Nov. 14, 1950 W. R. HARLOW 2,529,495

APPARATUS FOR TREATING FILM OR THE LIKE

Filed Oct. 31, 1947 2 Sheets-Sheet 1

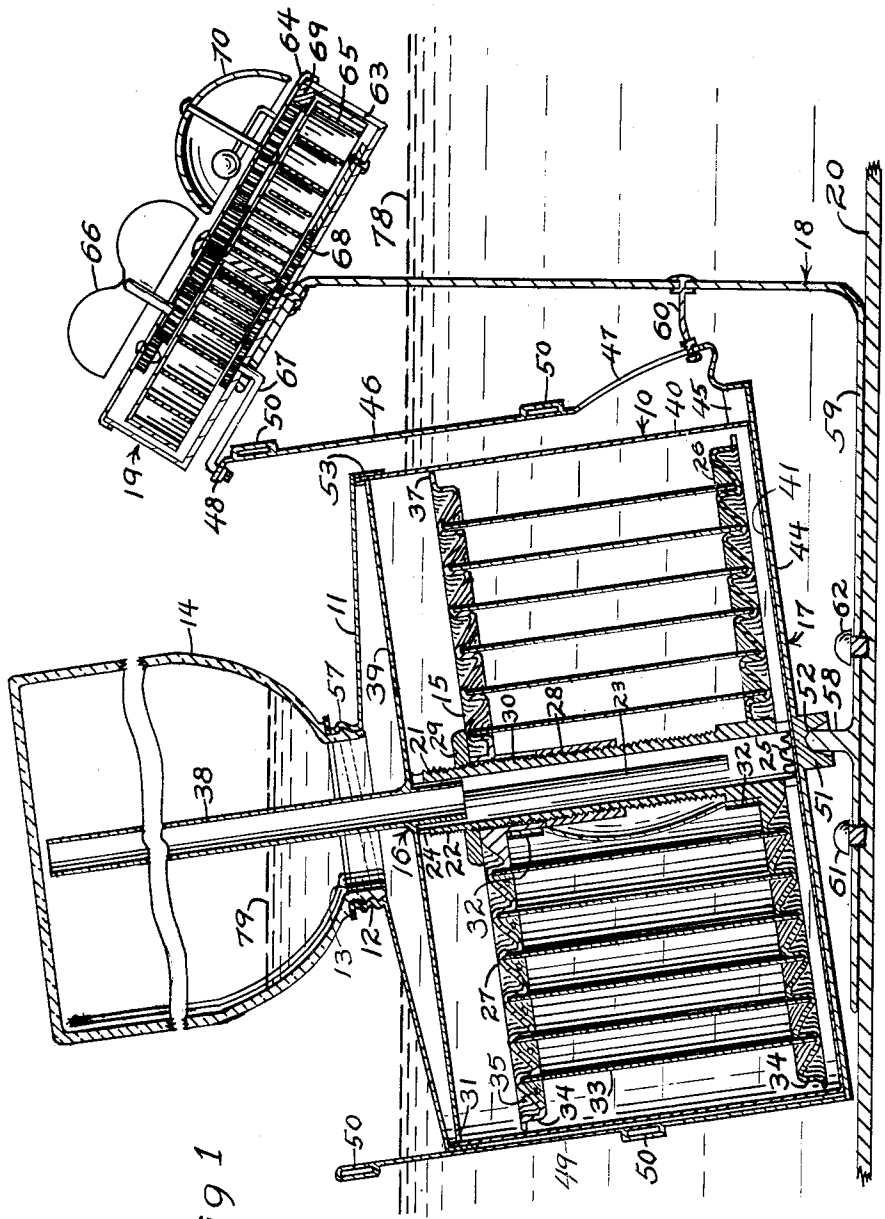


Fig 1

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Fig 2

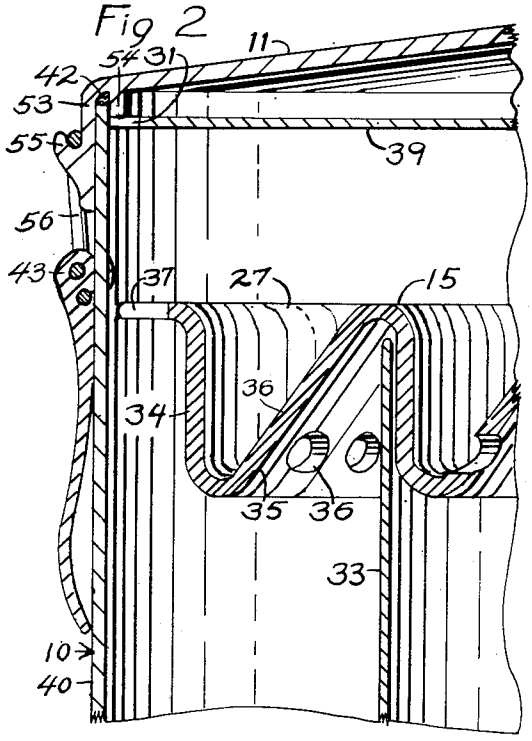
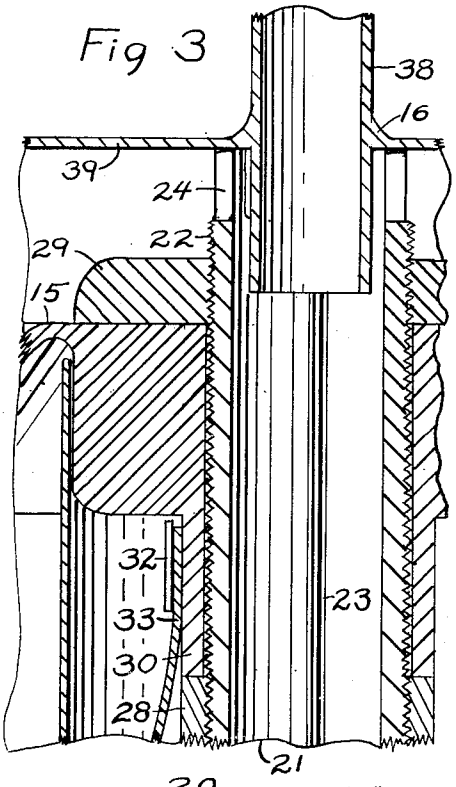


Fig 3



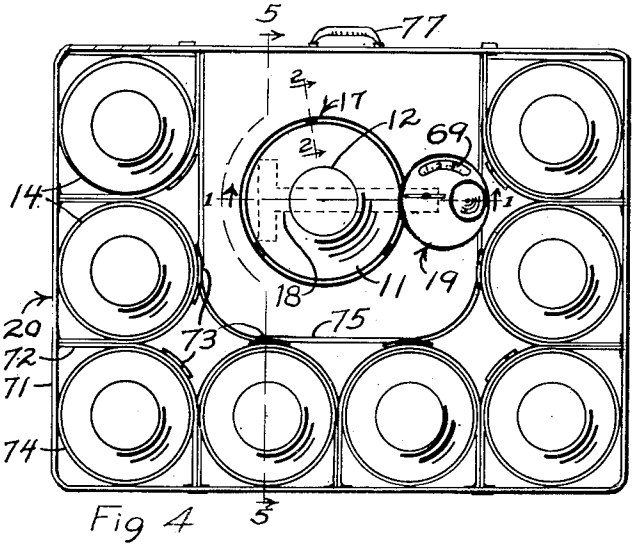


Fig 4

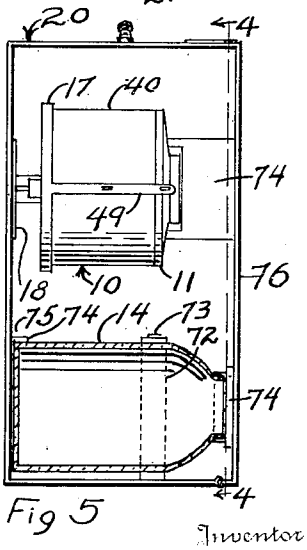


Fig 5

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UNITED STATES PATENT OFFICE

2,529,495

APPARATUS FOR TREATING FILM OR THE LIKE

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Application October 31, 1947, Serial No. 783,425

3 Claims. (Cl. 95—99)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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This invention relates to a new and improved apparatus for treating, as by developing, stopping, fixing, and washing, photographic film or the like and is particularly adapted to treatment of small amounts of film in which developing conditions are critical, as in color film processing or testing and scientific work.

An object of the invention is the provision of a novel apparatus for treating photographic film or the like in which means are provided for effecting a closed gravity system including a septum for transmission of treating solution from a solution container to a treating tank and from the tank to the solution container after treatment.

Another object of the invention is to provide such an apparatus in which the said closed system is agitated as a whole during the treatment.

A further object is the provision of a support providing for immersion of said apparatus in a temperature controlling fluid.

Another object is to provide in such apparatus a reel which is provided with novel means of adjustment to adapt it to different widths of film or the like.

Another object is to provide a novel means of mounting the apparatus for agitation and of agitating the apparatus.

Other objects and advantages of the invention will appear hereinafter.

