Feb. 13, 1923. 1,444,818

W. B. WESCOTT

APPARATUS FOR TREATING CINEMATOGRAPHIC FILMS

Filed Dec. 7, 1917 4 sheets-sheet 1

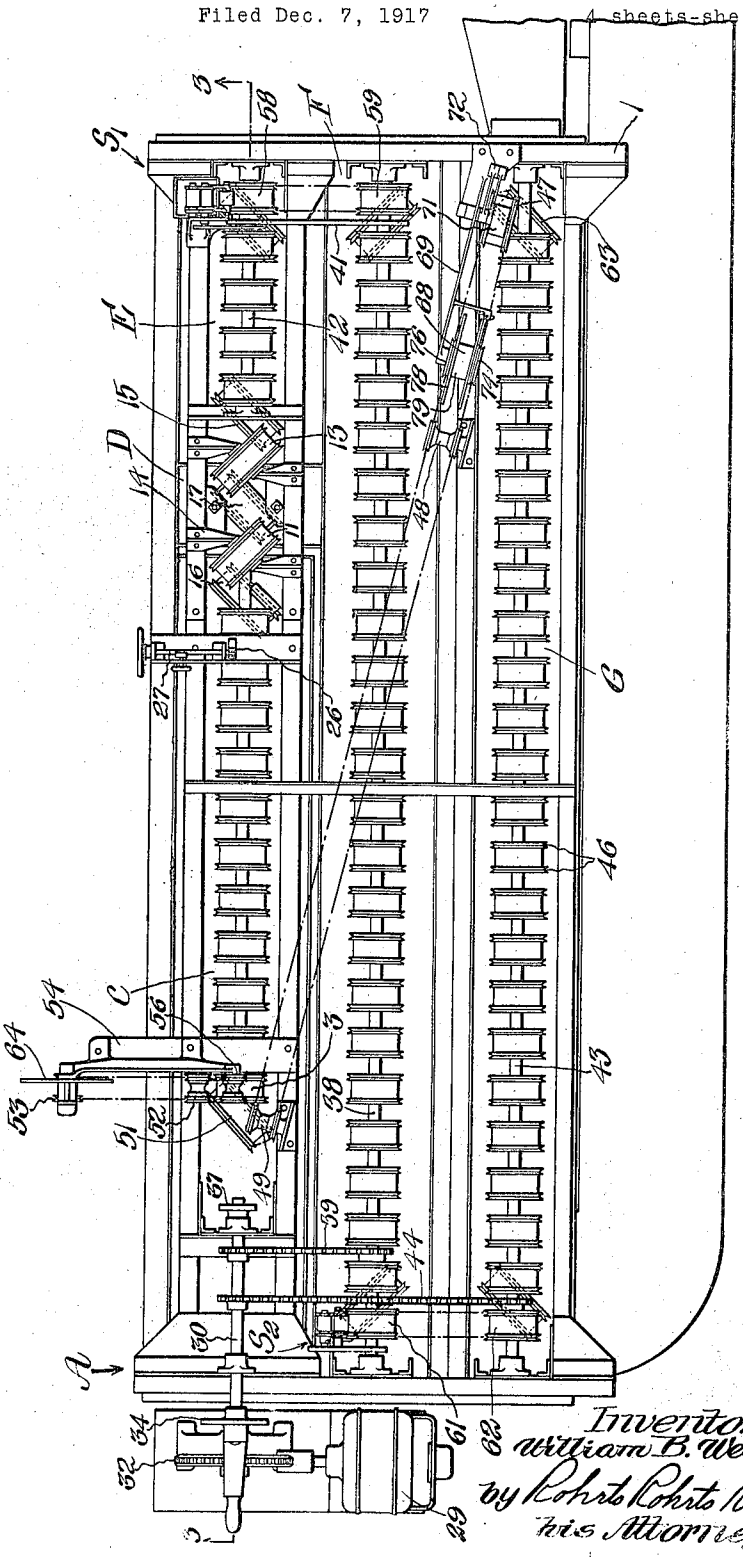


Fig. 1.

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

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Fig. 2.

