

PATENT SPECIFICATION



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PROVISIONAL SPECIFICATION

Improvements in and relating to Colour Photography

We, KODAK LIMITED, a Company registered under the Laws of Great Britain, of Kodak House, Kingsway, London, W.C.2, do hereby declare the nature of this invention which has been communicated to us by Eastman Kodak Company, a Company organised under the Laws of the State of New York, United States of America, of 343, State Street, Rochester, New York, United States of America, to be as follows:—

This invention relates to the production of colour photographic records, especially for colour motion pictures.

15 In the production of colour photographic records it is known to employ a photographic record element having a plurality of superimposed emulsion layers sensitised to different colours and to 20 expose such an element so as to obtain images in the respective layers corresponding to the colour sensations to which the respective layers are sensitised. The images in the respective layers may 25 then be processed to different colours and are so processed in the subtractive processes to substantially the minus colours corresponding to the colours to which the respective layers were 30 sensitised. Such reversal of the colour is, for example, employed in specification 245,198. After a negative record element is thus formed by exposing a multi-layer record element in a camera and processing 35 it in this way it is usually necessary to print it upon a similarly constituted positive photographic element which, after processing, gives a representation in substantially true colours.

40 The present invention relates to a three layer photographic element, for example one in which the layers respectively contain records of the red, green and blue colour sensations. Such a film, especially 45 a motion picture film, may comprise a support carrying on one side one emulsion layer protected by a removable waterproof coating and on the other side two emulsion layers, of which three layers 50 two are uncoloured and sensitised to red and green respectively, while the third is sensitive to blue but insensitive to red

and green, and removable yellow light filter means arranged to subtract the blue component from light passing through the blue sensitive layer into the red and green sensitised layers. Thus the support may carry on one side the emulsion layer sensitive to blue and on the other side the two uncoloured layers sensitised to red and green respectively. 55

The light filter means may comprise a layer containing removable or bleachable yellow colouring matter such as tartrazine and this is situated between the layer sensitive to blue and the other layers. Where the layer sensitive to blue is a single coating on one side of the support the yellow-coloured filter layer may be next to the support and may be on either or both sides thereof. Alternatively a bleachable or removable yellow dye may be incorporated in the blue sensitive layer itself or in part of this layer. 60 65 70 75

Preferably the green sensitised layer lies between the red sensitised layer and the support. By way of example a suitable three-layer film is constructed as follows. On one side of a support or carrier there is coated a bleachable yellow filter layer. Over this is coated a silver halide emulsion layer which is sensitive to blue but insensitive to red and green. Over this layer is coated a clear colourless waterproof strippable varnish. On the other side of the support there is coated a silver halide emulsion sensitised to green and over this there is superposed a silver halide emulsion sensitised to red. Between the green sensitised and red sensitized emulsions there may be provided a thin layer of clear gelatine which prevents wandering of the sensitising dyestuffs from one layer to another and facilitates differential treatment of the two layers. Over the red sensitized emulsion there may be coated a removable anti-halation backing. Such a film is exposed from the blue sensitive side so that the single layer retains a record of the blue colour component while the double layers retain records of the red and green colour components respectively. 80 85 90 95 100

[Price 1/-]

Dated this 11th day of December, 1935.

