

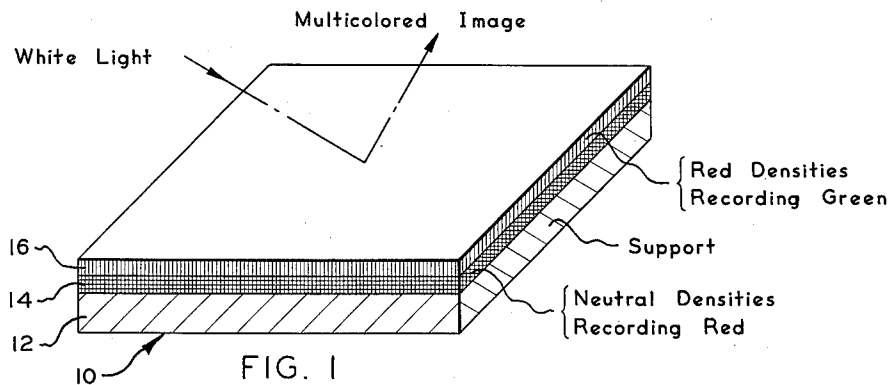
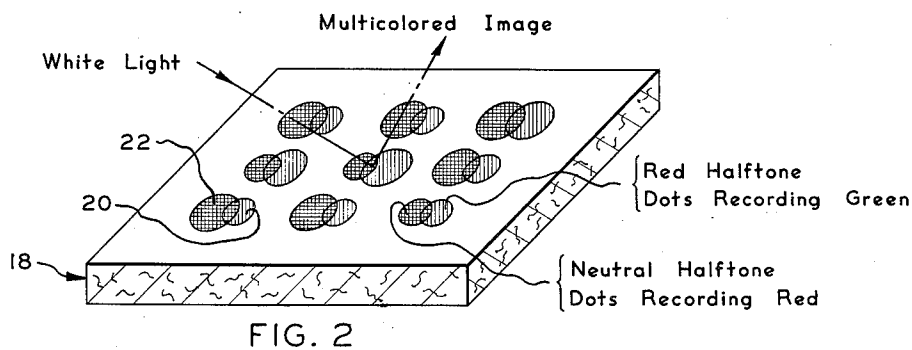
May 15, 1962

E. H. LAND
COLOR FORMATION

3,034,890

Filed May 31, 1955

2 Sheets-Sheet 1



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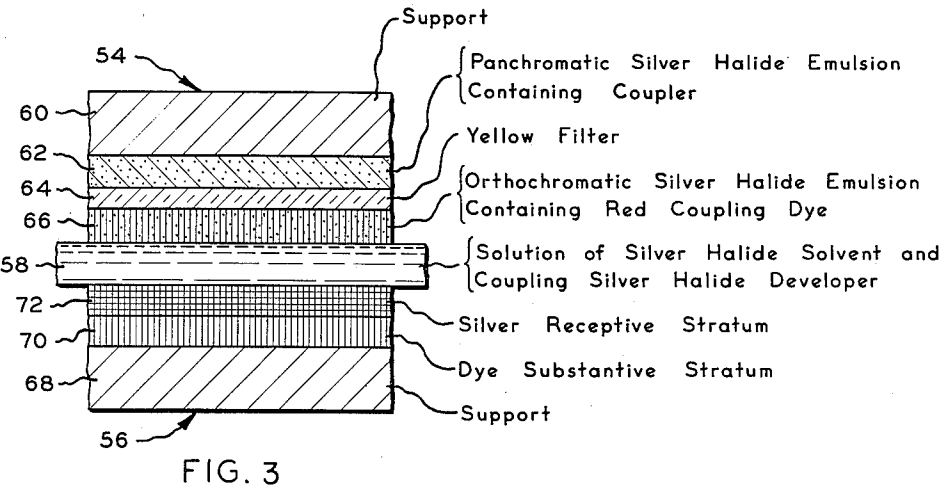
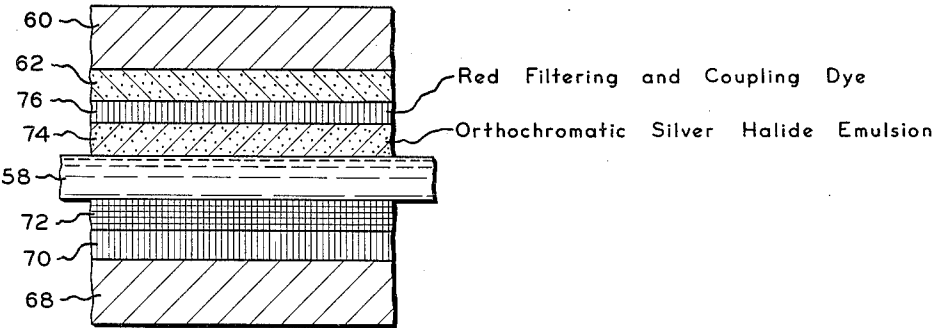
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COLOR FORMATION

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This invention relates to color formation and, more particularly, to the formation of a composite print of many colors from component prints each of a different character.

