April 2, 1929. J. F. KIENNINGER 1,707,733

WATER AGITATOR

Filed May 27, 1927 3 Sheets-Sheet 1

Fig. 1

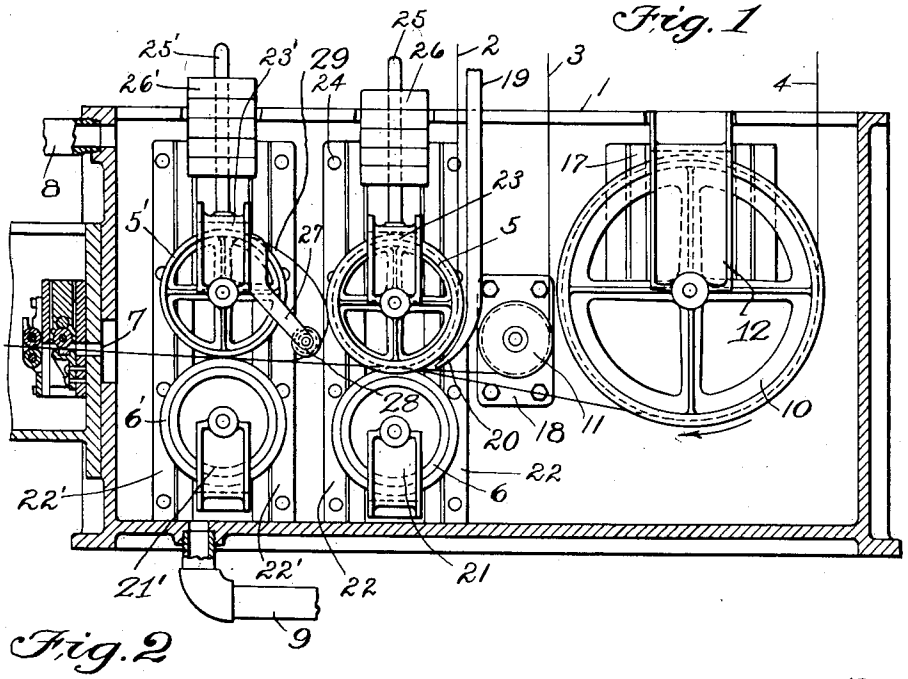


Fig. 2

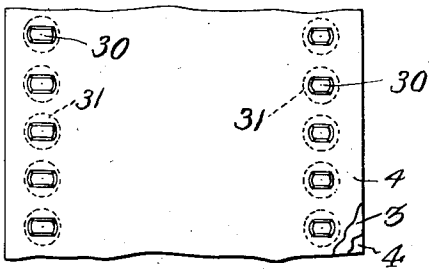


Fig. 3

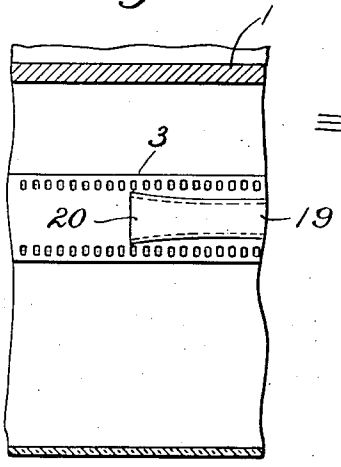
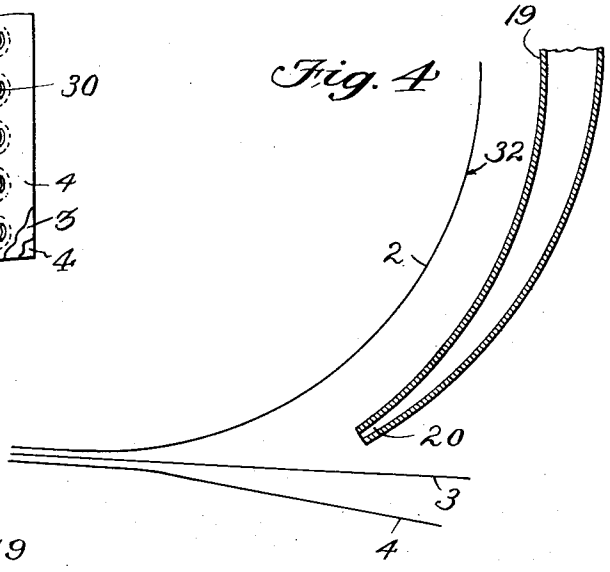


Fig. 4



Inventor
John F. Kienninger
by Robb Cushman & Woodbury,
Att'ys

April 2, 1929. J. F. KIENNINGER 1,707,733

WATER AGITATOR

Filed May 27, 1927 3 Sheets-Sheet 2

Fig. 5.

