

PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Improvements relating to Photographic Reproduction from Lenticular Films.

We, I. G. FARBENINDUSTRIE AKTIEN-GESELLSCHAFT, 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:—

The lenticular film, the principle of which is set forth in Specification No. 10,611 of 1909, though in the first place intended to be used for cinematographic purposes, may also be adopted for producing single photographic colour pictures. Now the problem arises how to print from the lenticular film on to any photographic material the support of which is not provided with refractive microscopic lens elements. For this purpose orthochromatic, as well as panchromatic silver halide emulsion layers, may be used and also layers which are exposed to light behind a screen formed of coloured grains or lines. Finally, layers not containing a silver salt may likewise be used as printing material, it being, however, in all cases important to obtain the pictures not laterally reversed.

In the hitherto known processes for printing from lenticular films, the film is arranged with the side bearing the lens elements facing towards the film on which the copy is to be produced, and is illuminated from the side remote from the lens elements, which are thus situated between the photographic image on the lenticular film and the film on which it is to be reproduced. This arrangement is subject to disadvantages which arise owing to the diffusion by the lens elements of the light proceeding from the image to the film on which the image is to be copied.

According to the present invention, printing from a lenticular film onto a photographic layer whose support is not embossed with lens elements is conducted by arranging the lenticular film with the side bearing the lens elements remote from the layer to be printed and facing an objective equal in function to the optical system by means of which the lenticular film was originally taken, through which

objective the lenticular film is illuminated during the printing operation. Printing may be conducted optically, a photographic reversal system being interposed in some cases (as will be hereinafter explained) in the course of the light rays proceeding to the layer to be printed; in some cases, printing may be by contact. As lens system the objective may be used which has served for exposing the negative film. Since, however, it is as a rule advantageous when printing to select other focal lengths than those used in taking the picture, there is chosen in these cases for the exposure an optical system which is equal in function to the lens system selected for taking the picture.

An optical system is said to be equal in function, in the sense of the present specification, to the optical system by means of which the negative was taken when the following conditions are satisfied:—

(a) If the objective and colour screen be viewed by placing the eye at an aperture of the size of the picture to be copied and in the plane which is to be occupied by the picture during copying, the colour screen appears to subtend a certain angle, namely, the difference between the angles at which the opposite sides of the screen appear when viewed from the mid-point of the aperture (the screen being arranged with the colour strips in the vertical direction). This angle must be the same in the case of each of the optical systems.

(b) By noting the difference in the angles at which the mid-point of the colour screen appears when viewed from points on opposite sides of the aperture referred to in (a) and in the same horizontal plane as the mid-point of the colour screen, the apparent distance of the screen from the aperture can be determined trigonometrically. This distance must be the same in the case of each of the optical systems.

When these conditions are fulfilled, and the colour screen to be used for copying consists of strips of the same colours as those of the screen used for taking and arranged in the same order, the film, when in position with its lens elements facing

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the objective and viewed from the side remote from the objective, will show a reproduction of the original in natural colours (if it is a positive film) or in the complementary colours (if it is a negative film). If the colour screen is removed, the film shows a black and white reproduction of the original having luminous portions corresponding with the colour values of the said natural or complementary colours.

A good illumination to the corners of the picture is obtained by placing immediately before the condenser a lens, of the same or of a larger diameter than that of the illuminating objective, in the focal plane of which a diffusely illuminated screen or the like, is arranged. By this arrangement of the lenses any predominance of colours is avoided.

The lens system may be used either with or without the multicolour screen employed for taking the picture. Since the colour screen impairs the light intensity it will only be used if the positive material is panchromatically sensitised, that is to say, if one intends for instance to print on to the known colour plate. If, however, monochromatic sensation pictures, for example for a three-colour process, are to be prepared from the negative lenticular film it is generally preferable to operate without a colour screen, because in this case in the positive layer only a black and white picture has to be produced corresponding with the colour values of a single colour.

The negative film must be illuminated through the objective above described in such a manner that if the colour screen is placed in the objective the negative film shows when viewed from the emulsion side a picture in which the colours of the object are represented by their complementary colours.

If the picture printed according to the process of the present invention is to be viewed from that side on which the rays have been incident in printing, that is to say if a picture to be viewed by reflection has to be produced, printing is conducted optically, and a reversal system of known construction, for instance a mirror or a totally reflecting prism, must be interposed in the course of rays in order to obtain the picture not laterally reversed. In cases in which the print is one which can be viewed from either side (as in the case of a transparency) or is produced by printing through its support (as in the case of a carbon print or the like), printing may be conducted optically, without the necessity for a reversal system. In such cases, when no enlargement or reduction

of the film is desired, the negative film illuminated as hereinbefore described is advantageously printed by contact, that is to say the positive material is brought into intimate contact with the emulsion side of the negative film. This process is always applicable with advantage in such cases, because when the picture is viewed from the side remote from that on which the rays were incident during printing, it does not appear laterally reversed. If, however, an enlargement or a reduction is to be produced the negative film illuminated in the same manner is printed by optical means on to the positive material according to one of the known methods, if necessary with a reversal system. The optical enlarging system must be arranged in such a manner that all the rays emanating from the negative film are caught by it and are utilised for projecting the picture.

If single colour records, for example for three-colour photography are to be produced from the negative lenticular film, only rays of a single colour are allowed to illuminate the positive layer at each exposure. For this purpose there is fitted into the plane of the colour screen of the illuminating objective a diaphragm which masks during each exposure the area of all but one of the colour strips of the filter. In this case the colour screen itself can generally be dispensed with. When the colour screen is removed from the objective the diaphragm must be placed at a point which corresponds with the position of the colour screen.

In order clearly to illustrate the subject of the present invention there has been described above only the particular case in which, on a sensitive layer the support of which is free from microscopic lens elements, a picture is produced from a negative film the support of which is embossed with refractive lenticular elements. The process can, of course, also be used for printing a negative from a positive lenticular film. With the aid of one of the known photographic reversal processes negatives may furthermore be printed in the same manner from lenticular negatives and likewise positives from lenticular positives.

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) Process of printing a lenticular film on to a photographic layer the support of which is not embossed with refractive microscopic lens elements so as to obtain a print which is not laterally reversed with respect to the original, which consists in

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illuminating the film, arranged with the lenticular support facing towards the source of light, through an objective equal in function to the lens system by means of which the lenticular film was originally taken, with or without the application of a colour screen, in such a manner that the lenticular film when viewed from the film side shows a picture in which the colours of the object are represented by their complementary colours (in the case of a negative film) or by their natural colours (in the case of a positive film), or by luminous portions corresponding with the colour values of the said complementary or natural colours, printing being effected by optical means, if required with interposi-

tion of a reversal system in the path of the incident rays between the objective and the sensitive layer, or in some cases, by contact. 20

2) The modification of the process referred to in claim 1, which consists in placing in the plane of the colour screen or immediately before the colour screen of the illuminating condenser a diaphragm which masks at each exposure the area of all but one of the colour strips. 25

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