May 8, 1928. 1,669,394

C. ELLIS ET AL

PROCESS FOR TREATING FILMS

Filed Dec. 16, 1921 3 Sheets-Sheet 1

Fig. 1.

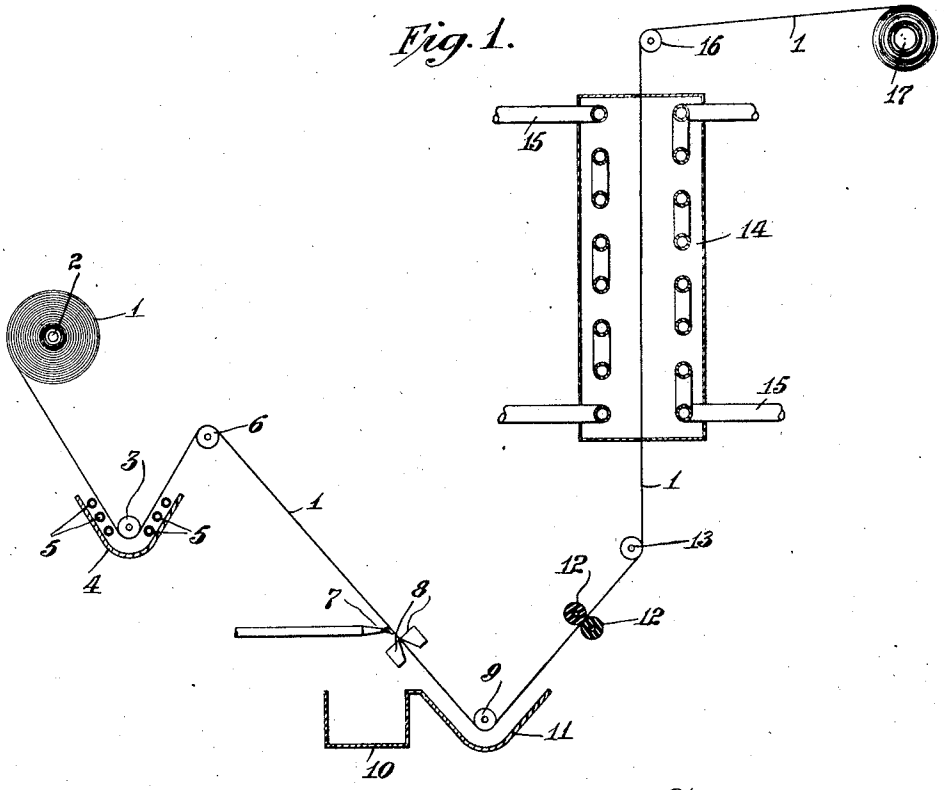
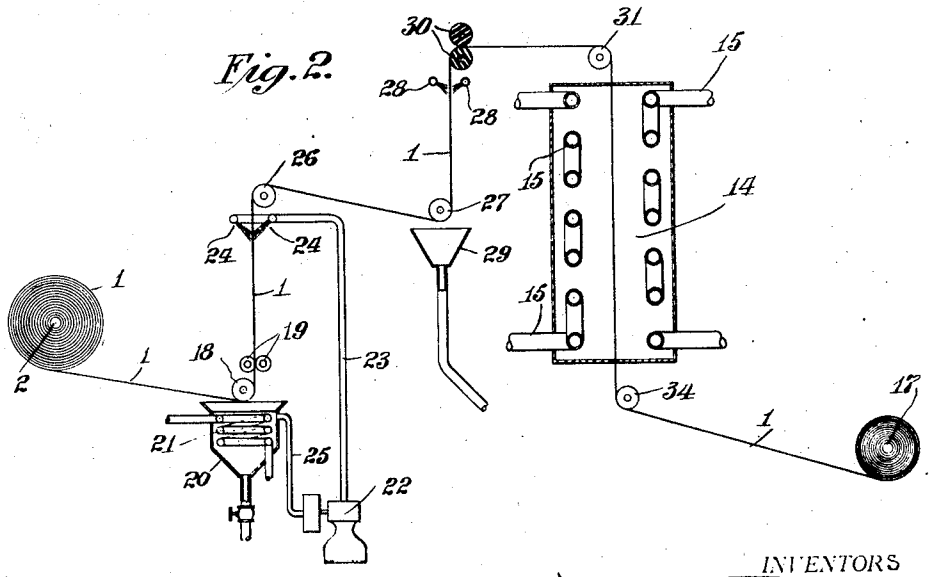


Fig. 2.



