April 4, 1944. H. NEUWIRTH 2,345,682

FILM DEVELOPING APPARATUS

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Fig. 1.

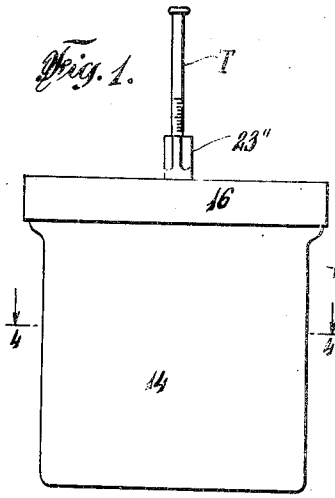


Fig. 3.

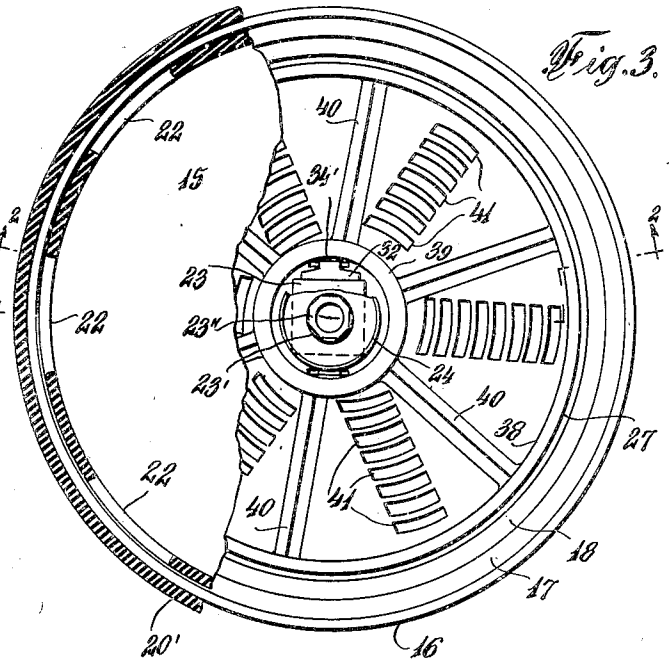


Fig. 2.

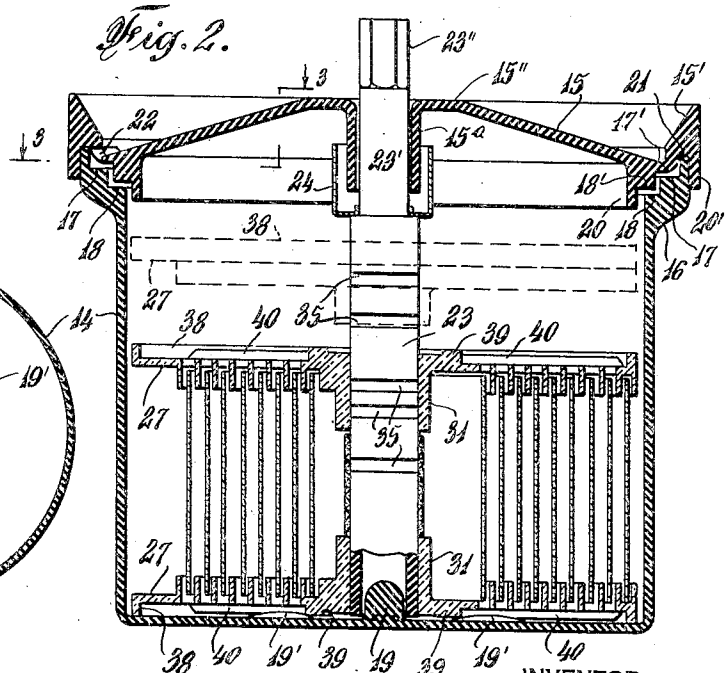
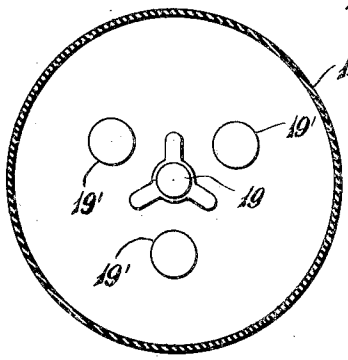


Fig. 4.



