Dec. 6, 1938. W. L. DOUDEN 2,139,224

METHOD OF DEVELOPING MOTION PICTURE FILMS

Original Filed Aug. 31, 1934

FIG. 1.

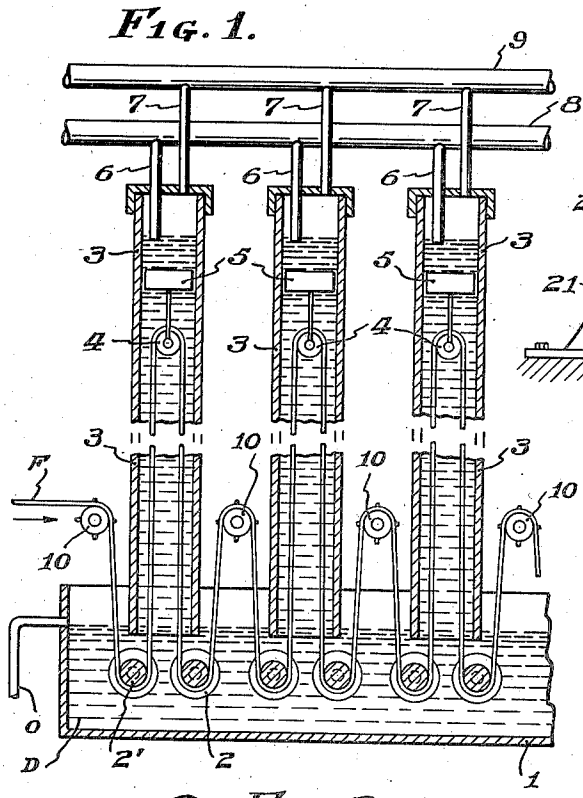


FIG. 4.

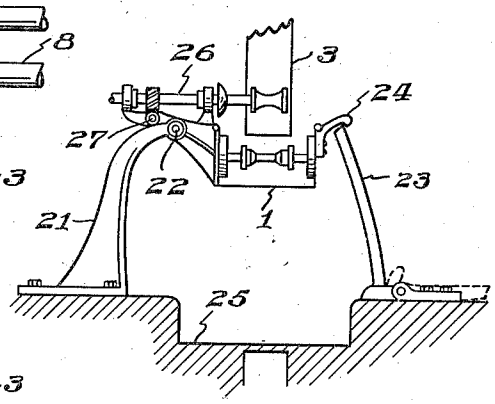


FIG. 2.

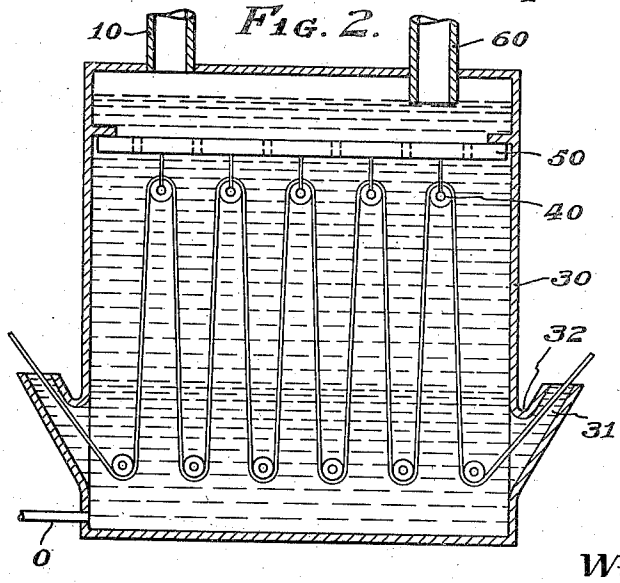
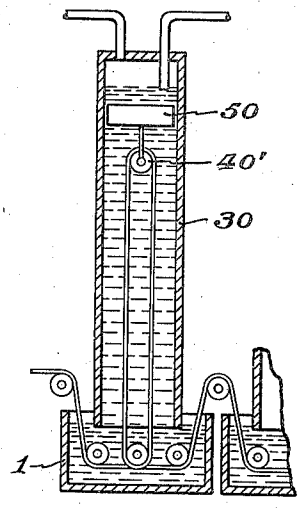


FIG. 3.