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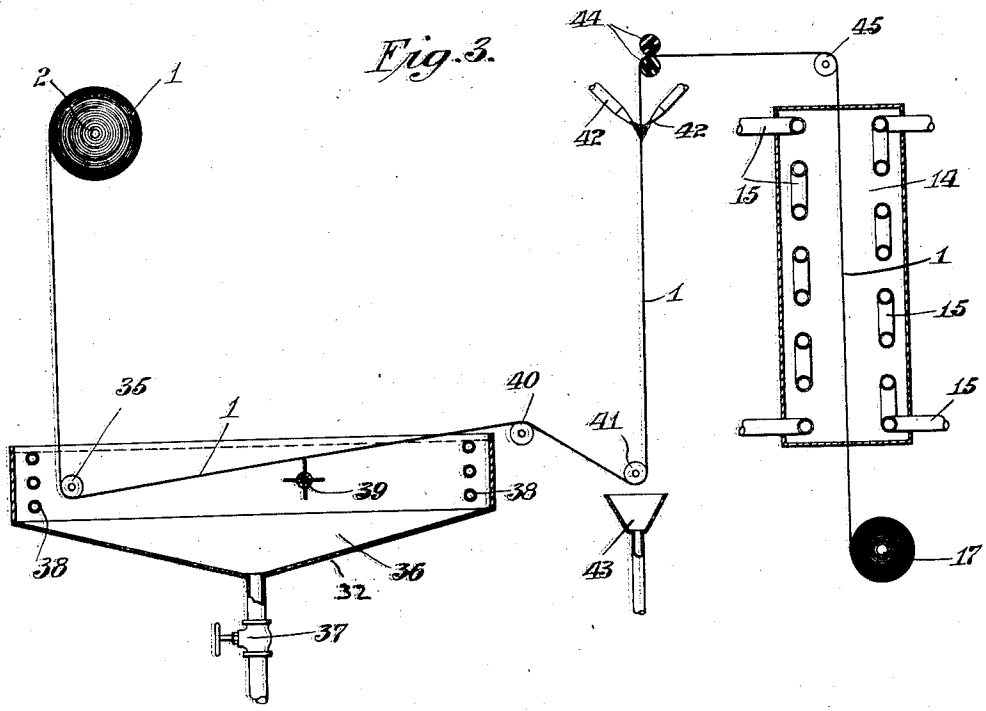
May 8, 1928. 1,669,394

C. ELLIS ET AL

PROCESS FOR TREATING FILMS

Filed Dec. 16, 1921 3 Sheets-Sheet 2

Fig. 3.



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PROCESS FOR TREATING FILMS

Filed Dec. 16, 1921 3 Sheets-Sheet 3

Fig. 4.

