Dec. 24, 1940. W. B. MOORE 2,226,438

FILM-DEVELOPING TANK

Filed May 28, 1938

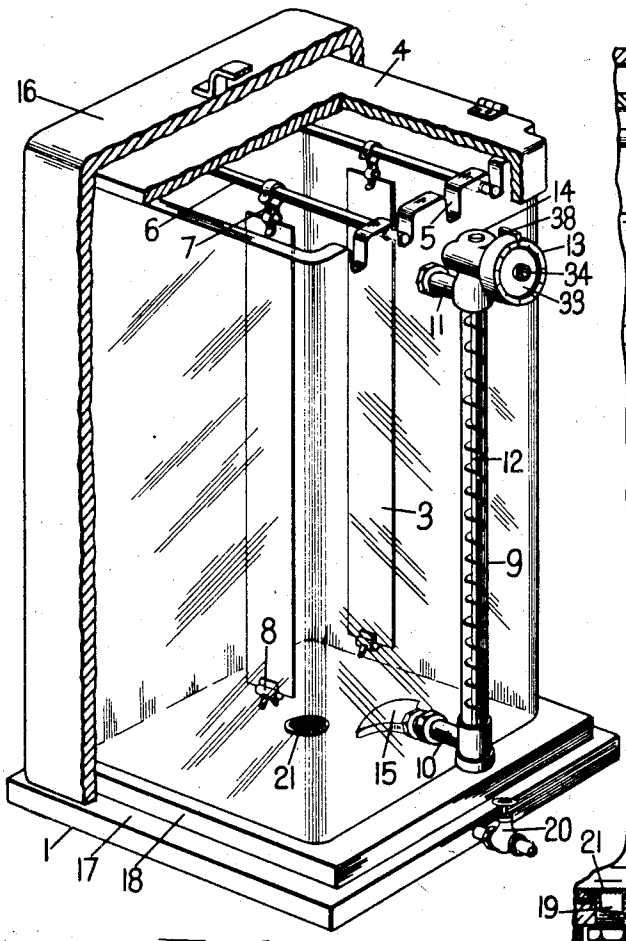

Fig. 1

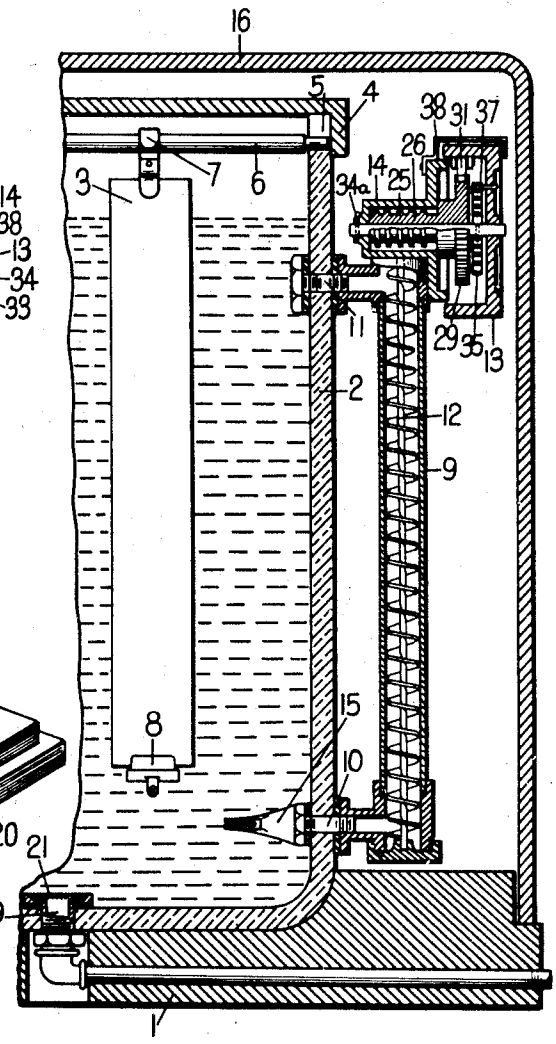

Fig. 2

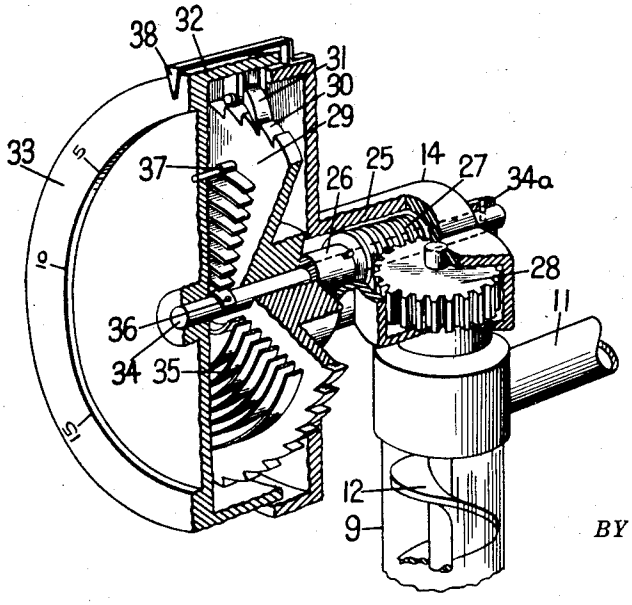

Fig. 3

INVENTOR
Walter B. Moore.

BY Corbett & Mahoney

ATTORNEYS

Patented Dec. 24, 1940 2,226,438

UNITED STATES PATENT OFFICE

2,226,438

FILM-DEVELOPING TANK

Walter B. Moore, West Lafayette, Ohio

Application May 28, 1938, Serial No. 210,735

2 Claims. (Cl. 95—90)

My invention relates to a film-developing tank. It has to do, more particularly, with a tank for developing photographic film and which is particularly useful in developing roll films, although it is not necessarily limited thereto.

In the past, no satisfactory tank has been provided for developing roll film whereby it is possible to observe the films while they are in the developer in the tank so as to observe the progress and development. Also, the tanks commonly used for developing films are not provided with efficient means for circulating the developer in such a manner as to eliminate all the air bubbles and thereby result in a more accurate development of the film. Prior art tanks of this general nature have also been possessed of many other defects.

One of the objects of my invention is to provide a film-developing tank which is particularly useful for developing roll film and which is of such a nature that the film may be observed while supported in the tank in order to note the progress of development.

Another object of my invention is to provide a tank of the type indicated which has means associated therewith for efficiently circulating the developer in such a manner as to prevent the accumulation of any air bubbles on the films which interfere with the proper development.

In its preferred form, my invention contemplates the provision of a film-developing tank which is constructed mainly of a transparent material so that films supported therein may be seen without removing them from the tank. The tank is preferably vertically disposed and is preferably so disposed that the roll film may be suspended therein. Although