

UNITED STATES PATENT OFFICE

2,011,544

COLOR PHOTOGRAPHY

Isaac P. Rodman, South Orange, N. J., assignor
to Lektophone Corporation, Jersey City, N. J.,
a corporation of Delaware

No Drawing. Application October 18, 1930, Serial
No. 489,709. Renewed March 30, 1934

5 Claims. (Cl. 95—2)

In the past there have been several processes for photographically reproducing objects in color which processes fall into two general classifications known as additive and subtractive. These processes are described in "Natural Colour Photography", by Keonig and Wall, published May, 1906.

All the heretofore known processes absorb light and are objectionable in that the time of exposure is materially increased. In those processes in which semi-transparent filters are used between the object and the sensitive surface, it is necessary to use deep colored filters to obtain a high quality, and the deeper the color of the filter, the less will be its light transmission and consequently, in practice, a compromise between the depth of color of the filter and quality is employed to avoid the necessity of making very long exposures.

Length of exposure is not always objectionable from the photo-engraver's point of view, more particularly where the object is stationary. However, in the colored photography of animate objects where short exposures are essential none of the known methods are satisfactory and none of them render a scientifically accurate color reproduction.

It is an object of this invention to provide a method whereby a scientifically accurate reproduction of both moving and still objects can be photographically reproduced in natural colors with none of the objectionable features of the heretofore known processes.

It is a further object to provide an improvement in the method of making plates to be used for photo-engraving or color printing purposes.

It is a further object to provide an improvement in the method of making photographs in color to be used for still projection purposes.

It is a further object to provide a method for making colored motion pictures.

My method consist primarily in directly illuminating the object being photographed by a plurality of different colored lights in succession, for example, the lights may be blue, green and red, and successively exposing negatives sensitive to the colored lights being used. The blue, green and red lights are applicable to the additive system.

For the subtractive system the lights may consist of (a) blue; (b) a combination of blue, green and yellow; (c) a combination of green, yellow and red.

First the camera is focused on the object being photographed, any suitable light being used for this purpose. Then all white or other extraneous

light is shut out of the enclosure or studio within which the picture is being taken. Next, the object is illuminated by a blue light and an exposure is made using a negative sensitive to blue light. The blue light is then shut off and the object is illuminated with a green light and an exposure is made on a new negative surface sensitive to green light. The green light is then shut off and the object illuminated with a red light and an exposure made on a new surface sensitive to red light.

The negatives are then developed and fixed by ordinary and well known photographic methods. There has now been produced one negative on which there is a record of all the blue light reflected by the object, one negative recording the green light and a third recording the red light. If desired, these negatives may now be used for photo-engraving purpose, and in the color separation obtained they will be at least equal in value to those which are obtained by the present known standard practice, but my invention makes it possible to obtain a more perfect separation as will be clearly shown by the following example.

In actual practice, I have found that, when it is desired to produce a plate to be printed with red ink, it is desirable that the negative from which the plate is to be produced should register all colors with the exception of red, namely, blue, yellow and green. This combination of colors can be obtained by the use of an unfiltered pure mercury vapor arc, the spectrum of which includes violet, blue green and yellow lines. I have found, in actual practice, that where a plate is to be produced to be printed in blue ink, a more perfect result is obtained by a negative which registers all colors with the exception of blue, I have produced such negatives by the use of a neon gas arc, the spectrum of which contains red, yellow and green lines. It is impossible to obtain this result by the use of filters, with a white light source.

In actual practice I have also dispensed with all filters between the object and the light sensitive surface. It will be seen from the foregoing that no filters are used or are necessary between the object and the light sensitive surface.

It will be further seen that the intensity of the respective lights may be easily varied making it possible to secure either equal intensity for each of the lights or to secure the accentuation of one or more of the lights, if desired, or to adjust the lights to those values with respect to the relative sensitivity of the light sensitive surface used to secure the same exposure for each light.

A light sensitive surface may be sensitized for the particular color with which it is to be used and a plurality of light sensitive surfaces may be sensitized for their respective colors; but it is not always practical to make such color sensitized surfaces so that they will have equal sensitivity with respect to each other. Accordingly it is necessary to compensate by some means for such inequality and it can readily be seen that compensation may be made by adjusting the intensities of the illuminating sources.

Occasion might arise when it would prove desirable to accentuate one or more colors. It can readily be seen that this also can be accomplished by adjusting the intensities of the illuminating sources.

In colored photographic work there is frequently used a light sensitive surface known as "panchromatic" which is sensitive to all colors. However, the sensitivity of the panchromatic surface is not equal for all colors and accordingly it is necessary that compensation be made with this type of surface in order that all colors may be reproduced uniformly. This compensation may also be made by adjusting the intensities of the illuminating source.

The colored lights may be produced by filters between the object and a source of white light; or such colored lights may be produced by lights depending upon ionization of gases. For example a red light may be produced by a clear glass tube containing neon gas; a yellow light by a tube containing sodium vapor; a green light may be obtained by using a special glass tube (for example didymium glass) containing mercury vapor; and a blue may also be obtained by a special glass tube (for example cobalt glass) containing mercury vapor.