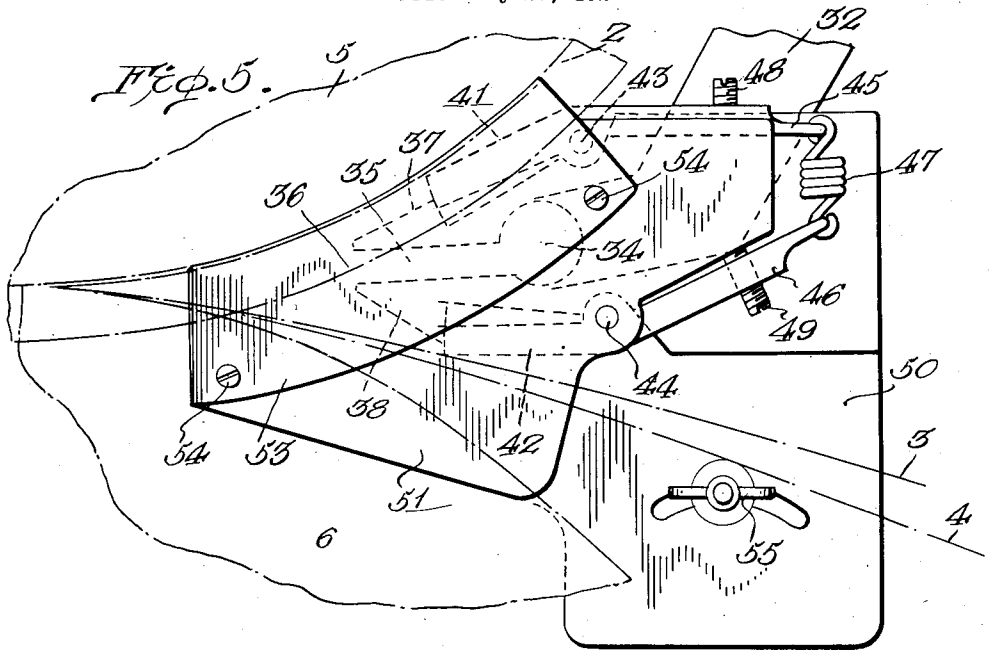
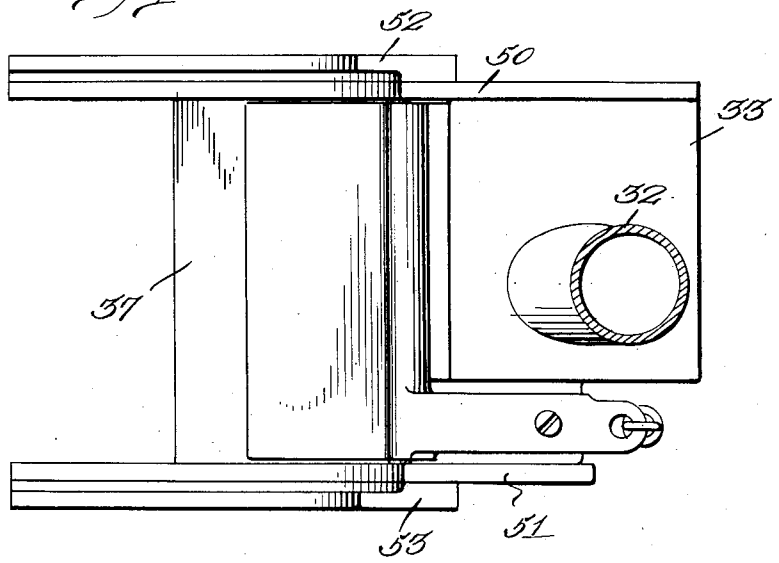


Fig. 6.



Inventor
John F. Kienninger
By Roberts Cushman & Woodbury,
Attorneys

April 2, 1929. J. F. KIENNINGER 1,707,733

WATER AGITATOR

Filed May 27, 1927 3 Sheets-Sheet 3

Fig. 7.