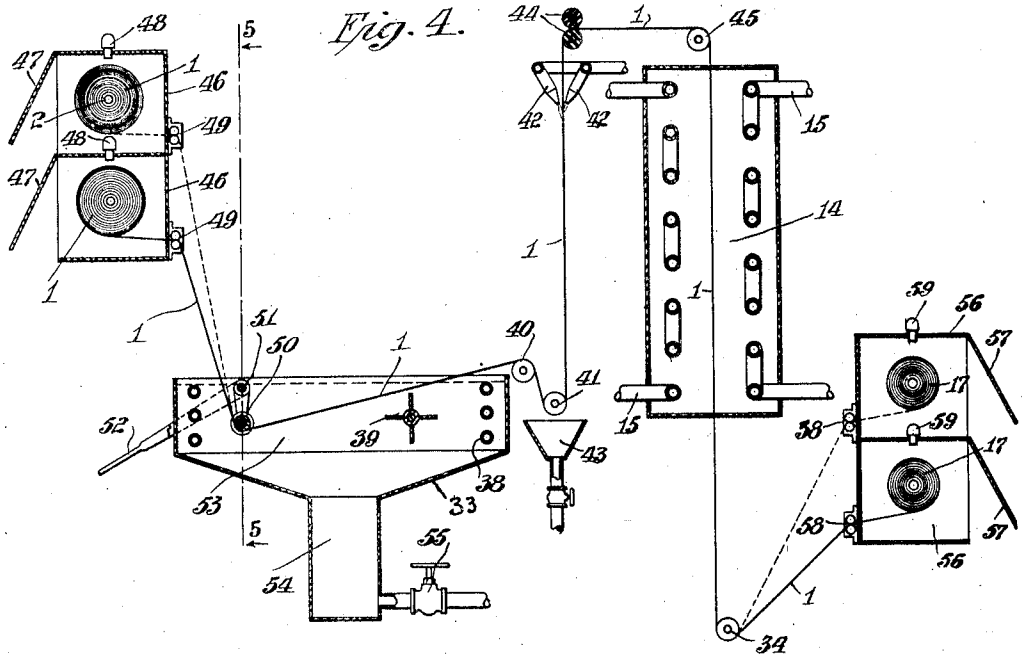
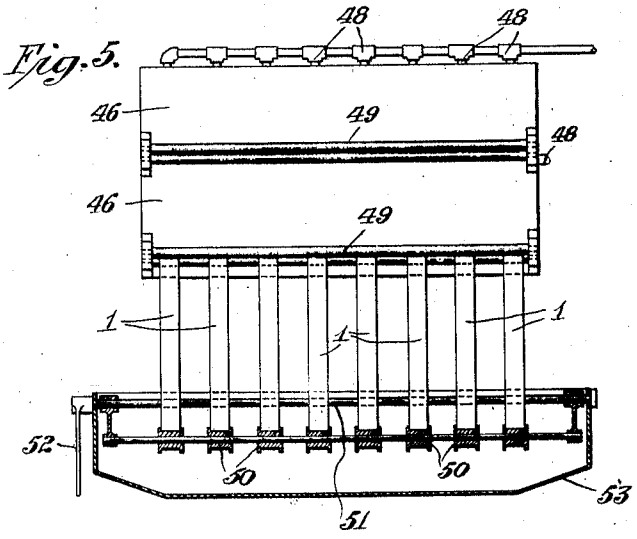


Fig. 5.



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UNITED STATES PATENT OFFICE.

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PROCESS FOR TREATING FILMS.

Application filed December 16, 1921. Serial No. 522,915.

This invention relates to a process of treating moving picture film and other photographic film to remove the emulsion therefrom whereby the silver contained therein may be recovered and the nitrocellulose film basis utilized in various ways and also relates to apparatus adapted for carrying out such process.

The process involves primarily a continuous method of feeding film such as used moving-picture film through a zone where it is subjected to a moistening treatment, preferably an alkaline solution preferably hot in order to soften and dislodge the gelatin coating and after the latter has been suitably removed by rubbing, brushing, squeezing or similar treatment, washing off any of the alkaline material which may have been used as the softening liquid and thereupon drying such film, the entire operation preferably being conducted continuously under conditions minimizing the fire risk or hazard to a substantial degree.

The invention will be illustrated by reference to the appended drawings in which Figure 1 shows in vertical section an apparatus which is adapted for carrying out the foregoing process. Figure 2 shows also in vertical section a modified form of the apparatus. Figure 3 also shows in vertical section still another modification of the apparatus and in Figure 4 further details are furnished of such apparatus, the latter drawing being a vertical section. Figure 5 is a section along the line 5—5 of Figure 4 and shows the feed end of the apparatus including the feed boxes from which the film is delivered to the moistening trough.