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Fig. 5.

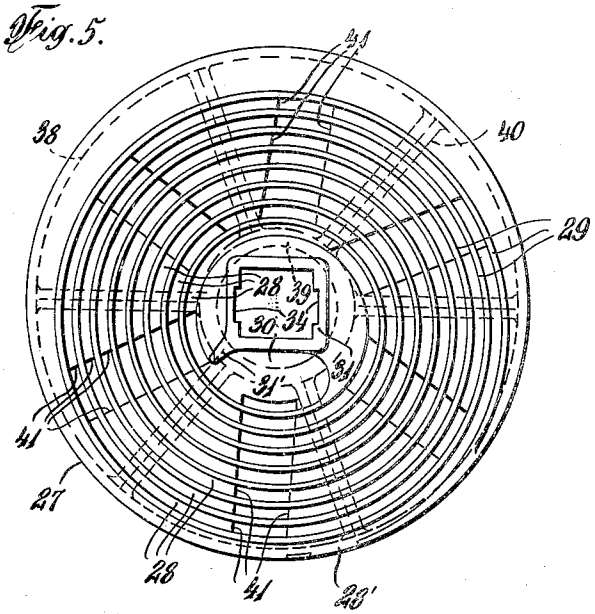


Fig. 7.

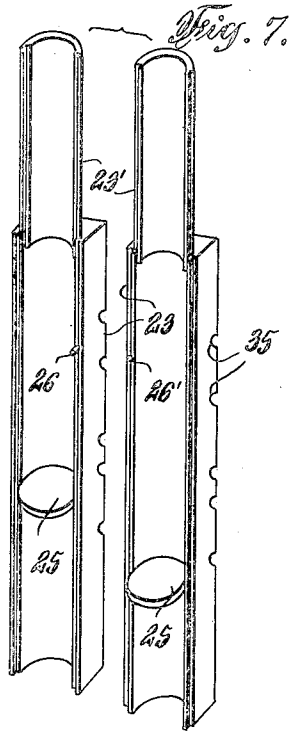


Fig. 10.

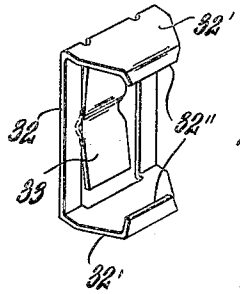


Fig. 6.

Fig. 8.

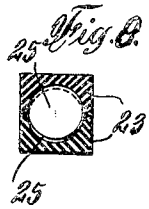


Fig. 9.



Fig. 12.

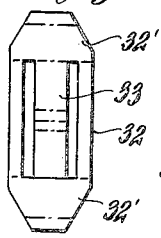
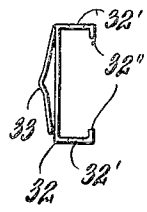


Fig. 11.



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Patented Apr. 4, 1944

2,345,682

UNITED STATES PATENT OFFICE

2,345,682

FILM DEVELOPING APPARATUS

Herman Neuwirth, Brooklyn, N. Y., assignor to Testrite Instrument Company, Inc., New York, N. Y., a corporation of New York

Application October 10, 1940, Serial No. 360,603

7 Claims. (Cl. 95—90.5)

This invention relates to apparatus for use in developing a web of photographic film of the type including a tank to contain the liquid for treating the film and a carrier to support the film at the opposite edge portions adapted to be removably mounted in the tank, and the tank arranged for filling into and emptying therefrom the developing, fixing or washing liquid without removing the film from the tank.

It is an object of the invention to provide in apparatus of this character an improved tank comprising a cup shaped body and a cover therefor having a peripheral recess in the under side the outer wall of which recess is adapted to have a slip joint connection with the body, and the bottom surface of said recess and the end of the side wall of the body arranged to form in the body closing position of the cover a staggered passage in communication with the body and openings in the cover through which to fill liquid into and empty liquid from the tank and prevent light passing into the cover openings entering into the tank, and said body and cover arranged to support a film carrying reel in the tank.

