PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Improvements in or relating to Liquid Treatment of Cinematograph Films.

We, TECHNICOLOR MOTION PICTURE CORPORATION, a corporation organized under the laws of the State of Maine, United States of America, of 110, Brookline Avenue, Boston, Massachusetts, United States of America, LEONARD THOMPSON TROLAND, JOSEPH ARTHUR BAIL and JARVIS MELVIN ANDREWS, all citizens of the United States of America, and all of the above, 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 the liquid treatment of photographic films, particularly cinematographic films, and specifically to that mode of treatment in which only one side of the film is treated at a time. In making color-picture films, for example, in which a series of pictures representing one color aspect are carried on one side of the film and a complete mental series representing another color aspect is carried on the other side of the film, it is frequently desirable to treat the opposite sides of the film separately and differently, as, for example, by staining one side a reddish color and the other side a greenish color.

The object of the invention is to provide a method and apparatus for treating one side of a film independently of the other side with rapidity and uniformity, without injury to the film, and without affecting the other side of the film. Another object is to provide a method and means for automatically restoring a film to normal position in the event that the film tends to submerge on one side as the result of a wavy edge such as films frequently have.

According to the present invention the film is passed along the surface of a body of liquid in such manner that it is supported solely by the liquid without the aid of any auxiliary supports, thereby avoiding the difficulty of maintaining the liquid at a definite predetermined level relatively to the supports and also avoiding friction and scratching of the film by the supports. While this has hitherto been considered impossible in the case of the thin and tenuous liquids such as are used in treating cinematographic and other photographic films, and where the liquid has a relatively low surface tension, we have discovered that it is not only possible but highly practicable.

In one aspect the invention involves maintaining the film substantially flat and thereby restraining it from contacting with the liquid on its upper side and, where the film is supported by floating, preventing it from sinking, by making the film multi-ply. For example, if two films are properly secured together back-to-back with the coatings on the outer sides, the resulting double film will have less tendency to curl and buckle, even when only one side is wet, presumably for the same reason that a multi-ply board or cardboard has less tendency to warp and curl than a single ply piece.

In another aspect the invention consists in aiding the flotation of the film by making the film water-repellent at the sides, preferably from the extreme edges inwardly to lines extending longitudinally of the film slightly inside the sprocket holes. One way of rendering the marginal portions of the film water-repellent is to make the celluloid support bare and clean throughout such portions. This is preferably accomplished by dissolving off the unexposed gelatine emulsion and thoroughly washing the film, thus leaving the celluloid perfectly bare and clean outside the lateral edges of the images which are slightly inside.
the rows of sprocket holes. The unexposed portions may be dissol
out affecting the images between the rows of sprocket holes by first hardening the
5 gelatine throughout the exposed image spaces in known manner. The marginal portions of the film may be rendered even more liquid-repellent by a coating which is not readily wet by aqueous solutions, such as stearic acid wax.

In order to illustrate the invention, one concrete embodiment is shown in the accompanying drawings, in which,

Fig. 1 is a side elevation of a complete
15 machine;
Fig. 2 is an enlarged section on the line 2—2 of Fig. 1;
Fig. 3 is an enlarged plan, viewed from line 3—3 of Fig. 1 of a portion of
20 the drying chamber showing the drying-air feed-pipe in cross section;
Fig. 4 is an enlarged sectional view of the liquid trough, showing a film float
25 ing upon the surface of the liquid within the trough;
Fig. 5 is a view similar to Fig. 4 showing the action of the film and the liquid
when the former becomes displaced;

Fig. 6 is a longitudinal sectional view
30 of the liquid trough and general assembly of the lower portion of the apparatus, the central portion of the trough being cut away;

Fig. 7 is a detail section of line 7—7
35 of Fig. 6, showing surface liquid removing means;
Fig. 8 is a sectional view on the line
8—8 of Fig. 1, showing in elevation the means for drawing the film through the
40 machine;
Fig. 9 is a sectional view on the line
9—9 of Fig. 6 showing in elevation the devices for applying the liquid repelling substance to the edges of the film;

45 Fig. 10 is a detail vertical sectional
view through one of the devices shown in Fig. 9; and

Fig. 11 is an enlarged cross section of a film such as above described (in which S and S' are the two celluloid strips cemented together and R and R' are the images carried by the respective strips).