In Figure 1 No. 1 represents the film, 2 being the shaft on which the reel of film is mounted. 3, 6, 9, 13, 16 are roller guides for the film. 4 is the trough or vat for the moistening liquor which is heated by heating coil 5. 7 is a water jet to wash the silver emulsion away as it is removed by scrapers 8, 10 being the receiving tank for the water containing the silver and gelatin. 11 is a trough or vat for the wash waters used for washing the film free of any alkaline softening liquor which may still adhere to the film. 12 is a pair of wringers for removing the excess of water carried by the film, 14 being a hot box containing steam coils 15 for drying the film, 17 being the take-up reel for the cleaned film.

In operating the process using the above described apparatus the reel of film to be cleaned is mounted on the shaft 2 and is then passed over the various guide rollers as shown in Figure 1. The alkaline softening liquor is then introduced into trough 4 and heated to a temperature of 85–90° C. The film is then made to pass slowly, i. e. about 20 ft. per minute through the bath, the silver, gelatin and the majority of the softening liquors adhering to the film being removed by the scrapers and water jet. The film is then washed by passing through the washing trough and the greater portion of the water carried out of the trough by the film is removed by the wringers. The almost dry film then passes through the hot box where it is thoroughly dried and is then wound on the take-up rolls.

In Figure 2, No. 1 represents the film, 2 being the shaft on which the feed reel of film is mounted. 18, 26, 27, 31, 34 are guide rolls for the film. 19 is spreading rolls to insure an even distribution of the softening liquors over the surface of the film. 20 is the storage and feeding tank for the softening liquor which is heated by the heating coil 21. The softening liquor passes from the feed tank through pipe 25 to centrifugal pump 22, where it is pumped through outlet pipe 23 to jets 24. 28 is a wash water jet, 29 being the receiving tank, having an outlet, for the waste wash waters. 30 are wringer rolls for removing the majority of water being carried by the film. 14 is a hot box containing steam coils 15 for drying the cleaned film. 17 is the shaft on which the take-up reel for the cleaned film is mounted.

In carrying out the process in accordance with Figure 2 the film to be cleaned is passed over the various guide rolls as shown. As the film is made to pass slowly over the various rolls the hot alkaline softening liquor for example 2% caustic soda solution is forced by means of the pump through the jets out on the surface of the film and thereby removing the silver containing coating. The liquor containing the silver is returned to the receiving and feed tank where the silver settles, the clear liquor being again pumped through the jets. In this

manner the caustic solution is used over and over again, the strength of the liquor being maintained by the addition of caustic soda. The temperature of the caustic soda solution in the feed tank is maintained between 85 and 95° C. depending upon the temperature of the surrounding atmosphere in order that the temperature of the solution on passing through the jets should be in the neighborhood of 85–90° C. The film then passes over the succeeding guide rollers to the washing jets where it is thoroughly washed with water in order to remove the small amount of caustic liquor adhering to the film. The wash water passes away to the wash water receiving vessel. The clean film then passes through wringers which remove the greater proportion of the water carried by the film and is then passed through the hot box, thoroughly dried and is finally wound on the take-up reels.

In Figure 3 No. 1 represents the film, 2 being the shaft on which the reel of film to be cleaned is mounted. 35, 40, 41, 45 are guide rollers. 36 is the tank or vat containing the cleaning or softening liquor 32, having valve 37, the liquor being heated by means of heating coils 38. 39 is an agitator which serves to throw the hot cleaning liquor against the emulsioned side of the film. 42 are water jets for washing the film free from any softening liquor which may adhere to it, 43 being the receiving tank for the wash waters. 44 are wringer rolls for removing most of the water carried by the film. 14 is a hot box for completing the drying of the film containing steam coils 15. 17 being a shaft upon which the cleaned film reel is mounted.

