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G. RAUGLAS

2,393,654

FILM DEVELOPER TANK

Filed May 8, 1943

2 Sheets-Sheet 1

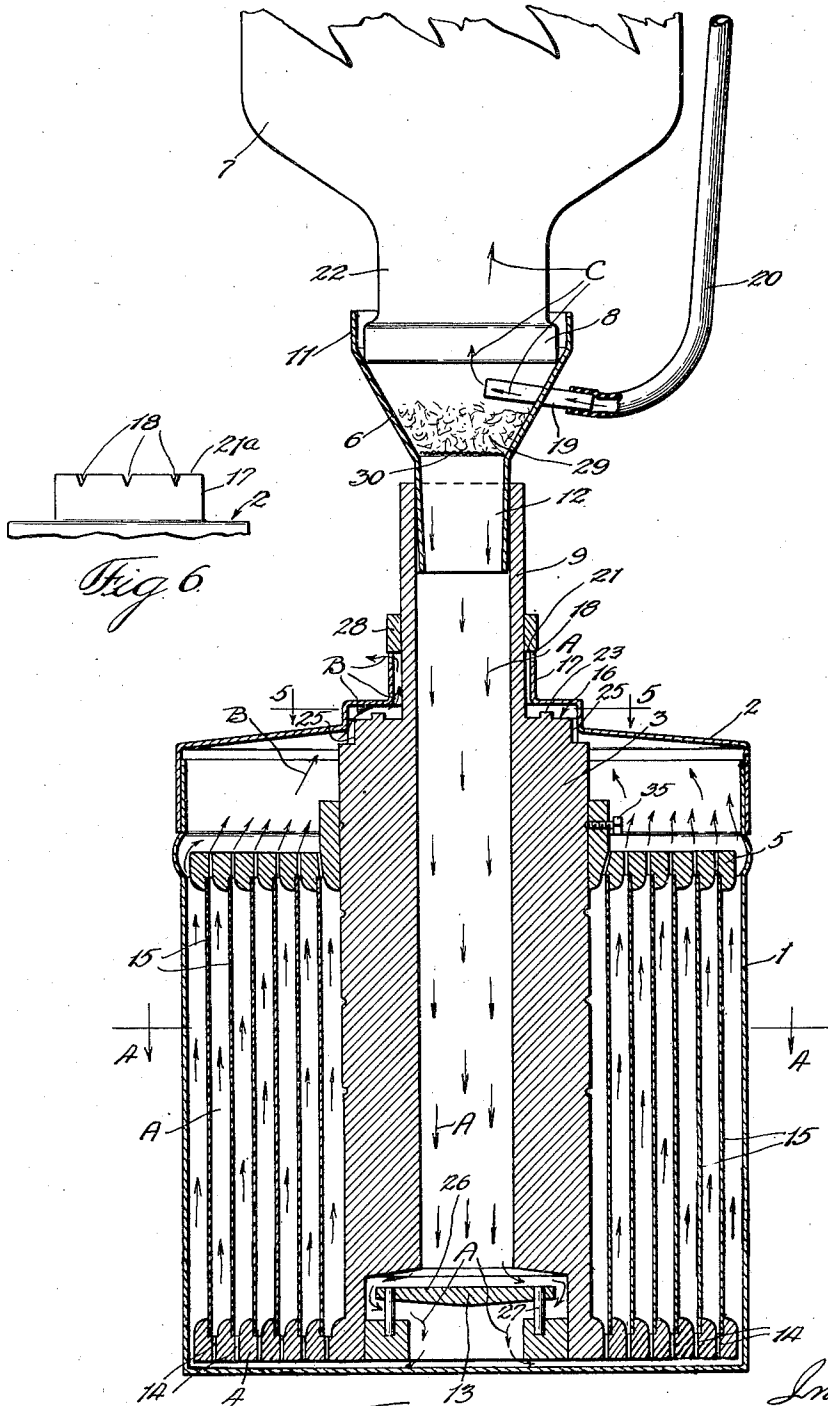


Fig. 1.