the tank is made mainly of transparent material to permit the film to be viewed while suspended therein, I preferably provide a light-tight cover which may be placed over the tank so that the developing may occur, if desired, while there is light in the room where the device is located, for example, while the user is performing some other task in the room which requires the room to be lighter. I provide means in association with the tank for circulating the liquid developer past the films in the tank. This means is of such a nature that it will prevent the accumulation of any air bubbles on the films which would interfere with proper development of the films.

Various other objects and advantages will be apparent from the drawing and the following description.

The preferred embodiment of my invention is illustrated in the accompanying drawing wherein similar characters of reference designate corresponding parts and wherein:

Figure 1 is a perspective view, partly cut away, showing a film-developing tank constructed in accordance with my invention.

Figure 2 is a vertical section taken through the structure illustrated in Figure 1.

Figure 3 is a detail partly in section and partly in perspective illustrating a combined timing device and driving means for the liquid circulating device.

With reference to the drawing and, particularly, to Figures 1 and 2, I have illustrated a film-developing tank made in accordance with my invention. This film-developing tank comprises a base 1 which may be of wood or metal or of any other suitable material. A container 2 for the developing liquid is mounted on the base 1, in the manner illustrated. This container is constructed of transparent material. The material may be glass, a clear plastic or any other clear and transparent acid-resisting material. It may be in one piece, as illustrated in the drawing, or may be made of several sections secured together in a suitable manner. The tank is comparatively tall so that films 3 of the roll-film type may be suspended therein and, during the process of development, they will be constantly submerged in the developing fluid.

