Jan. 26, 1926. 1,570,809

W. B. WESCOTT

TREATMENT OF CINEMATOGRAPHIC FILMS

Original Filed Dec. 7, 1917 3 Sheets-Sheet 1

Fig. 1.

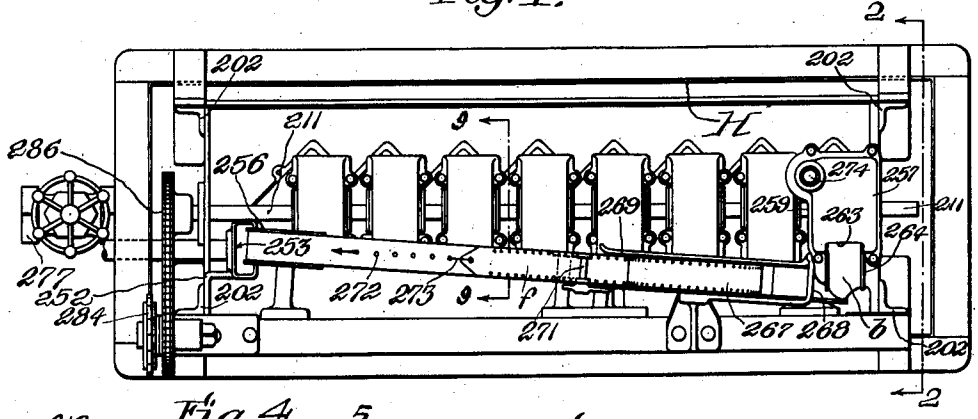


Fig. 4.

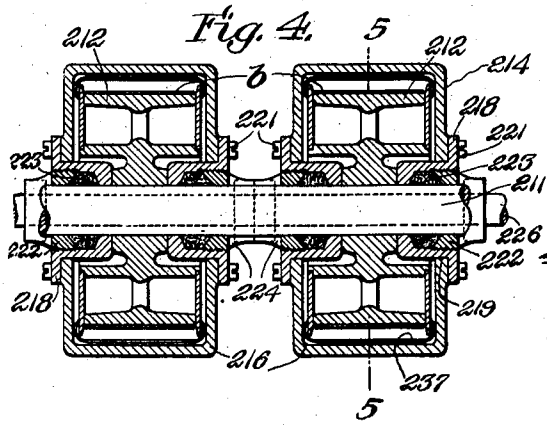


Fig. 5.

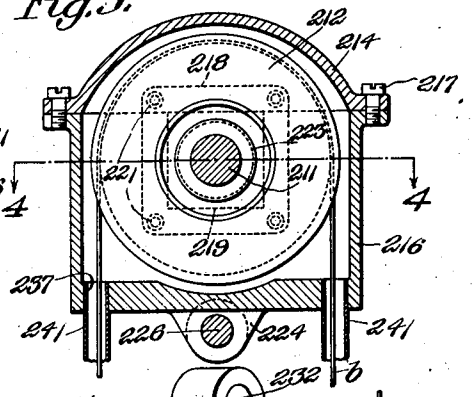


Fig. 7.

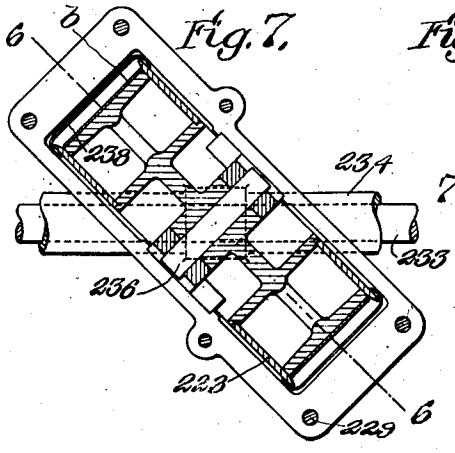
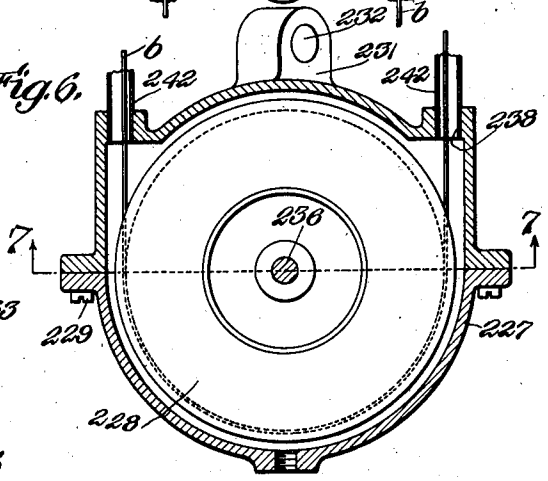


Fig. 6.