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2 Sheets-Sheet 2

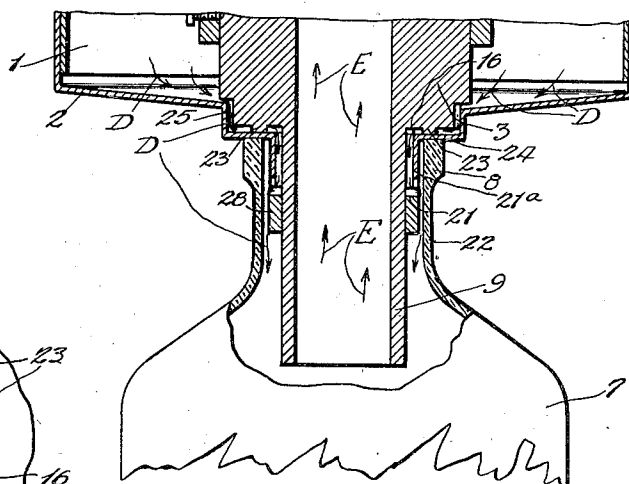


Fig. 2.

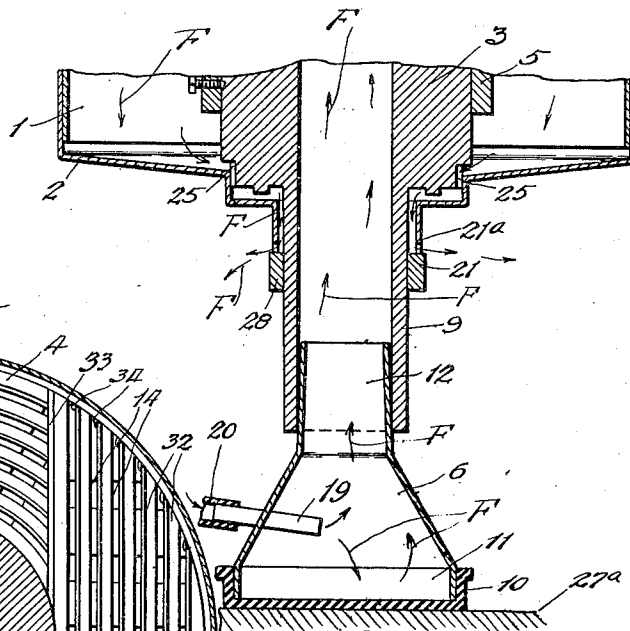


Fig. 3.

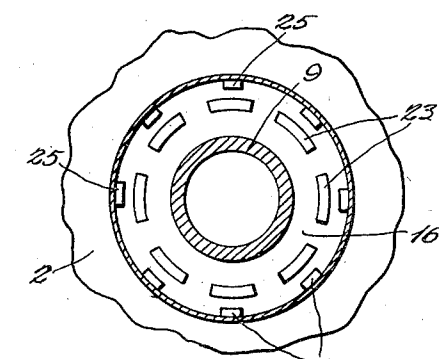


Fig. 5.

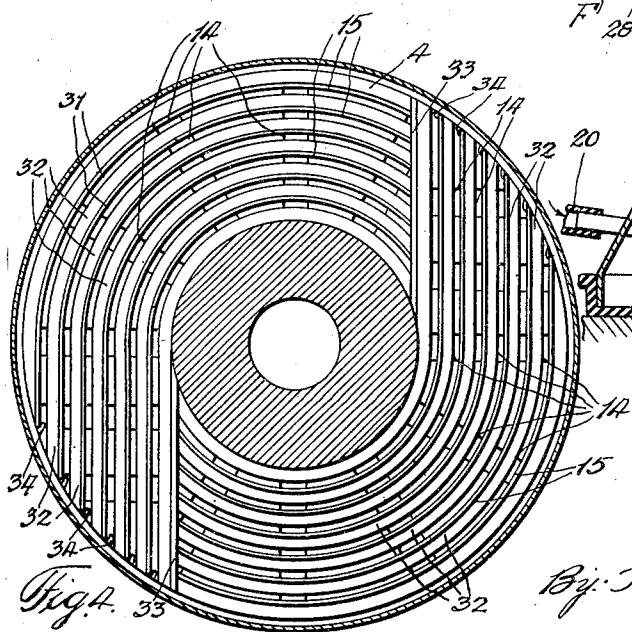


Fig. 4.

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UNITED STATES PATENT OFFICE

2,393,654

FILM DEVELOPER TANK

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Application May 8, 1943, Serial No. 486,120

5 Claims. (Cl. 95—90.5)

My invention relates to film developer tanks.

One of the objects of my invention is to provide a tank which minimizes the formation of air bubbles in the tank.

