

PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

Improvements in and relating to Photographic Elements having Yellow Screening Dyes

We, KODAK LIMITED, a British Company, 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 body corporate organised according to 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 photographic elements having yellow screening dyes either in the emulsion or emulsions or in a separate layer or layers.

Emulsions which are to be used in recording different colours in known processes of colour photography are usually sensitized with cyanine dyes. Since all silver halide emulsions thus sensitized are sensitive to blue light, it is frequently necessary to make use of a yellow screening dye to prevent blue light from reaching such portions of the sensitive element as are to record only colour other than blue, e.g. red or green light. The yellow dye used for this purpose is frequently mixed directly with a sensitive emulsion, although it may be coated as a separate layer over an emulsion layer to be screened. Several well-known yellow dyes such as Tartrazine, Naphthol yellow and Quinoline yellow have been used for this purpose, but they are unsuitable for incorporation in cyanine-sensitized emulsions as they cause considerable desensitizing in the colour sensitized region. Even when employed in a separate unsensitized layer the dyestuff may wander into the adjacent sensitized layer or layers.

According to the present invention a photographic element has included therein as a yellow screening dye, an acid azo dye having a yellow colour.

It has been discovered that such yellow dyes do not desensitize cyanine-sensitized or other sensitive emulsions. Such dyes are generally easily removable or decolorizable, for example by some of the usual photographic processing baths, especially baths used in reversal processes.

[Price 1/-]

Dyes which have been found suitable are aromatic azo compounds having an acid reaction, particularly those in which one or more hydroxy groups are substituted in one or more of the benzene or naphthalene nuclei, such as benzene-azophenol, α -naphthalene-azo phenol, benzene-azo-resorcinol and 1-hydroxy 4(*p*-hydroxyphenyl-azo) naphthalene. Other substituents such as alkyl groups may be present, as for example in benzene-azocresol. The invention is not limited, however, to the employment of mono-azo dyes. Disazo dyes, such as Pyramidol brown (Rowe, Color Index—1924—No. 380), or the dye obtained by coupling two molecules of salicylic acid to one of *p*-phenylene-diamine, may also be used. Dyes suitable for carrying out the invention include also azo dyes having other nuclear substituents such as carboxyl, alkoxy, chlorine or bromine groups. Dyes containing the carboxyl group are benzene azo benzoic acid and Diamond yellow G, formed by coupling *m*-aminobenzoic acid and salicylic acid (Rowe, Color Index No. 218).

The following example serves to illustrate one method of carrying out the invention: a yellow dye of the type referred to, for example, benzene-azo-resorcinol, is dissolved in water and acetone in the amount of about 1 gram in 5 cc. of water and 5 cc. of acetone. This is mixed with a solution of 10 grams of gelatin and is then ready to be coated over the emulsion layer, and when so coated forms after drying a water pervious yellow filter layer.

As already stated, however, the yellow screening dye may be included in a sensitive emulsion layer.

The invention includes a photographic element having an emulsion layer sensitive to blue light and a screening layer comprising a transparent material containing a nuclear hydroxy derivative of an aromatic azo compound uniformly dispersed therethrough.

The invention also includes a sensitive photographic material comprising a support, at least two differently sensitized emulsion layers on one side of the support, and an acid azo dye uniformly dis-

persed in a layer over the sensitive layer nearest the support, as well as a sensitive photographic material comprising a support, at least two differently sensitized emulsion layers on one side of the support, the emulsion layers farthest from the support having an acid azo dye uniformly dispersed therein.

The invention further includes a sensitive photographic element comprising a support, at least two superposed sensitive layers thereon, both being sensitive to blue light and the lower one only being also sensitive to a colour other than blue, said element including above said second named sensitive layer a screening layer containing uniformly distributed there-through an acid azo dye absorptive of blue light.

The invention further includes a sensitive photographic element comprising a support, at least two superposed sensitive layers thereon, both being sensitive to blue light and the lower one only being also sensitive to a colour other than blue, and an inert layer between said two layers and containing a uniformly distributed acid azo dye.

The invention further includes a sensitive photographic element comprising a support, at least two superposed sensitive layers thereon, both being sensitive to blue light and the lower one only being also sensitive to a colour other than blue, the outer sensitive layer containing a uniformly distributed acid azo dye.