In the operation of the process in accordance with Figure 3 the reel of film to be cleaned is mounted as shown and the film fed over and under the various guide rollers and attached to the take-up shaft. A 2% solution of caustic soda is introduced into the tank 36 and is heated to 85–90° C. The agitator is then rapidly revolved at for example 400 R. P. M. and in this manner the hot caustic soda solution is thrown against the emulsioned surface of the film, the gelatin and silver being washed away. The cleaned film carrying a small quantity of caustic soda solution passes on to the washing jets where the film is washed by forcing either hot or cold water through the washing jets onto the surface of the film, the wash water running down the film and passing away through the wash water receiving tank. The film then passes through the wringer rolls by means of which the greater excess of water is removed and then passes through the hot box where the last traces of moisture are evaporated from the surface of the film. It then passes on to the take-up reel of cleaned film.

In the drawing Figure 4 No. 1 is the film, 2 being the shaft on which the reel of film to be cleaned is mounted. 46 is a steel magazine having a hinged cover 47, safety rollers 49, and sprinkler system 48. 50 is a movable guide roller associated with a tripping arm 52. 51 is the shaft upon which the tripping arm is mounted. 33 is a tank or vat containing the aqueous softening liquor 53 which is heated by means of heating coils 38. The tank 33 has a settling chamber 54 and valve 55. 39 is an agitator, 42 being the wash water jets. 43 is the tank for catching the waste wash waters. 40, 41, 45, 34 are guide rollers. 44 are wringer rolls for removing most of the water adhering to the film. 14 is a hot box containing steam coils 15 for thoroughly drying the film. 56 is a steel magazine having hinge cover 57 with safety rolls 58 and sprinkler system 59. 17 is the shaft upon which the reel of cleaned film is taken up.

Figure 5 is a cross section along the line 5—5 of Figure 4. 1 is the film, 46 is the magazine containing the reels of film to be cleaned. 48 is a manifold for the sprinkler system in case of fire etc. 49 are the safety rollers. 50 are the guide rollers immersed in the hot aqueous cleaning solution. 52 is the tripping arm for raising the guide rollers clear of the solution when first threading the film over the various guide rollers and 51 is the shaft on which the tripping arm and guide roller arms are mounted.

In the operation of the process using the apparatus as illustrated in Figures 4 and 5, 8 reels of film to be cleaned are mounted on shaft 2 in one of the magazines as shown in the drawing. The film is fed through the safety rolls 49 under guide roll 50. In order to eliminate the necessity of passing the film under the guide roller while it is immersed in the hot feeding medium, the roller is raised by means of the tripping arm clear of the solution. The film is then passed over guide roller 40, under guide roller 41, through wringer rolls 44, over guide roller 45, under guide roller 34 through safety rollers 58 and attached to the take-up reel. The caustic soda solution is first heated to 85–90° C. and the film lowered into the hot solution by raising the tripping arm. The covers of both magazines are then closed and the film is passed slowly by means of suitable driving device through the various steps of the process. The agitator is then revolved at about 400 R. P. M. and in this manner the hot aqueous alkaline solution is thrown against the surface of the film removing the silver containing emulsion. The film then passes on to the wash water jets where it is washed free of any caustic liquors which may have been carried by the film mechanically, the waste wash water passing into the wash water receiving tank, the wash wa-

ter being preferably hot in order to prevent coagulation and thereby interfere with the removal of any small quantity of gelatin which may have adhered to the film. The film then passes through wringer rolls 44 where the greater proportion of moisture is removed and over the guide roll 45. It then passes through the hot box where any moisture remaining on the film is removed by evaporation, and then passes through the safety rollers onto the take-up reel. When the supply of film to be cleaned on the first reel is almost exhausted a fresh supply of film is placed in the second magazine and is attached to the end of the film from the first magazine by any suitable means such as clips, film cement etc. In this manner the necessity of re-threading the film over the various rolls and thereby preventing the continuity of the process is overcome. The shaft on which the exhausted reels of film were mounted is recharged with additional reels of film to be cleaned and these in turn attached to the end of the reels of film in the second magazine as fast as they become exhausted. On the take-up side of the apparatus, as the reels become of any desired size the film is cut and attached to the second take-up reel. The shaft upon which the filled take-up reels are mounted is removed from the magazine, the cleaned film removed from the shaft and the shaft replaced in the magazine ready for the film to be attached when the reels of film on the second shaft have attained the desired size.

