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A. F. SULZER

PROCESS FOR LESSENING CURLING TENDENCIES OF PHOTOGRAPHIC FILMS

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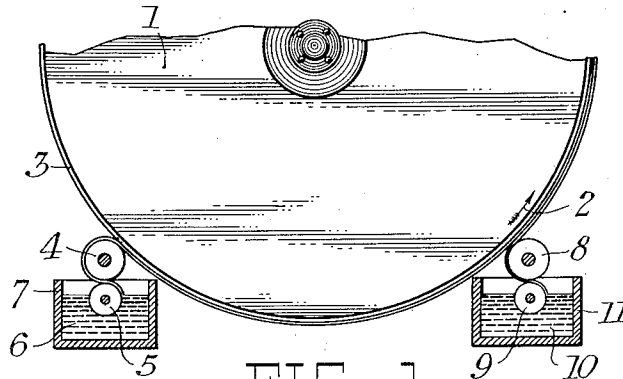


FIG. 1.

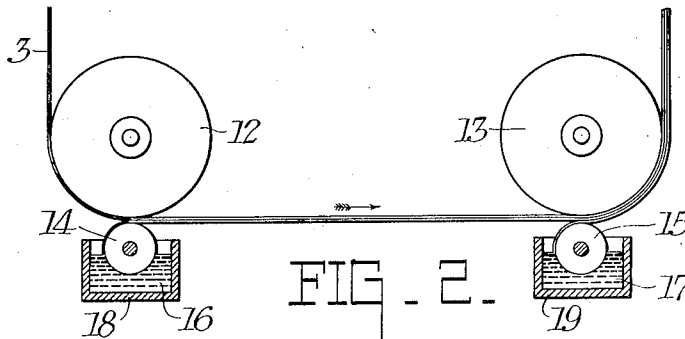


FIG. 2.

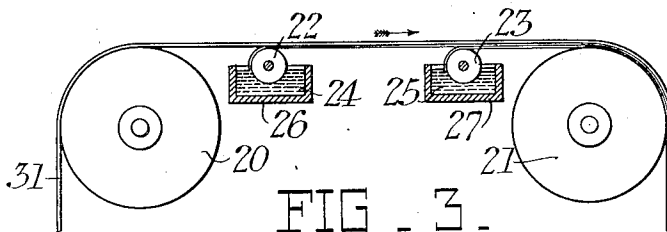


FIG. 3.

INVENTOR,
Albert F. Sulzer,
BY *R. L. Strickfield*

ATTORNEY

UNITED STATES PATENT OFFICE.

ALBERT F. SULZER, OF ROCHESTER, NEW YORK, ASSIGNOR TO EASTMAN KODAK COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

PROCESS FOR LESSENING CURLING TENDENCIES OF PHOTOGRAPHIC FILMS.

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This invention relates to processes for lessening the curling tendencies of photographic films, particularly those films in which a film comprising a cellulosic addition compound, such as cellulose nitrate, cellulose acetate, or cellulose ether, or a mixture thereof, supports a light sensitive layer, such as a gelatino-silver halid emulsion. One object of the invention is to provide a comparatively inexpensive and easily controlled process for, at least partially, lessening the curling tendency of such films. Other objects will hereinafter appear.

In the accompanying drawing,—

Fig. 1 is a diagrammatic fragmentary side elevation of apparatus in which my process may be carried out, the relative sizes of the parts being exaggerated for the sake of clearness;

Fig. 2 is a fragmentary side elevation of another form of apparatus in which my process may be carried out, the relative sizes of the parts being exaggerated for the sake of clearness;

Fig. 3 is a fragmentary side elevation of another form of apparatus in which my process may be carried out, the relative sizes of the parts being exaggerated for the sake of clearness.

Photographic films, each comprising a light sensitive photographic layer carried on a film or support composed essentially of a cellulosic addition compound in admixture with modifying or plastifying agents, are well known in the art. When they are given the usual fluid treatment in photographic baths and then dried, a curling tendency manifests itself. This is particularly noticeable where the back face of the support is free or uncovered. This curling tendency has been counteracted by coating such films on the back with a layer, like gelatine, which shrinks at approximately the same rate as the photographic layer as a result of the treatment in the baths and in the drying operation. But in the case of some films, it is desirable that the back face (the face opposite the one for the photographic layer) be left uncoated with any material which becomes softened when wet to the extent that gelatine does. It is to the problem of lessening curling tendencies in such film that my invention is directed.

I have found that this curling tendency in photographic films of cellulosic addition

compounds, such as nitrocellulose, cellulose acetate and cellulose ether, can be usefully lessened by applying to the back face of said films a plurality of successive coats of varnish, the varnish for each coat comprising a cellulosic addition product carried in a liquid vehicle containing a solvent of said films. In the preferred embodiment of my invention I employ a liquid solvent vehicle comprising a mixture of a volatile film solvent with a non-solvent, the latter being preferably volatile also. Even a single coat of such a varnish has some curl-reducing tendency. Dilute varnishes, containing about 2% of the cellulosic compound, act well.