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TREATMENT OF CINEMATOGRAPHIC FILMS

Original Filed Dec. 7, 1917 3 Sheets-Sheet 2

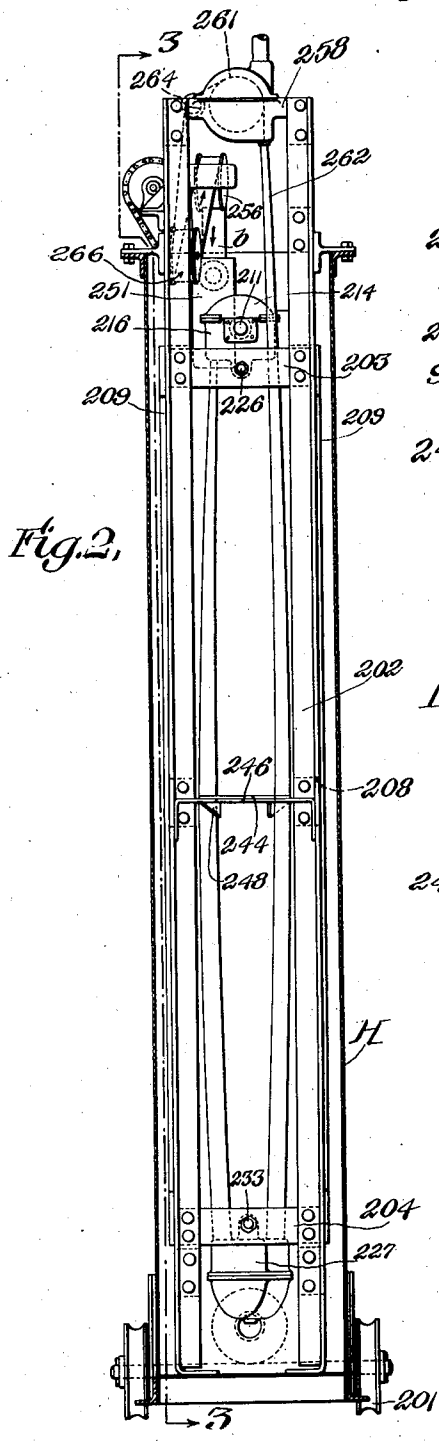

Fig. 2.

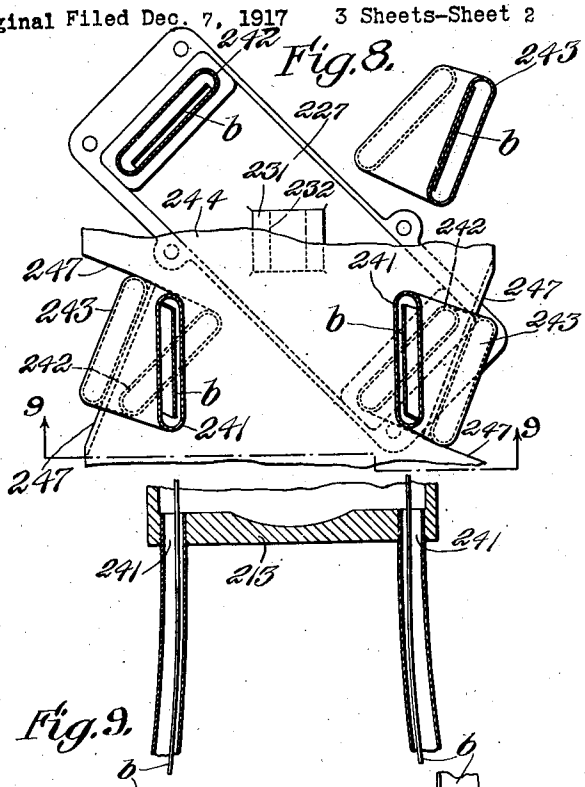

Fig. 8.