I do not restrict myself to the aforesaid light sources but it should be noted that the light sources should be so chosen that when their respective spectra are added together the result will cover the entire visible spectrum thereby producing a white light.

It may not always be practicable to adjust the intensities of the light sources to the desired values, in which cases an equivalent result can be obtained by the proper adjustment of the aperture and shutter timing.

It is necessary to determine the proper intensities of the light sources, and for this purpose I employ a flat surface divided into areas progressively graded from white through the greys to black. By examining the image of this surface on the ground glass of the camera, alternately using each of the light sources, an approximate adjustment of the intensities of the light sources is made. Subsequent trial exposures and readjustments make it possible to secure an accurate balance.

My method is especially adapted for photoengraving or color printing purposes. The usual method employed heretofore for producing color prints has been very expensive, complicated, inaccurate and slow.

In the making of a color print by these well known methods it has been first necessary for an artist to make a picture in color of the object; this picture is then photographed through three color filters such as red, green and blue, and also black and white photographs are taken. From the four negatives thus obtained proofs are made and it is then necessary to retouch the negatives in order to compensate for inaccuracies therein.

The next step in the process is to make a continuous tone positive which is also retouched.

From this continuous tone positive which has been retouched, half-tone negatives are made, which are also retouched, and then from the half-tone negatives, which have been retouched, the plates for the press are made, which also have to be retouched.

From the above it will be seen that the method is inaccurate and very slow as the retouching must be carefully done by an expert, and the time consumed in making the color reproduction is about four weeks.

In accordance with my method, practically all of the steps enumerated above in the usual photoengraving method are eliminated. By using my method, the object is photographed directly in three color lights to produce three negatives, one of the negative records only red, yellow and green qualities of the object; a second negative records only the blue, yellow and green qualities of the object; and a third negative records only the blue qualities of the object.

A half tone screen is placed in the camera so that the above mentioned negatives are half tone negatives. From the three half tone negatives thus produced, it is only necessary now to make from them the print plates for the press, and no retouching is necessary.

It will be seen that my method eliminates entirely the necessity of employing an artist to make a painting or color drawing of an article and also the various retouching operations are obviated.

The foregoing disclosure is to be regarded as descriptive and illustrative only, and not as restrictive or limitative of the invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. The method of making color separation negatives in color photography, comprising adjusting a neon arc light to a desired color value for a red negative, adjusting a mercury arc light to a desired color value for a green negative, adjusting a mercury arc light to a desired color value for a blue violet negative, then separately adjusting the intensity of each of said lights, successively illuminating an object with each of said lights, and photographing the object through a half-tone screen at each of said illuminations.

2. The method of making color separation negatives in color photography, comprising limiting the emission of one set of vapor arc lights, a large part of the emission of which is in the blue-violet part of the spectrum, to the blue-violet part of the spectrum, adjusting the relative intensity of the blue and violet lines to conform to the sensitivity of the emulsion, adjusting the intensity of the total blue-violet light emitted to conform to the sensitivity of the emulsion, similarly limiting and adjusting similar sets of green and red lights, successively illuminating an object with each of said lights, and photographing the object through a half-tone screen at each of said illuminations.

3. In color photography without filters between the object and light sensitive surfaces, and wherein the object to be photographed is directly and separately successively illuminated by a plurality of different colored light sources in succession, with short exposures of the light sensitive surface, the method of making color separation negatives having predetermined characteristics, which comprises, adjusting the spectral emission of a source of red light to a desired color value

for a red negative, adjusting the spectral emission of a source of green light to a desired color value for a green negative, adjusting the spectral emission of a source of blue light to a desired color value for a blue negative, correlating said adjustments so as to obtain a desired proportionate color resolution relationship between the spectral emissions of the several light sources, then separately adjusting the intensity of each of said light sources to balance the component exposures to the relative sensitivities of the light sensitive surface to secure substantially the same effective exposure for each light source, separately and successively illuminating the object to be photographed with light from each of the said light sources, and photographing the object on a separate sensitive surface at each of said adjusted illuminations for relatively short exposures.

4. In color photography without filters between the object and light sensitive surfaces, and wherein the object to be photographed is directly and separately successively illuminated by a plu-

5 rality of different colored light sources in succession, with short exposures of the light sensitive surface, the method of making color separation negatives having predetermined characteristics, which comprises, proportionately adjusting the spectral emission of each of a plurality of different colored light sources to each other, then separately adjusting the intensity of each of said light sources to balance the component exposures to the relative sensitivities of the light sensitive surface to secure substantially the same effective exposure for each light source, separately and successively illuminating the object to be photographed with light from each of the said plurality of light sources, and photographing the object on a separate sensitive surface at each of said adjusted illuminations for relatively short exposures.

5. In color photography a method according to claim 4 which comprises producing said negatives by photographing said object at each of said adjusted illuminations through a half-tone screen.

ISAAC P. RODMAN.