J. MASON.

METHOD AND APPARATUS FOR TREATING FILMS.

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1,348,029.

Patented July 27, 1920.

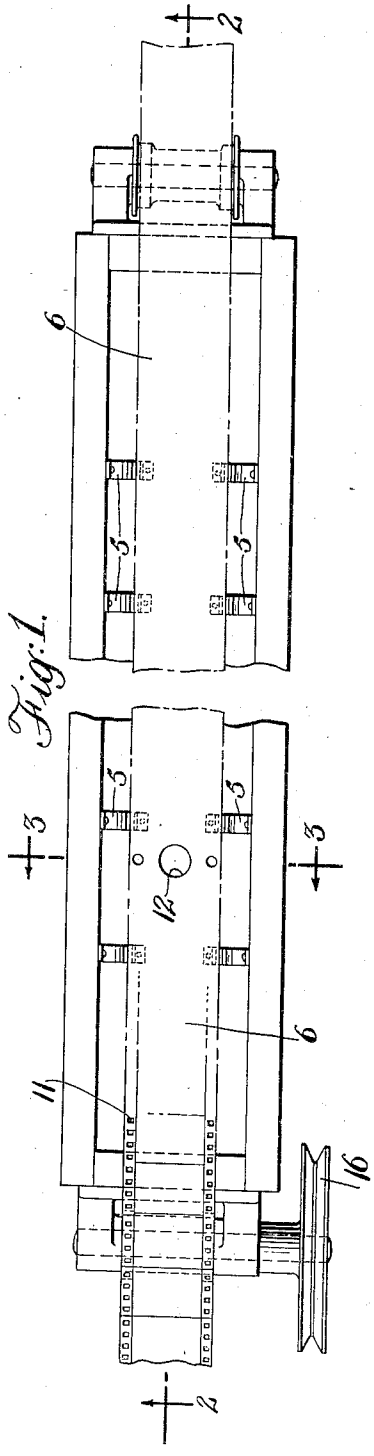


Fig. 1.

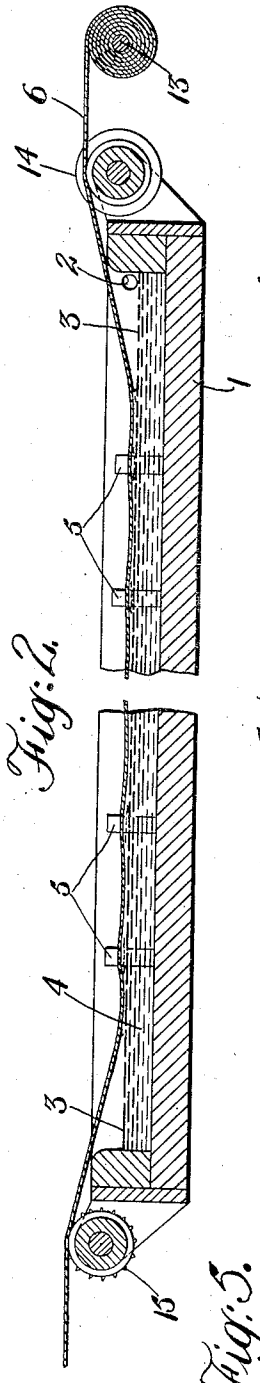


Fig. 2.

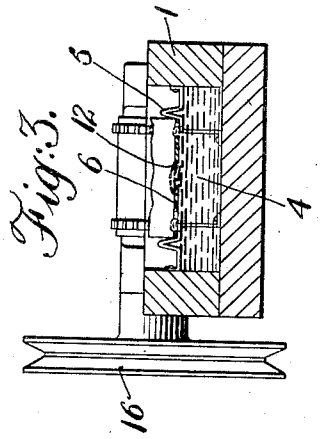


Fig. 3.

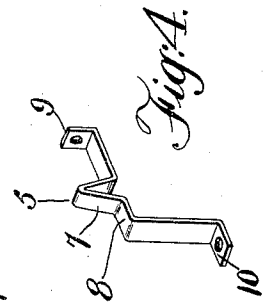


Fig. 4.