It is a further object of the invention to provide in apparatus of this character an improved film carrying reel including a core and sides or heads adapted to be interchangeably and adjustably mounted on the core to adapt the core to support film of different widths, and the provision of means to releasably secure the reel sides in adjusted position on the reel core.

It is another object of the invention to provide in apparatus of this character wherein the tank comprises a cup shaped body and a cover therefor to arrange the bottom with an axial stud and protuberances circularly spaced about the stud, and the film carrying reel is adapted to engage said stud and the cover to have rotative and axial movement, and the outer surface of the reel sides or heads arranged with projections adapted by rotative movement of the reel to ride over said protuberances and impart axial vibratory movement to the reel and agitate the liquid in the tank.

It is another object of the invention to provide in apparatus of this character an improved film carrying reel comprising a tubular core and sides or heads having hubs whereby they are adjustably mounted on the core, the hubs extending from a face of the reel sides arranged with a spiral groove for the engagement and supporting of the film at the opposite edge portions and having a portion extending laterally therefrom to the inner wall of the groove at the entrance thereof to guide the film into the grooves as it is wound onto the core, and the reel core adapted for the passage of liquid therein from the tank and having plate like portions extended from opposite portions of and spaced longitudinally of the bore of the core to intercept the bore and prevent the entrance of light through the bore of the core into the tank and to support a thermometer in the bore of the core in contact with the liquid to determine the temperature of the liquid and thereby the interval of time the film is to be subjected to the action of the liquid in the tank.

In the drawings accompanying and forming a part of this application

Figure 1 is a side elevation of a film treating apparatus embodying the invention and showing a thermometer supported in the core of the reel.

Figure 2 is a longitudinal sectional view of the apparatus taken substantially on the line 2—2 of Figure 3.

Figure 3 is a view looking at the top of the apparatus with the cover partly broken away and partly in section the section of the cover being taken substantially on the line 3—3 of Figure 2.

Figure 4 is a cross sectional view of the body of the tank taken on the line 4—4 of Figure 1 to show the arrangement of the reel supporting stud and the protuberances at the bottom of the body.

Figure 5 is a view of a reel side or head looking at the face thereof arranged with the film engaging and supporting groove and showing the arrangement of the hub relative to the groove.

Figure 6 is a side elevation of the reel with a portion of the reel core extended from a side of the reel in longitudinal section.

Figure 7 is a perspective view of longitudinal sections forming a reel core and looking at the interior thereof to show the arrangement of the plate like portions extended from the wall of the bore forming portion of the sections to intercept the bore in the core in the assembled condition of the sections and provide a trap for light passing into the bore of the core.

Figure 8 is a cross sectional view of the assembled sections of the reel core to show the arrangement of the plate like portions extended inwardly from the wall of the bore and intercepting the bore to prevent entrance of light into the tank through the bore of the core.

Figure 9 is a cross sectional view of the sections of the reel core showing the same in separated relation and the arrangement of the plate like

portions extended from the wall of the bore portions.

Figure 10 is a perspective view of a clip carried by the reel sides or heads and operative to releasably secure the reel sides in adjusted positions on the reel core.

Figure 11 is a side elevation, on a reduced scale, of the reel side securing clip shown in Figure 10; and

Figure 12 is a blank from which the clip shown in Figures 10 and 11 is formed.

The embodiment of the apparatus illustrated in the drawings for carrying out the invention comprises a tank including a cup shaped body 14 and a removable cover 15, the body and cover preferably being constructed of a suitable molded thermoplastic material or vulcanite. The end portion of the side wall of the body is arranged of increased width or thickness and extends laterally, as at 16, whereby the interior of the body is of uniform diameter. The end surface of the portion of increased thickness is of staggered form effected by arranging the same with portions of two diameters providing annular recesses of right angle form in cross section having annular surfaces stepped inwardly from the periphery of the portion of increased thickness toward the inner surface of the body, as shown at 17 and 18 in Figure 2. The bottom of the body is arranged with an axial inwardly extending stud 19 and protuberances 19' of globular form, shown as three in number, spaced radially from the stud 19 and circularly about the bottom of the body.