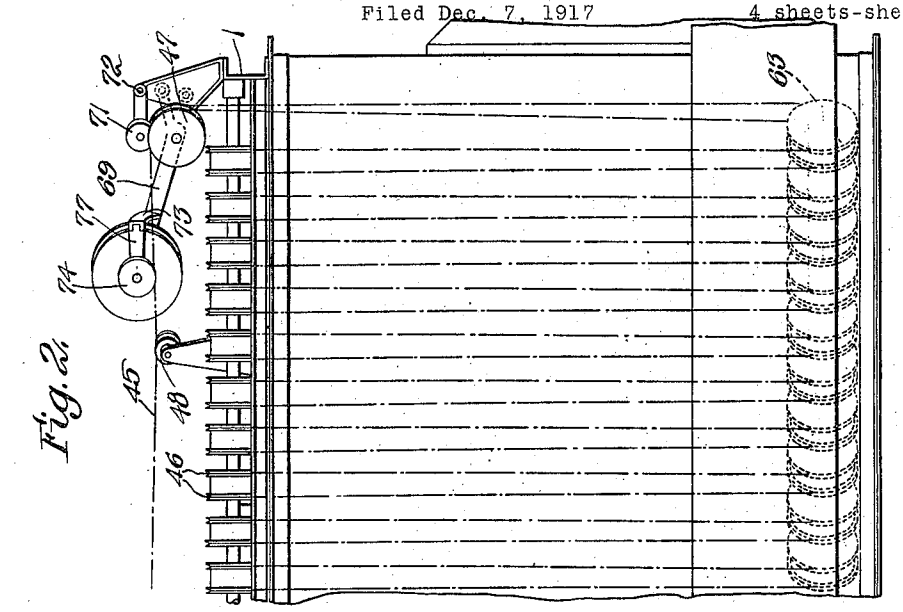
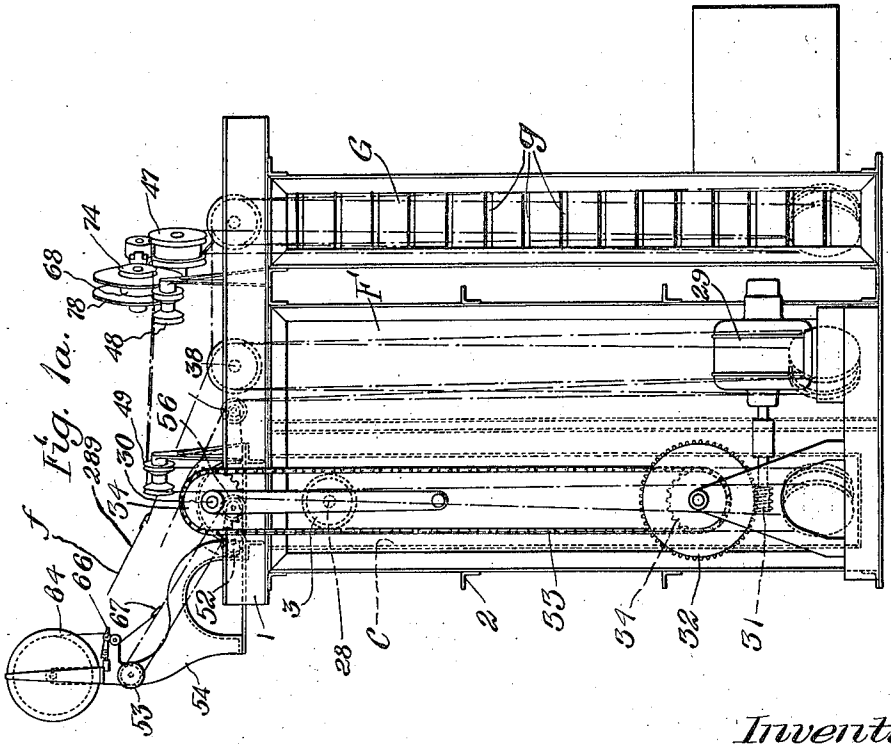


Fig. 1a.



Inventor:
William B. Wescott,
by Rohrs Rohrs Kuchman
by Attorneys.