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COMPLETE SPECIFICATION

Improvements in and relating to Colour Photography

- We, KODAK LIMITED, a Company registered under the Laws of Great Britain, of Kodak House, Kingsway, London, W.C.2, do hereby declare the nature of this invention which has been communicated to us by Eastman Kodak Company, a Company organised under the Laws of the State of New York, United States of America, of 343, State Street, Rochester, New York, United States of America, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—
- 5 This invention relates to photographic elements for colour photography and especially for colour motion pictures.
- 10 In the production of multi-colour photographic elements it is known to employ a photographic element having a plurality of emulsion layers, sensitised to different colours, superimposed on the same side of a single support and to expose such an element so as to obtain
- 15 images in the respective layers corresponding to the colour sensations to which the respective layers are sensitised. The images in the respective layers may then be processed to different colours and are so processed in the subtractive process to substantially the minus colours of the colours to which the respective layers were sensitised. Such reversal of the colour is, for example, employed in Specification 245,198. It has also been proposed to provide a photographic element such as a film with an emulsion layer sensitive to blue on one side of a support and emulsion layers sensitised to
- 20 green and red respectively on the other side of the support. After a negative record element is thus formed by exposing a multi-layer sensitised element in a camera and processing it in this way it is usually necessary to print it upon a similarly constituted positive photographic element which, after processing, gives a representation in substantially true colours.
- 25 The object of the present invention is to provide a new or improved sensitive element, especially a film, for colour photography suitable for exposure in a camera and for directly processing to a picture in natural colours. To secure this
- 30 results are to be obtained, to protect against blue light those emulsion layers which are not required to record the blue colour sensation. If this is done by exposure of the element from both sides by means of optical division of the image employing a yellow screen for the light falling on one side special camera mechanism is required and the risk of inaccurate register is introduced. If a yellow filter layer is incorporated in the photographic element adjacent to the red or green sensitised layers there is a risk of the yellow colouring matter wandering into the sensitised layers and affecting their sensitivity. Most yellow colouring matters known today tend to wander rather freely in gelatine layers.
- 35 According to the present invention there is provided a sensitive element, especially a film, for colour photography having inseparably coated on a single support at least three gelatino-silver halide emulsion layers differentially sensitive to colours substantially covering the whole of the visible spectrum in which a layer sensitive to blue but insensitive to colours to which the other layers are sensitised is the sole light sensitive layer on one side of the support, the layers on the other side of the support are uncoloured, and between the layer sensitive to blue and the support is arranged a water-pervious decolourable yellow filter layer. The sensitised layers on the side of the support remote from the blue sensitive layer are preferably two in number respectively sensitised to red and green and are, as stated above, uncoloured, except in so far as the sensitising dye employed may have colour. It is important to avoid the presence in these layers of foreign bodies which would be detrimental to the sensitivities over the bands of wave lengths to which they are respectively sensitised. The layer or layers of gelatino-silver halide emulsion on one side of the support may be covered with a removable water - proof varnish. Preferably there is placed between adjacent layers of differentially colour sensitive emulsions a thin layer of clear gelatine to resist wandering of the sensitising dyestuffs and to facilitate differential processing of the layers.
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Similarly, a thin layer of clear gelatine may be placed between the water-pervious decolourable yellow filter layer and the adjacent blue sensitive layer to resist wandering of the yellow colouring matter into the blue sensitive layer. It will be seen that in the photographic elements constructed according to the present invention only the blue sensitive layer is adjacent to the yellow filter layer; the yellow filter layer is isolated from the other layers by the support which is impervious to the yellow colouring matter. Any wandering of the yellow colouring matter into the blue sensitive layer is of less consequence in view of the high sensitivity to blue light of an ordinary rapid emulsion which can be used for recording the blue colour sensation.

By way of example the film may comprise a transparent support of the usual type, for example of cellulose acetate or of cellulose nitrate, on the rear side of which is coated a thin layer of red sensitised emulsion, a thin intermediate layer of clear uncoloured gelatine and a thin layer of green sensitised emulsion and on the front side of which is coated a layer of clear yellow coloured gelatine, and a thin layer of blue sensitive emulsion. If desired the blue sensitive emulsion may be covered with a transparent waterproof stripping varnish layer. Benzyl cellulose forms a suitable waterproof coating as it may be easily stripped from the emulsion surface when it is desired to process the blue sensitive layer. A suitable varnish for this purpose is:

40	Benzyl cellulose	-	-	150 gm.
	Benzene	-	-	1550 cc.
	Toluene	-	-	100 cc.
	Xylene	-	-	400 cc.

(the manufacture of a low viscosity benzyl cellulose suitable for this purpose is described in British patent specifications Nos. 327,714, 333,902 and 356,303).

There may be coated on the green-sensitised emulsion layer, if desired, a removable anti-halation backing.