A further object is to provide a tank which is filled directly from a bottle or similar container and empties directly back into the bottle.

A further object is to provide a tank which can be quickly filled and emptied and in which the filling and emptying time will be of definite duration for both filling and emptying, thus enabling accurate timing which is important.

A further object is to provide a tank which avoids the waste of liquid.

A further object is to provide an improved light trap.

A further object is to provide an improved tank which will permit the film holder to be rotated in the liquid to agitate the liquid, and which will permit the temperature to be taken during the developing operation.

Further objects and advantages of the invention will be apparent from the description and claims.

In the drawings, in which an embodiment of my invention is shown:

Figure 1 is a vertical axial sectional view showing the liquid being poured from the bottle into the tank;

Fig. 2 is a fragmentary vertical sectional view showing the tank being emptied into the bottle;

Fig. 3 is a fragmentary vertical sectional view showing the washing operation;

Fig. 4 is a horizontal sectional view on the line 4—4 of Fig. 1, showing the film holder arrangement;

Fig. 5 is a sectional view on the line 5—5 of Fig. 1; and

Fig. 6 is a detail view showing the upper edge of the cap.

Referring to the drawings in detail, the construction shown comprises a tank 1 in which the developing is done, a tight-fitting removable cover 2 for the tank, a tubular filling, emptying and film carrying core 3 rotatable in the tank having a portion extending through the cover 2, a grooved annular film positioning and supporting flange 4 (Figs. 1 and 4) on the lower end of the core, a grooved annular film positioning and supporting flange 5 adjustable vertically on the upper portion of the core, a funnel 6 insertable into the upper end of the core 3, a bottle or container 7, the mouth 8 of which may fit inside the flanged end of the funnel, as shown in Fig. 1, and into the mouth of which the outside extension 9

of the core may fit, as shown in Fig. 2, and a rubber cap 10 for fitting over the flared end 11 of the funnel for use in the washing operation, as shown in Fig. 3.

In general, there may be four operations in the use of this tank: (1) the operation of filling the tank with the developer and the emptying of the developer from the tank at the end of the developing period; (2) the filling of the tank with water or with a short-stop bath solution and the emptying of the tank after this operation; (3) the filling of the tank with a fixing bath solution and the emptying of the tank of this solution, and (4) the washing of the film and equipment after the fixing bath.

In the developing operation, the film carrying core 3 is placed in the tank 1, the cover 2 is put in place, the bottle 7 containing the developing liquid is placed in upright position, the flaring end 11 of the funnel 6 is placed over the mouth 8 of the bottle and the tank 1 is inverted and the extension 9 of the core is slipped over the discharge spout 12 of the funnel. The assembly of bottle and tank is then inverted and placed in the position shown in Fig. 1. The developer liquid runs, as indicated by arrows A, out of the bottle 7 through the funnel 6 into the core 3, past the light trap 13, thence radially outwardly, thence up through the perforations 14 in the bottom flange 4 and between the photographic films 15 until the tank is filled with developer liquid above the level of the upper edges of the films. Air is forced by the liquid out of the tank into the cap 2 through the restricted passages between the cap and the shoulder 16 on the core, thence upwardly inside the neck 17 of the cap around the core and out through the notches 18 in the upper edge of the neck of the cap, as indicated by the arrows B. Air is enabled to flow up into the bottle through the small tube 19 inserted through the side of the funnel, as indicated by the arrows C. In order to prevent any possibility of liquid escaping out through the short tube, a flexible tube 20 may be provided which, in this filling operation, may be held up in the position shown in Fig. 1. It has been found that without this tube the leakage is almost negligible, but if absolute leak prevention is desired, the rubber tube may be used.

In this filling operation, the core 3 is suspended in the tank by the engagement of the shoulder 21 on the extension 9 with the upper edge 21a of the neck 17 of the cap. This insures a definite spacing of the shoulder 16 with respect to the cap and a definite spacing of the

lower flange 4 with respect to the bottom of the tank. This insures uniform flow and a definite time for the filling operation. After the funnel 6 is removed, the core 3 may be rotated in the tank by catching hold of the extension 9 and turning it. This causes the core to revolve in the tank, agitating the liquid and causing all parts of the photographic films 15 to be bathed by the adjacent films of liquid.

