

PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION.

No. 10,383, A.D. 1930.

Improvements in or relating to Colour Photography.

We, SPICERS LIMITED, a British Company, of 19, New Bridge Street, London, E.C. 4, Dr. JOHN NAISH GOLDSMITH, Ph.D., M.Sc., F.I.C., British Subject, of 67, Chancery Lane, London, W.C. 2, THOMAS THORNE BAKER, British Subject, of The Hut, Hatch End, Middlesex, and CHARLES BONAMICO, a French Citizen, of 19, New Bridge Street, London, E.C. 4, do hereby declare the nature of this invention to be as follows:—

This invention consists of improvements in or relating to colour photography. One object is to enable photographs in natural colours to be taken or reproduced on non-inflammable films, viz. films made from cellulose acetate or similar cellulose ester of an organic acetate. Another object is to enable photography in natural colours to be applied successfully to the cinematograph.

Non-inflammable films are generally made from a composition which consists in the main of cellulose acetate. They are generally called cellulose acetate films, but they in fact contain various other bodies such as plasticisers and non-volatile solvents. It is impracticable to apply directly to such films lines or geometrical patterns made up of two, three, or more colours.

A specific object of the present invention is to enable such colour patterns to be successfully and readily applied to non-inflammable films.

According to this invention a process of making a multicolour screen for colour photography or cinematography includes

the step of so treating a non-inflammable film as to render it capable of absorbing dyes or colours and of having them bleached or discharged therefrom.

According to one form of this invention the process includes the step of treating a non-inflammable film in such a way that its normal surface is altered, and instead of being resistant to dyes and to chemical agents which discharge these dyes, becomes absorbent thereof or pervious thereto.

According to another form of this invention a non-inflammable film, the surface of which is resistant to dyes, is treated with a partial solvent such as ether alcohol or toluene which modifies the surface by rendering it porous. Again, according to this invention the non-inflammable film may be treated with a chemical agent such as caustic soda in water or alcohol, which saponifies the surface layer of the film and has the effect of rendering the surface of the film pervious to dyes.

Again, according to this invention the surface of a non-inflammable film may be treated with dyes which are dissolved in a medium which is a solvent of the non-inflammable film. In other words, the dyes are contained in a penetrating solvent, such for example as a mixture of alcohol and acetic acid.

Dated this 1st day of April, 1930.

BOULT, WADE & TENNANT,
111 & 112, Hatton Garden, London,
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Chartered Patent Agents.

PROVISIONAL SPECIFICATION.

No. 23,706, A.D. 1929.

Improvements in Colour Photography.

We, Dr. JOHN NAISH GOLDSMITH, a British Subject, of 67, Chancery Lane, London, W.C. 2, THOMAS THORNE BAKER,

[Price 1/-]

a British Subject, of The Hut, Hatch End, in the County of Middlesex, CHARLES BONAMICO, a Citizen of the French

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Republic, of 19, New Bridge Street, London, E.C. 4, and SPICERS LIMITED, a British Company, of 19, New Bridge Street, London, E.C. 4, do hereby declare the nature of this invention to be as follows:—

This invention consists in improvements in or relating to colour photography, and particularly to the production of photographic films which carry a reseau or multicolour screen as well as a sensitised emulsion. Films of this type can be used for taking photographs, or for reproduction of photographs or for cinematograph films in natural colours.

By means of the process described in British Patent Specification No. 22,607/28, successful results have been achieved in applying the multicolour screen to a film made of cellulose acetate composition.

The object of the present invention is to enable the multicolour screen to be successfully applied on cinematograph film made from celluloid or nitrocellulose.

Taking the case where a film is to receive

- (1) a dye of one colour, say, green;
- (2) a series of lines of a resist (such, for example, as fatty ink);

(3) a treatment with a bleaching or colour-discharging liquid; and

(4) a dye of another colour in the spaces thus bleached, difficulties arise if ordinary celluloid or nitrocellulose film is used.

For example, the original dyeing may be found to lack that uniformity which is essential for good photography in natural colours. Again, it may be necessary to conduct the bleaching or discharging operation at a comparatively slow rate, (i.e. with a lengthy period of contact with the discharging liquid) and in that case the original dye (e.g. green dye) may penetrate farther into the film with the result that effective discharge is not achieved.

According to this invention, a process of making a multicolour screen for colour photography or cinematography upon a film of celluloid or nitrocellulose includes the step of treating that surface of the film which is to receive the dye so as to modify the surface and render it uniformly amenable to the dyes and to the bleaching or discharging agents.