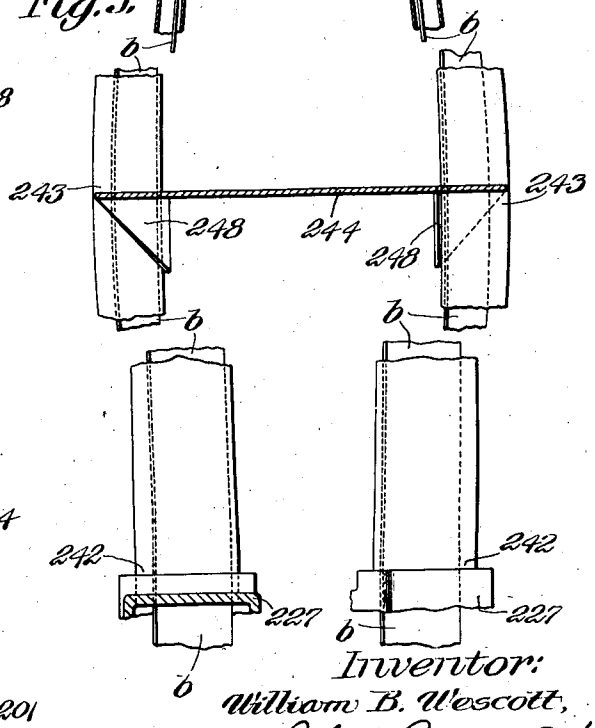

Fig. 9.

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TREATMENT OF CINEMATOGRAPHIC FILMS

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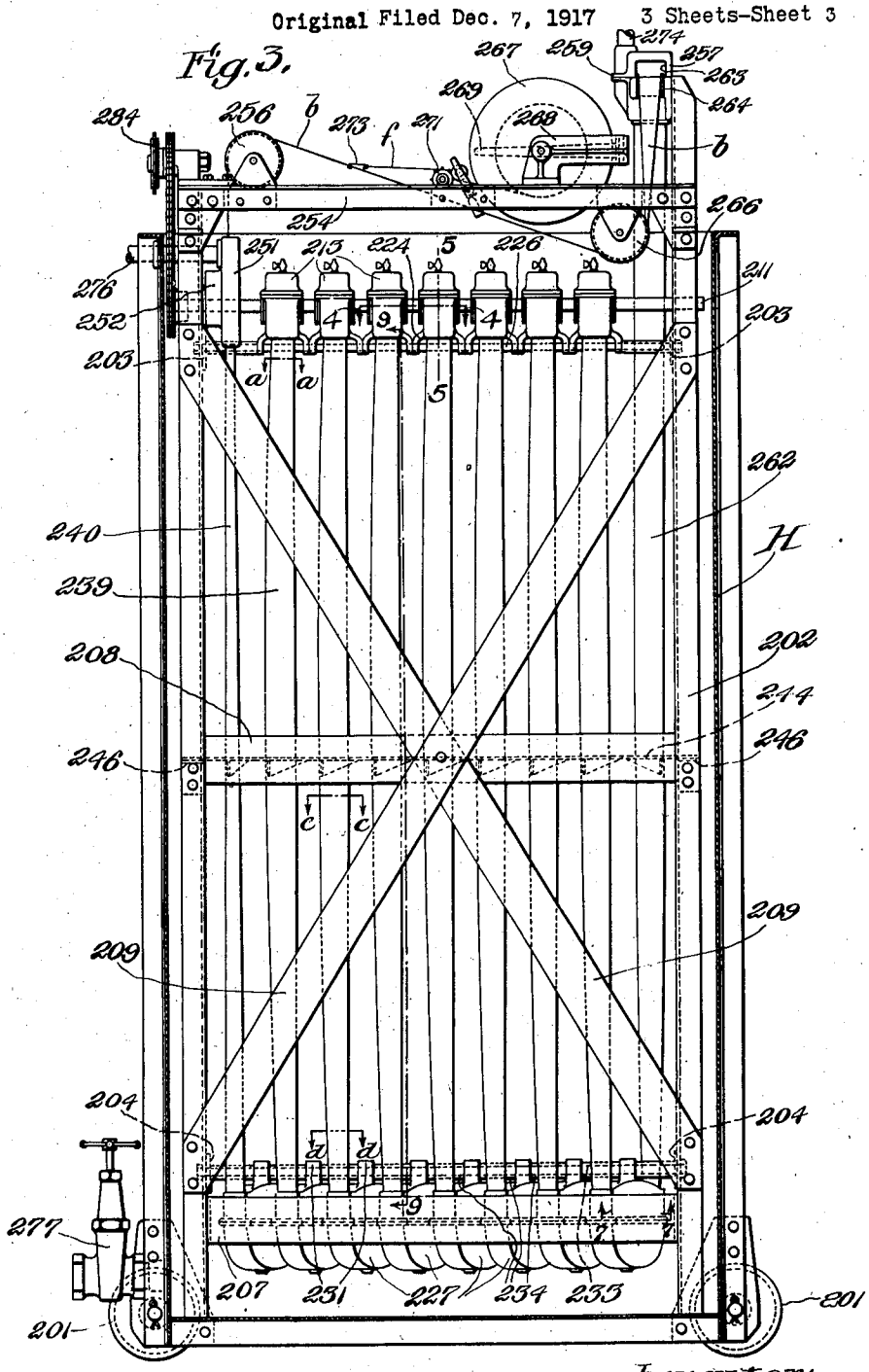
Fig. 3.