Typically, a multicolored print is produced in a photoexposed integral tripack comprising a red-sensitive stratum, a green-sensitive stratum and a blue-sensitive stratum. From a negative in the red-sensitive stratum is produced a positive in terms of cyan densities, from a negative in the green-sensitive stratum is produced a positive in terms of magenta densities, and from a negative in the blue-sensitive stratum is produced a positive in terms of yellow densities. The result is a print comprising three component positives which, registered in white light, present a multicolored composite image.

The inherent complexity of three-color processes has led to simplified processes which require only two components to produce results that are satisfactory for particular situations. In one two-color process, a multicolored print may be obtained in an integral bipack comprising a red-sensitive stratum and a green-sensitive stratum in which a cyan positive and an orange positive are produced in situ.

The present invention contemplates a still further simplified process which, in consequence of physiological phenomena not understood with certainty, requires only one color component together with a neutral component to produce pleasing multicolored effects. By way of example, one such print comprises two registered images, one in terms of red densities derived from a negative recording green and the other in terms of neutral densities derived from a negative recording red. Thus, essentially by subtractive synthesis a multicolored print of remarkable spectral range is produced by a method that is substantially simpler than any heretofore known.

A multicolored image has been produced from two registered component images one in terms of red densities recording red and the other in terms of neutral densities recording green; Cornwell-Clyne, *Color Cinematography*, Chapman and Hall Limited, London, 1951. In contrast, in accordance with the present invention, a multicolored image is produced from two registered component images one in terms of red densities recording green and the other in terms of neutral densities recording red. As used herein, the term "chromatic" refers to light which produces a hue visual sensation such as red, orange, yellow, green, blue and violet, and the term "achromatic" refers to light which produces a substantially hueless or neutral visual sensation such as black, white and shades of gray. Consistent with generally accepted meaning, and as contained in Webster's New International Dictionary, 2nd Edition Unabridged, page 2875, col. 3, ninth definition, the colors red, orange and yellow are considered to be of a "warm" category while the colors of a hue near green or blue are classified as "cool." Where the terminology "warm" or "cool" is employed herein, it is intended to have the foregoing meaning.

Accordingly, objects of the present invention are: to provide processes, devices and products for synthesizing a composite image from component images, a first of which, in densities of a first chromatic character, represents the distribution of light of a second chromatic character emanating from a subject, and a second com-

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ponent, in densities of an achromatic character, representing the distribution of light of the first chromatic character emanating from the subject; and to provide processes, devices and products of the foregoing type wherein the first component, in reddish densities, e.g., red and red-orange, represents a record of the greenish light, e.g., green and green-blue, emanating from the subject, and the second component, in gray densities, represents a record of the reddish light emanating from the subject.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the several steps and the relation and order of one or more of such steps with respect to each of the others, the product possessing the features, properties and relation of elements, and the devices possessing the construction, combination of elements, and arrangement of parts which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the appended claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

FIGURE 1 illustrates one example of a product embodying the present invention;

FIG. 2 illustrates another example of the product embodying the present invention; and

FIGS. 3 and 4 illustrate diagrammatically, in exaggerated cross section, materials for effecting processes of the present invention.

FIG. 1 illustrates an embodiment of the present invention in the form of a laminated sheet 10 that includes, in sequence, a white support 12, a first component print 14 recording in neutral densities the red light emanating from a subject and a second component print 16 recording in red densities the green light emanating from the subject. Component print 14, for example, may be produced in a red-sensitive gelatino silver halide emulsion which, after being photoexposed to red light, is subjected to any suitable reversal process which converts the latent image in situ to a black-and-white positive in terms of silver density. Component print 15 is produced from a green-sensitive silver halide emulsion which, after being photoexposed to green light, is subjected to any suitable color-forming process which converts the latent image in situ to a red-and-white positive in terms of a suitable red dye. Component prints 14 and 16 on the white background provided by support 12 constitute a multicolored reflection print.

Example

A print of the foregoing type was produced as follows. Eastman Kodak Plus X emulsion was photoexposed through a red Eastman Kodak Wratten #24 filter to a subject illuminated by a General Electric Photoflood B-2 lamp. A similar emulsion was exposed similarly through a green Eastman Kodak Wratten #69 filter. The resulting negatives were developed to gamma 0.5 in Eastman Kodak Elon-Hydroquinone Borax Developer D-76 for 8½ minutes at 72° F. Both negatives were fixed in Eastman Kodak Rapid Fixing Bath F-7 for 5 minutes at 68° F., rinsed for 10 minutes at 68° F. and dried.

