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PHOTOGRAPHIC STRIPPING FILM

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Fig. 1

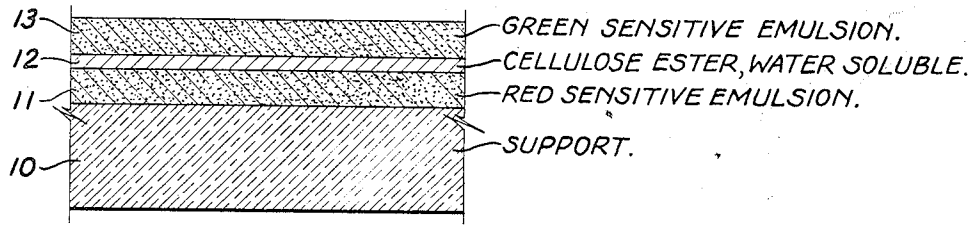
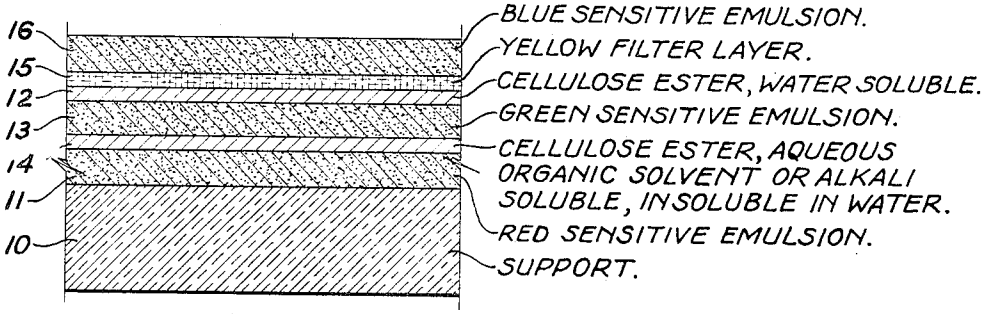


Fig. 2



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PHOTOGRAPHIC STRIPPING FILM

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10 Claims. (Cl. 95—2)

This invention relates to photographic film, and more particularly to a photographic stripping film, having separable sensitive layers which can be transferred to suitable supports and capable of use in the imbibition process of motion picture color photography.

Stripping films of various types and for diverse purposes have been known and used for many years in certain types of still photography. However, to applicants' knowledge stripping film of the multilayer type has not heretofore been successfully developed for motiou picture work. For such work, at least three new requirements enter that were absent from still photography. First, the cementing stripping medium must stick tightly enough and yet be flexible and resilient enough so that the film can be passed over numerous pulleys and sprockets without the layers coming apart; second, the emulsion layers must be stripped in accurate registry with the perforations on their permanent supports; and third, the very large magnification in the projected pictures makes it mandatory to keep the overall thickness of the sensitive film to a minimum so that sufficient resolving power is achieved.

One object of the present invention is to provide a multilayer stripping film comprising in its simplest form a support having on one side at least two superposed silver halide emulsion layers separated by a layer of colloidal material soluble in aqueous media or at least so softened that it will strip readily from one of the emulsion layers.

Another object of the present invention is to provide a multilayer stripping film comprising a support having on one side three superposed silver halide emulsion layers, the two outer emulsion layers separated by a layer of colloidal material soluble or at least permeable in an aqueous medium, the inner two emulsion layers separated by a layer of water insoluble colloidal material soluble in aqueous organic solvent media or alkaline solution. Other objects will appear hereinafter.

Our invention will now be described with particular reference to the accompanying drawings in which Fig. 1 represents a magnified cross-section of a film of the simplified form of our invention, and

Fig. 2 represents a magnified cross-section of a film of more complicated structure embodying our invention.

Various examples and equivalents will be described.

As shown in Fig. 1, a film of the simplified form of our invention consists of a support 10 carrying on one side a red sensiitve emulsion layer 11 and a green sensitive emulsion layer 13 separated by a stripping layer 12 of a water soluble or permeable cellulose ester. A stripping film of this type may be prepared as described in the following example.

