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PHOTOGRAPHIC AND CINEMATOGRAPHIC MULTICOLOR IMAGES OF CORRECT COLOR VALUE

Wilhelm Schneider and Heinz Schulze, Dessau, and Gustav Wilmanns, Wolfen, Kreis Bitterfeld, Germany, assignors to General Aniline & Film Corporation, New York, N. Y., a corporation of Delaware

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This invention relates to color photography and more particularly to the production of photographic and cinematographic multicolor images of correct color value.

It is an object of the present invention to provide a process for the production of multicolor images on multilayer photographic materials.

Another object is to provide a process for the production of multicolor images of correct color value on multilayer photographic material.

A still further object lies in the provision of a suitable material to carry out the process.

Still further objects will be apparent from the detailed specification following hereinafter.

This invention is based on the observation that it is generally necessary, when taking color images, to alter the sensitization of the material according to the illumination used for exposure, for instance day-light, arc-light and nitra-light, since in each light source another spectral region is predominating. If the light used is different from that for which the material was sensitized, i. e. if "wrong light" is applied, it is impossible to obtain images of correct color value without additional measures.

Errors in illumination for instance may be eliminated by suitable filters during the exposure. This, however, has the disadvantage that the sensitivity of the material is not fully utilized on account of the longer exposure-time caused by the filter. It is therefore practical to correct the colors only in the printing process. Here the color correction may be accomplished in different ways, for instance by a colored printing light, a suitable color developer containing, if necessary, dyestuff components or by dyeing the finished image itself. As proposed in our German Patent application I.63 538 IV*a*/57*b*, filed January 18, 1939, corresponding to the U. S. Patent 2,316,291, it is especially practical, when dyeing the picture, to use such dyestuffs, the absorption maxima of which correspond to those of the image dyestuffs. The use of filters for the color correction here also brings about an undesirable prolongation of the exposure-time, not to forget, that too strong filtering of the light often yields incorrect colors.

It has been found that these disadvantages are dispensed with when using for the production of the color negative a multilayer photographic material of such kind, that one color predominates and that the dyestuff images of the multilayer photographic material do not fit together as to show a neutral black. The negative therefore is to be printed on a multilayer printing material, on which the partial color pictures produced do likewise not form a neutral black, but deviate from the neutral point in such a way, that the color component, predominating in the negative, is just compensated resulting in a neutral multicolor positive of correct color value.

According to this invention it is for instance possible to take pictures on the same negative material in day-light, artificial light and at different hours of the day without a filter by using the full sensitivity of the material. Without color correcting means the negative is printed onto a positive of correct color value by using a printing material balanced correctly according to the respective negative. The invention is of special advantage in the production of color prints on paper. When the colors differ largely, a filter besides the printing material may be used corresponding to the respective negative. In this way too strong filtering and incorrect colors caused thereby are avoided.

In carrying out the present invention a negative material with complementary or non-complementary color is used the neutral point of which, i. e. the point where all three fundamental colors of the different emulsion layers together show a neutral gray, is adjusted for an illumination with a light lying between arc-light and day-light. The actual illumination of the negative material is made, however, not with this merely theoretical light, but either with arc-light or with day-light, regardless of the resulting false color tinge produced on the negative material. In the case of arc-light the resulting image shows blue in preponderance, whereas in the case of day-light the resulting image is short of blue color values. Care must be taken in all events that the scantiest color is still represented in the negative to such an extent that a positive partial picture can be registered.

It is advisable therefore to choose the neutral point of the negative material about in the center of all possible light sources. It is obvious that in this case the false color tinges will be less remarkable than in the case of the neutral point being shifted entirely to one side.

Up to now the negative just described had to be printed by means of different colored light sources and strong filtering means in order to produce a positive image of true color values on a standard positive multi-layer material of given quality.

According to the present invention a plurality of different printing materials is kept in stock

and for each negative the most suitable one of these different brands of printing material is chosen. The printing materials mentioned differ from each other in the ratio in which they register the three fundamental colors.

When, for instance, a negative is to be printed which failed in fully recording the red color values, then a positive printing material is chosen in which the blue values preponderate so that the color deficiencies of both negative and positive film are contrary to one another and therefore just compensate each other so as to yield a true color positive. The same principle is applied to negatives in which yellow or purple are poorly recorded. In each case the correction of untrue color representation in the negative is effected not by colored filters or colored light-sources, but by selecting a printing material which as much as possible is the contrary of the negative material as to its color recording capacities.