After the films 15 have been in the liquid the desired length of time, the liquid is emptied back into the bottle. This is accomplished by slipping the mouth 8 of the bottle over the extension 9 of the core and then inverting the assembly to bring it into the position shown in Fig. 2. In this position the liquid will flow from the tank into the bottle as indicated by the arrows D, through the restricted passage between the core 3 and cap 2 and down between the extension 9 and the neck 22 of the bottle. The air is forced out of the bottle by the inflowing liquid up through the inside of the core, as indicated by the arrows E. In this operation, the projections 23 (Fig. 5) on the shoulder 16 of the core rest on the flange 24 of the cap, which flange in turn rests on the upper edge of the mouth 8 of the bottle. In this operation there is no interference between the liquid flowing into the bottle and the air flowing out of the bottle. This is desirable as it is detrimental to the developing to have air bubbles flowing through the liquid in the tank. This avoidance of the necessity for air to come bubbling up through the liquid in the tank also makes for quick emptying and for a definite time of emptying. This operation of filling and emptying of the tank is substantially the same for the filling and emptying of the developer liquid, the filling and emptying of the water or short-stop bath liquid, and the filling and emptying of the fixing bath liquid. In all of these there is no bubbling of air along the surfaces of the films being treated and the time of filling and emptying is definite.

A light trap construction is provided adjacent the neck 17 of the cap and also adjacent the lower end of the core 3. The light trap construction at the upper end comprises, in addition to the notched flange 17, a plurality of arcuate upwardly extending ribs 23 on the shoulder 16 of the core, circumferentially spaced from each other to provide for a flow of fluid therebetween, as indicated in Figs. 1, 2 and 5, and a plurality of circumferentially spaced grooves 25 in the cylindrical portion of the core 3. It will be noted that the arcuate ribs 23 are located in radial alignment with the circumferentially spaced grooves 25, thus resulting in a staggered path for any light which might seek to penetrate the tortuous passages indicated by the arrows B and D. The light trap construction at the bottom of the core comprises a circular disc 26 (Fig. 1) extending across the bottom of the passage through the core supported by the pins 27 on the lower flange 4 and spaced to allow the passage of fluid, as indicated by the arrows A, but positioned so as to present a tortuous path for any light which might seek to enter through the passage in the tubular core. The passage in the core enables a thermometer to be inserted to test the temperature of the liquid in the tank to enable the proper time for developing to be determined.

In order to wash the film and the tank after the fixing bath has been drained off, the tank is placed in upright position, the funnel 6 is inserted into the extension 9 of the core, the rubber

cap 10 is fitted over the flaring end 11 of the funnel, the flexible hose 20 is connected with a water supply, and the tank is filled with water. The assembly is then inverted and brought to the position shown in Fig. 3. In this position the cap 10 may rest on a suitable support 27a so that the funnel 6 supports the assembly. The water supply is adjusted to give it a steady flow, as indicated by the arrows F, up through the core and down along and between the films and out between the core and the adjacent portions of the cap and through the notches 18 to a waste receptacle. In this operation, the notched edge 21a of the neck of the cap 2 rests on the shoulder 21 of the ring 28 which is secured to the extension 9. The notches 18 are so small and so few that air pressure will keep the water from escaping from the tank unless water is forced into the tubular core 3 by pressure from the water supply. If, for any reason, the pressure should be cut off, as by accident or swelling of a valve, the tank would not drain but would remain full of water so that the photographic film would not be exposed to air. In this washing operation, the flow of water past the films is always in a downward direction, which facilitates the removal of the hypo which is always carried downwardly, so that the water does not have to act against the force of gravity on the hypo. The film and the equipment are washed at the same time, which materially shortens the time required. In general, the time is reduced from about an hour, required with the usual apparatus, to about 15 minutes, required with this apparatus.

It is usual to provide a filter 29 in the filling funnel, such as a bunch of cotton placed on a perforated screen 30 extending across the entrance to the discharge spout 12 of the funnel. This filter is removed and a new one may be substituted in the washing operation shown in Fig. 3.

For the sake of compactness, the film positioning grooves 31 and ridges 32 in the upper and lower flanges 4 and 5 are designed as shown in Fig. 4. There are two sets of these ridges 32, each set of which extends substantially half way around the flange. Each set comprises an arcuate portion concentric with the core and a straight portion tangential to this arcuate portion. It will be found by measurement that the lengths of these ribs are substantially equal. The arcuate portion of the rib having the smallest radius of arc has a greater angular extent, and the tangential portion of this rib has a greater length than the corresponding parts of a rib, the arcuate portion of which has a greater radius.

