serves as a red light recording layer and which comprises silver halide grains that are substantially smaller than the silver halide grains comprising layer 16 as described above. Layer 12 preferably contains a nondiffusible photographic color coupler that forms a nondiffusible cyan dye when reacted with oxidized color developing agent. Over layer 12 is coated interlayer 13. Over layer 13 is coated green-sensitive silver halide emulsion layer 14 which serves as a green light recording layer and which comprises silver halide grains that are substantially smaller than the silver

halide grains comprising layer 16 as described above. Layer 14 preferably contains a nondiffusible photographic color coupler that forms a nondiffusible magenta dye when reacted with oxidized color developing agent. Over layer 14 is coated yellow Carey Lea silver interlayer 15 which serves as a filter for blue light. Over layer 15 is coated blue-sensitive silver halide emulsion layer which serves as a blue light recording layer and which comprises silver halide grains that are substantially larger than the silver halide grains in layers 12 and 14 as described above. Layer 16 can also contain a bleachable yellow dye material as described above. Similarly, a layer superposed on layer 16 can contain a yellow filter material. However, as described above, the speed sensitivities of the silver halide emulsion layers in layers 12, 14 and 16 can be prepared to be substantially equivalent with chemical sensitizers, a yellow filter not being necessary in layer 16.

The following examples further illustrate preferred embodiments of the present invention.

Example 1

A multilayer color photographic element having the structure substantially as shown in the figure of the drawing was prepared by coating on a gelatin-subbed cellulose acetate film support the following layers numbered in sequence from the support:

(1) *Antihalation layer* (e.g., layer 11 of the figure).—A neutral colloidal silver-gelatin layer containing 454 mg. per square foot of gelatin and 28 mg. per square foot of silver.

(2) *Red-sensitive emulsion layer* (e.g., layer 12 of the figure).—A coating of a developing-out negative gelatino-silver bromiodide (6 mole percent iodide) emulsion having an average grain diameter of 0.44 micron and sensitized to red light was coated at a coverage of 165 mg. of gelatin per square foot and 99 mg. of silver per square foot. The layer also contained 90 mg. per square foot of the cyan coupler, 1-hydroxy-N-[8-(4-tert.-amyl-2-butylphenoxy)butyl]-2-naphthamide.

(3) *Interlayer* (e.g., layer 13 of the figure).—A gelatin layer coated at a coverage of 51 mg. per square foot.

(4) *Green-sensitive emulsion layer* (e.g., layer 14 of the figure).—A coating of a developing-out negative gelatino-silver bromiodide (2.8 mole percent iodide) emulsion wherein the silver halide has an average grain diameter of 0.488 micron and sensitized to green light was coated at a coverage of 135 mg. of gelatin per square foot and 136 mg. of silver per square foot. The layer contained 90 mg. per square foot of the magenta coupler, 1 - (2,5 - dichlorophenyl) - 3 - [3-(4-tert.-amylphenoxy)benzamido]-5-pyrazolone.

(5) *Yellow Carey Lea silver interlayer* (e.g., layer 15 of the figure).—A filter layer comprising gelatin at a coverage of 50 mg. per square foot and yellow Carey Lea silver at a coverage of 10 mg. per square foot.

(6) *Blue-sensitive emulsion layer* (e.g., layer 16 of the figure).—A coating of a developing-out negative gelatino-silver bromiodide (2.8 mole percent iodide) emulsion wherein the average grain diameter of the silver halide is 0.782 micron was coated at a coverage of 188 mg. of gelatin per square foot and 140 mg. of silver per square foot. The layer contained 132 mg. per square foot of the yellow coupler, α -{4-[(2,4-di-tert.-amylphenoxy)acetamido]benzoyl}-2-methoxyacetanilide.

A control film was coated as described above except that the top-coated blue-sensitive emulsion layer (layer 6) was prepared so that the silver halide grains had an average grain diameter of 0.488 micron. In the control film, the blue and green recording layers had silver halide emulsions with the same average grain size. All emulsions utilized in the light-sensitive layers of the prepared photographic films were finished to have substantially the same sensitivity when exposed from the emulsion side of the photographic elements. The two films were both exposed

to colored subjects and also to a sinusoidal test object having a spacial frequency from 1 to 180 cycles per millimeter by the method described by Perrin in *Journal of the Society of Motion Picture and Television Engineers*, vol. 69, pages 151-156 and 239-249 (March and April 1960). The exposed films were color processed to form reversal color images by the method described below. Comparison of the two films showed a marked improvement in image sharpness and in high frequency response observed in the modulation transfer function derived from the sinusoidal test object for the film of the invention. At a 5% response, the control film utilizing substantially the same size silver halide grains in all three emulsion layers had a resolving power of 90 lines per mm., while the film of the invention containing the larger silver halide grains in the blue-sensitive emulsion had a resolving power of 120 lines per mm. The reversal color development was carried out at 72° F. as follows.