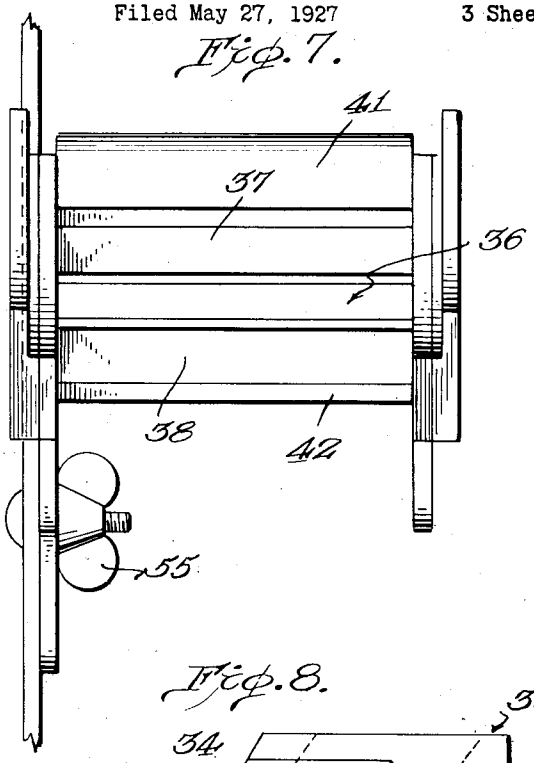


Fig. 8.

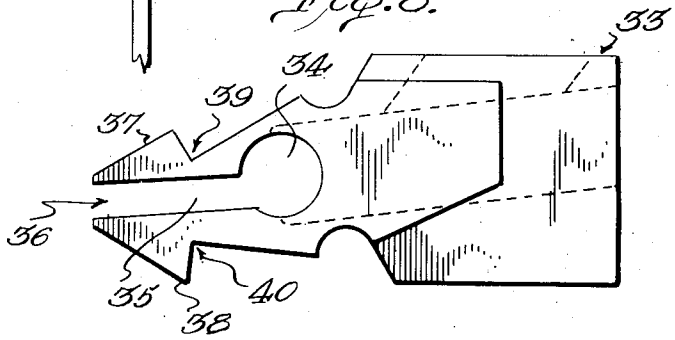
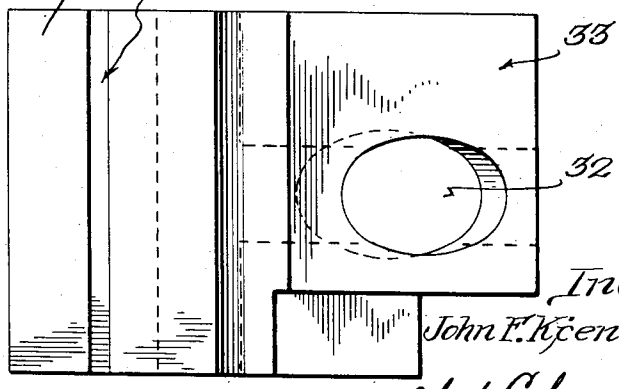


Fig. 9.



Inventor
John F. Kienninger
By Roberts Cushman & Woodbury
Attorneys

Patented Apr. 2, 1929. 1,707,733

UNITED STATES PATENT OFFICE.

JOHN F. KIENNINGER, OF NORTH CAMBRIDGE, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO TECHNICOLOR MOTION PICTURE CORPORATION, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MAINE.

WATER AGITATOR.

Application filed May 27, 1927. Serial No. 194,839.

This invention relates to a method of and apparatus for effecting uniformity of imbibition contact between a matrix and a blank film surface, or the like.

In the printing of cinematographic films by imbibition it is essential that the dye-wet matrix surface shall be contacted uniformly with the blank film to be printed and that the conditions at the interface shall not be interrupted except in so far as to correspond to the irregularities of the matrix image to be transferred.

To facilitate such uniformity of contact it has been proposed (copending patent of Melvin G. Young, No. 1,675,743, granted July 3, 1928) to bring the matrix film and blank film along acutely converging paths and into contact with each other at a point where they are immersed in a surrounding fluid medium, and subsequently to compress the thus registered films into intimate face contact with each other.

In this procedure however it is found that extraneous particles of solid substances or surplus or loosened dye may be present upon the film surfaces, and also that gases may in some instances be absorbed by the surfaces of the contacting films, moreover solid particles or surplus dye or gases may be present in the liquid medium surrounding the contact point and be entrained as the films are rolled together. In either case, the presence of such foreign materials interrupts the uniformity of contact and hence produces irregularities and imperfections in the printed reproduction of the matrix images.