Further, the treatment of the surface may be such that the dyeing and bleaching is substantially confined to the modified surface layer.

Thus, in one preferred form of this invention the celluloid film may receive (say, on one surface) a preliminary treatment with a liquid such as benzene or petroleum spirit; or, again, the treating liquid may contain acetone or a mixture of

acetone and water, with or without glycerine.

These liquids modify the surface layer of the celluloid. They may remove camphor to a greater or less extent. Alternatively, they may also cause the surface layer to swell slightly, but in any case it is a feature of this invention that the modified layer is uniformly and readily permeable by a dye, such as a green dye, dissolved in the usual solvents, such as alcohol, or will accept dyes or dye solutions of suitable type when presented to it.

Again, the surface may be treated first with benzene to remove camphor more or less, and then treated with water, alcohol and triacetin to cause the surface layer to swell slightly.

An alternative solution for modifying the surface layer of the film is an alcoholic or aqueous solution of an alkali, such as caustic potash or soda. Good results have been obtained by the use of a solution of 0.1% caustic potash in alcohol.

The modification of the surface may be effected by a pretreatment with a vapour, such as a solvent vapour, e.g. with a vapour of alcohol or acetone.

The following is a description, by way of example, of one method of carrying this invention into effect. The basic film employed is a standard celluloid film of the type used for cinematograph or roll or flat films in black and white. The film is passed first between an impression roller and another roller which is fed with benzene. Thereafter the film may pass between an impression roller and a roller fed with an alcoholic solution containing 0.1% caustic potash. Thereafter the film may be passed between an impression roller and a roller fed with a solution of green dye. It is characteristic of the process described that the dye penetrates with great uniformity into the modified layer of the film.

Now proceeds the process of applying the reseau or multicolour screen.

The film (the surface layer of which is dyed uniformly green all over) is then led through a printing machine by means of which extremely fine parallel lines of a resist (such, for example, as a greasy ink) are printed upon it. The printing may be effected by means of a small engraved steel roller having (in one case) 15 lines and 15 intervening grooves per millimetre. The film at this stage exhibits 15 clear green lines and 15 opaque greasy lines (green underneath) per millimetre, both kinds of line being of about the same width. After an interval to let the ink dry, the film is led in succession (*a*) over a bath which bleaches and dissolves out the

green dye from only the unprotected spaces, leaving unattacked the green lines protected by the ink; (b) over a roller or distributing device which applies a red dye to the spaces between the ink lines, after which the film is thoroughly washed with water to remove excess of dye; (c) through a solvent cleansing bath of benzene to remove the ink lines, leaving exposed the clear green lines.

The film is again led (when dry) through the printing machine which produces parallel lines of a resist (such as greasy ink) as before, but this time at right angles to those formerly made. After an interval for the ink to dry, the film is led in succession (a) over a bath which bleaches and dissolves out the red and green dye from only the unprotected spaces between the greasy line, (b) over a roller or distributing device which applies a violet dye which dyes the interline spaces, and (c) through a solvent cleansing bath of benzene. The film is then dried, is coated with a suitable substratum and is thereafter coated with a layer of sensitised emulsion (a colour-sensitive emulsion). The bleaching and subsequent dyeing operations may be carried out in the apparatus described in Specification No. 22,675 of 1928.

Dated this 1st day of August, 1929.
 BOULT, WADE & TENNANT,
 111 & 112, Hatton Garden, London,
 E.C. 1,
 Chartered Patent Agents.

COMPLETE SPECIFICATION.

Improvements in or relating to Colour Photography.

We, SPICERS LIMITED, a British Company, of 19, New Bridge Street, London, E.C. 4, Dr. JOHN NAISH GOLDSMITH, a British Subject, of 67, Chancery Lane, London, W.C. 2, THOMAS THORNE BAKER, a British Subject, of The Hut, Hatch End, in the County of Middlesex, and CHARLES BONAMICO, a Citizen of the French Republic, of 19, New Bridge Street, London, E.C. 4, 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 consists in improvements in or relating to colour photography, and particularly to the production of photographic films which carry a reseau or multicolour screen as well as a sensitised emulsion. Films of this type can be used for taking photographs, or for reproduction of photographs or for cinematograph films in natural colours.

By means of the process described in British Patent Specification No. 322,432, successful results have been achieved in applying the multicolour screen to a film made of cellulose acetate composition.

The object of the present invention is to enable the multicolour screen to be successfully applied on cinematograph film made from celluloid or nitrocellulose, cellulose acetate or other ester or ether of cellulose.