The green sensitised emulsion may comprise a layer of a thickness of the order of .0002 of an inch of a very rapid emulsion sensitised to the green region of the spectrum between 510 and 590 μ . The sensitivity should be sharply limited towards 600 μ . Suitable sensitisers, adapted to this are well known and erythrosin may be mentioned as suitable. The red sensitised emulsion is of the same order of thickness and is a rapid emulsion sensitised in the region from 600 to 700 μ , preferably with a maximum near 650 μ . It is preferably relatively insensitive to light of wave lengths around 520

to 530 μ . Sensitisers suitable for this purpose are also well known and naphthocyanol may be mentioned as an example. It is desirable for the upper layer to be more dilute as regards its content of silver halide so as to give greater transparency, less density, less tendency to exhaust the developer diffusing through it, and less tendency to harden the gelatine where the image develops.

The intermediate layer of clear gelatine and the yellow filter layer may be from 1 to 3 ten thousandths of an inch in thickness or less and the amount of yellow dye incorporated in the filter layer will generally be not more than between 0.25 m.gm. to 2 m.gm. per square centimeter, the exact amount depending upon the strength of the dye chosen and the efficiency of the filtering required. Suitable dyes are, for example, tartrazine (about 0.25 to 0.5 m.gm. per square cm.) which is removable or decolourized in water or the processing baths, quinoline yellow (about 1 m.gm. per square cm.) or brilliant yellow (about 0.5 m.gm. to 1 m.gm. per square cm.). When using such dyes as tartrazine, for example, which tend to diffuse into the adjacent layers, a further clear gelatine layer may be coated between the emulsion layer and the filter layer.

The layer of clear uncoloured gelatine between the green sensitised layer and the red sensitised layer prevents wandering of the sensitising dyestuffs and facilitates differential processing of the layers. It must be clear enough to permit adequate exposure of the layer therebeyond and may, if desired, be suitably coloured to serve as a filter for the light falling on the layer therebeyond; e.g. it may contain a bleachable or removable red or green dyestuff according to the sensitivity of the layer therebeyond.

The silver halide employed in all the emulsion layers may be silver bromide and rapid emulsions should be used.

The thin layer of clear gelatine which is preferably present between two emulsion layers on the one side of the support facilitate the differential treatment of the images in the respective layers by allowing some leeway in controlling the penetration of the processing baths.

The film described above is exposed in the usual way from the front (so that the light falls first on the blue sensitive layer) to form latent images in the respective layers corresponding to the blue, green and red colour sensations, and since no filter is essential except that which is incorporated in the film itself, a shorter exposure may be made than with coloured films, heretofore used. However, a filter

may be used to overcome errors in the colour ratio, or to produce special effects.

The processing of such a film may be accomplished by the methods described 5 in co-pending application No. 16013/35 to convert the latent images directly to positive images in minus colours so that the film is, in effect, a positive in substantially the correct colours correspond- 10 ing to the object to which the film was exposed. The employment of colour development, as defined in application 16013/35, for the production of the coloured images results in obtaining 15 accurately superimposed clear transparent dye images containing no silver so that there is very little loss of light when the film is viewed as a transparency. Moreover, colour fringing is impossible.

20 Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, as communicated to us by our foreign correspondents, we declare 25 that what we claim is:—

1. A photographic sensitive element, especially a film, for colour photography having inseparably coated on a single support at least three gelatino-silver 30 halide emulsion layers differentially sensitive to colours substantially covering the whole of the visible spectrum in which a layer sensitive to blue but insensitive to colours to which the other layers are sensitised is the sole light sensitive layer on 35 one side of the support, the layers on the other side of the support are uncoloured

and between the layer sensitive to blue and the support is arranged a water-pervious decolourable yellow filter layer. 40

2. A photographic sensitive element, especially a film, for colour photography as claimed in claim 1 in which the layers on the side of the support remote from the blue sensitive layer are two in number, 45 respectively sensitized to red and green.

3. A photographic sensitive element, especially a film for colour photography, as claimed in either of claims 1 or 2, in which the layer or layers of gelatino-silver halide emulsion on one side of the support are covered with a removable waterproof varnish. 50

4. A photographic sensitive element, especially a film, for colour photography, as claimed in any of the preceding claims in which between adjacent layers of differentially colour sensitive emulsions is placed a thin layer of clear gelatine for the purpose indicated. 60

5. A photographic sensitive element, especially a film, for colour photography, as claimed in any of the preceding claims in which between the water-pervious decolourable yellow filter layer and the 65 adjacent blue sensitive layer is placed a thin layer of clear gelatine for the purpose indicated.

Dated this 11th day of December, 1935.

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