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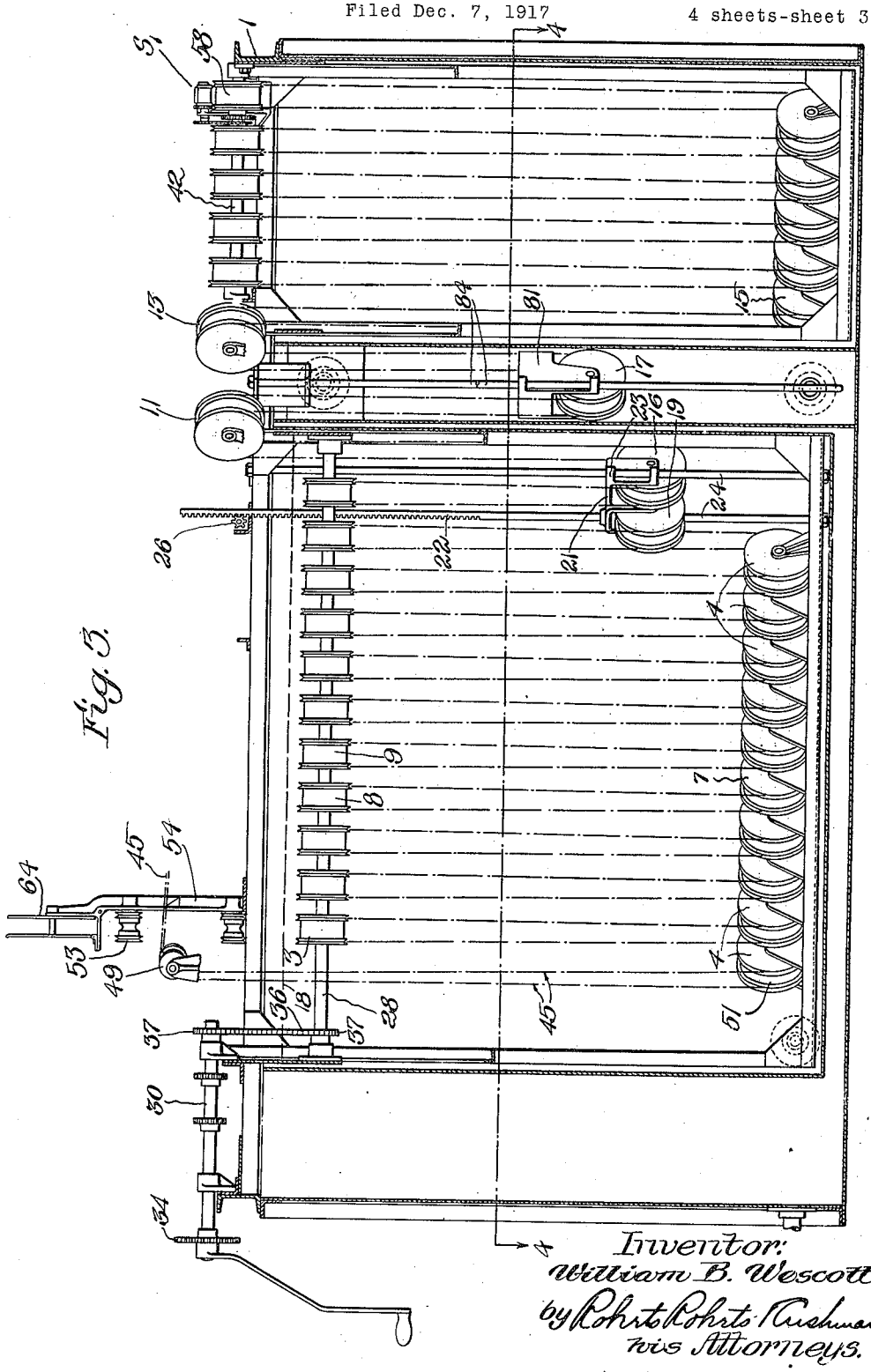


Fig. 3.

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

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W. B. WESCOTT

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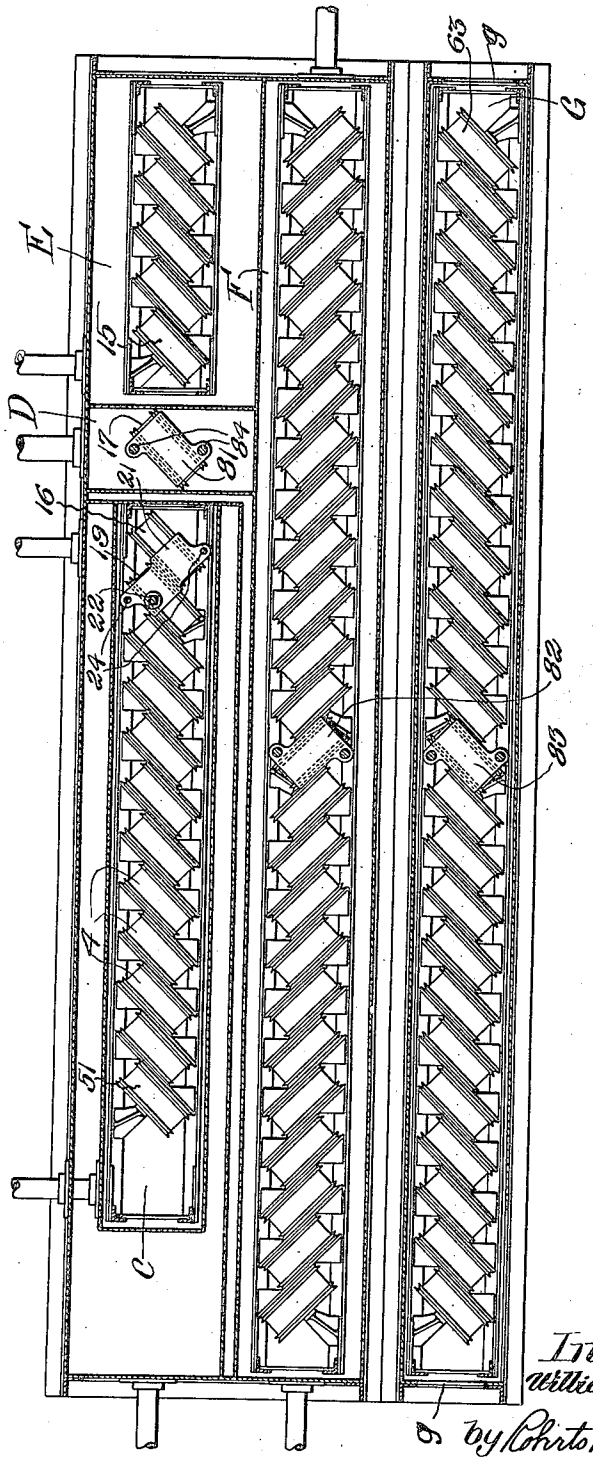