Taking the case where a film is to receive

- (1) a dye of one colour, say, green;
- (2) a series of lines of a resist (such, for example, as fatty ink);
- (3) a treatment with a bleaching or colour-discharging liquid; and

(4) a dye of another colour in the spaces thus bleached, difficulties arise if ordinary celluloid or nitrocellulose film is used. For example, the original dyeing may be found to lack that uniformity which is essential for good photography in natural colours. Again, the original dye (e.g. the green dye) may penetrate too far into the film with the result that the bleaching or discharging operation can only be conducted at a comparatively slow rate (i.e. with a lengthy period of contact with the discharging liquid) so that in many cases effective discharge is not achieved.

Further in the case of cellulose acetate and celluloid films difficulties of another type arise due to the presence in the film of plasticisers and/or non-volatile solvents or improvers which render the surface shiny and repellant to dyestuffs, so that it is impossible to apply lines or other patterns of colour directly to the surface of such a film.

It has already been proposed in the preparation of multicolour screens on a celluloid film to submit the film to treatment with a gas or vapour, such as ammonia, or to incorporate a solvent for celluloid with the dye solutions employed in the formation of the multicolour screen. It has also been proposed to treat the surface of the film with a fluid base such as aniline, which treatment, however, has the effect of darkening the celluloid, a result which, as will readily be understood, is fatal to the production of a satisfactory multicolour screen. This invention, however, provides a method of applying a multicolour screen to a film which does not involve treating the film with gaseous reagents, with solvents for the

film, or with reagents which tend to discolour the surface of the film.

According to the invention a method of applying a multicolour screen for colour photography or cinematography to a film of cellulose acetate, celluloid, nitro-cellulose or other ester or ether of cellulose includes the step of treating the surface of the film with a liquid alkaline reagent, which alters said surface without producing discolouration thereon, so as to render it capable of absorbing dyes or colours, and of having them bleached or discharged therefrom.

In a preferred form of the invention, the surface of the film is modified by treating the latter with a solution of an alkali hydroxide, such for example as caustic potash, caustic soda or ammonia.

An example of this method of carrying the invention into effect will now be given. A cinematograph film of celluloid is immersed for a period of one minute in a solution of between 0.5% and 5% of caustic potash in methylated spirit and washed. It is found that the celluloid film thus treated will readily take up a solution of green dye-stuff of the following composition:—

30	Malachite Green - - -	2 grms.
	Methylated Spirit - - -	60 cc.
	Water - - - - -	40 cc.
	Glacial acetic acid - - -	4 cc.

although the same dye solution is almost without effect on the original untreated film, in for example twenty seconds. The dyeings can be bleached out by aqueous-alcoholic caustic soda solution.

A weaker alcoholic caustic potash solution, such as a 0.1% solution produces the same effect but to a less marked degree. Untreated cellulose acetate film is stained by the above dye solution, but more strongly so after treatment preferably with aqueous alcoholic 1:1 caustic potash of 0.56%. The dye can then be bleached out as described. The use of stronger caustic potash solution or of undiluted alcohol as solvents causes difficulty with acetate film in the subsequent bleaching operations. A prolonged treatment of celluloid by immersing it for 22 hours in

8% aqueous caustic soda solution is much less effective in rendering the film amenable to dyes than the much shorter treatment with alcoholic potash of 0.56%.

The probable effect of the treatment of the film with caustic alkali is to saponify its surface, thus rendering it receptive to dyes and bleaching agents.

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 method of applying a multicolour screen for colour photography or cinematography to a film of cellulose acetate, celluloid, nitro-cellulose or other ester of cellulose, wherein the surface of the film is treated with a liquid alkaline reagent which alters the said surface without producing discolouration thereon, so as to render it capable of absorbing dyes or colours, and of having them bleached or discharged therefrom.

2) A method according to Claim 1 wherein the surface layer of the film is modified by treatment with a solution of an alkali hydroxide, such for example as caustic potash, caustic soda, or ammonia.

3) A method according to Claim 1 or Claim 2, wherein the surface layer of the film is modified by treatment with an alcoholic solution containing from 0.5% to 5% of caustic potash.

4) A method of applying a multicolour screen for colour photography, or cinematography to a film of cellulose acetate, cellulose nitrate, celluloid, or other ester of cellulose substantially as described and claimed herein.

5) A film of cellulose acetate, cellulose nitrate, celluloid or other ester of cellulose to which a multicolour screen has been applied by any of the special methods described or claimed herein.

Dated this 1st day of April, 1930.

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