

April 24, 1934.

G. GUALTIEROTTI
PROCESS FOR BICHROMATIC RECORDING AND PROJECTION
OF IMAGES IN NATURAL COLORS
Filed March 22, 1930

1,955,804

FIG. 1.

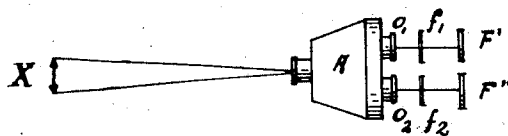
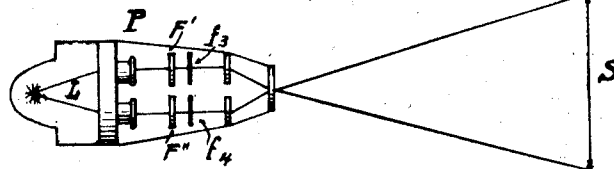


FIG. 2.



INVENTOR
Gualtiero Gualtierotti
by *R. Rolin*
Attorney

UNITED STATES PATENT OFFICE

1,955,804

PROCESS FOR BICHROMATIC RECORDING
AND PROJECTION OF IMAGES IN NATURAL
COLORS

Gualtiero Gualtierotti, Milan, Italy

Application March 22, 1930, Serial No. 438,120
In Italy April 2, 1929

1 Claim. (Cl. 88—16.4)

It is already known in natural color photography that the three fundamental colors indicated by the trichromatic theory may be reduced (as to their chromatic value) to two by substituting for two of the tones of the trichromatic group, the intermediate color indicated by the chromatic circle.

This is a welcome circumstance especially in the case of the projection in natural-color cinematography. If, however, it is practicable when the photograph is being taken, to fix upon two photograms the luminous value of all colored light passing through the filters, the conditions are no longer the same nor so favourable when additional white light is conveyed through the filters in order to color the selected photograms. The two lights issuing from the filters have acquired a well determined tone corresponding to the tones of the filters employed and, though these lights added to one another in equal amounts reproduce a white light, it has been found in practice and is apparent from theory that to equal luminous intensities of different colors equally passing through a two-color filter at the moment the photograph was taken, there correspond intensities of a color which does not agree with the original, because they are affected by the particular and invariable tone of the filter used for the projection. Hence the obvious objection of an untrue, altered and limited reproduction of the colors that is raised against bichromatic reproduction. Yet the practical advantages inherent to the employment of only two photograms, especially in connection with cinematography, are such as to make it worth while to look about for means capable of improving the chromatic efficiency of said bichromatic process.

The present invention just has this aim in view and mainly consists in introducing only during the projection a third luminous element completing the illumination conditions of the projected photograms.

This third element is the white light such as it issues from the light source, the white light being used concomitantly with the monochromatic lights supplied by the filters. An effect of the white light on all colors generally is that it makes them greenish, so that for instance the red light issuing from one of the filters with a wave length that is special to the kind of red used and with a wave amplitude determined by the degree of transparency or opacity of the corresponding photogram can be so far modified as to attain the tones of the spectrum zone D—E.

In other words, if the tone of one of the taking filters is approximately located at zone E of the spectrum, then the corresponding projection filter has the same tone E and also the rest of the tones from zones E to A of the spectrum.

From this zone, or better, from the zone F on towards the zone H all the colors of the corresponding chromatic scale are obtained with satisfactory approximation by the simple variation of the wave amplitude of a colored light suitably selected in the spectrum zone F—G.

The practical application of the abovesaid cannot be satisfactorily realized by the mere superposition of white light on the images already compounded together on the screen, then this would be equivalent to uniformly distributing the white light over all the points indiscriminately and not on those points alone where it is required in order to bring the color to the desired tone.

The present invention takes into account all the abovesaid conditions. Whereas thus far the practice has been to use for the taking of photograms and the projection of the same alike or but slightly different colored filters, the present invention, with regard to the filters employed in the projection, generally ignores or does not take into strict account the tone and intensity of the filters employed in taking the photograms, and after including a proper choice of matched taking filters confines itself to assigning to one alone of the projection filters (for instance the one intended to produce the tones of the zone A—E) of the spectrum the tonality capable of giving, with sufficient approximation and by the mere variation of the wave amplitude, the tones which, starting from the tone of the corresponding taking filter, go towards the zone A of the spectrum.

The other projection filter is intended to let the white light spoken of above pass through well defined points of the images i. e. is nearly colorless.

In order, however, to obtain also the tones corresponding to the zone E—H of the spectrum, which could not be obtained from the first projection colored filter, according to the present invention, a very slight haze of a tone chosen in the spectrum zone G is given to said almost colorless filter. The effect of this haze is that, starting from a certain wave amplitude of the light thus transmitted, this light acquires the tones corresponding to the zone F—H and thus, by superposing itself to the light conveyed by the other filter, completes on the screen the

tones comprised in the zone E—F of the spectrum.

An example of the invention as applied to the taking and projecting of two differently colored photograms of the same object so as to obtain a single reproduction in natural colors of the same on the screen is illustrated in the accompanying diagrammatic drawing, in which:

Figure 1 is a diagram of the taking.

Figure 2 is a diagram of the projection of said two photograms.

In Figure 1, X is the object to be reproduced in its natural colors; A is a camera capable in any suitable way of giving two identical images of the said object X through the objectives 01 and 02;

f1 and f2 are two taking filters colored according to the tonalities of the two determined spectrum zones;

F' and F'' are the two identical photograms of the said object X obtained on the sensitive plate or film and selectioned according to the value (tonality and intensity) of the filters.

In Figure 2:

L is the white light source of the projector P, which is capable of projecting in accurately superposed conditions the two identical images supplied by the photograms F' and F'';

f3 and f4 are two projection filters differing from the taking filters f1—f2. Filter f3 comprises the maximum scale of the spectrum tones; f4 on the contrary is transparent to white light but possesses a hazing of a tone capable of covering the tones of a determined spectrum zone with suitable graduations of intensity;

S is the screen on which any suitable optical

device P superposes and forms into a single image with natural colors, the two identical but differently colored images supplied by the filters f3 and f4.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

Process for bichromatic recording and projection of images in natural colors which consists in first exposing a pair of sensitized photograms to the same object through appropriate lenses and a pair of differently colored taking filters of corresponding color density, one being a red filter and the other being a blue green filter which are individually assigned to each of said photograms in order to produce two individual images of said object upon said photograms, and thereafter simultaneously projecting the images thus obtained through a pair of non-complementary colored projection filters of different quality and density of color than said taking filters, in which pair of projection filters utilized, one corresponds to the red filter with yellow and green added of the corresponding taking filter, and the other one is almost colorless but has a slight haze of a tone located in zone G of the spectrum in order to produce the tones located in zones F—H of the spectrum, and producing the tones located in zones E—F of the spectrum by superposing on each other the respective lights conveyed by said two projection filters in order to complete the spectrum.

GUALTIERO GUALTIEROTTI. 110

40 115

45 120

50 125

55 130

60 135

65 140

70 145

75 150