Inventor:
William B. Wescott,
by Rohrs Rohrs Cushman
his Attorneys.

Patented Jan. 26, 1926.

1,570,809

UNITED STATES PATENT OFFICE.

WILLIAM BURTON WESCOTT, OF WELLESLEY, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO TECHNICOLOR MOTION PICTURE CORPORATION, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MAINE.

TREATMENT OF CINEMATOGRAPHIC FILMS.

Original application filed December 7, 1917, Serial No. 205,999. Divided and this application filed April 25, 1922. Serial No. 556,535.

To all whom it may concern:

Be it known that I, WILLIAM BURTON WESCOTT, a citizen of the United States of America, and resident of Wellesley, in the county of Norfolk and State of Massachusetts, have invented new and useful Improvements in the Treatment of Cinematographic Films, of which the following is a specification.

This invention relates to a photographic method and apparatus and more particularly to a method and apparatus for dyeing, or otherwise treating motion picture films or other strips of photographic material.

This application is a division of my prior application Serial No. 205,999, filed December 7, 1917, which matured into Patent No. 1,444,818, dated February 13, 1923.

Heretofore it has been the common practice in developing, fixing or otherwise treating motion picture films to employ pans and racks, the films being suspended upon the racks and dipped into the photographic solutions. This method is exceedingly awkward and unsatisfactory in treating long lengths of films, and it has long been recognized that some means for conveniently and rapidly treating films would greatly facilitate the manufacture and treatment of films. Various types of apparatus for continuously feeding films through the developing and other solutions have been proposed, but for various reasons they have not been practical and they have therefore not come into commercial use.

It is the object of the present invention to provide a method and means for continuously treating any desired length of film or other strip of photographic material, to render the treatment rapid and accurate and so to manipulate the film that it is in no wise injured or mutilated in the various stages of the treatment. Another object of the invention is so to handle the film throughout the processes of treatment that the emulsion side of the film will not come into contact with the parts of the apparatus along which it moves. A still further object of the invention is to provide a method and means for sensitizing a film after the emulsion has been applied to the celluloid or other support whereby the action of the dye throughout the entire length of a film may be made more uniform whereby a relatively small quantity of dye solution is required for completely covering and treating a film, and whereby the degree of the action of the dye upon the film may be readily and accurately controlled.

In the accompanying drawings,—

Figure 1 is a plan view of the dyeing apparatus;

Figure 2 is a vertical transverse section of the dyeing apparatus taken on line 2—2 of Fig. 1;

Figure 3 is a vertical longitudinal section of the dyeing apparatus taken on line 3—3 of Fig. 2;

Figure 4 is a horizontal section of a portion of the dyeing machine taken on line 4—4 of Figs. 3 and 5;

Figure 5 is a vertical transverse section of the same portion of the dyeing machine taken on line 5—5 of Figs. 3 and 4;

Figure 6 is a vertical longitudinal central section of one of the lower pulley casings of the dyeing machine taken on line 6—6 of Fig. 7;

Figure 7 is a horizontal section through one of the lower pulley casings taken on line 7—7 of Figs. 3 and 6;

Figure 8 is a horizontal sectional view of four adjacent tubes of the dyeing apparatus, the lower tubes being sectioned on line *a*—*a* of Fig. 5, the upper right-hand tube being sectioned on line *c*—*c* of Fig. 3, and the upper left-hand tube being sectioned on line *d*—*d* of Fig. 3; and

Figure 9 is a vertical transverse section of the dyeing apparatus taken on line 9—9 of Figs. 1, 3 and 8, sections of the tubes being broken away.

The particular embodiment of the invention chosen for the purpose of illustration is constructed as follows: A tank H of suitable water-tight construction is provided to house the apparatus, the tank being open at its top and preferably being provided with rollers 201 adapted to roll on tracks so that the apparatus may be moved. Within the