Fig. 4.

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

Patented Feb. 13, 1923. 1,444,818

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.

APPARATUS FOR TREATING CINEMATOGRAPHIC FILMS.

Application filed December 7, 1917. Serial No. 205,999.

To all whom it may concern:

Be it known that I, WILLIAM BURTON WESCOTT, a citizen of the United States, and resident of Wellesley, in the county of Norfolk and State of Massachusetts, have invented new and useful Improvements in Apparatus for Treating 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 developing, fixing, drying or otherwise treating motion picture films or other strips of photographic material.

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. Other objects of the invention are 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, to provide a uniform tension for the film throughout its entire length, to provide means for conveniently regulating the tension of the film, to provide means for quickly and accurately regulating the time of treatment and otherwise to render the machine convenient and reliable.

In the accompanying drawings,—

Figure 1 is a plan view of the apparatus, parts of the apparatus being omitted;

Figure 1ª is a left-hand view of the developing apparatus;

Figure 2 is a front elevation of the right-hand portion of the developing apparatus;

Figure 3 is a vertical longitudinal section of the developing apparatus taken on line 3—3 of Fig. 1; and

Figure 4 is a horizontal longitudinal section of the developing apparatus taken on line 4—4 of Fig. 3.

The particular embodiment of my invention illustrated in the drawings comprises developing apparatus A consisting of a series of tanks or containers C, D, E, F and G, the tank C being intended to contain a developing solution, the container D a water or other washing solution, E a fixing solution, F a water or other washing solution and G a drying fluid such as air suitably conditioned. It is desirable to immerse considerable lengths of the film in the various solutions and also to keep the dimensions of the apparatus down to a minimum. To this end I have provided a series of guides, which are preferably pulleys, in and along each of the containers so that a film may be fed continuously over and around the pulleys along each tank and from one tank to the succeeding tank. I have also so arranged the feeding mechanism that the tanks may be arranged side by side instead of end to end, thereby rendering the apparatus more compact. As shown in Figs. 1 to 3, the respective rows of tanks are spaced apart somewhat and are tied together by means of channel members 1 at their upper ends and each tank is preferably provided with angle irons or other suitable means disposed along its sides to prevent the pressure of the fluid within the tanks from distorting the side walls.

The mechanism for continuously feeding a film through the apparatus preferably consists of a row of pulleys 3 fixedly mounted on a shaft extending longitudinally of the container, either at the top or bottom of each container but preferably at the top as shown in the drawings, and another row of pulleys 4 mounted at the other end of each container, preferably at the bottom of each container, as illustrated. The pulleys 4 in the lower rows are preferably disposed obliquely with respect to the pulleys in the upper row and the two rows are preferably arranged in par-

allelism. As shown in the drawings, the upper pulleys 3 are disposed transversely of the respective containers and the lower pulleys are disposed at an angle of approximately 45° to the transverse plane of the upper pulleys. The pulleys of the respective rows 3 and 4 are so spaced apart and so positioned relatively to each other that one side of each of the lower pulleys is in alinement with one side of one of the upper pulleys while the other side of the lower pulley is in alinement with the other side of the adjacent upper pulley. In Fig. 3 for example, the forward side of the pulley 7 is in alinement with the forward side of the pulley 8, while the rear side of pulley 7 is in alinement with the rear side of the pulley 9. By virtue of this arrangement a film leaving the forward side of one of the upper pulleys extends directly downwardly to the forward side of one of the lower pulleys and from the rear side of the lower pulley the film extends directly upwardly to the rear side of the adjacent upper pulley, whereby a film may be continuously fed through a tank from end to end along a looped path, the film being maintained out of contact with the walls of the tank and the various portions of the film being also maintained out of contact with each other.