It is therefore an object of this invention to overcome or prevent such imperfections and to provide means for effecting a uniform pressure contact between the film surfaces. It is a further object to provide such contact under conditions which shall assure complete transfer of the dye from the matrix (as by imbibition) into the surface of the blank film. Other objects will be manifest from the following disclosure.

The method of the invention generally includes passing a dye-wet matrix film and a blank film substantially continuously into surface contact with each other, simultaneously maintaining the contacting portion of the film surfaces surrounded or submerged in a suitable liquid (such as water, free from dissolved gases) and providing a vigorous agitation or current of the water adjacent to the contacting portions of the films. The contacting films may be positively pressed together and, if desired, into fixed engagement with a suitable backing or other support.

A specific application of the invention will be described with respect to the printing of cinematographic films, such as gelatin coated celluloid or the like, from matrix films which have been previously wet with suitable dyes. Apparatus suitable for such procedure is shown in the accompanying drawings, in which,

Fig. 1 is a longitudinal cross-section of a tank and apparatus for contacting the films therein;

Fig. 2 is a detail plan view of the films and a suitable carrier or backing strip therefor;

Fig. 3 is a detail plan view, with parts broken away, of the tank, films and agitator;

Fig. 4 is a diagrammatic elevation of the film strips and agitator;

Fig. 5 is an elevational view of a part of Fig. 1 showing a preferred embodiment of the invention with parts removed;

Fig. 6 is a plan view of the nozzle shown in Fig. 5;

Fig. 7 is an end view of the nozzle removed from Fig. 5;

Fig. 8 is a side view of part of the nozzle removed from Fig. 5; and

Fig. 9 is a plan view of the nozzle shown in Fig. 8.

Referring to the drawings, numeral 1 indicates a tank, arranged to receive the blank film 2, matrix film 3 and backing strip 4 to direct the same is converging relationship to pass betwen rollers 5 and 6 and thence between pulleys 5′ and 6′, and to leave the tank at exit 7 while an overflow is provided at 8 and a drain at 9. The backing strip 4 is guided by pulley 10 and the matrix film by fixed pulley 11. Pulley 10 is conveniently mounted in a bearing 12 sliding between the vertical ways 17, while pulley 11 is attached to the fixed mounting 18 on the inner side of the tank. The blank film 2 is guided by the pulley 5. Between the films 3 and 2, and curved substantially parallel to the latter is provided a water inlet 19, with a tapered outlet at 20 above the upper (printing) surface of the

matrix film 3 and adjacent to the line of contact in which the films meet as they pass into the nip between rollers 5 and 6.

Roller 6 is mounted in permanent bearings 21, while roller 5 is mounted in bearings 23, adapted to slide vertically between guideways 22 attached to the side wall of the tank by screws 24. The upper part of the bearing carries a post 25 and adjustable weights 26 thereon.

Likewise, roller 6′ is mounted in bearings 21′ and pulley 5′ in the bearing 23′ sliding in the guideways 22′. The upper bearing also has a post 25′ and weights 26′ and at one side a projecting arm 27 with roller 28 thereon and a flexible perforated metal band 29 surrounding both roller 5′ and roller 28.

The backing strip 4 has parallel rows of upwardly projecting teeth 30 adjacent to the margins and spaced apart to correspond to the sprocket holes 31 in the films 3 and 2 respectively, as shown in Fig. 2.

In operation, the tank is first filled with water to a level even with overflow pipe 8. The water is preferably as pure as may be possible, free both from solid particles and also from occluded or dissolved gases or liquids, and is kept in constant circulation through the tank. The metal backing strip 4 (of which the portion shown may be only a part of a continuous belt) is passed, in the direction of the arrow around pulley 10, and thence between rollers 5, 6 and between rollers 5′, 6′, being received between the faces of the rollers which are suitably shaped to closely fit the backing and teeth thereon. The matrix film 3 is led downwardly under pulley 11, its sprocket holes brought into registry with the teeth of the belt 4 and thence upon the belt (its sprocket holes engaging the teeth upon the backing strip) into the nip of rollers 5, 6.

The blank film 2, having perforations corresponding to those in matrix film 3, is then led around pulley 5 and into registry with the matrix film 3 and its sprocket holes into engagement with the teeth upon the backing strip 4 and directly between the rollers 5, 6. The backing 4, the matrix 3, and blank film 2, in registered relationship, pass between the compression rollers 5, 6, and are thereby contacted and almost simultaneously compressed into firm engagement and intimate surface contact with each other.