tank H is mounted a framework consisting of upright angle irons 202 at the four corners of the tank, the angle irons at each end being connected together at the top and bottom by means of flat bars 203 and 204. The pairs of angle irons 202 on each side of the frame are connected together at the bottom and central portion of the tank by means of stiffening bars 207 and 208. The side pairs of angle irons are also preferably connected together by diagonal braces 209, which cross at the central stiffening bars 208 and which are preferably connected to the bars 208. Extending between the top end bars 203 is a shaft 211 to which is keyed a plurality of pulleys 212, as shown in Figs. 4 and 5, the pulleys 212 being completely encased in casings 213. Each of the casings 213 is preferably formed in upper and lower parts 214 and 216, connected together by screws 217 or other suitable means. In order to render the casings 213 liquid-tight, stuffing boxes are preferably provided around the shafts at each end of each casing, each of the stuffing boxes comprising a cup shaped member 218 (Fig. 4) of rectangular cross-section adapted to fit into rectangular openings in the ends of the pulley casings and to be secured to the pulley casings by means of screws 221. At the bottom of the cup shaped members, openings for the shaft 211 are provided, and threaded into the circular interior of the cup members 218 are annular nuts 222, suitable packing material 223 being provided in the space between the cup members 218, the annular members 222 and the shaft 211. At the bottom of each of the casings 213 on either side are provided depending lugs 224, these lugs having openings therein adapted to fit over a rod 226, the rod being mounted at its opposite ends in the top end bars 203.

At the bottom of the tank H are mounted a plurality of pulley casings 227, each casing containing a pulley 228. As shown in Figs. 6 and 7, the pulley casings 227 comprise upper and lower portions connected together by screws 229, and at the top of the upper portions are provided lugs 231 having openings 232 therein adapted to fit over a rod 233, the rod 233 being mounted at its opposite ends in the lower end bars 204. The lugs 231 are obliquely disposed on the casing 227 so that when supported on the rod 233 the pulleys are disposed in vertical planes orientated substantially 45° with respect to the transverse vertical planes of the upper pulleys 212. Spacing sleeves 234 may be provided between the lugs 231 in order suitably to space the casings 227 apart. The pulleys 228 are mounted in the casings 227 to rotate freely about the shafts 236.

The upper pulley casings 213 are provided with elongated openings 237 in their lower walls, the elongated openings being somewhat greater in length than the width of the pulleys 212 and being in vertical alinement with the opposite sides of the pulleys. The lower casings 227 are provided with similar elongated openings 238 in their upper walls, the openings 238 likewise being in vertical alinement with the opposite sides of the pulleys 228 contained within the casings 227. Extending between the openings 237 in the upper casings and the openings 238 in the lower casings are flattened tubes 239, the tubes being of the same cross-sectional contour as the openings 237 and 238 and being brazed or otherwise tightly secured within the openings 237 and 238 at their opposite ends. The pulleys at the bottom of tank H are disposed with relation at the top of the tank substantially the same as in the developing apparatus; that is, one side of each of the lower pulleys is in vertical alinement with one side of an upper pulley, while the other side of each of the lower pulleys is in alinement with an adjacent upper pulley. It will therefore be obvious that a film fed onto the left-hand lower pulley will travel in loops around the upper and lower pulleys through the upper and lower pulley casings and through the vertical tubes 239 from one end of the tank to the other.

The emulsion side of the film is disposed outwardly so that the celluloid side will contact with the pulleys 212 and 228 and in order to prevent the emulsion side of the film from contacting with the tubes 239 the tubes are preferably constructed in the manner illustrated in detail in Figs. 8 and 9. As shown at 241 in Fig. 8, the tubes 239, as they emerge from the upper casings 213 are disposed longitudinally of the tank H whereas, as indicated at 242, the tubes are orientated substantially 45° with respect to the vertical transverse planes as they enter the lower casings 227. The tubes are therefore twisted, preferably substantially uniformly throughout their length, so as to enter the openings in the upper and lower casings substantially perpendicularly. As shown at 243 in Fig. 8, the central portions of the tubes are orientated substantially 22½° with respect to the vertical transverse planes. In addition to the twist in the tubes, an outward bow or curvature is provided in each tube so that the film *f*, if it engages the tubes at all, will engage the inner sides of the tubes with its celluloid side and so that the outer emulsion side of the film will never engage the tubes. In order rigidly to maintain the tubes 239 in the described position throughout their central portions, a horizontal plate 244, is disposed therebetween, the plate being mounted at its opposite ends in frame members 246 and being notched at its sides as indicated at 247 in Fig. 8 to receive the tubes 239. The notches 247 are

preferably provided by striking up triangular portions 248 from the sides of the plate. The tubes 239 may, if desired, be brazed or otherwise secured to the depending ribs 248 along which they extend.

The interior surface of the tubes 239, casing 213, and casings 227 may if desired be coated on their inner surfaces with paraffin, glass, celluloid, or other substance which is unaffected by the chemical solutions employed in the machine, thereby to avoid any action of the solutions upon the tubes and casings which might be injurious either to the machine or the solution. When the casings are so coated they may be made of iron or tin or other suitable metal. Moreover, I also contemplate constructing the tubes and casings of hard rubber or other matter which is unaffected by the chemical solution and which does not affect the chemical solutions.