The means for transferring the film from one tank to the succeeding tank preferably comprises pulleys such as 11, 13, etc. disposed above the partitions between the respective tanks in oblique relationship to the partitions. For example, the pulleys 11 for transferring the film from the developing tank C to the wash tank D is mounted by means of brackets 14 directly above the adjoining end walls of the tank C and D in approximately perpendicular relationship to the planes of the lower pulleys 16 and 17 in the respective tanks (Fig. 1), the rear side of pulley 11 being in alinement with the rear side of the lower end pulley 16 in the developing tank C, and the forward side of the pulley 11 being directly in alinement with the forward side of pulley 17 in the wash tank D. The row of upper pulleys 3 in the developing tank D are preferably disposed somewhat below the level 18 of the developer in the tank so that the film is completely immersed during its entire travel through the tank. The upper row of pulleys in the fixing tank E, however, are preferably mounted above the tank so that the film passes out of the liquid during its course around the upper end of each of the looped ends of its path through the tank. In the wash tank F and in the drying tank G the upper rows of pulleys are preferably disposed above the tops of the respective tanks in the horizontal plane of the top row of pulleys in tank E.

In order to control the degree of development of the film during its passage through tank C, I provide means for raising and lowering one or more of the pulleys of the lower row 4. In Fig. 3, for example, the last two lower pulleys 16 and 19 are mounted in a frame 21 to the upper side of which is attached a vertical rack bar 22. On the sides of the frame 21 are provided lugs 23 having openings adapted to receive the upright guide rods 24. At the top of the developing tank is provided a pinion 26 in mesh with the rack 22 and a hand wheel (Fig. 1), or other suitable means is connected to the pinion through the medium of a horizontal shaft 27 for reciprocating the pulleys 16 and 19 through the medium of the rack 22, the frame 21 sliding vertically on the guides 24. Inasmuch as the sides of the lower pulleys are in alinement with the sides of the upper pulleys, owing to the oblique disposition of the lower pulleys, the pulleys 19 may be raised any desired extent without causing the film to tend to run off the pulleys. By virtue of the adjustable pulleys 16 and 19, the length of the path through the developing tank may be varied and the degree of development thus controlled without varying the velocity of film travel, it being desirable to maintain the film travel substantially constant so that the treatment in the washing, fixing and drying tanks will be of sufficiently long duration.

In order to propel the film through the series of tanks the pulleys in each of the upper rows are preferably fixedly connected to their respective shafts, while the lower pulleys preferably run idly. The upper shaft 28 in the developing tank is connected to the source of power 29 through the medium of a worm 31, a worm gear 32, a chain 33, sprocket wheels 34, shaft 30, chain 36 and sprocket wheels 37. The upper shaft 38 in the wash tank F is connected to the shaft 30 through the medium of a chain 39 and sprocket wheels on the respective shafts. The upper row of pulleys on shaft 42 in tank E are driven from shaft 38 by means of a chain 41 and sprocket wheels on the shafts 38 and 42, respectively. The upper row of pulleys in the drying tank G, which are fixedly mounted on the shaft 43, are driven by means of a chain 44 and sprocket wheels mounted respectively on shafts 30 and 43.

While the film may be fed over the pulleys in such manner as itself to drive the idler pulleys obliquely disposed in the bottom of the tanks, I preferably provide one or more belts or cables for positively driving the lower idler pulleys from the upper pulleys and for other reasons hereinafter made apparent. The preferred form of the driving means comprises endless belts in the form of cables 45 extending around the pulleys in the upper and lower rows, these belts

preferably being disposed in grooves 46 disposed at one or preferably both of the peripheries of the pulleys. In order to guide the belts 45 from the end of the drying tank to the beginning of the developing tank, guide pulleys 47, 48 and 49 are mounted at the top of the apparatus along the line extending between the said two ends.