The bottom of the tank is closed and the top is open as indicated. However, I provide a hinged cover or lid 4 for closing the top of the tank. This cover is adapted to keep dust out of the tank. The lid is preferably a tight-fitting lid which serves to make the container air-tight so that the developing fluid may be kept in the container for long periods, if desired, and will retain its strength for a longer period than if the container were not air-tight.

In order to suspend the films 3 in the tank, the upper edge of the tank is provided with a series of oppositely disposed notches 5 formed therein. These notches receive rods 6 which may be of wood, metal, glass, or other suitable material. The films may be suspended from these rods by means of clips 7. The lower ends of the films also have clips 8 secured thereto, which serve as weights to maintain the film vertically suspended in the tank. Thus, the films will be suspended in spaced relationship in the tank and will be vertically disposed. Because all of the sides of the tank are made of transparent material, the film may be viewed without removing it from the tank. Thus, the progress of the development may be noted from time to time with-

out removing the films from the tank through the use of "safe light" moved up and down back of the tank.

In order to provide means for effectively circulating the liquid developer past the films suspended in the tank, a device of the type illustrated in Figures 1 and 2 may be mounted on the tank. This device comprises a vertically disposed tube 9 which is secured to one of the side walls of the container 2 and on the exterior thereof. A member 10 for developing fluid to enter the container 2 leads from the lower end of this tube into the container adjacent the bottom thereof. A member 11 for developing fluid to leave the container 2 leads from the container into the upper end of the tube 9. The outlet 11 is disposed adjacent the upper end of the container. A helical or spiral screw member 12 is rotatably supported within the tube 9 and in close association with the wall thereof. The screw member 12 is driven by a motor unit 13 which is connected to the upper end of the screw by a worm and gear drive 14. The inlet member 10 has a fan-shaped nozzle member 15 associated therewith.

In the operation of this circulating device, when the unit 13 is operated, it will drive the screw 12 in the proper direction. This will force the liquid developer from the tube 9 and through the inlet 10 into the bottom of the container. The fan-shaped nozzle 15 will serve to widely distribute the liquid forced into the container 2. The container 2 will always be full of the developing liquid during the developing operation. At the same time, the liquid is forced into the lower end of the container 2 through the inlet member 10, the liquid will be withdrawn from the upper end of the container through the outlet 11 and back into the tube 9. Thus, there will be a constant circulation of liquid from the bottom to the top of the container.

Thus, vertical circulation of the developing liquid from the bottom to the top of the container past the films is provided. This type of circulation will prevent the accumulation of any air bubbles on the films which would interfere with the proper development of the films and would result in bare spots or defects on the finished films which would require retouching of the negatives. It also provides for even development, if desired. The direction of circulation could be reversed, that is, it would circulate from the top towards the bottom of the container although I prefer to circulate it from the bottom to the top of the container.

The tank may be used in a dark room and, from time to time, the development of the films may be observed by using a safe light and without removing the films from the tank. However, in some instances, it may be desirable to provide a light-proof cover for covering the entire device while the developing operation is in progress. For example, it may be desirable to have the developing room illuminated so that the user of the device could be performing some other task while the development is occurring. For this purpose, I provide a light-proof cover 16 which is adapted to cover completely the container 2. This cover 16 is made of a suitable material through which light will not pass and takes the form of a hood with its lower end only open and which is adapted to be put over the container 2. The lower edge of this member 16 will rest on a shoulder or ledge 17 formed on the base. The inner surface of the member 16 adjacent its lower edge cooperates with a vertical surface 18 formed on the base which will prevent displacement of the cover 16 on the base. The cover is sufficiently large to cover the circulating device provided on the side of the container.

The bottom of the container is provided with an outlet 19 by means of which the liquid developer may be removed from the container. This outlet is under the control of an adjustable valve 20. A removable screen 21 is preferably associated with the outlet so that as the liquid developer is drained from the container it is strained. The liquid developer may then be used over again.