The process of the present invention may be compared to some extent with the well-known technique of black and white photography. In black and white the negative obtained may be too soft or too hard depending upon the illumination. According to the gradation characteristics of the negative printing paper of flat gradation is applied for a hard negative and paper of steep gradation is used for a flat negative.

The new process presents a very convenient way of obtaining satisfactory prints of the various types of color negatives without necessitating a complicated printing outfit. One single negative color material is used together with a scale of different brands of positive color printing material, for instance one positive material for arc-light, one for day-light, one for incandescent light, one for sun-set light and one for mountain light. Without applying color filters, different colored light-sources and complicated apparatus the operator will soon develop the capacity of picking out for each negative the most suitable of the different printing materials.

Example I

An exposure in day-light is made on negative material, which carries on a transparent support a red sensitized emulsion to be developed into a blue-green image, on top of it, a green sensitized emulsion, to be developed into a purple image, and furthermore a third unsensitized emulsion for registering the yellow image. The sensitization is done in such a way, that in day-light a negative of correct color value is obtained. This is developed and the resultant negative copied onto a neutrally balanced positive material. A neutral image of correct color value is thus obtained.

Example II

A picture of the same object is registered on the same negative material in arc-light, the latter containing substantially more blue rays than day-light. A negative with an over-balance of yellow is therefore the result. This negative yields bluish images, if copied without precautions. If, however, the print is made on a positive material the dominating color sensitivity of which counter-balances the fault of the negative, an image of correct color value is obtained. With a "neutral" negative this type of positive material would only give a yellowish image.

Example III

This process is not limited to print a falsely tinted negative without additional filtering, but shows special advantage in the reproduction of certain colors, for instance, when it is desirable to emphasize the red color. A certain color of a color negative is reproduced best in the printing process if this color is registered in the negative as strongly as possible. This may be accomplished by adjusting the thickness of the emulsion layer. In such a case the light is completely filtered, whereas white light still penetrates through thinner emulsion layers. It is therefore possible in spite of an increased color density of a single layer to obtain neutral images in the printing process by increasing one color component in the negative, provided the printing material used is corrected accordingly.

Example IV

Moreover, the process may be advantageously used for the production of sound tracks consisting of dyestuffs. In scanning a color film with white light, only the blue-green layer absorbs the actinic rays, as the usual photocells are only sensitive to red and infrared. An intensification of the blue-green layer results therefore in an increased absorption effect and consequently in a bigger output of the sound film intensifier. In order to obtain a multicolor image of correct color value on a printing material with a surplus of blue-green components, the suitably corrected negative material according to this invention is used for the production of the negative.

In the present invention silver halide emulsion layers containing color formers fast to diffusion are advantageously applied, as described in U. S. Patents 2,178,512, 2,179,228, 2,179,239, 2,179,344 and 2,186,849.

We claim:

1. A method of producing subtractive photographic multicolor images of correct color registration which comprises taking a color negative on a photographic multicolor material containing dyestuff formers in which one of the dyestuff formers predominates and printing said negative onto a photographic multilayer printing material containing dyestuff formers in which another dyestuff former predominates to such an extent as to compensate the color failure of the negative.

2. A method of producing subtractive cinematographic multicolor images of correct color registration which comprises taking a color negative on a photographic multicolor material containing dyestuff formers in which one of the dyestuff formers predominates and printing said negative onto a photographic multilayer printing material containing dyestuff formers in which another dyestuff former predominates to such an extent as to compensate the color failure of the negative.

3. A method of producing subtractive cinematographic multicolor images with sound track of correct color registration which comprises taking a color negative on a photographic multicolor material containing dyestuff formers in which one of the dyestuff formers predominates and printing said negative onto a photographic multilayer printing material containing dyestuff formers in which another dyestuff former predominates to such an extent as to compensate the color failure of the negative.

4. A process of making color photographs by

the negative-positive process which includes the steps of exposing a negative multi-layer material, having dyestuff components in the individual layers balanced for light of given spectral composition, to an object illuminated by light of different spectral composition, developing said negative material in a color-forming developer, to produce dyestuff images the color of which is unbalanced due to color distortion in at least one layer, selecting for the copying material multi-layer material containing color formers and having the layer designed to receive that image, the color of which is distorted, so constituted that on exposure and color development, the color of the image thus produced predominates over that of the images formed in the other layers, and copying the images of said negative material into said copying material with the same source of printing light and while avoiding the use of filters.

5. The process as defined in claim 4 wherein the layer in said copying material which is designed to receive the image, the color of which is distorted, contains a preponderance of color former over that present in the other layers of said copying material.

WILHELM SCHNEIDER.
HEINZ SCHULZE.
GUSTAV WILMANNS.