Example 1

A cellulose ester film support 10, preferably cellulose nitrate, and preferably having an antihalation layer and an antistatic layer (not shown) on its rear surface, is first coated with a red sensitive emulsion layer 11. Over the emulsion layer is coated a stripping layer 12 of a water soluble cellulose ester such as cellulose acetate, preferably of an acetyl content of approximately 17 per cent. The layer of water soluble cellulose ester is coated from a 1 per cent solution of the ester in water. Over the water soluble cellulose ester stripping layer may be coated a layer 13 of green sensitive emulsion. If desired, the cellulose ester film support may consist of other esters of cellulose besides cellulose nitrate, for instance, cellulose acetate, mixed esters of cellulose such as cellulose acetate propionate, cellulose acetate butyrate, etc., using suitable subbing techniques for causing adherence between the emulsion layers and the support. In addition to the specific cellulose ester mentioned for the water soluble stripping layer, other cellulose esters such as cellulose propionate, cellulose acetate propionate, etc., ranging in acyl content from approximately 13 per cent to approximately 19 per cent, may be used. Cellulose acetate of that range of acyl content is particularly useful. If desired, a surface active agent such as saponin may be used in coating the water soluble stripping layer.

The order of arrangement of the sensitive layers in the film is not critical, that is, in an alternative arrangement the outermost emulsion layer may be blue sensitive and the inner emulsion layer red or green sensitive, the particular arrangement being that chosen for the process in use.

As shown in Fig. 2 of the accompanying drawing, a stripping film constructed according to the more complicated manner of our invention has a cellulose ester film support 10, preferably of cellulose nitrate, coated with a red sensitive emulsion layer 11, a cellulose ester stripping layer 14 of a cellulose ester soluble in aqueous organic solvent or soluble in alkaline solutions, but insoluble in water, a green sensitive silver halide emulsion layer 13, a water soluble cellulose ester stripping

layer 12, a yellow filter layer 15, and outermost, a blue sensitive silver halide emulsion layer 16. If desired, a magenta filter layer may be placed between emulsion layers 11 and 13. A film of this type may be prepared as described in the following example:

Example 2

A cellulose nitrate or other cellulose ester film support 10 provided on its rear surface with antihalation and antistatic layers is first coated with a layer 11 of red sensitive silver halide emulsion. Over this layer is coated a very thin layer 14 of a cellulose ester, such as cellulose acetate, soluble in a mixture of water and alcohol such as cellulose acetate of approximately 19 per cent acetyl, from a coating solution containing 1 per cent of the cellulose acetate in a mixture of 30 parts of ethyl alcohol, 30 parts of methyl Cellosolve and 39 parts of water. In an alternate formula the cellulose acetate may be coated from a solution of equal parts of acetone and water. Over the thin layer 14 of cellulose acetate is then coated a green sensitive emulsion layer 13, and following this, a layer 12 of water soluble cellulose ester, such as cellulose acetate of an acetyl content of approximately 17 per cent, from a 1 per cent solution of the cellulose acetate in water. Over the water soluble cellulose ester stripping layer is then coated a yellow gelatin filter layer 15 followed by a layer of blue sensitive silver halide emulsion 16.

The dye of the filter layer 15 may, for instance, be a pyrrole polymethine dye of the type disclosed in Brooker and Sprague U. S. Patent 2,298,731, granted October 13, 1942 as for example, (3-ethyl-2-benzoxazole)-(1-lauryl-2,5-dimethyl-3-pyrrole)-dimethine cyanine iodide or a dye of this type in which the alkyl group in the 3-position is selected from the range of decyl to octadecyl. Also useful are aldehyde-azo dyes, as for instance, those disclosed in Mannes et al. U. S. Patent No. 2,078,398 granted April 27, 1937, and other removable dyes.

As mentioned in Example 1, the cellulose ester of the water soluble stripping layer separating the green and blue sensitive emulsion layers may consist, in general, of cellulose esters of a range of acyl content of from approximately 13 per cent to approximately 19 per cent, and cellulose acetates of this range of acyl content are especially good. For the aqueous organic solvent soluble stripping layer separating the red and green sensitive emulsion layers, in addition to the specific cellulose ester mentioned, one may use other cellulose esters such as cellulose propionate or mixed esters of cellulose such as cellulose acetate propionate and cellulose acetate butyrate, etc., of a range of acyl content from approximately 19 per cent to approximately 33 per cent.