The invention further includes a sensitive photographic material comprising a support, at least three differently sensitized emulsion layers on one side of the support, and an acid azo dye uniformly dispersed in a layer over the two sensitive layers nearest the support.

The invention further includes a sensitive photographic material comprising a support, at least three differently sensitized emulsion layers on one side of the support, the emulsion layer farthest from the support having an acid azo dye uniformly dispersed therein.

The invention further includes a sensitive photographic material comprising a support, at least three differentially colour sensitized emulsion layers all sensitive to blue, separated by inert gelatine layers on

one side of the support, one of the inert gelatine layers, preferably the outermost, having an acid azo dye absorptive of blue light uniformly dispersed therein.

By way of example, a photographic element having a gelatin screening layer prepared according to the invention comprises a support, which is preferably a transparent sheet of cellulosic derivative but may be of glass or paper, carrying three coated emulsion layers which are differentially sensitive to various regions of the spectrum such as red, green and blue, respectively. Between the red and green sensitized emulsion layers there is a plain gelatin layer and between the green and blue sensitive emulsion layers there is the yellow screening layer prepared in the manner already described. This screening layer prevents blue-light rays from reaching the green and red sensitized emulsion layers when the film is exposed to light. The emulsion layers, which are intended to record red and green light, are unavoidably sensitive to blue light, consequently, blue light must be excluded from them.

In a modified form of film in which the layers are, as before, sensitive to red, green and blue light, respectively, and are coated on the support. The intermediate layers may be omitted but, if present, consist of plain gelatin, and the yellow screening dye is incorporated in the outer blue sensitive emulsion layer. The yellow screening dye used in these films is of a type which is decolorized and or removed in the baths in which the films are processed.

In a further modified form of film suitable for two-colour photography the lower layer may be green or red sensitive or panchromatic and the outer layer blue sensitive, an intervening insensitive yellow dyed layer having the function and properties already described being arranged between the two sensitized layers.

The invention is not limited to the examples described above.

Dated this 3rd day of April, 1935.
W. P. THOMPSON & CO.,
12, Church Street, Liverpool, 1,
Chartered Patent Agents.

COMPLETE SPECIFICATION

Improvements in and relating to Photographic Elements having Yellow Screening Dyes

We, KODAK LIMITED, a British Company, 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 body corporate organised

according to 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:—

This invention relates to photographic elements having yellow screening dyes either in the emulsion or emulsions or in a separate layer or layers.

Emulsions which are to be used in recording different colours in known processes of colour photography are usually sensitized with cyanine dyes. Since all silver halide emulsions thus sensitized are sensitive to blue light, it is frequently necessary to make use of a yellow screening dye to prevent blue light from reaching such portions of the sensitive element as are to record only colour other than blue e.g. red or green light. The yellow dye used for this purpose is frequently mixed directly with a sensitive emulsion, although it may be coated as a separate layer over an emulsion layer to be screened. Several well-known yellow dyes such as Tartrazine, Naphthol yellow and Quinoline yellow have been used for this purpose, but they are unsuitable for incorporation in cyanine-sensitized emulsions as they cause considerable desensitizing in the colour sensitized region. Even when employed in a separate unsensitized layer the dyestuff may wander into the adjacent sensitized layer or layers.

According to the present invention, there is provided a photographic element having one or more sensitive layers and including as a yellow screening dye an azo dye containing a carboxyl group, but free from nitro, amino or sulpho groups. The yellow screening dye may be present in a gelatino-silver halide emulsion layer, itself, or may be present in a separate layer adjacent to a gelatino silver halide emulsion layer, especially one containing as a sensitizer a cyanine dye.

The invention includes a photographic element having an emulsion layer sensitive to blue light and a yellow light screening layer comprising a transparent material containing a nuclear carboxy derivative of an aromatic azo compound, free from nitro, amino or sulpho groups uniformly dispersed therein.

Photographic elements constructed according to the invention may have at least two differently sensitized emulsion layers on one side of the support and a layer containing the yellow screening dye over the layer nearest to the support. Alternatively, the yellow screening dye may be uniformly dispersed in the emul-

sion layer farthest from the support. For example, the photographic element may comprise a support having thereon two layers sensitive to blue light one of which layers is also sensitive to a colour other than blue and the screening dye is uniformly distributed throughout a transparent layer situated between the two sensitive layers. Alternatively, the photographic elements may comprise a support having one unsensitized layer and at least one sensitized layer, all the layers being sensitive to blue light but only the sensitized layer being sensitive to colour other than blue, and the yellow screening dye is uniformly distributed throughout the unsensitized layer.