The cover is provided with an annular laterally extending rim or flange 15' and the portion within said flange converging upwardly from the juncture thereof with the rim toward the axis and merges with a portion 15'' extending substantially in the plane of the rim and arranging the cover of dished form. The portion 15'' of the cover merges in a sleeve or hub 15a extending axially from the under side of the cover. A peripheral recess is arranged in the under side of the cover, said recess being of a width slightly greater than the width or thickness of the portion 16 of the body. The inner wall portion 20 of said recess extends slightly beyond the outer wall portion 20' and the diameter of the inner circumference of said latter wall portion 20' is slightly greater than the diameter of the outer surface of the portion of increased thickness 16 to adapt it to have a slip joint connection with the body, the inner recess wall 20 in the body closing position of the cover being spaced from the inner surface of the body, as shown in Figure 2. The bottom surface of said recess is arranged with annular surfaces 17' and 18' complemental to the stepped surfaces 17 and 18 at the end of the portion 16 of the body and stepped upwardly from the inner recess wall 20, the surface 17' merging in a curved surface with a wall of an annular recess adapted for engagement of the riser portion of the stepped surface 17 of the body, as shown at 21 in Figure 2, the engagement of said riser portion in said recess 21 limiting the movement of the cover onto the body and sealing the connection between the cover and body. The depth of the recess 21 relative to the stepped surface 17' of the cover is such as to position the cover on the body with the stepped recess surfaces 17' and 18' spaced from the stepped surface 17 and 18 of the body and cooperating with said surfaces to provide a staggered passage, as clearly shown in Figure 2, opening to the tank and in communication with a circular row of openings 22 extended through the cover at the base of the rim or flange 15'. To fill into the tank liquid to the action of which the film is to be subjected the liquid is poured into the dished portion of the cover, the liquid flowing from the cover through the cover openings 22 and the staggered passage into the tank, and the liquid may also be emptied from the tank through said passage and the cover openings 22. By this arrangement of the passage between the cover and body it also serves as a trap to prevent light passing into the cover openings entering into the tank.

The film when subjected to the action of the liquid in the tank to develop, fix or wash the same is carried by a reel comprising a tubular core, also of suitable thermoplastic material or vulcanite, having a portion 23 of rectangular form or square in cross section and a portion 23' of cylindrical form of a diameter less than the width of the portion 23. The core is adapted to be rotatably and slidably engaged with the tank stud 19, the stud being of less diameter than the bore in the core to permit liquid to enter from the tank into the bore of the core. The cylindrical portion 23' of the core is loosely engaged in and extended through the hub 15a of the cover, and a ferrule 24 on the core abutting the shoulder formed by the portions 23, 23' of the core adapted to telescopically receive the cover hub as the cover is engaged on the body and form therewith a trap to prevent light passing through the space between the portion 23' of the core and the cover hub entering the tank. The core is provided with plate like portions 25 extended from opposite wall portions of the bore in the core and one spaced longitudinally of the core relative to the other, said plate portions being of less dimension than the diameter of the core bore, or the outer portion arranged eccentric to the curvature of the wall of the bore and adapted to intercept and arrange the bore with a trap to prevent light passing into said bore entering the tank, and also adapted to support a thermometer T (Figure 1) engaged in the bore to determine the temperature of the liquid in the tank and thereby determine the interval of time the film is to be subjected to the action of the liquid in developing or fixing the film. To facilitate arranging the plate portions 25 on the wall of the core bore the core may comprise longitudinally split and laterally separable sections, as shown in Figure 7, and arranged with means to properly position the sections relative to each other and prevent longitudinal movement of the sections one relative to the other, and shown as a pin 26 carried by and projecting from a mating edge of one section adapted to engage a socket 26' in a mating edge of the other section.