The specific embodiment of the invention chosen for purpose of illustration comprises a base 11 to which are fastened U-shaped supporting uprights 12 connected by cross members 13. These upright and cross members are preferably made in one piece. Upon the cross members 13 is supported an elongated drying chamber 14 enclosed on the top, bottom and sides and open at the ends.

Within the drying chamber and mounted in U-shaped supports 15 are rollers 16 consisting of a central drum 17 with shoulders 18 of greater diameter than the drum and beyond these guide flanges 19 of still greater diameter. When the film is fed through the drying chamber after the liquid treatment the edges of the film rest upon the shoulders 18 so that the moist face of the film cannot contact with the drum 17. At one end of the drying chamber is a pipe 20 through which warm air is forced into the drying chamber through the side openings 21.

Supported upon the base 11 by blocks 22 is a broad U-shaped trough 23 shown in cross-section in Fig. 2. Within the trough 23 is mounted the elongated shallow trough 24 for the liquid treatment of the film (Fig. 4). The trough 23 serves as a means for taking care of accidental overflow from trough 24, pipe 23' (Fig. 6) being arranged to carry away this overflow. The trough 24 has upwardly flaring or diverging sides 25 which extend above the level at which the liquid is constantly maintained. The distance between the sides 25 at the level of the liquid is slightly greater than the width of the film A to be treated. The trough 24 may be supported at intervals upon legs, or as shown in Fig. 4 it may be stamped from a single sheet of metal. At one end of the troughs 23 and 24 are the triangular supports 26, one being located upon each side of the troughs as shown in enlarged scale in Fig. 6. These triangular supports are connected together by a rod 27 upon which is mounted guide roller 28 similar in construction to guide rollers 16. At the apex of the triangular support are registering holes 29 serving as bearings for a shaft 30 forming a portion of the carriage 31 which comprises side arms 32 connected by rods 33 upon which are rollers 34 and 35. In order to hold the carriage 31 in adjusted position the triangular supports are provided with binding screws acting upon the shaft 30.

At the opposite end of the treatment tank are brackets 36 extending upwardly from the base 11. These brackets are connected by rods 37 and 38 upon which are mounted respectively plain roller 39 and guide roller 40. Supported between rods 37 and 38 by means of attachment members 41 is a block 42 shown in detail in Figs. 6 and 7. This block acts as a means for removing the excess liquid from the fibers and the latter issues from the treatment trough. The means for removing the excess liquid comprises a transverse nozzle 43 fast at the lower portion of the block and allowing space through a recess in the block for the passage of the treated film above the nozzle. The nozzle has an elongated slot
44 directed at an angle of approximately
45° toward the film as it issues from the
treatment trough. A pipe 45 connects
the nozzle with any suitable source of
compressed air. The portion of the block
42 directly above the film has a hollow
chamber 46 shown in Fig. 1 with open-
ings into the recess in which the film
travels directly above the sprocket holes in
the film. Threaded into the chamber 46 is
a pipe 47 to which there is a connection
from a suction pump. The blast of air
from the slot in the nozzle below the
block cooperates with the suction means
above the film to completely remove all
liquid from the sprocket holes of the film,
and also sweep the lower portion of the
film which has been treated clear of sur-
face liquid.

20 Suitable means for applying a liquid
repelling substance to the edges of the film are shown in detail in Figs. 9 and
10. The substance applied by this
device is stearic acid wax, although other
substances, e.g., paraffin, may be used.
Removably clamped to the side arms 39
of the carriage 31 by means of set screws
48 are bracket arms 49 extending in-
wardly and over the edges of the film
in proximity to roll 54. The outer ends of
bracket arms 49 support tubes 50 con-
taining pistons 51 urged downwardly by
springs 52, the tension of the latter being
regulated by hand screws 53. A stick of
wax 54 is placed in the lower end of the
tube 50 and held in frictional contact
with the edges of the film by the spring-
pressed piston 51. The application of
wax or the like is particularly desirable
prior to treating the second side of a film
as the tendency for the liquid to flow over
the top is sometimes greater if the upper
surface has already been treated.