In case the film outside of the magazine is accidentally ignited through any cause whatsoever the safety rolls 49 and 58 prevent the film from burning back to the feed or take-up reels and as an added precaution the springler system for drenching the reels in the magazine is provided. In this manner the fire risk or hazard is minimized inasmuch as only the film which might be passing from the feed magazines to the alkaline softening liquor and that film passing from the wringer through the hot box to the take-up magazine could burn.

By constructing the hot box of steel which is suitably heat insulated by means of any suitable insulating material the fire risk could be further reduced. We do not wish to limit ourselves to the use of a hot alkaline solution as the emulsion can also be removed by the use of steam, boiling water, a hot salt solution, a hot acid solution etc. We have found however that in using boiling water or steam there is a certain amount of shrinkage of the film depending upon the length of time that the film is subjected to the high temperature involved by the use of boiling water which is objectionable when the film is to be resensitized and used for the manufacture of motion picture film. However, when the film is to be used for other purposes such as lacquers, artificial leather coatings, etc., the shrinkage of the film is immaterial.

What we claim is:—

1. The process of recovering moving picture film which comprises passing the film through a moistening zone whereby it is exposed to the action of hot slightly alkaline aqueous medium, stripping the softened gelatin from its celluloid support, washing the stripped film free from alkaline substances and passing said film through a drying chamber, the foregoing steps being carried out in a continuous manner.

2. The process of recovering moving picture film which comprises passing the film through a moistening zone whereby it is exposed to the action of hot slightly alkaline aqueous spray, stripping the softened gelatin from its celluloid support, washing the stripped film free from alkaline substances and passing said film through a drying chamber, the foregoing steps being carried out in a continuous manner.

3. The process of recovering moving picture film which comprises passing the film through a moistening zone whereby it is exposed to the action of hot aqueous detergent liquid, stripping the softened emulsion from its support, washing the stripped film and passing the latter through a drying chamber, the foregoing steps being carried out in a continuous manner.

4. The process of recovering moving picture film which comprises continuously passing the film through a moistening zone wherein it is exposed to the action of hot water in order to soften and dislodge the gelatin coating, stripping the moistened and softened film from its celluloid support, and then passing the support through a drying chamber.

5. The process of treating moving picture film to separate the gelatin emulsion from the film support which comprises continuously passing the film through a moistening zone wherein it is sprayed with hot aqueous solution in order to soften and dislodge the gelatin coating, removing the softened emulsion, washing the film support and passing the wet support through a drying chamber.

6. The process of treating moving picture film to separate the gelatin emulsion from the film support which comprises continuously passing the film through a moistening zone wherein it is sprayed with hot aqueous alkaline solution in order to soften and dislodge the gelatin coating, removing the softened emulsion, washing the film support and passing the wet film through a drying chamber.

7. In the continuous process of treating moving picture film to remove the emulsion, the steps which comprise spraying the

film with a hot aqueous solution at a temperature approximately between 85 and 95° C. in order to soften and dislodge the gelatin coating and removing the softened coating by the impact of a spray of hot water.

8. In the continuous process of treating moving picture film to remove the emulsion, the steps which comprise spraying a plurality of films each carrying a gelatin coating with a hot aqueous alkaline solution in order to soften and dislodge the gelatin coating and removing the softened coating by the impact of a spray of hot water.

9. In the continuous process of treating moving picture film to remove the emulsion, the steps which comprise moistening the film by a spray of hot water and removing the softened coating by the impact of a spray of hot water.

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