The invention is not limited to photographic elements having only two sensitive layers. Elements having three or more sensitive layers may be used. Thus a photographic element may comprise a support having at least three differently sensitized emulsion layers all sensitive to blue light on one side thereof and separated by inert clear gelatine layers of the inert clear gelatine layers having the yellow screening dye uniformly dispersed therein.

It has been found that yellow screening dyes comprising azo dyes containing a carboxyl group show very much less tendency to desensitize cyanine sensitized or other sensitive emulsions than the yellow dyestuffs hitherto employed. Such dyes, moreover, are generally easily removable or decolourable, for example, by some of the usual photographic processing baths, especially baths used in reversal processes.

Typical azo dyes containing the carboxyl group which may be used in accordance with the present invention are benzene azo benzoic acid and Diamond yellow G, formed by coupling *m*-aminobenzoic acid and salicylic acid (Rowe, Color Index No. 218). Diazo dyes, such as the dye obtained by coupling two molecules of salicylic acid to one of *p*-phenylenediamine, may also be used. Other substituents such as alkyl groups may also be present. Dyes suitable for carrying out the invention include also azo dyes having additional nuclear substituents such as alkoxy, chlorine or bromine groups.

The following example serves to illustrate one method of carrying out the invention: A yellow dye, of the type referred to, is dissolved in water and acetone in the amount of about 1 gram in 5 cc. of water and 5 cc. of acetone. This is mixed with a solution of 10 grams of gelatine and is then ready to be coated over the emulsion layer, and when so coated forms after drying a water pervious

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yellow filter.

As already stated, however, the yellow screening dye may be included in a sensitive emulsion layer.

5 The invention is particularly suitable for use in making the photographic sensitive elements described in our prior specifications Nos. 441,325 and 444,198.

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

15 1. A photographic element having one or more sensitive layers and including, as a yellow screening dye, an azo dye containing a carboxyl group but free from nitro, amino or sulpho groups.

20 2. A photographic element as claimed in Claim 1 in which the yellow screening dye is present in a gelatino-silver halide emulsion layer.

25 3. A photographic element as claimed in Claim 1 in which the yellow screening dye is present in a layer adjacent to a gelatino-silver halide emulsion layer.

30 4. A photographic element as claimed in Claim 3 in which the gelatino-silver halide emulsion layer adjacent to the yellow screening layer contains as a colour sensitizer a cyanine dye.

35 5. A photographic element having an emulsion layer sensitive to blue light and a yellow light screening layer comprising a transparent material containing a nuclear carboxy derivative of an aromatic azo compound, free from nitro amino or sulpho groups uniformly dispersed there-
40 through.

6. A photographic element as claimed in Claim 4, having at least two differently colour sensitized emulsion layers on one

side of a support and the layer contain-
ing yellow screening dye over the colour
sensitive layer nearest to the support. 45

7. A photographic element as claimed in Claim 2, having at least two differently
colour sensitized emulsion layers on one
side of the support, the yellow screening
dye being uniformly dispersed in the
emulsion layer farthest from the support. 50

8. A photographic element as claimed in Claim 4 comprising a support having
thereon two layers sensitive to blue light
one of which layers is also sensitive to a
colour other than blue and in which the
screening dye is uniformly distributed
throughout a transparent layer situated
between the two sensitive layers. 60

9. A photographic element as claimed in Claim 2 comprising a support having
one non-colour sensitized layer and at least
one colour sensitized layer all the layers
being sensitive to blue light but only the
colour sensitized layer or layers being
sensitive to colour other than blue and in
which the yellow screening dye is uni-
formly distributed throughout the non-
colour sensitized layer. 70

10. A photographic element as claimed in Claim 4 comprising a support having
at least three differently colour sensitized
emulsion layers all sensitive to blue light
on one side thereof and separated by inert
clear gelatine layers one of the inert
clear gelatine layers having the yellow
screening dye uniformly dispersed there-
in. 75

11. Photographic elements having yel-
low screening layers substantially as here-
in described. 80

Dated this 2nd day of April, 1936.

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