NOTE.—*The application for a Patent has become void.*

*This print shows the Specification as it became open to public inspection under Section 91 (3) (a) of the Acts.*

# PATENT SPECIFICATION

*Convention Date (Germany): April 17, 1929.* **359,474**

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*Complete not Accepted.*

COMPLETE SPECIFICATION.

## Process of Producing Colour Pictures on Lenticular Films and a Method and Optical System for Projecting Them.

We, I. G. FARBENINDUSTRIE AKTIENGESELLSCHAFT, a Joint Stock Company organised according to the laws of Germany, of Frankfurt a/Main, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

When taking pictures on a lenticular film prepared according to Berthon's Specification No. 10,611 of 1909 a diaphragm has hitherto been used provided with a red screen, a green screen and a blue screen arranged adjacent to each other in the form of strips in the optical centre of the objective. Each of the lens elements arranged on the back side of the support produces in the sensitised layer an image of the three-colour screen.

In this process, however, not all of the partial pictures produced have the same position relative to the optical axis of the corresponding lens element, for, whereas the images in the middle of the picture frame are placed exactly in the optical central axis of the lens element by which they are projected, the pictures lying towards the margins of the frame are somewhat laterally displaced. A reproduction in the true colours is only possible with a film thus taken if the reproduction screen or its real or virtual image is arranged at exactly the same distance from the film as the screen used during the exposure and if it has furthermore the same size as the said screen which served for taking the picture. To arrive at this result it is necessary to adopt a construction of the taking and reproduction devices such that there is strict coincidence as regards the filter, by mounting, for instance, in the reproduction device an additional lens system which has for its purpose to compensate correspondingly the position and the size of the filter. If one intends to project successively in the projection device films taken by means of several different apparatus, each film will require a special additional lens system. Hence it becomes almost impossible to operate with the same film in different projection devices. In view of the great number of various types of projection apparatus used in practice the above requirement constitutes a considerable disadvantage.

According to this invention, all of these inconveniences are remedied by performing the exposure in such a manner that all images of the colour filter produced in the emulsion layer lie exactly vertically below their corresponding lens elements. If all of the partial pictures produced in the emulsion layer are placed in the same position relative to the optical axis of their corresponding lens elements, the pictures reproduced will be represented in the actual colours even if the projection screen is not in the same relation to the film as the filter used for the exposure. In this case it is even sufficient to place the colour screen at infinity or at least relatively far in front of the film.

A uniform position of the partial pictures relative to their corresponding lens elements all over the picture plane can be procured in a very simple manner by means of an arrangement which in the optical art is known as "telecentric course of rays". For this purpose the colour screen is not fitted in the plane of the diaphragm but at a certain distance in front of the objective. When working with this arrangement the reproduction in the proximity of the axis of the objective occurs under the microscopic lens elements in the same manner as with the hitherto used arrangement of the colour screen because all rays in front of the objective must be considered as parallel rays. However, in the lens elements at the border of the picture field the projected images of the plane of the diaphragm are some-

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what outwardly displaced in comparison with the optical axis of the corresponding lens element so that the filter placed in front of the objective will no longer be completely reproduced. According to this invention this fault is compensated by extending the filter beyond the original limits, that is to say a filter is used which carries the usual colour strips in several repetitions one beside the other. When operating with a filter of the kind described also the lens elements of the marginal parts will always produce a whole series of colour strips, although with varying succession of the colour strips.

When the colour screen is placed at focal distance in front of the objective and the breadth of the single series of colour strips is chosen as the product of the focal length of the view-taking objective and the light intensity of the respective elements of the film, the images of the filter-plane reproduced show vertically under each lens element of the picture field the same succession of the colour strips as will be found in the filter. The light intensity of the lens elements is determined by the quotient $\frac{\text{diameter}}{\text{focal length}}$.

In order to reproduce a lenticular film taken according to this process in its true colours, it is no longer necessary to adjust the projection system by means of a special additional lens system to the optical system of the exposure device used in each particular case, but on the contrary every projection device is applicable in the focal plane of which in front of the objective a colour screen is provided which carries the usual colour strips in several repetitions and in which the breadth of the single series of colour strips is equal to the product of the focal length of the projecting objective and the light intensity $\left(=\frac{\text{diameter}}{\text{focal length}}\right)$ of the lens elements of the film. The sole variable of the reproduction device is now the breadth of the single series of colour strips of the colour screen which changes proportionally to the diameter of the lens elements of the film and in inverse proportion to the focal length of the lens elements of the film. But this scarcely entails further alterations of the reproduction apparatus, as the lenticular films are provided, as a rule, with the same refractive embossing and as, on the other hand, a variation in the shape of the refractive embossing of the films which may occur can be compensated in a most simple manner by inserting a colour screen of other breadth of the colour strips.

In order to avoid the appearance of dominant hues it is furthermore advantageous to operate, both when exposing and when projecting the film, with an optical system which contains in the objective a diaphragm of rectangular form the sides of which parallel to the longitudinal edges of the colour strips of the filter are so far distant from one another that from any point of the picture plane in each case only one series of colour strips can be seen.

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

1. A process of producing colour pictures on lenticular films wherein when exposing the film all images of the colour screen are reproduced in the emulsion layers exactly vertically under their corresponding lens elements.

2. A process of producing colour pictures on lenticular films as referred to in Claim 1, wherein in front of the objective in its focal plane, a colour screen is fitted which carries a number of the usual colour strip series and in which the breadth of the single series of colour strips is equal to the product of the focal length of the view-taking objective and the light intensity $\left(\frac{\text{diameter}}{\text{focal length}}\right)$ of the lens elements of the film.

3. A process of projecting a lenticular film prepared according to the process referred to in Claim 1 or 2 by using for the projection a colour screen which is equal in function to the colour screen which has served for the exposure with the exception that the breadth of colour strip series is calculated on the focal length of the objective used for the reproduction.

4. An optical system for the execution of the process referred to in Claim 1, 2 or 3, in which the diaphragm in the objective has a rectangular form whose sides parallel to the longitudinal edges of the colour strips of the colour screen are so far distant from each other that from any point of the picture plane in each case only one series of colour strips can be seen.

Dated this 17th day of April, 1930.

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