Since nitrocellulose films are at present most widely used, I shall describe one embodiment of my invention by way of illustration in connection with such films, but it will be understood that my invention is not restricted thereto, except as indicated in the appended claims.

Referring to the accompanying drawing, 1 represents a wheel rotating in the direction of arrow 2 and carrying a film 3 of a cellulosic addition compound, say nitrocellulose, thereon. The face of the film 3 in contact with the smooth even face or periphery of wheel 1 is the face for supporting the photographic layer, such as a coating of gelatino-silver halid emulsion. The outer face of the film 3, therefore, constitutes the back to which my curl-lessening coatings are successively applied. This can be done, for instance, by coating wheel 4 contacting with supply wheel 5 wholly or partially immersed in a bath 6 of varnish contained in a suitable tank 7. The layer of varnish applied by the roll 4 to the back of film 3 sets rapidly and is, therefore, sufficiently hardened to prevent its being washed away when the film 3 reaches roll 8 which applies a second coating of varnish which it receives from supply roll 9 partially immersed in bath 10 contained in tank 11. The film 3 may be merely passed under wheel 1 in close contact therewith, or it may be formed on wheel 1 by the usual film-forming methods, the film 3 being sufficiently hardened and set before it reaches the coating stations represented by rolls 4 and 8. In other words the film is always cured to the extent that the potential curling tendency is present before my process is applied to it. Of course, any equivalent well known

varnish-applying devices can be substituted, as will be understood by those skilled in the art.

Another apparatus in which the film may be treated by my process before the photographic emulsion is applied thereto is illustrated in Fig. 2. Film 3 passes under rolls 12 and 13, beneath which are rolls 14 and 15 for applying varnish from baths 16 and 17 contained in tanks 18 and 19. The distance between rolls 12 and 13 can be varied so as to have the first varnish coating set and dried to the desired extent before it reaches roll 15. Of course, any of the customary heating and drying devices may be located between rolls 12 and 13 for assisting the rapid setting of the varnish layer.

While my process may conveniently be applied to the photographic film before the photographic coating is placed thereon, nevertheless my curl-lessening operations may be performed on the back of the film after it is covered with the sensitized layer. Thus in Fig. 3, 31 represents a film of cellulosic addition compound bearing upon its upper face a gelatino-silver halid emulsion, for example. This passes over wheel 20 and wheel 21, the delicate photographic sensitive layer being outward and upward, so that it does not contact with the peripheries of the wheels. The rear face of the film is successively treated with varnish coatings by wheels 22 and 23 from baths 24 and 25 in tanks 26 and 27. The distance between the rolls 22 and 23 is designed to allow the first coating to properly set on the flat tensioned film before the second coating is applied, and any conventional intermediate drying means can be employed for hastening the evaporation of the volatile ingredients from the coatings. Of course, the wheels in all of the above examples are power driven in the usual way where it is desirable, and the coating rolls or other equivalent coating devices are adjustable to and from the film to vary their effect, as will be understood by those skilled in the art and familiar with the customary expedients. The volatile solvents may be drawn off and recovered by any known or preferred means.

As an example of a suitable varnish bath which may be used in each of the above described tanks a 2% (by weight) solution of nitrocellulose in a mixture of acetone and ethyl alcohol is excellent. The acetone and

ethyl alcohol are preferably present in equal parts by volume. When this is applied to the back of nitrocellulose film, for instance, the acetone is a volatile solvent of the film, whereas the ethyl alcohol is a non-solvent and is likewise volatile. Of course, the fluid vehicle represented by the mixture of acetone and alcohol likewise has sufficient solvent power to carry the small percentage of nitrocellulose that is present. For rapid work, a solution of the order of 2% of nitrocellulose is very useful.

The curl-lessening action is heightened by the volatile active solvent, acetone, and its action is tempered by the non-solvent, ethyl alcohol, and by the small per cent of nitrocellulose, so that the film is not impaired under the working conditions described above, although the film and all the coatings mutually adhere with firmness. The relatively thin layers of varnish seem to fix or clinch the comparative freedom from curling tendency brought about by the application of the liquid varnish. I apply the term "volatile" for convenience of description herein to liquids which boil at or below about 100° C.

One coating of varnish on the back, particularly when the vehicle carrying the cellulosic addition compound is wholly volatile, is useful and, of course, can be applied by any one of the hereinabove described coating machines, one of the pair of coating wheels being omitted or temporarily put out of use. For the maximum effect, however, a plurality of coatings on the back are recommended, these being applied successively, one on top of the other.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

The process of lessening the curling tendency in photographic nitrocellulose films, which comprises applying to the rear face only thereof a plurality of relatively thin coats of varnish one on the other, said varnish being a solution of nitrocellulose in a mixture of a volatile solvent and volatile non-solvent thereof, the proportion of nitrocellulose in said varnish being of the order of magnitude of two per cent.

Signed at Rochester, New York, this 14th day of May, 1924.

ALBERT F. SULZER.