The real sides or heads comprise like disk members 27, preferably of a transparent material and may be made of a suitable thermoplastic material. One face of each disk is arranged with a spiral groove 28 defined by a spiral rib 29 and adapted to be engaged by and support the film at the side edge portions therein. One end of the groove, which may constitute the entrance end of the groove, terminates in a recess 30 at a side of a hub 31 extending from the face of the disks from which the groove forming rib 29 extends and is of a length to extend beyond said rib. The hub is of rectangular form in cross section and has a bore corresponding to the shape of the portion 23 of the reel core to be slidably engaged

thereon, a projection or lug 31' extending laterally from a corner of the hub 31 to the inner surface of the wall of the groove 28 at the entrance end thereof and adapted to guide the film into the groove as the film is wound around the core.

The real sides or heads are slidably and adjustably mounted on the core with the faces arranged with the film engaging groove in opposed relation to each other by the engaging the core in the disk hubs, and means is provided to releasably secure the reel sides in adjusted position on the reel core. As shown in Figures 10 to 12 this means comprises resilient clips or detent members 32 formed from a substantially rectangular sheet metal plate having portions at the opposite ends of equal length flanged laterally, as at 32', and said flanges arranged with lips by reversely flanging the free end portions thereof, as shown at 32''. A tongue 33 is stamped from the portion 32 of the plate intermediate the flanges 32' and arranged to obtuse angle form in longitudinal section with the angle portion projecting from the face of the plate 32 opposite the flanges 32'. The clips are mounted in the disk hubs to extend relative to longitudinal recesses 34 (Figure 5) with one flange 32' engaged over the end of the hub and the lip engaging a recess in the end of the hub, and the opposite flange 32' engaging over the wall and into a recess at the opposite end of the hub, as shown at 34' in Figure 6 with the angle portion of the tongue extending into the opening in the hub, the clips being of resilient material are adapted to be readily sprung over the ends of the hub. The disks are releasably secured to the real core by the angle portion of the clip tongues yieldingly engaging recesses 35 arranged in pairs extending parallelly and transversely of opposite side portions of the core 23. As shown the core is provided with six pairs of said recesses 35, one pair being adjacent the end of the reel core for engagement of the clips carried by one disk to releasably secure said disk adjacent said end of the core, and the other recesses spaced therefrom predetermined distances to secure the other disk in different positions to the core and adapt the reel sides or heads to support film of different standard widths. As the reel sides 27 are moved along an unrecessed portion of the core the angle portion of the clip tongues 33 will ride along said surfaces and move said tongues into the hub recesses 34 and as they come opposite recesses 35 said angle portion of the tongues will engage the recesses under the resiliency of the material of the tongues and yieldingly hold the reel side in adjusted position. To adjust the reel sides all that is necessary is to exert sufficient force thereon to cause the tongues to ride out of the recesses 35. It will be obvious that should the core be made of longitudinally split sections the engagement of the same in the bore of the disk hubs will retain them in assembled position.

Instead of winding the film around the core it may be fed into the outer convolution of the disk grooves and follow the centripetal path of the grooves to the recess 30 at the side of the hubs. To facilitate guiding the film into the grooves a portion of the groove defining wall 29 adjacent the end of the outer convolution is cut away, as at 28' in Figure 5. To facilitate winding the film around the core of the film an attaching member 36 of flexible material is connected at one end to the core between the reel sides, as shown in Figure 6. The opposite end of the attaching member 36 is provided with a hook 37 adapted to engage in an opening adjacent the and centrally of the film, as shown in dotted lines at F in Figure 6. After the film has been connected to the attaching member as the reel is rotated the film will be wound around the core and guided in the disk grooves 28 by the portion 31' extended from the disk hubs.