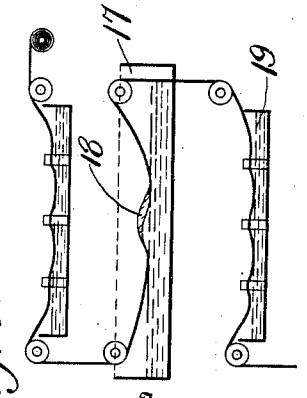


Fig. 5.

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UNITED STATES PATENT OFFICE.

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METHOD AND APPARATUS FOR TREATING FILMS.

1,348,029. Specification of Letters Patent. Patented July 27, 1920.

Application filed March 14, 1919, Serial No. 282,527. Renewed February 19, 1920. Serial No. 359,851.

To all whom it may concern:

Be it known that I, JOSEPH MASON, a citizen of the United States, and resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Methods and Apparatus for Treating Films, of which the following is a specification.

This invention relates to method and apparatus for treating film and analogous surfaces, and has for its object to provide a method and apparatus whereby a film strip or the like can be treated with a liquid on one side in a rapid and uniform manner in long lengths, without permitting the liquid to contact with the other side. A large field of use for an invention of this character is in the treatment of motion picture film during coloring operations, wherein it is frequently desired to treat one side of the film independently of the other side or without wetting the other side. Large quantities of colored motion picture film are now made from double coated positive stock printed on both sides, and the two sides being colored in different or complementary colors. Heretofore, it has been proposed to treat one side while protecting the other side by winding the film on inflatable drums, or tightly on the surface of wheels, so as to protect the inner side. Another way has been to use such process that one side could be treated and finished and then covered with a protective coating for the purpose of protecting the finished side while finishing the other side. These several methods and apparatus are objectionable because of the increased amount of handling of the film required with consequent risk of damaging the emulsioned surface, also in cost of time and labor required for winding the film on and off of the protecting carriers, and also because of the limitations imposed where it is necessary to finish, dry and coat one side before treating the other side.

This invention provides a novel method and apparatus wherein the film is drawn along in contact with the surface of the treating liquid in such manner that the surface tension present in all liquids is availed of to prevent access of the liquid to the upper side, either around the edges of the film strip or through the sprocket perforations. While the action is not exactly that of floating the film on the surface of the liquid nor exactly that of supporting the film just at the surface of the liquid, the action may be said to be a combination of the two, in that the film is to be supported adjacent but slightly above or below the surface of the liquid in a zone defined by the limits of the tension of the particular liquid employed. I have found that if the lower surface of the film is once wet by contact with the liquid, the film can be lifted an appreciable distance above the surface without breaking contact with the liquid, the liquid rising up and holding on to the wet surface without dropping back, even though the film is drawn along at the same time. Thus, it is possible to continuously treat long lengths of film on one side only without any possibility of having the liquid break through the sprocket holes or around the edges and reach the upper side. The physical character of motion picture films varies very considerably with atmospheric conditions, and for example in a very humid atmosphere the film tends to curl longitudinally, but I have found that even under extreme conditions the liquid holds on to the film but does not reach the other side. In some instances, I have observed that the liquid in the holes has a very pronounced meniscus curve above the upper surface of the film, but does not break and flow over the upper surface. Not only is this true for the ordinary sprocket perforations, but it is also true for special perforations sometimes put in films at the center indicating changes of subject or scene, and which are generally somewhat larger than the sprocket perforations.

In carrying out the method, I have devised a novel tank and film supporting apparatus wherein the liquid level is maintained by an overflow, and the film is periodically and slidably supported on separated supports located at or about the surface of the liquid and within the zone in which the liquid will rise above or be depressed below its normal level by reason of its tension without breaking contact in the one case, or overflowing the film in the other.

While capillarity and adhesion may contribute to this result, my investigations lead me to conclude that the phenomena of liquid tension furnish a better explanation.

The invention will be understood in connection with the description of the accompanying drawings, wherein—

Figure 1 is a plan view of an apparatus for carrying out the invention,

Fig. 2 is a longitudinal section,

Fig. 3 is a transverse section on the line 3—3 of Fig. 1,

Fig. 4 is a detail view of one of the supports, and

Fig. 5 is a diagram of apparatus for treating two sides of a strip or film in succession.