In order to feed the film to and from the above described train of pulleys and tubes, the following mechanism is preferably provided: The tube 240 at the extreme left-hand end of the tank H (Fig. 3) is connected at its upper end to a casing 251, the casing 251 being mounted on the frame by means of a bracket 252 and having a slot 253 in its upper wall. On the upper portion 254 of the framework Fig. 3 is mounted a pulley 256 whose left-hand face is in alinement with the slot opening 253 in the casing 251. At the upper right-hand corner of the framework is mounted a casing 257 by means of a member 258 extending between the end uprights 202. The casing 257 is preferably comprised of an upper and lower portion fitting tightly together along the horizontal plane 259. Within the casing is mounted a pulley 261 whose rear side is in alinement with an opening in the bottom of the casing which receives the upper end of the extreme right-hand end tube 262 (Fig. 3). In the forward side of the upper portion of the casing 257 is provided an opening 263, and outside of the casing in alinement with this opening is provided a pulley 264. Below and in alinement with pulley 264 is a pulley 266 which is also in alinement with the pulley 256.

The reel of film which is to be supplied to the machine is mounted in a magazine 267, the magazine 267 being mounted on the frame member 254 by means of a bracket 268, and an arm 269 being pivotally mounted on bracket 268 to maintain the reel within the magazine. The film *f* leads from the feed reel through a suitable friction sprocket device 271 and thence to the pulley 256. A film may if desired be threaded through the tubes by means of a leader film or any other suitable manner, but an endless belt is preferably provided to draw the film through the apparatus. The belt, which is designated *b* in the figures, passes over the pulley 256, downwardly through casing 251, left-hand end tube 240, through the series of lower casings 227, tubes 239 and upper casings 213, upwardly through the right-hand end tube 262, over the pulley 261 in casing 257, out from casing 257 through opening 263, downwardly over pulley 264, around pulley 266, and thence to pulley 256. The belt is preferably provided with a central row of openings 272 and the forward end of the film is preferably secured to the belt by means of a clip 273 adapted to extend through an opening in the belt and an opening in the end of the film. The belt *b* is preferably composed of flexible film-like material and the openings 272 are preferably reinforced with eyelets. The dye solution (or other film-treating fluid) is fed into the series of tubes 239 and upper and lower casings through an inlet 274 disposed at the top of the casing 257 and is withdrawn through an outlet pipe 276 extending from the left-hand side of the casing 251.

In accordance with one of the principal objects of the present invention the dye solution is continuously fed through the series of tubes in a direction opposite to the direction of feed of the film, the film entering at casing 251 and emerging from casing 257, whereas the dye enters at 257 and emerges from casing 251. Any suitable means may be provided for supplying the dye solution to the apparatus at a suitable rate and it is preferably fed through the series of tubes by means of gravity, the dye inlet being disposed at a higher level than the dye outlet. The rate of supply of the dye solution is so regulated that the level of the dye in the inlet casing 257 never rises to the level of the opening 263 through which the film emerges, and in the normal operation of the system the dye solution does not rise in the right-hand tube 262 to a level much above the outlet opening 276. The temperature of the dye solution during its passage through the series of tubes may be maintained constant by filling the tank H with a temperature controlling medium such as water, a drain 277 being provided at the left-hand corner of the tank for withdrawing the temperature controlling liquid from the tank.

From the above description it will be apparent that my improved apparatus affords a number of unique advantages. It may be employed either for dyeing, or otherwise treating a film or other photographic strip in an expeditious manner and in such a way that the treatment may be very accurately controlled. Another important feature of the invention is the arrangement whereby the emulsion side of the film is maintained out of contact with all portions of the apparatus. By virtue of the oblique disposition

of the pulleys at the bottom of the respective loops the film travels smoothly over the pulleys without tending to become buckled or distorted and without tending to run off of the pulleys. The endless belt arrangement relieves the tension on the film and affords an exceedingly convenient method of drawing the film through the apparatus.

A cardinal feature of the invention resides in the method of dyeing or sensitizing the film wherein a thin stream of sensitizing solution is caused to flow along the film. When a film is treated in a sensitizing solution the dye ingredient of this solution is rapidly absorbed by the film emulsion and the dye solution rapidly becomes weaker. In dipping films into a tank of dye solution it is impossible to maintain the dye solution at a constant degree of concentration. In my improved method and apparatus fresh dye is continuously being supplied to the dye compartment and by maintaining the rate of flow of the dye solution constant relatively to the film the action of the dye solution on all parts of the film is the same. Owing to the small dimensions of the tubular channel for the dye solution, a minimum amount of dye is required and owing to the unique construction of the elongate channel the emulsion side of the film is maintained out of contact with the apparatus throughout its entire course through the tubular channel.