A peripheral flange 38 is extended laterally from the face of the disk opposite the face with the groove forming rib 29, and an annular rib 39 is extended from the face of the disks opposite the hubs in the direction of the peripheral flange 38. The rib 39 and the peripheral flange 38 are arranged eccentrically of each other and extend to the same extent from the face of the disk. The face of the disks from which the annular rib 39 extends is also provided with reinforcing ribs 40 extending radially between the rib 39 and peripheral flange 38, the ribs, as shown, being six in number equidistantly spaced about the disks. The disks are also provided with openings 41 extended through the bottom of the grooves 28 and arranged in radial rows equidistantly spaced between reinforcing ribs 40. The annular rib 39 is of a diameter relative to the spacing of the protuberances from the tank stud 19 whereby said rib 39 will engage upon said protuberances and support the reel with said rib 39 and the peripheral flange 38 spaced from the bottom of the body of the tank, thereby permitting liquid in the tank to pass below said flange and rib and through the space between stud 19 and the wall of the bore in the reel core 23 and rise to a level in the reel core substantially equal to the level of the liquid in the tank. The disk ribs 40 are adapted to engage upon and in the spaces between the protuberances 19'. By the arrangement of mounting the reel core upon the tank stud 19 and extending the core portion 23' through the cover hub and arranging said end of the reel core, as at 23'', for the engagement of a crank or other implement to rotate the same, as the reel is rotated the ribs 40 of the lower reel side or head 27 will ride onto and off from the protuberances 19' and thereby imparting axial vibratory movement to the reel not only agitating the liquid in the tank and causing it to move relative to the film but also moving the film relative to the liquid.

Having described my invention, I claim:

1. In a film developing device, a tank comprising a cup shaped body, and a dished cover therefor having a peripheral flange and a circular row of openings within the flange, said flange being adapted to have a slip joint connection with the body and the under surface of the cover within said flange arranged with a portion to engage and support the cover on the side wall of the body and space the surface of the under side of the cover within said flange from the end surface of the side wall of the body, and said surfaces on the under side of the cover and end of the side wall of the body arranged with complemental annular surfaces stepped downwardly and inwardly from the cover flange and end of the body toward the inner surface thereof to provide a stepped passage between said surfaces of the cover and body in communication with the body and cover openings adapted for filling liquid therethrough from the dished portion of the cover into the body and constitute a trap for light passing through the cover openings.

2. In a film processing device, a tank comprising a cup shaped body having an end of the said

wall arranged with annular surfaces stepped downwardly and inwardly from the end surface toward the inner surface of the side wall of the body, and a dished cover for the body having a peripheral recess in the under side the bottom of which recess is arranged with annular stepped surfaces complemental to the stepped surfaces at the end of the side wall of the body and a circular row of openings extended through the outer stepped surface of the cover recess, the outer wall of said cover recess being adapted to have a slip joint connection with the body and arranged to be supported on the body with the stepped surfaces of the recess opposed to and spaced from the stepped surfaces at the end of the side wall of the body and form therewith a downwardly and inwardly stepped passage in communication with the body and cover openings for the flow of liquid therethrough into the body from the dished cover and constitute a light trap, and the bottom of the body and the cover arranged for the rotatable engagement and supporting of a film carrying reel centrally of the body.

3. In a film developing device, a tank comprising a cup shaped body having the end portion of the side wall arranged of increased thickness and the end thereof arranged with concentric annular surfaces stepped downwardly from the outer to the inner side surfaces of the body, and a dished cover for the open end of the body having a peripheral recess in the under side, the bottom of said recess being arranged with concentric annular surfaces stepped downwardly from the outer to the inner walls of the recess complemental to the stepped surfaces at the end of the body and an annular row of openings in the cover extended through the outer stepped surface of the cover recess, and the outer wall of the recess adapted to have a slip joint connection with the body and arranged to support the cover on the body with the stepped surfaces of the cover recess in spaced relation to the stepped surfaces of the body and form therewith a stepped passage in communication with the body to fill liquid therethrough from the dished portion of the cover into the body and trap light passing into the cover openings, the dished portion of the cover serving as a reservoir for the liquid passing through the cover openings.

4. In a film developing device, a tank comprising a cup shaped body having concentric annular stepped surfaces at the end of the side wall stepped downwardly and inwardly from the end surface to the inner surface of the body, and a cover for the open end of the body arranged with a hub extended axially from the under side with the bore extended through the cover and having a peripheral recess in the under side, the outer wall of which recess is adapted to have a slip joint connection with the body and the bottom of the recess arranged with concentric annular stepped surfaces stepped downwardly from the outer wall to the inner wall of the recess and a circular row of openings extended through the wall of the outer stepped surface, said recess surfaces being complemental to and forming with the stepped surfaces at the end of the side wall of the body in the body closing position of the cover a stepped passage in communication with the body and the cover openings for filling liquid therethrough into the body and constituting a trap for light passing through the cover openings, a film carrying reel supported centrally at the bottom of the body and having a core arranged with a reduced end portion extended through and supported in the cover hub, and a ferrule engaged on the reel core and supported on the shoulder formed by the reduced portion of the core adapted to telescopically receive the cover hub and form therewith a trap for light passing through said hub.