The apparatus consists of a tank 1 having an overflow, as 2, to maintain the normal level 3 of the liquid 4, and a series of spaced supports 5 located so as to support the film 6 preferably slightly above the normal liquid surface. The spaced supports are found satisfactory, but continuous or practically continuous rails would also serve. If the film is supported too low, it will sink and overcome the tension of the liquid, which will then flow up and over the upper side, while if the film is supported too high the tension of the liquid will be insufficient to maintain contact of the liquid and the lower surface of the film. Between these limits is what I consider the zone of tension, since it is unsafe to make a support so low as to risk sinking of the film in case of sagging, or in case of longitudinal curvature of the film either up or down. The supports 5 have vertical portions 7 which act as side guides for the film and flat portions 8 which support the edges of the film without permitting contact with the image portions, and feet 9, 10 for attachment to the side and bottom of the tank 1 respectively. 11 represents the sprocket perforations in the film and 12 one of the indicating perforations, Fig. 3 showing on a very small scale how the liquid rises up through the holes with a pronounced meniscus without breaking through. In Fig. 2 is seen a similar curve at each end of the contacting portions of film and liquid. The roll of film 6 on shaft 13 is run over guide roller 14 at one end and out over sprocket 15 which will be suitably driven from a pulley 16, it being found that in a long length the friction between the film and the liquid and the supports furnishes proper tension.

In starting up the apparatus the film is led over roller 14 and pushed into contact with the surface of the liquid, and then drawn along over the supports and interlocked with the sprocket 15. The power is then applied and the operation continues without attention. If a prolonged contact is required, the drive is stopped, as it is not necessary to keep the film moving in order to prevent it from submerging. By properly locating the supports 5 relatively to the surface of the liquid the weight of the film while moving is to a large extent carried by the liquid on account of its tension, so that although the supports are rounded and provided with smooth surfaces, there is so little contact between the supports and the film that no damage at all is done to the emulsion or coating of the film which contacts with the supports.

A particular application of the process relates to the treatment of double coated positive stock printed on both sides with registering color value images so that one side can be colored, as for example red, and the other side, as for example complementary green, the images on one side being printed from red value negatives and those on the other side from green value negatives. In producing this kind of colored motion picture film, after the positive is printed on both sides it is developed and washed, but not necessarily fixed on both sides in all cases. If the color is to be applied by any of the well known toning, mordanting, or dyeing processes, one or both sides will be bleached or prepared to set a color, so that one side will take one color and the other side the other color. In making double coated and colored film, I preferably bleach and then wash both sides at once, and then with or without drying the film pass it through the first tank, according to the method of this invention, to apply one color. After washing, as in tank 17, and after reversing the film through 180°, as at 18, the next color is applied by repeating the process of this invention in another tank 19 containing the second color. Driving sprockets for the film will be provided where necessary. This process especially lends itself to coloring by dyes, because control can be so easily effected by varying the strength of bath, and the time of contact according to the speed of movement, or the length of the tank, so that widely varying requirements can be met for different films, baths or colors.

I have thus eliminated by this invention an intermediate drying step required where the side first colored is protectively coated before applying the second color, and in cases where the film is wound on a soft surfaced wheel or inflatable drum, have eliminated winding and unwinding the film on the drum before and after the first and second coloring operations. By this process it will be seen that the application of different treatments or colors is a continuous operation without any intermediate drying and coating, or coiling, and uncoiling the film on drums. This not only eliminates a large amount of labor and apparatus, but reduces the chances of damage to the film, and the film can be inspected at any point and the progress of the coloring observed, resulting in a more uniform product. In large plants, the tanks will be in multiple,

or one tank will be made wide enough to carry several sets of supports, so that a number of films in parallel can go through at once without increase of labor.

So far as I am aware this is an entirely new method of treating films, as all previous methods have either been by immersion with or without one side protected by a soft surfaced wheel or inflatable drum, or else it has been sought to apply treatment to one side at a time by means of sprays. Spray treatment is objectionable because there is always liability of the spray reaching the other side and also because of liability of non-uniformity of action, besides being slow and requiring careful supervision.

By this invention, the cost of treating films is largely reduced both in labor and in apparatus required, the necessity of protective coatings is done away with, and a more uniform product is procured. While the invention is described with particular reference to washing, bleaching, mordanting, toning and dyeing of thin double colored films used for motion picture positives, it can be advantageously applied to many other operations in treating or preparing films or other analogous surfaces, and I do not restrict myself either to the treatment of films or strips for photographic purposes, or to materials coated on both sides, as it is possible to advantageously carry out this method with single coated stock wherein it is not desired to wet the upper surface but to wash or otherwise treat the lower surface only. It will also be understood that the invention is applicable to various other purposes such as coating, washing, developing and fixing, without departure from the scope of the appended claims.