Another unique feature of my preferred dyeing method and apparatus consists in the circulation of the dyeing solution in a direction opposite to the motion of the film. If the film entered the tubular dye channel at the same end as the dye solution it would be rapidly affected until the surface became thoroughly sensitized and then action would be very slow whereas with the film entering at one end of the channel and the dye solution entering at the other end the fresh film first comes in contact with the thin stream of dye solution which is somewhat weakened by its action upon the film throughout the entire length of the channel and therefore does not act upon the fresh film very rapidly. As the film progresses through the channel it becomes more and more sensitized and at the same times comes into contact with fresher dye solution whereby the action of the dye solution throughout the entire length of the channel is rendered substantially constant. This not only utilizes the dye solution to the maximum extent but it renders the sensitization of the film more superior particularly for the reason that too rapid action of the sensitizing solution on the photographic emulsion causes the sensitization to be irregular throughout the surface of the film.

While certain unique advantages are incident to the circulation of the dye in a direction opposite to the movement of the film which are not incident to the circulation of the dye relatively to a stationary film or relatively to a film moving in the same direction as the dye it will be understood that certain novel advantages pertain to the circulation of a thin stream of dye over a film where it is stationary or moving either faster or slower than the dye, or at the same rate as the dye, in the same direction as the dye.

Other advantages of the improved apparatus will be apparent and it will also be obvious to those skilled in the art that many modifications of the details of operation and construction may be made within the scope of the appended claims.

I claim:

1. Cinematographic film treating apparatus comprising an elongate tubular container having a transverse dimension slightly greater than the width of the film and constructed to contain liquid, and means for continuously feeding a cinematographic film in the container at one point, thence through the container, and thence out of the container at a widely separated point along its length.

2. Cinematographic film treating apparatus comprising a liquid container having a long narrow passageway whose transverse dimension is somewhat greater than the width of the film and whose ends are disposed above the level of the liquid therein, and means for continuously feeding a cinematographic film through the container, from one end to the other end.

3. The method of treating photographic films comprising circulating a liquid in one direction through a chamber disposed in a series of loops and passing a film through the chamber in the opposite direction so that as the film progresses through the chamber it progressively comes into association with fresher liquid.

4. The method of treating photographic films comprising circulating a liquid through an elongate, bent container whose cross-sectional area is relatively small and passing a film through the container in the direction opposite to that of the circulation of liquid so that the film progressively comes into association with fresher liquid.

5. The method of treating photographic films comprising disposing a film lengthwise of an elongate chamber disposed in a series of loops whose cross-sectional area is relatively small and circulating a liquid through the container so that portions of the film progressively come into association with fresher liquid.

6. The method of sensitizing photographic films comprising circulating a small stream of dye solution along a film so that successive portions of the film are progressively

acted upon by the dye solution and so that each portion of the film is progressively acted upon by dye of increasing freshness.

7. The method of sensitizing cinematographic films comprising passing a film through an elongate chamber whose cross-sectional area is relatively small, and circulating a stream of dye solution through the container in the direction opposite to the direction of film travel, the stream of dye solution being of such small volume that it is appreciably spent during passage along a film in the chamber, whereby as the film enters one end of the chamber it is first acted upon by dye of diminished activity and as it progresses through the container it is progressively acted upon by dye of greater activity.

8. The method of sensitizing cinematographic films comprising passing a film through a small tubular chamber in one direction, and circulating dye solution through the chamber in the opposite direction so that as fresh film having a relatively great affinity for dye enters the chamber it comes into association with partially spent dye solution and as the film progresses through the chamber absorbing dye and losing its affinity for dye, it comes into association with dye solution of progressively increasing strength, whereby the film is acted upon by the dye solution effectively and relatively uniformly during the entire period of its association with the solution.

9. In apparatus of the character described, the combination of an elongate liquid chamber disposed in a loop, means for circulating liquid through the chamber in one direction, and means for longitudinally passing a strip of material through the chamber in the opposite direction.

10. In apparatus of the character described, the combination of a bent tubular liquid chamber, means for circulating liquid through the chamber in one direction, and means for longitudinally passing a strip of material through the chamber in the opposite direction.

11. In apparatus of the character described, the combination of a tubular liquid chamber having a bend intermediate its ends, means for circulating liquid through the chamber in one direction, means for longitudinally passing a strip of material through the chamber in the opposite direction, and means at said bend to maintain the strip out of contact with the walls of the chamber.

12. In apparatus of the character described, the combination of a tubular liquid chamber disposed in a series of loops, means for circulating liquid through the chamber in one direction, and means for passing a strip of material through the chamber in the opposite direction.