By referring to Figs. 1 and 2 of the accompanying drawing, it is now apparent how the films constructed in the manner described in the preceding examples would be used. In order to strip the emulsion layers of the film shown in Fig. 1, it is only necessary to subject the emulsion side of the film to the action of water in order to cause a separation to occur between emulsion layers 11 and 13. In a similar manner, the film shown in Fig. 2 and constructed as above described in Example 2 may be treated with water on the emulsion side to cause a separation to occur between the green and blue sensitive emulsion layers, and when the blue sensitive emulsion layer has been stripped from the film, by application of a dilute alcohol solution, as for example, of the lower alcohols such as methyl or ethyl alcohols, the cellulose ester stripping layer 14 is softened and the green sensitive emulsion layer 13 may be stripped from the red sensitive emulsion layer 11.

It has also been found that it is possible to strip the emulsion layers of the film shown in Fig. 2 by the sole application of water. That is, the outer emulsion layer 16 strips readily after the film has been wetted with water for a suitable length of time, and the green sensitive emulsion layer 13 remains bonded to emulsion layer 11 by means of stripping layer 14. If the remaining film carrying emulsion layes 11 and 13 is again treated with water for a suitable length of time it is found that the green sensitive emulsion layer may be stripped away from emulsion layer 11. This latter stripping action differs from the action observed when an aqueous organic solvent solution is used, in the respect that when water is used the adhesive bond between the emulsion layer and the stripping layer 14 is merely destroyed, whereas, when an aqueous solvent medium is used the stripping layer 14 is partially or completely dissolved allowing separation of the layers to occur.

In general, complete solution of the layer is not achieved nor is it desirable during the stripping operation. While the stripping layer is of a material that may be completely soluble in water, use is not made of this property. The film is wetted or moistened only to the extent necessary to destroy the slight adhesive bond, between the outer emulsion layer and the stripping layer; or to render this bond less than the bond between the outer emulsion layer and the new support layer which is applied to it.

In an alternative method a film of the type described in Example 2 and also illustrated in Fig. 2 of the accompanying drawing, may be prepared as described in the following example.

Example 3

In the manner described in Example 2, after the film support 10 has been provided with the red sensitive emulsion layer 11, a layer 14 of alkali soluble but water insoluble cellulose ester is coated. Suitable for this purpose is a cellulose dicarboxylic acid ester of suitable viscosity, such as cellulose acetate phthalate of a phthalyl content of at least approximately 15 per cent and of suitable viscosity. A suitable composition for coating cellulose acetate phthalate of this type is 1 to 5 per cent of the cellulose ester in equal parts of methyl alcohol and acetone. Alternately, the ester may be coated in similar concentration from a mixture of 20 parts of water, 20 parts of methyl Cellosolve and 60 parts of acetone. After coating this layer the remaining layers may be coated as described in Example 2. The film so constructed is treated on the emulsion side with water in order to separate the blue sensitive emulsion layer from the remainder of the film, however, in order to separate the red and green sensitive emulsion layers after the blue sensitive emulsion layer has been removed, the film is treated with a dilute solution of alkali.

In a specific procedure alternative to that described in Example 2, the layer corresponding to layer 14 of Fig. 2 may be composed of cellulose acetate propionate 9–10 per cent acetyl and 13–14 per cent propionyl, and layer 12 of cellulose acetate propionate 7–8 per cent acetyl and 11–12 per cent propionyl. Similarly, in the process de-

scribed in Example 2, the cellulose ester for layer 14 may consist of a mixture of water soluble and water insoluble varieties of hydrolyzed cellulose esters, such as cellulose acetate. Likewise, the layer may consist of a mixture of various proportions of the lower and higher acyl esters of cellulose of the water insoluble type, such as cellulose acetates.