The films and belt are continued in their movements along the paths indicated while a continuous current of water, preferably pure and gas free and, if desired, at a predetermined temperature, is conducted through pipe 19 and directed through outlet 20 against the upper surface of the matrix film 3. The water jet is preferably under appreciable pressure and directed closely adjacent to the point at which the films are effectively contacted with each other. It also impinges upon the under surface of the blank film 2, and thus serves to clear both of the contacting surfaces and to effect a complete and uniform water-wetting of both films just before they come together. This also conditions the two surfaces for uniform imbibition of dye from the one to the other. More especially is this effective to dislodge and remove impurities, both solid and gaseous, from the central portion of the film surfaces.

The films, as thus brought into registered contact and in engagement with the backing strip, are next conducted between rollers 5′, 6′, the flexible perforated metal band 29 fitting between and around the rows of teeth 30 and pressing the films more closely together and more firmly into engagement with the backing, and at the same time expelling any accumulations of extraneous materials along the margins of the films. A similar pair of rollers and flexible perforated metal band may be provided outside and beyond the water tank for still further urging the films together and assuring accurate and continuous contact therebetween.

In the modified form of apparatus shown in Figs. 5 to 9, in which like numerals indicate like parts, the nozzle 20 includes a pipe 32 leading through a solid nozzle head 33 to a transverse passage 34 which in turn opens through a transverse slit 35 to the outlet opening 36. The nozzle head 33 is substantially equal in width to the width of the film or to the space between the flanges on pulley 5. The upper and lower surfaces 37, 38 of the head taper toward the opening 36 and are provided with recesses 39, 40 respectively in which rest flapper plates 41, 42 hinged at 43, 44, with their opposite end portions 45, 46, joined together by a spring 47 and provided with set screws 48, 49. On either side of the nozzle head are provided filler plates 50, 51 corresponding to the thickness of the flanges on pulley 5 and side plates 52, 53 upon the spacing plates and projecting above and below, but fitting closely adjacent to the sides of pulleys 5 and 6. These filler plates and side plates are held in position on either side of the nozzle head by rivets or machine screws 54. The whole may be secured to the side of the tank, as by an adjustable wing nut 55.

As thus arranged, it is to be observed that the nozzle may be introduced between the blank and matrix films 2, 3 so that the blank film 2 passes over the upper flapper plate 41, slightly depressing the same into its recess 39 against the tension of spring 47 when a splice or irregularity in the film passes. Ordinarily a slight clearance of about .005 is maintained. The matrix film 3 and backing 4 likewise pass over the lower flapper plate 42, pressing the same into recess 40 likewise against operation of spring 47 when splices or irregularities of the film pass.

Thus between the upper surface 37 and blank film 2 and between the lower surface 38 and matrix film 3 are formed very narrow spaces which extend across the film surface and are substantially closed by the flapper plates and by the side plates 52, 53, and by the line of contact of the film in front of the nozzle. When the liquid such as water is now supplied through pipe 32, under pressure, it expands into a wide thin sheet as it passes out through opening 36, impinges against the films at their line of contact and, due to its confinement, sweeps back along the surfaces of the films 2 and 3, past the restriction of the flappers 41, 42, in a thin, confined sheet, and thence into the main volume of liquid in the tank 1.

When fastening members upon either of the films or irregularities from any cause reach the nozzle, they may depress the flappers temporarily and pass by freely, without binding and without necessitating a permanently wide opening. In this way a relatively constant and rapid sheet of water surges over the surface of each of the films just before they come into actual surface contact. Moreover, absolutely fresh water is maintained at the contact point, it being impossible for any of the surrounding polluted water to enter the restricted contact area. The opposed directions of the films and the jets of water passing over them increases the cleaning effects upon the film surfaces.

I claim:

1. Method of effecting intimate contact of films or the like, as in imbibition printing, which comprises leading the same along converging paths into face contact with each other, immersing the films in a liquid medium adjacent to the contacting portion of the film surfaces, and agitating the liquid medium.

2. Method of effecting contact of films or the like, as in imbibition printing, which comprises leading the same along converging paths into line contact with each other, advancing the line contact longitudinally of the film, immersing the films in a liquid medium adjacent to the contacting portion of the film surfaces, and maintaining agitation of the liquid medium.