13. In apparatus of the character described, the combination of a tubular liquid chamber disposed in a series of loops, means for circulating liquid through the chamber in one direction, and means for passing a strip of material through the chamber in the opposite direction, the latter means comprising guides within the chamber for maintaining the strip out of contact with the walls of the chamber during its passage therethrough.

14. In apparatus of the character described, the combination of a tubular liquid chamber having a sharp bend therein, and a pulley disposed at the bend with its periphery in alinement with the portions of the chamber on each side of the bend, whereby a strip of material may be passed through the chamber over the pulley substantially without contacting with the walls of the chamber.

15. Photographic apparatus for treating films comprising a casing having spaced openings, tubular members communicating with the casing through the openings, and a pulley journaled in said casing with its periphery in tangential alinement with said openings, whereby a film may be circulated through the members and over the pulley.

16. Photographic apparatus for treating films comprising two juxtaposed casings, pairs of tubular members extending in substantial parallelism from openings in the respective casings, and a third casing disposed obliquely to the said two casings with openings communicating respectively with one of each of said pairs of tubular members.

17. Photographic apparatus for treating films comprising a row of casings, each casing having a pair of openings in the side facing in one direction, pairs of tubular members extending from the openings, and other casings connecting the other ends of the tubular members, the other casings being angularly disposed with respect to the said row of casings so that each of the other casing connects with one member of one of said pairs and with one member of the next succeeding pair, whereby a continuous looped channel is formed by the casings and members.

18. Photographic apparatus for treating films comprising two rows of casings disposed in the same plane, each of the casings of one row having a pair of openings disposed in a plane approximately perpendicular to said plane and facing toward the other row of casings, tubular members extending from the openings toward the other row of casings, each of the casings of the other row having openings disposed in a plane oblique to said first plane so as to communicate with tubular members extending from adjacent casing of the first row.

19. Photographic apparatus for treating films comprising two rows of casings dis-

posed in the same plane, each of the casings of one row having a pair of openings disposed in a plane approximately perpendicular to said plane and facing toward the other row of casings, tubular members extending from the openings toward the other row of casings, each of the casings of the other row having openings disposed in a plane oblique to said first plane so as to communicate with tubular members extending from adjacent casings of the first row, and a pulley journaled in each of said casings with the opposite sides of its periphery in alinement with the openings in the casing.

20. Photographic apparatus for treating films comprising a driving shaft, a row of pulleys mounted in juxtaposition thereon, a second row of pulleys disposed in the plane of the first row, the pulleys of the second row being disposed obliquely to the first row so that each pulley of the second row is in tangential alinement with one side of one pulley in the first row and with the other side of the next adjacent pulley in the first row, casings surrounding the respective pulleys, and tubular members extending between the casings of the two rows in tangential alinement with said pulleys.

21. Photographic apparatus for treating films comprising a row of casings, the casings being disposed transversely of the row, a shaft extending through the row of casings, pulleys mounted on the shaft in the respective casings, a second row of casings disposed in the plane of the first row, the casings of the second row being disposed obliquely of the row, pulleys idly mounted in the casings of the second row, tubular members extending between openings in the casings of the respective rows in tangential alinement with the pulleys, the tubular members and casings forming a continuous elongate channel along which a film may be moved over said pulleys, and means for driving said shaft thereby to move the film through the elongate channel.

22. Photographic apparatus for treating films comprising a tubular conduit arranged in a series of loops, an endless belt extending through the conduit, and means for advancing the belt along the conduit.

23. Photographic apparatus for treating films comprising a tubular conduit arranged in a series of loops and having openings at its opposite ends, an endless belt extending through the conduit and thence between said openings outside of the conduit, means for moving the belt through the conduit in one direction, thereby to carry a film through the conduit, and means for circulating a film conditioning fluid through the conduit in the opposite direction.

24. Photographic apparatus for treating films comprising a flat tubular member having internal dimensions somewhat larger than a cinematographic film, the member being bowed outwardly intermediate its ends so that a film passing therethrough with its emulsion side directed outwardly will not contact with the member on its emulsion side, and means for feeding a film therethrough.

25. Photographic apparatus for treating films comprising a flat tubular member having internal dimensions somewhat larger than a cinematographic film, the member being twisted so that one end thereof is angularly disposed relatively to the other end and being bowed outwardly intermediate its ends so that a film passing therethrough with its emulsion side directed outwardly will not contact with the member on its emulsion side, and means for feeding a film therethrough.

Signed by me at Boston, Massachusetts. this 24th day of April, 1922.

WILLIAM BURTON WESCOTT.