

June 29, 1937.

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2,085,188

FILM DEVELOPING APPARATUS

Filed April 26, 1935

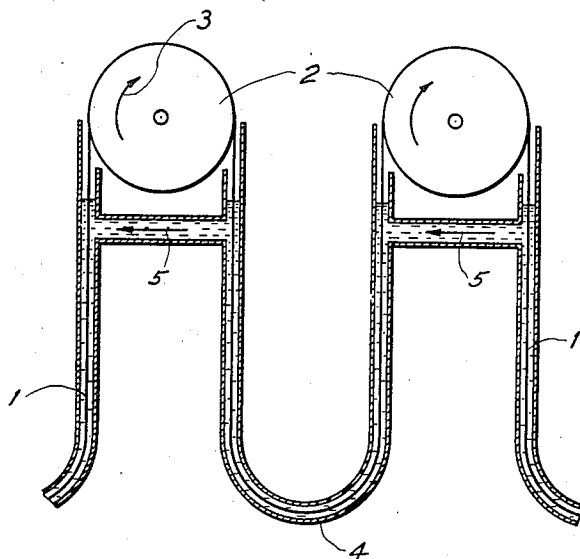


Fig. 1

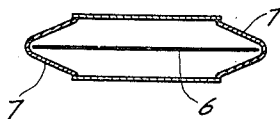


Fig. 2

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2,085,188

FILM DEVELOPING APPARATUS

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Application April 26, 1935, Serial No. 18,299
 In Germany April 30, 1934

4 Claims. (Cl. 95—94)

This invention relates to the continuous processing of photographic film, and has for its principal object the provision of an improved film processing apparatus whereby the film is effectively brought into contact with different parts of the developing fluid.

It is customary to pass the film sequentially over rollers through the baths required for its treatment. Since such baths are incidentally exhausted and consumed a steady change in concentration of the baths takes place. Such change in concentration may, to a certain extent, be compensated by gradual replenishing with fresh solutions. However, it is not readily possible in this manner to insure a reliable and constant effect. If unspent solutions being as fresh as feasible are to be used, this means a large consumption of chemicals. If the developer is to be employed under optimum conditions from an economic viewpoint, the film will be largely treated in exhausted or partly exhausted developer.

According to the present invention, these drawbacks are avoided by keeping the treating solution in motion in reference to the material to be developed. Thus, the solutions are preferably kept in motion by means of pumps or other suitable conveying means at a suitable rate of speed in a sense contrary to the direction of travel of the film. With this end in view, the film is drawn or pressed through suitably proportioned piping, for instance, if pressure is applied, such shortcomings and inconvenience as is usually attendant upon the threading or insertion of the film will be avoided. The inlet or entrance point of the film into such a pipe is at the same time the outlet for the spent solution, while the outlet point for the film in the pipe is at the same time the inlet point for fresh solution. The rate of speed of the two opposite movements should preferably be so regulated that, especially where high grade and costly chemicals are concerned, the solution will leave in a state near exhaustion. The treatment of the film, therefore, takes initially place with practically spent solution, this being admissible and practical in this instance inasmuch as the emulsion of the film at this point still possesses its full reaction powers. The fresh solution, on the contrary, acts upon an emulsion which is nearly completely treated so that the chemical reaction will be safely terminated.

Instead of one long pipe for each solution, it is possible also to use several smaller pipes inasmuch as it is somewhat difficult to convey the film through unduly long pipes. These smaller

pipes are preferably connected in series. The counter-current principle is in this case just as readily practicable as if a single long pipe were employed. For the various developing stages and solutions, the film may be made to travel sequentially through different pipes or groups of pipes. It will be evident that the pipes may contain any desired curvatures or bends provided that it is feasible by the aid of rollers and the like to convey the film in a satisfactory manner.

It is also possible to employ a plurality of seriated vats or troughs rather than groups of pipes. Inside each vat developing may be produced in the same manner as in the single vat process according to the prior art, the film being conveyed in each vat over suitable rollers several times in opposite directions. However, since the solution flows continuously from the first to the last vat in the series the film travels in opposition to the sense of travel of the liquid.

If the length of stay of the film in one of the various baths traversed by the film consecutively is to be altered without altering the rate of travel of the film or the rate of flow or velocity of the solution, then, according to another object of this invention, the height or level of the liquid or bath inside the vat or the pipe may be changed so that the film is caused to travel, say, for a shorter period through a diminished volume of liquid.

Under certain circumstances it may also be advisable to use different rates of flow for the solutions. Thus, cheaper solutions may be caused to flow through at a higher rate of velocity than more expensive ones.

The invention will be better understood from the following description when considered in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

Referring to the drawing,

Fig. 1 is a sectional view of a continuous film processing machine constructed in accordance with the invention, and

Fig. 2 is a sectional view of a suitable form of film conduit.

Referring to Fig. 1, the film 1 is conveyed over the conveyor roll 2 in the direction of the arrow 3 through the pipe system 4. Inside the latter is the developer which, according to this invention, is conducted therethrough in a sense contrary to the direction of travel of the film, that is to say, in the direction indicated by the arrow 5. The admission and supply of the liquid and the conduction thereof may be insured by suitable conveyor means (not shown), such as

pumps. The conveyor rolls 2 may be mounted upon the same spindle, and may be of the sprocket or of any other suitable type.

A particularly convenient cross-sectional form for the pipe system is indicated in Fig. 2. This cross-section is adapted to the form of the film 6. The film is introduced in the lateral V-shaped part 7 in such a manner that it can not come in contact on its emulsion face with the wall and is still afforded a small lateral play. A cross-sectional form of this kind offers the advantage that the film may be thrust or pressed through the piping, and that the volume of liquid required for insuring development is comparatively small. Instead of liquid solutions, it is also possible to use gases without departing from the scope of this invention.

I claim:

1. A continuous film processing machine including a plurality of conduits curved at the bottom and open at the top, pipes interconnecting the upper ends of said conduits for carrying a developing liquid from one conduit to another, and a roller above the liquid level arranged to guide a film from one to another of said conduits.

2. A continuous film processing machine in-

cluding a plurality of U-shaped conduits having V-shaped sides for contacting only the edge of the film, pipes interconnecting the upper ends of said conduits for carrying a treating liquid from one to another of said conduits, and means above the liquid level at the upper ends of said conduits for moving said film from one to another of said conduits.

3. A continuous film processing machine including a plurality of U-shaped conduits having V-shaped sides for contacting only the edge of the film, pipes interconnecting the upper ends of said conduits for carrying a treating liquid from one to another of said conduits, and means above the liquid level at the upper ends of said conduits for moving said film from one to another of said conduits against the current of said liquid.

4. A continuous film processing machine including a plurality of conduits having V-shaped sides for contacting only the edge of the film, pipes interconnecting said conduits for carrying a treating liquid from one to another of said conduits, and means above the liquid level for moving said film from one to another of said conduits against the current of said liquid.

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