5. In a film processing device, a tank comprising a cup shaped body having a stud extending inwardly axially of the bottom and the inner surface at the end of the body arranged with annular stepped portions, a dished cover for the body arranged with an axial hub and a peripheral flange extended from the under side thereof and having a circular row of openings within the flange and the under side of the cover within the flange arranged with stepped annular surfaces complemental to the stepped surfaces of the body arranged to provide in the body closing position of the cover a stepped passage in communication with the cover openings and the body for filling liquid into the body and form a light trap, a film carrying reel having a tubular core loosely engaging the stud axially of the bottom of the body and arranged to permit liquid in the tank to enter the bore in the reel core, and said core projecting from a side of the reel and loosely extended through the cover hub and arranged at the end for the engagement of means to rotate the reel exterior of the tank, and said reel core having plate portions of less width than the bore in the core extended from opposite portions of the wall of the bore and spaced longitudinally of the portion of the core disposed within the body to permit passage of liquid and air therethrough from the tank and form a light trap and adapted as a support, for a thermometer engaged in the core bore, and a ferrule on the projecting portion of the reel core within the tank to telescopically receive the cover and hub and form therewith a light trap.

6. In a film processing device, a tank comprising a cup shaped body having a stud extending axially inwardly from the body and protuberances circularly spaced about said stud and the inner surface at the end of the body arranged with downwardly stepped annular surfaces, a cover for the body arranged of exterior dished form having a circular row of openings adjacent the rim and an axial hub extended from the under side thereof, said cover having a peripheral flange extending from the under side thereof adapted to have a slip joint connection with the body, and the under side of the cover within the flange arranged with stepped surfaces adapted when the cover is in body closing position to form with the inner surfaces at the end of the body to form a passage in communication with the cover openings and the body and a light trap and adapted for filling liquid therethrough from the dished portion of the cover into the body, a film carrying reel including a tubular core and sides mounted thereon having radial ribs projecting from the outer surface thereof, the one end of the core projecting from the lower reel side adapted to be rotatably engaged upon the body stud and the portion of the core projecting from the upper reel side loosely extended through the cover hub and adapted for engagement of means exterior of the tank to impart rotative movement to the reel and rotative movement of the reel causing the ribs of the lower reel side to ride over the body protuberances and impart axial vibratory movement to the reel, and a ferrule mounted on the projecting portion of the reel core adapted to telescopically receive the cover hub and form therewith a light trap.

7. In a film processing device, a cup shaped

receptacle having a stud extended axially inward from the bottom thereof and protuberances spaced about the stud, a dished cover having a hub extending axially from the under side of an upwardly diverging wall portion centrally of the dished portion of the cover and having a peripheral flange adapted to have a slip joint connection with the body and a circular row of spaced openings therein within the flange, the under side of the cover within the flange and the inner surface at the end of the side wall of the body arranged to form when the cover is in body closing position a passage in communication with the cover openings and body and a light trap for filling liquid therethrough from the dished portion of the cover into the body, a film carrying reel having a tubular core, one end of said core loosely engaging upon the body stud to have rotative movement thereon and spaced from the bottom of the tank by engagement of the reel with the body protuberances to permit liquid to enter from the tank into the reel core, and the opposite end of the core extended through the cover hub and arranged exterior of the body for engagement of means to rotate the reel, and said reel core having plate portions of less width than the cross sectional dimension of the core bore extended from opposite wall portions of the core bore and spaced longitudinally of the core intermediate the ends thereof and disposed in the liquid in the core bore and form a trap for light entering the core bore at the outer end of the core and adapted as a support for a thermometer engaged in the core bore, and a ferrule on the real core adapted for the reception of the core hub and form therewith a light trap.

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