At the right-hand end of the device as
seen in Fig. 1, and supported above the
base 11 by members 55 similar to sup-
ports 12, is a table 56 upon which is
mounted the means for drawing the film
through the machine. This means is
shown in detail in Fig. 8, and comprises
a main shaft 57 supported in bearings 58
and provided with sprocket wheels 59
which cooperate with the sprocket holes
on the sides of the film. The shaft 57
has keyed upon its central portion a worm
gear 60 meshing with a worm 61 upon
a shaft 62 mounted transversely of shaft
57 and below the same. Shaft 62 is
driven through pulley wheel 63 from any
suitable source of power. Upon the end
of shaft 57 opposite to the end of the
sprocket wheels is the driving member
64 comprising a large pulley wheel 65
and a smaller pulley wheel 66. Sus-
pended below table 56 is a bracket sup-
port 67 having an elongated bearing 68
for a shaft 69 arranged in parallel rela-
tion to shaft 57. Shaft 69 has a project-
ing end directly below sprocket wheels 58
over which a film reel is adapted to be
placed, upon which the film, after being
treated and dried, is adapted to be wound.

In order to turn the drum at a proper
speed to take up the film, the opposite
end of shaft 69 is provided with driven
member 70 comprising smaller pulley
wheel 71 directly below pulley wheel 69
and pulley 72 directly below pulley 66.
Driven member 70 is loose upon shaft 69
but is held by springs 74 in frictional
contact with disc 73 keyed to shaft 69.
The tension of spring 74 is regulated by
collar 75 held in adjusted position on
shaft 69 by screw 76.

The operation of the device is as
follows: A reel of film is placed upon
the bracket support 77 which is suspended
from the base 11. The film in this reel
is threaded upwardly through an open-
ing in the base 11 over the guide roller
27, then upwardly over roller 54 under
the wax ends 54, over roller 55 and then
downward the length of the treatment
trough 24, the film resting upon the sur-
facing of the liquid and being supported
thereby. The film is drawn along the
surface of the liquid, threaded upwardly
under roller 39 through the recess in the
surface liquid removing block 42 under
guide roller 40, up through a slot in the
drying chamber 14 over the guide rollers
16, throughout the length of the drying
chamber over the sprocket wheels 57, the
sprocket teeth being registered in the
sprocket holes of the film, and down
around an empty film reel upon the
extremity of shaft 69, the take-up reel
being driven by a belt (not shown) over
pulleys 65—71 or 66—72. Since it is
impossible to arrange for the slight vari-
ation in proportion between the speeds
of shafts 57 and 69 in reeling up the film,
a provision is made for slip between the
driven member 70 and shaft 69, compris-
ing arranging the driven member 70
loosely upon shaft 69 but in spring-
pressed frictional engagement with the
collar 73.

A feature of the invention consists in
the upwardly flaring sides of the liquid
trough and the slight clearance between
the edges of the film and the sides of
the trough when the film is floating
normally. If the liquid creeps over the
dege of the film, as a result of curling
or buckling, thereby submerging one side
of the film, the submerged edge engages
the inclined side and by virtue of the
inclination the other side is caused to
ride up the opposite inclined side, thc
film assuming a position such as shown in Fig. 5. Owing to the surface tension acting on the tipped-up side, the film is either restored to normal position or restrained from being submerged except in the immediate region of the curl or buckle.

In forming the relief images the marginal portions of the gelatine or other colloid material are completely removed in the hot-water etching bath, the marginal portions being unexposed. Thus the gelatine or other colloid material in which the images are formed terminates short of the marginal edges of the film and indeed is confined to the space between the series of marginal registering openings (Fig. 11). This is important in coloring the relief images inasmuch as pigment solution can be applied to one side with little or no tendency to creep around the edges of the film to the opposite side by virtue of bare cellloid margins.

We are aware that it has been proposed to pass a film over the surface of a liquid by mechanically supporting the film at recurrent intervals. It has also been proposed to wax the margins of a film for protective and lubricative purposes but so far as we are aware no one has used this expedient in floating film. 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. The method of preparing a roll of photographic film which comprises moving the film over a body of liquid in surface contact therewith to treat one side of the film without submerging the film, the film being normally supported solely by the liquid, substantially as described.

2. The method of preparing a roll of photographic film according to Claim 1 characterized by rendering the margins of the film liquid-repellent before passing the film over the surface of the liquid.

Dated this 31st day of October, 1923.

W.M. BROOKES & SON,
Chartered Patent Agents,