A positive of the red filter negative was made on Eastman Kodak Resisto Rapid N-2 paper using an Omega Enlarger with an Omegalite fluorescent light source. This print was developed for 90 seconds in one-half strength Eastman Kodak Dektol Developer at 68° F., fixed for 30 seconds in Kodak Rapid Liquid Fixer at 68° F., and rinsed for 1 to 2 minutes at 68° F. The

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terms of dye densities. The coupler or mordant in red-sensitive stratum 62 serves to trap oxidized developer in order to prevent its entrance into green-sensitive stratum 66, where, by reacting with red coupling dye, it would tend to disrupt the appropriate formation of red densities in dye substantive stratum 70.

FIG. 4 illustrates a modification of the materials of FIG. 3 wherein red coupling dye is omitted from green-sensitive stratum 66, the green-sensitive stratum now being designated by 74, and yellow filter stratum 64 is replaced by a red coupling dye stratum 76, for example, in the form of cellulose acetate phthalate containing 1,5-dihydroxy-naphthalene-4-azo benzene in relatively high concentration so that it serves to screen red-sensitive stratum 62 from light other than red light as well as to form a component image in stratum 70 in red densities by transfer.

The present invention thus provides a novel multi-colored print comprising two component prints in registration, only one of which is in terms of colored densities. This print may be formed by a transfer process with remarkable simplicity.

Since certain changes may be made in the above process, product and device without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A diffusion transfer process comprising the steps of exposing to a colored photographic subject a film comprising a support, a red-sensitive silver halide emulsion layer, and an orthochromatic silver halide emulsion layer superposed over said red-sensitive emulsion layer, said red-sensitive silver halide emulsion layer containing an immobile, nondiffusible color coupler, and said orthochromatic silver halide emulsion layer having associated therewith a diffusible red dye so positioned as to have substantially no effect upon the exposure of said orthochromatic emulsion, said immobile color coupler and said red dye being capable of coupling with the oxidation product of a silver halide developing agent, said red-sensitive emulsion layer being exposed through a filter absorbing blue interposed between said orthochromatic and red-sensitive layers to form in said red-sensitive emulsion layer a latent record of the warm color content of said photographic subject, said orthochromatic layer being exposed in the absence of a color filter to form in said orthochromatic layer a latent record of the cool color content of said subject; applying a processing liquid to said film to provide therein an alkaline solution in which said red dye is soluble and comprising a silver halide solvent and a silver halide developing agent which silver halide developing agent, upon oxidation, forms an oxidation product capable of coupling with said color coupler and with said red dye, and thereby developing said exposed areas of said red-sensitive layer and said orthochromatic layer; coupling said immobile color coupler in said red-sensitive emulsion layer with said oxidation product of said silver halide developing agent formed by development of said red-sensitive

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tive emulsion to prevent entrance of said last-mentioned oxidation product into said orthochromatic layer; forming in said red-sensitive layer a soluble silver complex of said silver halide solvent with unreduced silver halide in unexposed areas of said red-sensitive layer, diffusing said soluble silver complex through said orthochromatic layer to a superposed silver image-receiving layer, forming thereat a neutral-toned positive silver image representative of the warm color content of said photographic subject; forming in said orthochromatic layer, as a result of said development of said exposed silver halide in said orthochromatic layer, an oxidation product of said silver halide developing agent, and coupling said oxidation product with said red dye thereby insolubilizing said red dye in said exposed areas, diffusing said soluble red dye from unexposed areas of said orthochromatic layer to a superposed image-receiving layer to form thereat, in proper registration with said neutral-toned silver image, a positive red dye image representative of the cool color content of the photographic subject.

2. A diffusion transfer process as defined in claim 1, wherein said red dye is contained in said orthochromatic emulsion in the form of relatively large particles of low covering power.

3. A diffusion transfer process as defined in claim 1, wherein said red dye is contained in, and caused to transfer in an imagewise distribution from, a transparent liquid-permeable layer located between said red-sensitive and orthochromatic layers.

4. A diffusion transfer process as defined in claim 1, wherein said neutral-toned silver image and said red dye image are substantially continuous tone images.

5. A diffusion transfer process as defined in claim 1, wherein the exposure of the emulsion layers is performed through a halftone screen and said neutral-toned silver image and said red dye image are formed substantially of halftone dots in at least partial relatively superimposed relation.

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