Thus the wires 45 pass downwardly over pulley 49 to the forward side of the lower end pulley 51, thence upwardly over the forward side of idler pulley 52, thence to idler pulley 53 mounted on bracket 54, thence to the idler pulley 56 and thence to the end pulley 3 of the upper row of pulleys in the developing tank. The wires then extend around the upper and lower rows of pulleys in the developing tank, travelling along the loop path from one end to the other, passing downwardly on the forward sides of the upper pulleys and upwardly on the rear sides of the lower pulleys. From the right-hand end pulley 16 of the lower row the wires travel upwardly over the rear side of pulley 11, downwardly on the forward side of pulley 11 to the forward side of pulley 17, thence upwardly to the rear side of pulley 13 and thence downwardly to the forward side of the left-hand end pulley 15 of the lower row of pulleys in the fixing tank E. From the right-hand end pulley 58 of the upper row of pulleys in the fixing tank the wires extend to the right-hand end pulley 59 in the upper row of pulleys in the wash tank F. After travelling along the wash tank F from right to left (Fig. 1), the wires extend from the upper left-hand end pulley 61 to the upper left-hand end pulley 62 in the drying tank G. From the rear side of the right-hand end pulley 63 in the lower row in tank G the wires extend upwardly over the pulley 47, thence to the pulley 48 and thence to the pulley 49, thus completing the circuit. When the longitudinal shafts at the tops of the tanks are driven by the motor 29, the wires 45 are caused to travel continuously around the pulleys, thus driving the skewed pulleys at the bottom of the tanks.

The mechanism for supporting the feeding magazine and for feeding film into the apparatus, comprises a magazine holder 64 mounted at the top of the bracket 54 and a suitable tensioning device 66. As shown in Fig. 1a, the film is led downwardly from the feeding mechanism 64 through the tensioning device 66 and is secured to the wires 45 by means of a suitable clip 67 at a point between the idler pulleys 53 and 56. When the wires are put in motion the film is then fed downwardly over idler pulley 56 and the upper end pulley 57 in the developing tank, over the path above traced, namely, through the developing tank C, wash tank D, fixing tank E, thence backwardly through the wash tank F, and thence to the right through drying tank G. As the film comes upwardly out of the drying tank G it is preferably wound upon a take-up reel, such a reel being illustrated at 68 in the drawings. This reel is mounted on a bracket 69 upon which is also mounted the pulley 47 and a pressure pulley 71, the pressure pulley 71 being pivotally mounted at 72 so as to bear upon the film as it passes over the pulley 47. By virtue of the pressure pulley 71, the film continues to be drawn out of the drying chamber, even after the leader clip 67 has been detached from the wires 45. As the forward end of the film emerges from the pulleys 47 and 71 it is detached from the wires 45 and attached to the take-up reel 68. The wires 45 pass beneath the arm 73 on bracket 69 and contact with pulleys 74 and 76 mounted on the pivot arm 77 of the bracket 69 and the disk 78 of the take-up reel, respectively. The pulley 74 may be an idler pulley, but the pulley 76 is connected to the disk 78 of reel 68 and a pin is provided for connecting the disk 78 to the spool 79 when the spool is inserted in the bracket 69 so that the take-up reel 68 is rotated by means of the wires 45, thereby to wind the film upon the take-up reel as it emerges from the drying tank.

In order to control the tension of the film throughout the various tanks, when employing wire belts or cables suitably to tension the cables, and to distribute the tension uniformly throughout the course thereof, I preferably provide floating weights such as illustrated at 81, 82 and 83. As shown in Figs. 3 and 4 these weights comprise frames sliding vertically on upright rods 84 and carrying therebelow certain of the lower obliquely disposed pulleys. For example, the frame 81 carries the pulley 17 in the wash tank D, the pulley thus being supported in a floating manner so that as the tension of the wires increases the pulley is lifted, thereby relieving the tension. The upper surface of the frame 81 is disposed horizontally so that additional weights may be placed thereupon if desired, thereby suitably to control the tension of the belts. While any number of these tension controlling devices may be employed, the devices being distributed uniformly along the respective tanks, I have found that three such devices disposed as illustrated are sufficient for maintaining the tension substantially constant in a machine of the size herein illustrated.

In order to remove the major portion of the fixing solution which clings to the film as it leaves the fixing tank E, I preferably provide squeegee mechanism in the path of the film as it leaves this tank, as shown generally at S. in Figs. 1 and 3.

From the above description it will be ap-

parent that my improved apparatus affords a number of unique advantages. It may be employed either for developing, or otherwise treating and then drying a film or other photographic strip in an expeditious manner and in such a way that the various processes of treatment may be very accurately controlled. By virtue of the wire cables 45 the series of pulleys are uniformly and continuously driven in synchronism so that no portion of the film is subjected to undue tension. Owing to the arrangement of the various rows of compartments in parallelism, together with the improved means for conveying the film from one row to the next row the apparatus is rendered exceedingly compact and convenient. 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 in both developing and dyeing machines. By virtue of the oblique disposition of the pulleys at the bottom of the respective tanks 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 or cable arrangement relieves the tension on the film and affords an exceedingly convenient method of drawing the film through the apparatus. The weights in the various compartments are so constructed and arranged as suitably to tension the belts throughout their entire course. The arrangement of the drying mechanism is uniquely advantageous inasmuch as a current of air or other drying medium may be circulated lengthwise along the elongate drying compartment through perforations *g*, Figs. 1[a] and 4, in the ends of the compartment whereas the film is caused to travel along a looped path substantially in edgewise relationship to the current of air passing through the chamber, thus allowing the drying medium to exert a maximum drying effect upon both sides of the film.