3. Method of effecting contact of films or the like, as in imbibition printing, which comprises leading the same along converging paths into line contact with each other, advancing the line contact longitudinally of the film, immersing the films in a liquid medium adjacent to the contacting portion of the film surfaces, and directing a stream of the liquid medium toward the line contact of the films.

4. Method of effecting contact of films or the like, as in imbibition printing, which comprises leading the same along converging paths into line contact with each other, advancing the line contact longitudinally of the film, immersing the films in a liquid medium adjacent to the contacting portion of the film surfaces, and directing a stream of the liquid medium toward the line contact of the films and thence against the surfaces of the films approaching the line of contact of the films.

5. Method of effecting contact of films or the like, as in imbibition printing, which comprises leading the same along converging paths into line contact with each other, advancing the line contact longitudinally of the film, immersing the films in a liquid medium adjacent to the contacting portion of the film surfaces, and directing a stream of the liquid medium toward the line contact of the films and thence against the surfaces of the films approaching the line of contact of the films in a direction opposed to the direction of movement of the films.

6. Method of effecting contact of films or the like, as in imbibition printing, which comprises leading the same along converging paths into line contact with each other, advancing the line contact longitudinally of the film, immersing the films in a liquid medium adjacent to the contacting portion of the film surfaces, and directing a stream of the liquid medium toward the line contact of the films and directing a current of the liquid against said film surfaces prior to their line of contact and thence in opposition to the direction of movement of the films.

7. Method of effecting contact of films or the like, as in imbibition printing, which comprises leading the same along converging paths into contact with each other, providing a liquid medium surrounding the films adjacent to the contacting portion of the film surfaces, and maintaining agitation of the liquid medium, and effecting compression contact between the films.

8. Method of effecting contact of films or the like, as in imbibition printing, which comprises leading the same along converging paths into contact with each other, providing a liquid medium around the films adjacent to the contacting portion of the film surfaces, maintaining agitation of the liquid medium, and effecting compression contact of said films with each other and against a backing strip.

9. Apparatus for effecting the intimate contact of films or the like, comprising means for leading the films into face contact with each other, means for retaining a liquid medium between the contacting areas of the films and means for agitating the liquid medium against the films adjacent to the contacting portions thereof.

10. Apparatus for effecting the intimate contact of films or the like, comprising means for leading the films into face contact with

each other, means for retaining a liquid medium between the contacting areas of the films and means for directing a current of the liquid medium against the films adjacent to the contacting portions thereof.

11. Apparatus for effecting the intimate contact of films or the like, comprising means for leading the films along converging paths into line contact with each other, means for retaining a liquid medium between the contacting areas of the films and means for directing a current of the liquid medium against the films adjacent to the contacting portions thereof.

12. Apparatus for effecting the intimate contact of films or the like, comprising means for leading the films into face contact with each other, means for retaining a liquid medium between the contacting areas of the films and means for directing a current of the liquid medium, means for guiding the current toward the line of contact of the films and thence rearwardly along the surfaces of the films in a direction opposed to the direction of movement thereof.

13. Apparatus for effecting the intimate contact of films or the like, comprising means for leading the films into face contact with each other, means for retaining a liquid medium between the contacting areas of the films and means for directing a current of the liquid medium, means for guiding the current toward the line of contact of the films and thence rearwardly along the surfaces of the films in a direction opposed to the direction of movement thereof, and flexible means retaining said current closely against the surface of the films but yieldable to irregularities of the film surface.

14. Apparatus for effecting the intimate contact of films or the like, comprising means for leading the films into face contact with each other, means for retaining a liquid medium between the contacting areas of the films and means for agitating the liquid medium against the films adjacent to the contacting portions thereof, and means for compressing the films together upon contact.

15. Apparatus for effecting the intimate contact of films or the like, comprising means for leading the films into face contact with each other, means for retaining a liquid medium between the contacting areas of the films, and means for directing a current of the liquid medium against the films adjacent to the contacting portions thereof, and means for effecting pressure contact between said surfaces at the line of contact.

16. Apparatus for effecting the intimate contact of films or the like, comprising means for leading the films into face contact with each other, means for retaining a liquid medium between the contacting areas of the films, means for introducing into contact area fresh liquid medium, means for leading the liquid away from the contact area and for preventing used liquid from entering the contact area.

Signed by me at Boston, Massachusetts, this sixth day of May, 1927.

JOHN F. KIENNINGER.