The exposed films were first developed in a developer having the following composition:

Sodium hexametaphosphate	g--	2.0
N-methyl-p-aminophenol sulfate	g--	6.0
Sodium sulfite, anhydrous	g--	50.0
Hydroquinone	g--	6.0
Sodium carbonate monohydrate	g--	35.0
Potassium bromide	g--	2.0
Sodium thiocyanate	g--	1.5
0.5% solution of 6-nitrobenzimidazole nitrate	cc--	12.0
0.1% solution of potassium iodide	cc--	10.0
Water to make 1 liter.		

The elements were then thoroughly washed with water and treated in a hardening bath having the following composition:

Potassium chrome alum crystals, 30.0 g.	
Water to make 1 liter.	

The elements were then thoroughly washed with water and treated for 30 seconds in a solution having the following composition:

Sodium borohydride	G.	0.25
Sodium hydroxide		4.0
Water to make 1 liter.		

The elements were then treated in a color developer having the following composition:

Benzyl alcohol	cc--	6.0
Sodium hexametaphosphate	g--	2.0
Sodium sulfite, anhydrous	g--	5.0
Trisodium phosphate	g--	40.0
Potassium bromide	g--	0.25
0.1% solution of potassium iodide	cc--	10.0
Sodium hydroxide	g--	6.5
Color developer ¹	g--	11.33
Ethylenediamine sulfate	g--	7.8
Citrazinic acid	g--	1.5
Water to make 1 liter.		

¹ 4-amino-N-ethyl - N - (β - methanesulfonamidoethyl)-m-toluidine sesquisulfate monohydrate.

The elements were then thoroughly washed with water and treated in a clearing and fixing bath having the following composition:

Sodium thiosulfate	G.	150.0
Sodium bisulfite		20.0
Water to make 1 liter.		

The elements were then treated in a bleach bath having the following composition:

Potassium dichromate	G.	5.0
Potassium ferricyanide		70.0
Potassium bromide		20.0
Water to make 1 liter.		

The elements were again washed and treated once again with the clearing and fixing bath identified above. The elements were again washed and treated in a stabilizing bath having the following composition:

Formaldehyde (37% by weight) -----cc-- 7.0
Dispersing agent¹ -----g-- 0.5
Water to make 1 liter.

¹ Such as Triton X-100, i.e., an alkylaryl polyether alcohol (octylphenoxy polyethoxy ethanol).

Example 2

Samples of photographic films of the type described in Example 1 were prepared except that blue-sensitive silver halide emulsion layer 6 (e.g., layer 16 of the figure) was finished to a 50% higher speed sensitivity than red-sensitive silver halide emulsion layer 2 (e.g., layer 12 of the figure) and green-sensitive silver halide emulsion layer 4 (e.g., layer 14 of the figure), and which blue-sensitive silver halide emulsion layer was modified by the addition of sufficient amounts of the yellow dye tartrazine to reduce its effective speed so that the blue, red and green-sensitive silver halide emulsion layers had substantially the same effective speed sensitivities when exposed from the emulsion side of the films. The resulting films were exposed and processed as described in Example 1. Visual and sensitometric comparisons demonstrated a marked improvement in the sharpness of the image and in the high frequency response observed in the modulation transfer function derived from the sinusoidal test object for the film containing the larger silver halide grains in the blue light recording emulsion layer as compared to the film containing the smaller silver halide grains in the blue light recording emulsion layer.

The present invention thus provides novel multilayer photographic elements that are useful in color photography and which are useful for preparing multicolor images of improved sharpness.

The invention has been described in considerable detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinabove and as defined in the appended claims.

I claim:

1. A multilayer photographic element for use in color photography which comprises a support having coated thereon successively a red-sensitive silver halide emulsion layer, a green-sensitive silver halide emulsion layer and a blue-sensitive silver halide emulsion layer, said emulsion layers having substantially the same effective speed sensitivities when exposed from the emulsion layer side of said element, the improvement which comprises utilizing silver halide in said blue-sensitive silver halide emulsion layer having grains with an average diameter of at least about .7 micron, the average diameter of the silver halide grains in said red-sensitive and green-sensitive silver halide emulsion layers being at least about .3 micron and at least about 20% smaller in diameter than the silver halide grains in said blue-sensitive silver halide emulsion layer.

2. A multilayer photographic element for use in color photography which comprises a support having coated thereon successively

- (1) a red-sensitive silver halide emulsion layer having contiguous thereto a nondiffusible phenolic photographic coupler that forms a nondiffusible cyan dye when reacted with oxidized aromatic primary amino color developing agent,
- (2) a green-sensitive silver halide emulsion layer having contiguous thereto a nondiffusible 5-pyrazolone photographic coupler that forms a nondiffusible magenta dye when reacted with oxidized aromatic primary amino color developing agent, and
- (3) a blue-sensitive silver halide emulsion layer having contiguous thereto a nondiffusible open-chain

ketomethylene photographic coupler that forms a nondiffusible yellow dye when reacted with oxidized aromatic primary amino color developing agent,

said emulsion layers having substantially the same effective speed sensitivities when exposed from the emulsion layer side of said element, the improvement which comprises utilizing silver halide in said blue-sensitive silver halide emulsion layer having grains with an average diameter of at least about .7 micron, the average diameter of the silver halide grains in said red-sensitive and green-sensitive silver halide emulsion layers being at least about .3 micron and at least about 20% smaller in diameter than the silver halide grains in said blue-sensitive silver halide emulsion layer.

