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PATENT SPECIFICATION

501002



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COMPLETE SPECIFICATION

Process of and Materials for Colour Photography

We, KODAK LIMITED, a Company registered under the Laws of Great Britain, of Kodak House, Kingsway, London, W.C.2 (Assignees of KARL SCHINZEL, of Ottendorfergasse 12, Troppau (Silesia), Czechoslovakia, formerly residing in Vienna, Austria, a citizen of the Republic of Austria), 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:—

This invention relates to multi-layer colour photography.

It is known that the selective processing of reversed silver halide images in three layers, not containing colour formers, carried on a single support, can be accomplished by the controlled penetration of processing baths (see Specifications Nos. 427,518; 427,520; 454,498; 454,499 and 454,622).

The present invention is concerned with a process of producing colour developed reversed images in a three-layer photographic element of the type in which the upper layer is not specially colour sensitized and the other layers are respectively sensitized to the red and green regions of the spectrum, and which contains a colour sensitizer in the middle layer which is resistant to the action of photographic developing baths and mild silver-oxidising baths. The process of the invention is characterised by producing colour developed reversed images in a three-layer photographic element of the type defined above and removing the reduced silver from all the layers before exposure of the residual silver halide image of the middle layer to light of the colour to which it is sensitized but after exposure and colour

development of the residual silver halide image in the lower layer.

The middle layer is usually yellow and green sensitive and the lower layer is red sensitive. This order of the layers may be changed, if a very sharp blue image is desired, by having the middle emulsion sensitive to red and orange and the lower emulsion to yellow and green. This variation has been made possible by the fact that red sensitizers which do not sensitize to green and yellow but very strongly sensitize to the extreme orange red, in addition to the genuine red, can now be made; 4:4'-dichloro-2:2':8-triethylthiocarbocyanine chloride is suitable. The three layers may be coated on the same side of the support or the red- or yellow-green-sensitive emulsion can be situated alone on the back of the support and the two others on the front.

In the process of the present invention, it is assumed that the colour sensitizers in the red-sensitive and yellow-green-sensitive emulsions are stable to a neutral black developer and to the first weakly alkaline colour developer. This is true of most known sensitizers.

The advantage of this process is that the sensitizer of the bottom layer need not be resistant to silver-oxidising baths.

According to the invention, there is provided a process for producing colour developed reversed images in a three-layer photographic element of the type hereinbefore defined, and in which there is a colour sensitizer in the middle layer which is resistant to the action of photographic developing baths and mild silver-oxidising baths, which consists in developing the first latent images to silver, then exposing the residual silver halide image in the

lowest layer only by coloured light to which it is selectively sensitized, then colour developing the exposed residual silver halide image in the lowest layer, then removing the reduced silver, then exposing the residual silver halide image in the middle layer only to coloured light to which it is selectively sensitized, then colour developing the exposed residual silver halide image in the middle layer and finally colour developing the residual silver halide image in the upper layer.

The invention also includes a three-layer colour photographic element suitable for use in carrying out the process according to the present invention having a red-sensitized layer and a green-sensitized layer in either order beneath a blue-sensitive layer in which the sensitizer in the middle layer is resistant to photographic developing baths and mild silver oxidizing baths and the sensitizer in the bottom layer is resistant to photographic developing baths. The use of such an element enables exposure of the middle layer to be done with light for which that layer is sensitized.

Suitable known sensitizers for the middle layer are (a) For red, 2:2¹-dimethyl - 8 - ethyl - 3:4:3¹:4¹-dibenzthiocarbo-cyanine iodide. (b) For yellow-green, 2:1¹ - diethyl - 3:4 - benzthia-2¹-cyanine iodide.

There may be present between the top layer and the middle layer or in the top layer a yellow dyestuff which will be decolourised in photographic developing baths.

The process is, in general, as follows:— After camera or printing exposure, the superimposed latent images are first of all developed to the three black component silver images by an ordinary non-tanning, preferably neutral developer, such as ferrous oxalate, amidol or diamido-*o*-cresol. Most other organic developers in solutions containing sodium carbonate are also suitable, since they do not noticeably harm the colour sensitivity, and, if necessary, this can be at least partially restored by a known reagent such as an alkali sulphite or bisulphite.

In order to avoid the undesirable effect of local under-exposure in the lower layers it is best to saturate all three layers first in a solution of the developing agent (which does not act in the absence of alkali) of a considerably stronger concentration than usual, and then to develop in solutions of sodium carbonate, ammonia or other weak alkalies such as alkali bicarbonate, borax, trisodium phosphate or sodium aminoacetate. Alternatively, a concentrated developing solution can be allowed to diffuse into all

the layers at as low temperature as it is possible to employ without alteration in composition of the solution and the development process started or accelerated by warming the layers to room temperature or above.

COLOUR PROCESSING.

EXAMPLE.

The lowest layer is exposed to red light directly after primary general development, and its residual silver halide developed green-blue, and only then all silver which was previously reduced removed by completely dissolving it up with oxidising agents and washing it out.

The middle layer alone is then exposed to yellow light from above and developed purple, then the upper layer is exposed to blue light and developed yellow. Instead of exposing the middle layer to yellow light from above, it can be exposed to green light from below.

Development of the residual silver halide of the upper layer may be effected by alkaline solutions of the leuco-forms of various yellow vat dyes, best under exclusion of atmospheric oxygen to prevent fog. (See Specification No. 498,875).

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 for producing colour developed reversed images in a three-layer photographic element of the type hereinbefore defined, and in which there is a colour sensitizer in the middle layer which is resistant to the action of photographic developing baths and mild silver-oxidising baths which consists in developing the first latent images to silver, then exposing the residual silver halide image in the lowest layer only by coloured light to which it is selectively sensitized, then colour developing the exposed residual silver halide image in the lowest layer, then removing the reduced silver, then exposing the residual silver halide image in the middle layer only to coloured light to which it is selectively sensitized, then colour developing the exposed residual silver halide image in the middle layer and finally colour developing the residual silver halide image in the upper layer.

2. A process as claimed in claim 1, in which the middle layer is sensitive to yellow and green and the residual silver salt image therein is exposed to yellow light from above or green light from below.

3. Process as claimed in either of the preceding claims, in which for the first development all the layers are impregnated with the developing agent in high

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concentration and are then treated with weak alkali to effect development.

4. Process as claimed in any of claims 1 to 3, in which for the first development all the layers are impregnated at a low temperature, as herein described, with concentrated developing solution and are then heated to effect development.
5. A three-layer colour photographic element suitable for use in the process claimed in claim 1 having a red-sensitized

layer and a yellow-green sensitized layer in either order beneath a blue-sensitive layer in which the sensitizer in the bottom layer is resistant to photographic developing baths and the sensitizer in the middle layer is resistant to photographic developing baths and mild silver-oxidising baths.

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