In inserting the films 15, the upper and lower edges of the film are inserted into the space between a pair of ribs on the upper and lower flanges and the film is pushed inwardly, causing it to follow between the tangential portions of the ribs and to curl around the arcuate portions of the ribs until the leading edge of the film comes up against a stop rib 33 on the flange. It will be seen that with this arrangement almost the entire space between the upper and lower flanges is taken up by the film to be developed and the flow spaces therebetween. If desired, retaining lugs or projections 34 may be provided behind which the rear edge of the film slips when fully inserted. The upper flange 5 may be held in any desired position of vertical adjustment on the core 3 by means of a set

screw 35. The apparatus may be made of any suitable material. For example, the tank and cover may be made of sheet metal and the core 3, the flanges 4 and 5, and the light shield 26 may be made of any suitable plastic material which will not be affected by the contents of the container. The cap 10 may be made of rubber or any other suitable material.

I claim:

1. A film developer apparatus comprising a container for liquid and films, a cover therefor having an opening therethrough, a tubular filling, emptying and film carrying core centrally positioned in said tank and having a tubular filling portion extending through said opening, said apparatus having a fluid passage affording communication between the inside of the tubular core and the space between said core and the walls of the container and said cover having a tubular discharge extension surrounding said core and communicating with said fluid passage for fitting into the mouth of a receptacle whereby, in emptying the container, the mouth of a receptacle may be slipped over the core extension and tubular extension and the assembly may be inverted to enable the liquid to flow from the container into the receptacle through the passage between the outside of the core and tubular extension and to enable the air to flow from said receptacle into said container through said tubular core.

2. A film developer apparatus comprising a container for liquid and films, a cover therefor having an opening therethrough, a tubular filling, emptying and film carrying core centrally positioned in said tank and having a portion extending through said opening, a funnel, in communication with said tubular core, a removable cover for the flaring end of said funnel, and a connection for supplying liquid to the interior of the funnel and container when the removable cover is in place, whereby in filling the container the flaring portion of the funnel may be placed over the mouth of a receptacle, and the assembly may be inverted to enable the liquid to flow from the receptacle through the funnel and core into the container, and whereby for washing the apparatus and film, said removable cover may be applied to the funnel, the assembly may be inverted, and water may be forced into said funnel through said connection and caused to flow up through said core, down between the films and out of said container.

3. A film developer apparatus comprising a container for liquid and films, a cover therefor having an opening therethrough, a tubular filling, emptying and film carrying core centrally positioned in said tank and having a portion extending through said opening, said apparatus

having a fluid passage affording communication between the inside of the tubular core and the space between said core and the walls of the container and said cover having a tubular discharge extension surrounding said core and communicating with said fluid passage, whereby, in filling the container, the liquid may be caused to flow from a receptacle through the core into the container, and whereby, in emptying the container, the apparatus may be inverted to enable the liquid to flow from the container through said tubular extension and to enable the air to flow into said container through said tubular core.

4. A film developer apparatus comprising a container for liquid and films, a cover therefor having an opening therethrough, and a tubular filling, emptying and film carrying core centrally positioned in said tank and having a portion extending through said opening, said apparatus having a fluid passage affording communication between the inside of the tubular core and the space between said core and the walls of the container and said container having a tubular discharge extension surrounding said core and communicating with said fluid passage, whereby in filling the container the liquid may be caused to flow through the core into the container, and whereby, in emptying the container, the apparatus may be inverted to enable the liquid to flow from the container through the passage between the outside of the core and the cover and to enable the air to flow into said container through said tubular core, said cover having an abutment and said core having an abutment engageable and disengageable with respect to said cover abutment to limit the relative movement of the core and cover in one direction, said cover having another abutment and said core having another abutment engageable and disengageable with respect to said another cover abutment to limit the relative movement of the core and cover in the opposite direction whereby when either the cover or the core is supported in a definite position, either right side up or upside down, both the cover and core will be supported in definite relative position.

5. In a film developer apparatus comprising a tank, a removable cover therefor, a tubular core in said tank having a portion extending through said cover, film positioning means in said tank supported by said core, a funnel in communication with said tubular core, a cap for fitting over the end of the funnel, and a connection for supplying liquid to the interior of the funnel and tank when the cap is in place for use in washing the tank.

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