3. A multilayer photographic element for use in color photography which comprises a support having coated thereon successively

- (1) a red-sensitive gelatino-silver halide emulsion layer containing a nondiffusible phenolic coupler that forms a nondiffusible cyan dye when reacted with oxidized aromatic primary amino color developing agent,
- (2) a green-sensitive gelatino-silver halide emulsion layer containing a nondiffusible 5-pyrazolone photographic coupler that forms a nondiffusible magenta dye when reacted with oxidized aromatic primary amino color developing agent, and
- (3) a blue-sensitive gelatino-silver halide emulsion layer containing a nondiffusible open-chain ketomethylene photographic coupler that forms a nondiffusible yellow dye when reacted with oxidized aromatic primary amino color developing agent,

said emulsion layers having substantially the same effective speed sensitivities when exposed from the emulsion layer side of said element, the improvement which comprises utilizing silver halide in said blue-sensitive gelatino-silver halide emulsion layer having grains with an average diameter of about .7 to 1.5 microns, the average diameter of the silver halide grains in said red-sensitive and green-sensitive gelatino-silver halide emulsion layers being at least about .3 micron and at least about 20% smaller in diameter than the silver halide grains in said blue-sensitive silver halide emulsion layer.

4. A multilayer photographic element as defined by claim 3 wherein the gelatino-silver halide emulsions are gelatino-silver bromiodide emulsions.

5. A multilayer photographic element as defined by claim 1 wherein each of the light-sensitive silver halide emulsions has contiguous thereto a photographic color former capable of forming an image having a color substantially complementary to the color of the light recorded by the respective silver halide emulsions when exposed from the emulsion layer side of said element.

6. A multilayer photographic element for use in color photography which comprises a support having coated thereon successively

- (1) a red-sensitive silver halide emulsion layer containing a nondiffusible phenolic coupler that forms a nondiffusible cyan dye when reacted with oxidized aromatic primary amino color developing agent,
- (2) a green-sensitive silver halide emulsion layer containing a nondiffusible 5-pyrazolone photographic coupler that forms a nondiffusible magenta dye when reacted with oxidized aromatic primary amino color developing agent, and
- (3) a blue-sensitive silver halide emulsion layer containing a nondiffusible open-chain ketomethylene photographic coupler that forms a nondiffusible yellow dye when reacted with oxidized aromatic primary amino color developing agent,

said emulsion layers having substantially the same effective speed sensitivities when exposed from the emulsion layer side of said element, the improvement which comprises reducing the effective speed sensitivity of said blue-

sensitive layer with a bleachable yellow-colored filter positioned integral to said element, and utilizing silver halide in said blue-sensitive silver halide emulsion layer having grains with an average diameter of about .7 to 1.5 microns, the average diameter of the silver halide grains in said red-sensitive and green-sensitive silver halide emulsion layers being at least about .3 micron and at least about 20% smaller in diameter than the silver halide grains in said blue-sensitive silver halide emulsion layer.

7. A multilayer photographic element for use in color photography which comprises a support having coated thereon successively

- (1) a red-sensitive silver halide emulsion layer containing a nondiffusible phenolic coupler that forms a nondiffusible cyan dye when reacted with oxidized aromatic primary amino color developing agent,
 - (2) a green-sensitive silver halide emulsion layer containing a nondiffusible 5-pyrazolone photographic coupler that forms a nondiffusible magenta dye when reacted with oxidized aromatic primary amino color developing agent, and
 - (3) a blue-sensitive silver halide emulsion layer containing a nondiffusible open-chain ketomethylene photographic coupler that forms a nondiffusible yellow dye when reacted with oxidized aromatic primary amino color developing agent,
- said emulsion layers having substantially the same effective speed sensitivities when exposed from the emulsion layer side of said element, the improvement which com-

prises reducing the effective speed sensitivity of said blue-sensitive layer by incorporating therein tartrazine as a yellow-colored filter, and utilizing silver halide in said blue-sensitive silver halide emulsion layer having grains with an average diameter of about .7 to 1.5 microns, the average diameter of the silver halide grains in said red-sensitive and green-sensitive silver halide emulsion layers being at least about .3 micron and at least about 20% smaller in diameter than the silver halide grains in said blue-sensitive silver halide emulsion layer.

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Disclaimer

3,402,046.—*Daan M. Zwick*, Rochester, N.Y. MULTILAYER COLOR PHOTOGRAPHIC ELEMENTS. Patent dated Sept. 17, 1968. Disclaimer filed Sept. 12, 1977, by the assignee, *Eastman Kodak Company*.

Hereby enters this disclaimer to all claims of said patent.

[*Official Gazette May 16, 1978.*]