What is claimed is:

1. The step in treating a surface with a liquid which consists in holding the surface adjacent the liquid and maintaining contact of the liquid and the surface by the tension of the liquid.

2. The step in treating a surface with a liquid which consists in holding the surface of a moving strip adjacent the liquid and maintaining contact of the liquid and the surface by the tension of the liquid during movement of the strip.

3. The step in treating the surface of a strip with a liquid which consists in supporting the strip at intervals adjacent the surface of the liquid and maintaining contact of the liquid and the surface by the tension of the liquid.

4. The step in treating the lower surface of a thin perforated film with a liquid in such manner as to prevent access of the liquid to the other side which consists in holding the film on or adjacent to the liquid to maintain contact of the liquid and the lower film surface while preventing flow of the liquid in the upper surface by the tension of the liquid.

5. The process which consists in contacting the lower surface of a strip with the surface of a treating liquid and drawing the strip over the liquid while maintaining contact of the liquid and the lower surface of the strip by supporting the strip in a zone within the limits of the tension of the liquid.

6. The process which consists in contacting the lower surface of a strip with the surface of a treating liquid and drawing the strip over the liquid while maintaining contact of the liquid and the lower surface of the strip by slidably supporting the edges of the strip in a zone within the limits of the tension of the liquid and permitting curling or sagging of the film without breaking the contact or causing submerging of the film.

7. The process of dissimilarly treating a strip on opposite sides which consists in moving the strip over a treating liquid with only its lower surface in contact therewith within the limits of the tension of the liquid, reversing the film through an angle of 180°, and moving the film over another treating liquid with only its other surface in contact therewith.

8. The process of dissimilarly treating a strip on opposite sides which consists in moving the film over a treating liquid with only its lower surface in contact therewith while supporting the film at the edges in a zone within the limits of the tension of the liquid, reversing the film through an angle of 180°, and similarly moving the film over another treating liquid with only its other surface in contact therewith.

9. The process of continuously treating a film having images on opposite sides consisting in moving the film over and in surface contact with a coloring liquid, reversing the film out of contact with the liquid, and passing the other side of the film over and in surface contact with a second coloring liquid.

10. The process of treating images on opposite sides of double coated film in succession to apply color, consisting in coloring one side by moving it over and in surface contact with a coloring liquid while supporting the film in such relation to the liquid level as to be neither immersed in nor out of contact with the liquid, reversing the film, and passing the film over a second coloring liquid in like contact with the other side.

11. A film treating apparatus comprising a constant level tank, and film supporting means extending longitudinally of the tank and having supporting surfaces located relatively to the liquid level so as to support the film in surface contact with the liquid and within the limits of surface tension thereof.

12. A film treating apparatus comprising a constant level tank, and film supporting means extending longitudinally of the tank and having supporting surfaces located relatively to the liquid level so as to support the film in a zone within the limits of the tension of the liquid.

13. A film treating apparatus comprising a constant level tank, and film edge supporting means extending longitudinally of the tank and having supporting surfaces located relatively to the liquid level so as to support the film in surface contact with the liquid and within the limits of surface tension thereof.

14. A film treating apparatus comprising a constant level tank, film supporting means extending longitudinally of the tank and having supporting surfaces located relatively to the liquid level so as to slidably support the film in surface contact with the liquid and within the limits of surface tension thereof, and means for drawing the film through the tank.

15. An apparatus for treating double coated film on both sides in succession comprising a constant level tank, film supporting means extending longitudinally of the tank and having supporting surfaces located relatively to the liquid level so as to slidably support the film in surface contact with the liquid and within the limits of surface tension thereof, a second constant level tank located beyond said first tank and receiving the film thereupon after it has been reversed through 180° between the tanks, said second tank having supporting means similarly arranged to maintain surface contact between the liquid and the lower side of the film, and means for drawing the film through the tanks whereby first one side and then the other can be treated in a continuous process without intermediate drying or rehandling.

Signed at Jersey City, in the county of Hudson and State of New Jersey, this 12th day of March A. D. 1919.

JOSEPH MASON.