The stripping films of our invention may be used in the imbibition process of motion picture color photography as more fully described in the copending U. S. patent application Serial No. 453,959, filed concurrently herewith by Capstaff, one of the present applicants.

In addition to the alkali soluble but water insoluble cellulose esters above-mentioned as useful in stripping layers which are designed to be softened or dissolved in dilute alkaline solutions, we may use alkali soluble derivatives of cellulose such as oxidized cellulose described in Yackel et al. U. S. Patent 2,232,990, granted February 24, 1941, and oxidized cellulose esters insoluble in water but soluble in alkaline solutions, such as those described in Kenyon et al. U. S. patent application, Serial No. 380,164, filed February 24, 1941, and Fordyce U. S. patent application, Serial No. 347,198, filed July 24, 1940.

We also consider as within our invention the use of both stripping layers, in the form comprising three differentially color sensitive layers, of the same cellulose derivatives such as are above described. These may be utilized in a process wherein dependence is placed on the control of the wetting baths whereby the first emulsion is stripped when the first stripping layer has been sufficiently affected to permit ready stripping but before the water has permeated to the second stripping layer.

The wetting time must be carefully controlled with the two different types of interlayer. This control is of vital importance as is also the bonding time.

It is to be understood that the disclosure herein is by way of example and that we consider as included in our invention all modifications and equivalents falling within the scope of the appended claims.

What we claim is:

1. A photographic stripping film comprising a support having on one side two superposed silver halide emulsion layers separated by a layer of cellulose ester of an acyl content of from approximately 13 to approximately 19 per cent.

2. A photographic stripping film comprising a support having on one side two superposed silver halide emulsion layers separated by a layer of cellulose acetate, the acetyl content of which is of the order of 17 per cent.

3. A photographic stripping film comprising a support having on one side thereof three differentially colored sensitized emulsion layers and stripping layers between the successive sensitive layers, one of said stripping layers comprising a water soluble cellulose ester and the other stripping layer comprising a cellulose derivative insoluble in water and selected from the group comprising cellulose esters soluble in aqueous organic solvent media and cellulose derivatives soluble in alkaline solutions.

4. A photographic stripping film comprising a support having on one side three superposed silver halide emulsion layers, the outer two emulsion layers separated by a layer of cellulose ester soluble in water, the inner two emulsion layers separated by a layer of water insoluble cellulose derivative selected from the group consisting of cellulose esters soluble in aqueous organic solvent media and cellulose derivatives soluble in alkaline solution.

5. A photographic stripping film comprising a support having on one side three superposed silver halide emulsion layers, the outer two emulsion layers separated by a layer of cellulose ester soluble in water, the inner two emulsion layers separated by a layer of water insoluble cellulose ester soluble in aqueous organic solvent media.

6. A photographic stripping film comprising a support having on one side three superposed silver halide emulsion layers, the outer two emulsion layers separated by a layer of cellulose ester soluble in water, the inner two emulsion layers separated by a layer of water insoluble cellulose ester of an acyl content of from approximately 19 to approximately 33 per cent.

7. A photographic stripping film comprising a support having on one side three superposed silver halide emulsion layers, the outer two emulsion layers separated by a layer of cellulose ester soluble in aqueous media, the inner two emulsion layers separated by a layer of water insoluble cellulose acetate containing approximately 19 per cent acetyl.

8. A photographic stripping film comprising a support having on one side three superposed silver halide emulsion layers, the outer two emulsion layers separated by a layer of cellulose ester soluble in water, the inner two emulsion layers separated by a layer of water insoluble cellulose derivative soluble in alkaline solution.

9. A photographic stripping film comprising a support having on one side three superposed silver halide emulsion layers, the outer two emulsion layers separated by a layer of cellulose ester soluble in water, the inner two emulsion layers separated by a layer of water insoluble cellulose dicarboxylic acid ester soluble in alkaline solution.

10. A photographic stripping film comprising a support having on one side three superposed silver halide emulsion layers, the outer two emulsion layers separated by a layer of cellulose ester of approximately 17 per cent acetyl, the inner two emulsion layers separated by a layer of water insoluble cellulose dicarboxylic acid ester soluble in alkaline solution.

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