Inasmuch as this mechanism constitutes a separate invention the detailed description thereof is omitted from this patent.

The dyeing machine B and the method of dyeing therewith also constitutes a separate invention the detailed description of which is also omitted from the present patent.

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. Photographic apparatus for treating films comprising a drying chamber having openings at opposite sides thereof to permit the circulation of air therethrough, and means for continuously feeding a film through the chamber with its opposite edges directed towards said sides respectively.

2. Photographic apparatus comprising a chamber, and means for feeding a film through the chamber along a circuitous path, the chamber having openings arranged for circulating a current of fluid through the chamber edgewise of the film.

3. Photographic apparatus comprising an elongate chamber, and means for feeding a film longitudinally through the chamber in a plurality of transverse loops, the chamber having openings arranged for circulating a current of fluid longitudinally through the chamber.

4. Photographic apparatus comprising an elongate chamber, and means for feeding a film longitudinally through the chamber in a plurality of transverse loops so that the edges of the film are directed approximately longitudinally of the chamber, the chamber having openings arranged for circulating a current of fluid longitudinally through the chamber.

5. Photographic apparatus for treating films comprising two or more opposed pulleys having oblique axes and having film engaging surfaces in alinement, whereby a film may be continuously fed to the first pulley, thence to the second pulley, and thence from the second pulley in a plane oblique to the axis of the first pulley.

6. Photographic apparatus for treating films comprising a plurality of opposed pulleys angularly positioned with respect to each other in such manner that a plane through the center of one pulley will intersect the plane through the centers of the adjacent pulleys on either side of the first pulley in lines tangent to opposite sides of the adjacent pulleys respectively.

7. Photographic apparatus for treating films comprising two rows of pulleys disposed substantially in a single plane, the pulleys of one row being arranged at an oblique angle to the pulleys in the other row so that a film moving over the pulleys is progressively advanced along the said rows in loops.

8. Photographic apparatus for treating films comprising pulleys arranged in parallel rows and having their centers substantially in a common plane, and the cooperating pulleys in the respective rows being obliquely arranged with respect to each other so that a film moving over the pulleys is progressively advanced along the said rows.

9. Photographic apparatus for treating films comprising pulleys arranged in parallel rows and having their centers substantially in a common plane, and the cooperative pulleys in the respective rows being arranged at such angles that the opposite sides of each pulley in one row are in alinement with opposite sides of adjacent pulleys in the other

row so that a film moving over the pulleys is progressively advanced along the said rows.

10. Photographic apparatus for treating films comprising two parallel rows of pulleys, the pulleys in one row being arranged in oblique and staggered relationship with respect to the pulleys in the other row, whereby a film moving over the pulleys is progressively advanced along the said rows.

11. Photographic apparatus for treating films comprising pulleys arranged in parallel rows and having their centers substantially in a common plane, the pulleys in one row having parallel axes and the pulleys in the other row having parallel axes oblique to the axes of the first row, the operative surfaces of the pulleys being alined so that a film moving over the pulleys is progressively advanced along the said rows.

12. Photographic apparatus for treating films comprising a row of chambers, pulleys for guiding a film along a circuitous path through each chamber, and a pulley mounted obliquely to the longitudinal line of the chambers for guiding the film from one chamber to the succeeding chamber, whereby a film may be continuously fed through the successive chambers.

13. Photographic apparatus for treating films comprising a row of chambers, pulleys for guiding a picture strip along a circuitous path through each chamber, and pulleys angularly disposed relatively to the longitudinal line of the chambers between the chambers for guiding the film to and from the succeeding chambers, whereby a film may be continuously fed through the successive chambers.

14. Photographic apparatus for treating films comprising a shaft, a series of pulleys mounted on the shaft, a series of pulleys arranged in spaced relation to the shaft, the axis of each of the spaced pulleys being oblique to the axis of the shaft, and means for rotating the pulleys whereby a film may be caused to travel over the pulleys and to progress along a path comprising a series of loops.

15. Photographic apparatus for treating films comprising a row of fluid chambers, means to cause the film to progress through the chambers in transverse loops, and idler pulleys mounted between the chambers in oblique relationship to the longitudinal line of the chambers for continuously guiding the film from the looped path of one chamber to the looped path of the next chamber.