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2,139,224

METHOD OF DEVELOPING MOTION PICTURE FILMS

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Original application August 31, 1934, Serial No. 742,203. Divided and this application December 23, 1936, Serial No. 117,350

1 Claim. (Cl. 95—88)

The present invention relates to an improvement in the method of developing motion picture film and, more particularly, to an improvement in the method used in the continuous high-speed development of motion picture films. This application is a division of my application Serial No. 742,203, filed August 31, 1934.

It has heretofore been customary in the art to pass motion picture film through a series of tanks or tubes of developing fluids under the control of driving sprockets or rolls, the film being passed downwardly into the various fluids, upwardly therefrom, and again downwardly from the air into fluid until the termination of the process.

Such procedure is particularly objectionable in the case of motion picture film, which is perforated at the edges with sprocket holes, as the sprocket holes retain air and carry it into the developer. All photographic developers are notoriously subject to oxidation, since, from their very nature, they are required to be powerful (although controllable) reducing agents. As a consequence, the carrying of air and oxygen into the developer and other baths by the film shortens the life of the developer and, due to the irregular oxidation by the air bubbles, tends to produce irregular development resulting in spots and streaks on the film. This is particularly annoying in the case of combined sound and picture film, where the spots and streaks produce loud "pops" and "bangs" in the sound reproduction from the photographic sound track.

One object of the present invention is to provide a method which will prevent the introduction of air into any of the fluid baths used in treating the film.

Another object of my invention is the provision of a method of eliminating air or gas bubbles from the fluid baths.

Another object of my invention is to provide a method of development involving treating the film at less than atmospheric pressure.

Other and ancillary objects of my invention will be apparent to those skilled in the art from an inspection of the accompanying drawing and reading of the accompanying specification.

In the drawing:

Fig. 1 shows a longitudinal section of a preferred form of apparatus for performing my improved process;

Fig. 2 shows a second form of apparatus;

Fig. 3 shows a transverse section thereof; and

Fig. 4 shows a preferred detail applicable to both of the above forms.

As will be apparent from a casual inspection of the drawing, one of the major features of my invention is the complete processing of the film in a partial or complete Torricellian vacuum, where the highest pressure to which the film is subjected is approximately that of the atmosphere and the lowest pressure approximates that of the vapor-pressure of the developer at the temperature of development.

Referring first to Fig. 1: The film F passes into the apparatus, for example, from left to right as indicated over an idler roller and into the fluid D contained within the tank 1, and the level of which is maintained by the inlet pipe by which the supply is provided from the supply tank.

The film passes around an appropriately-bearinged corrosion-proof idler roller 2' and upwardly into the developing tube 3. This developing tube may be made of any desired material, but for negative film I prefer to make it of Monel metal or hard rubber, which is opaque and corrosion-resisting; while for positive film I prefer to make it of a strong corrosion-resisting glass such, for example, as that known under the trade name of "Pyrex" in order to permit inspection of the film during development, as the positive film may be safely handled in a relatively strong yellow light.

Near the top of the tube the film passes over an idler roller 4 which is supported from a float 5 in the fluid. It will be apparent that, since the roller 4 is supported by the float 5, the film can never be supported above the fluid level in the tube. The float may preferably be made of paraffined cork or balsa wood, or hollow, and of Monel metal, hard rubber, or plated copper or brass, but the invention does not exclude other constructions thereof.

The pulley 4 is of the same type of construction as the pulley 2'.

At the upper end of each of the fluid-treatment tubes is provided one or more pipes 6, 7, connected to manifolds 8, 9, for the purpose of extracting proper quantities of fluid from the tubes and maintaining an appropriate vacuum.