In Figure 3, I illustrate the unit 13 which consists of a combined timing device and operating motor for driving the screw 12 of Figures 1 and 2. This timing device comprises a housing 25 in which a sleeve member 26 is rotatably mounted. This sleeve 26 has a worm 27 thereon which meshes with a worm gear 28 keyed to the upper end of the screw 12. The forward end of the sleeve 26 carries a disk-like member 29 having ratchet teeth 30 formed on the periphery thereof. A spring-press pawl 31 contacts with these ratchet teeth. This pawl 31 is carried on the interior of a drum-like member 32. This member 32 has a clock face 33 on which the sleeve 26 is rotatably mounted. The shaft 34 is anchored to the housing 25 as at 34a so that it will not rotate. A spiral spring 35 is supported within the drum 32 and has its inner end secured to the stationary shaft 34 as at 36 and its outer end secured to the rotatable drum 32 as at 37.

In order to wind up the device to place the spring in tension, the drum member 32 is rotated counterclockwise relative to the housing 25 and the ratchet member 29. A pointer 38 is supported by the housing 25 and cooperates with the clock face 33 on member 32. Turning the member 32 relative to the member 29 will cause the pawl 31 to ride over the ratchet teeth 30. This will also wind up the spring 35 since one end thereof is anchored to the stationary shaft 34 while the other end is anchored to the member 32 which is rotatably mounted on shaft 34. The member 32 is rotated until the pointer 38 is adjacent to the time-indication selected. This time-indication will indicate the time required for the device to unwind. If the member 32 is now released, the spring 35 will rotate it in a clockwise direction. The pawl 31 will engage one of the ratchet teeth and, consequently, will rotate member 29 with member 32. Since member 29 carries the worm 27, the screw 12 will be driven. Rotation of the screw will continue until the spring 35 is completely unwound.

Thus, this device serves to time the developing operation as well as to drive the circulating means. The device will be set to run for a predetermined period which will be suitable for the developing operation. When it is completely unwound, this will indicate that the film has had sufficient time to be developed. If desired, the timing device may be arranged to actuate a signal which will indicate when the developing operation is completed.

It will be apparent from the description above that I have provided a film-developing tank having many advantages. It is particularly useful for developing roll film, but it is not limited thereto. Because of the tank being made of transparent material, the progress of development of the films may be noted without removing them therefrom. It will be noted that I have provided effective means for circulating the liquid developer in the tank and this circulation is carried

on in such a manner that there will be no danger of air bubbles accumulating on the film. Although I have only referred to photographic film, it is to be understood that my invention may be used for developing other types of film, such as X-ray film, et cetera.

As previously described, the film-developing tank is preferably of clear transparent material. It may, however, be made of a "safe" glass or plastic. This glass or plastic may have orthochromatic or panchromatic qualities. It will keep the film in the tank from being light-fogged when a bright light is used. Obviously, when the tank is made of this material, it will not be necessary to use a "safe" light or a hood or cover for the tank. For example, filter glass of a suitable color, such as yellow, red or green, depending on the type of film to be protected against light-fogging, may be employed.

Having thus described my invention, what I claim is:

1. A tank for use in developing photographic films or the like, said tank being adapted to receive the developing liquid, the film being adapted to be supported vertically within the tank, said tank being provided with an inlet and an outlet adjacent its ends, a tube supported outside of said tank and having one end connected to said outlet and its opposite end connected to said inlet, and means disposed within said tube for forcing developing liquid contained in said tube from said tube through said inlet into the tank and for simultaneously withdrawing developing liquid from said tank through said outlet and into said tube, said means comprising a rotatable screw member disposed within said tube, and spring-operated clock mechanism for rotating said screw member and for timing the developing operation.

2. A tank for use in developing photographic films or the like, said tank being adapted to receive the developing liquid, the film being adapted to be supported vertically within the tank, said tank being provided with an inlet and an outlet adjacent its ends, a tube supported outside of said tank and having one end connected to said outlet and its opposite end connected to said inlet, means disposed within said tube for forcing developing liquid contained therein from said tube through said inlet into the tank and for simultaneously withdrawing developing liquid from said tank through said outlet and into said tube, said means comprising a rotatable screw member disposed within said tube, and a combined timing device and driving motor for driving said screw.

WALTER B. MOORE.