16. Photographic apparatus comprising a series of pulleys arranged along a film path so that a film may travel therealong in a series of transverse loops, a belt extending over the pulleys in driving engagement therewith, and means for driving the belt, thereby to drive the series of pulleys.

17. Photographic apparatus comprising a series of pulleys arranged transversely along a film path so that a film may travel therealong, the pulleys having film-engaging surfaces and separate belt-engaging surfaces, a belt extending over the pulleys in engagement with the belt-engaging surfaces, and means for driving the belt, thereby to drive the pulleys so as to feed a film thereover.

18. Photographic apparatus comprising a series of pulleys arranged transversely in a plurality of rows so that a film may travel continuously thereover, a belt extending successively around the pulleys in the respective rows in driving engagement therewith, and means for driving the belt, thereby to drive the series of pulleys so as to feed a film thereover.

19. Photographic apparatus comprising a series of pulleys arranged in a plurality of rows so that a film may travel continuously thereover, along a looped path, the film extending first around a pulley in one row and then around a pulley in another row progressively along the respective rows, a belt extending successively around the pulleys in the respective rows in driving engagement therewith, and means for driving the belt, thereby to drive the series of pulleys so as to feed a film thereover.

20. Photographic apparatus comprising a series of pulleys arranged in a plurality of rows so that a film may travel continuously thereover, an endless belt extending successively around the pulleys in the respective rows in driving engagement therewith, and means for driving the belt, thereby to drive the series of pulleys so as to feed a film thereover.

21. Photographic apparatus comprising a series of pulleys arranged in a plurality of rows so that a film may travel continuously thereover along a looped path, the film extending first around a pulley in one row and then around a pulley in another row progressively along the respective rows, an endless belt extending successively around the pulleys in the respective rows in driving engagement therewith, and means for driving the belt, thereby to drive the series of pulleys so as to feed a film thereover.

22. Photographic apparatus comprising a plurality of film-treating compartments, a series of pulleys arranged in the compartments in a plurality of rows so that a film may travel continuously thereover, an endless belt extending successively around the pulleys in the respective compartments in driving engagement with the pulleys, and means for driving the belt, thereby to drive the series of pulleys so as to feed a film thereover.

23. Photographic apparatus comprising a plurality of film-treating compartments, a series of pulleys arranged in the compart-

ments in a plurality of rows so that a film may travel continuously thereover, an endless belt extending successively around the pulleys in the respective compartments in driving engagement with the pulleys, the belt contacting alternately with the pulleys in the respective rows and progressing along the rows, means for guiding the belt from the end of the rows back to the beginning of the rows, and means for driving the belt, thereby to drive the series of pulleys so as to feed a film thereover.

24. Photographic apparatus comprising a series of pulleys arranged along a film path so that a film may travel therealong, said pulleys having grooves therein, a belt extending over the pulleys and being disposed in the grooves, and means for driving the belt, thereby to drive the pulleys so as to feed a film thereover.

25. Photographic apparatus comprising a series of pulleys arranged along a film path so that a film may travel therealong, said pulleys having grooves disposed along one side of the peripheries thereof, a belt extending over the pulleys and being disposed in the grooves, and means for driving the belt, thereby to drive the pulleys so as to feed a film thereover.

26. Photographic apparatus comprising a series of pulleys arranged along a film path so that a film may travel therealong, said pulleys having grooves disposed along both sides of the peripheries thereof, a belt extending over the pulleys and being disposed in the grooves, and means for driving the belt, thereby to drive the pulleys so as to feed a film thereover.

27. Photographic apparatus comprising a plurality of film-treating compartments arranged in parallel rows, there being one or more compartments in each row, a series of pulleys arranged in the respective compartments so that a film may be fed along a circuitous path thereover, and an endless belt extending over the pulleys in the respective compartments so as to progress along alternate rows of tanks in opposite directions.

28. Photographic apparatus comprising a plurality of film-treating compartments arranged in parallel rows, there being one or more compartments in each row, a series of pulleys arranged in the respective compartments so that a film may be fed along a circuitous path thereover, and an endless belt extending over the pulleys in the respective compartments so as to progress along alternate rows of compartments in opposite directions, and means for guiding the belt from the end of the last compartment to the beginning of the first compartment.

29. Photographic apparatus for treating films comprising an endless, film-treating belt, a plurality of pulleys arranged to carry the belt continuously therearound, means for yieldingly urging one of the pulleys transversely of the path of the belt, and yielding means engaging the belt for maintaining the tension of the belt not withstanding transverse movement of said one pulley.

Signed by me at Boston, Massachusetts, this 3rd day of December, 1917.

WILLIAM BURTON WESCOTT.