An extraction pipe 6 is provided, preferably connected to a pump and extraction system of any known or desired type withdrawing a predetermined quantity of fluid per unit of time or influx, and preferably irrespective of the gaseous content thereof, i. e., such as gas-well clearing-pumps and the like.

Above the influx level of the pipe 6, there is preferably provided a second effusion pipe 7 connected to a second manifold 9 and which, in turn,

is connected to a second pumping system of known type adapted and adjusted to maintain a predetermined pressure difference between atmospheric pressure and the exhaust pressure, in order to maintain a constant fluid level. Such a system may be comprised, for example, of a relatively large capacity exhaust pump and either a control or a relief valve governed by atmospheric pressure to maintain a constant pressure difference; the large capacity of the exhaust pump being desired to provide for the initial elimination of dissolved gases, and such gases as might be accidentally introduced.

It will be apparent that, due to the reduced pressure in my developing tubes, air or gas bubbles, either trapped or occluded by the film or produced during development, will be enlarged and increased in buoyancy in proportion to the reduction in pressure, and will be correspondingly promptly eliminated, thereby preventing spots, streaks, and other irregularities in the development of the film.

The film passes downwardly through the tube 3 to the idler 2, which is identical with 2', and thence upwardly to the driving sprocket 10, which is illustrated as slightly above the fluid level, for reasons hereinafter described. In order to secure the simple film drive shown in Fig. 4, wherein the sprocket shafts 26 are driven through a helical gear from the line shaft 27, the driving sprockets are shown as located above the fluid level. It will be apparent, however, that if other driving means are substituted such, for example, as corrosion-resisting chains or gears, the sprockets may be immersed in the fluid and the film kept continually immersed during the entire process.

In the successive elements of the apparatus, the corresponding parts are designated by identical reference numerals 2 to 10 inclusive, and the pipes 6 and 7 are respectively connected to the manifolds 8 and 9.

It is apparent that if fluids of different density are to be used for the same time, or fluids of incommensurate density for incommensurate units of time, the manifolds must be correspondingly subdivided and controlled, or the lengths of the tubes selected or controlled, or both.

Fig. 2 shows a modified form of apparatus which is somewhat less expensively constructed but which attains the same general objects as the form of apparatus shown in Fig. 1.

In this form of the apparatus, a single tank for any one fluid 30 is provided, and the film supporting idlers 40 are supported by a common float 50.

The withdrawal pipes 60 and 70 function in the same general manner as the corresponding pipes 6 and 7 described in conjunction with Fig. 1.

The fluid level may be controlled in any appropriate manner either by control of the exhaust apparatus or by the provision of an exterior tank as shown in Fig. 1, and this fluid level is generally indicated at 31, the film being withdrawn through an appropriate trap 32. The inlet pipe is the same as that shown in Fig. 1.

As shown in Fig. 3, the film may be threaded laterally through the apparatus in a known manner, the float 50, tank 30 and rollers 40' being the same as those shown in Fig. 3, but the rollers being axially aligned on a single shaft. In this form of the apparatus the tank 1 is identical with that shown in Fig. 1.

As shown in Fig. 4, I prefer to make the tank 1 supporting the fluid in all the before-described forms of my invention in the form of a hinged trough. The trough is preferably supported at one side by the bracket 21 and pivoted at 22, and is supported at the other side by a movable member 23 which fits beneath a catch 24.

When it is desired to clean the apparatus, the trough 1 is raised slightly to release the member 23 from the catch 24, the member 23 is pulled backwardly and the trough 1 is permitted to hang from the pivot 22, thereby emptying its contents into a trough 25 formed in the floor of the room housing the apparatus and permitting a thorough scrubbing not only of the trough 1 but of the tubes or tanks 3.

Having now described my invention, I claim:

The method of continuously developing film of the motion picture type comprising the steps of continuously passing the film into a film processing liquid, continuously passing the said film to a region in said liquid where the pressure is materially less than that of the atmosphere to withdraw bubbles therefrom, completing the process of development while keeping the film immersed in liquid, and continuously withdrawing said film from said liquid.

WILLIAM L. DOUDEN.