The invention involves the provision of a series of reels of novel form adapted to hold various sizes of film, only one such reel being illustrated herein to show the principle; a septum which insures light-tightness, quick transfer of the solutions, and an even distribution of the solutions used over the film; a tank adapted to contain the reel and septum; a table adapted for agitation on a standard by an agitator; a tank cover with a central opening capable of receiving, in a liquid-tight fit, the openings of containers for the various solutions required in development; and a portable supporting and temperature controlling container or case adapted to carry and protect the entire outfit, accessories such as thermometers and extra chemicals, and also to act as a constant temperature bath for tank and solution containers during development.

Although the novel features which are characteristic of this invention will be pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be employed, may be better understood by referring to the following description taken in connection with the accompanying drawings, forming a part thereof and in which like numerals are used to designate like parts.

Figure 1 is a vertical section of the developing apparatus, table, standard, and agitator, taken on line 1—1, Figure 4.

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Figure 2 is an enlarged section of a part of the reel and taken taken on line 2—2, Figure 4, showing the placement of the film in the reel and the method of making a tight seal between the tank and tank cover.

Figure 3 is an enlarged section of the central core taken on line 1—1, Figure 4, showing the method of adjusting the position of the upper reel portion on the core.

Figure 4 is a plan view of the carrying case with cover removed, at line 4—4 in Figure 5, showing the placement of the various elements therein.

Figure 5 is a section of the carrying case on line 5—5 of Figure 4.

This invention relates to apparatus for treating photographic film or the like, and comprises a tank 10 having a cover 11 with a coupling 12 adapted for water-tight connection with the opposite coupling 13 on any one of several liquid containers 14. The film is carried in a reel 15, under a septum 16, both of which fit within the tank 10. The tank rests on a table 17, supported on a standard 18, which is adapted to be agitated by an agitator 19. The entire apparatus and accessories fit within a portable supporting container or case 20, which provides a means of maintaining the apparatus at desired temperature.

The reel 15 consists of a hollow core 21, the upper portion of which is threaded externally at 22, and grooved longitudinally as indicated at 23, and both ends of which are provided with a plurality of notches as at 24 and 25; a lower spirally grooved plate member 26, an upper spirally grooved plate member 27, the position of whose spiral is fixed in relation to the lower spiral member 26 by suitable means such as by the groove 23 in core 21 which receives an inwardly disposed projection on the upper spiral plate 27 but whose distance from the lower member 26 is regulated by the position of the internally threaded sleeve 28, and which is secured in place by the lock nut 29. The central portions of the spiral plate members 26 and 27 may desirably be integral with core 21 and sleeve 30, respectively, which serve to hold the members 26 and 27 parallel to each other and perpendicular to the core 21. Attached to sleeve 30 and core 21 are clips 32, which hold, by spring pressure, the internal end of film 33. The spiral plate members 26 and 27 consist of an outward spiraling plane surface 34 with connecting material 35 through which holes 36 preferably are punched. The circumferences of the spiral plate members are preferably provided with a plurality of notches 37. The reel shown illustrates the principle which adapts it to many sizes and types of film, and is not limited to the exact structure shown.

A septum 16 preferably comprises a hollow cylindrical stem 38, adapted to reach almost to

the bottom of the solution container 14, and a plate 39 integral with the stem, said septum removably fitting within and on top of the cylindrical core 21. The septum plate 39 with cover 11 forms a restricted passage which acts to stop most of the light from entering the tank 10, yet permits the free flow of liquids and gases through its central tube portion 38 and around its outer edge which is provided with a plurality of notches 31. The septum stem 38 acts as a vent to enable the air in the tank 10 to escape readily through the notches 24 and the core of stem 38, to the bottom of the inverted container 14, thus permitting rapid transfer of the liquid from the container to the tank by gravity flow.

The tank 10, within which the reel 15 and septum 16 fit, preferably consists of a cylinder 40 with closed bottom 41, and having a light or liquid-tight connection with the cover 11 desirably by means of a gasket 42 and several clips or fasteners 43 of conventional design.

The tank 10 rests loosely on a table 17, which consists of a circular plate 44 of larger diameter than tank 10 with a surrounding upstanding rim 45. An agitating arm 46 extends upward from the ring 45, and has a slot 47 which pivotally and slidably engages the end of arm 60; and a bearing surface 48 in which rotates the arm 67 of the agitator. Another arm 49 extends up from the opposite side of the rim 45. Each arm, 46 and 49, preferably has a slot 50 through which an elastic strap (not shown) may be threaded to hold narrow objects on the table 17. A socket member 51 in the center of plate 44, having a socket bearing surface 52, supports the table 17 on ball pivot 58 on the standard 18.

The cover 11 is formed to completely seal and to thereby permit complete drainage of the tank in the inverted position. In the embodiment shown, the cover circumference carries two downward-extending rims, 53 and 54, adapted for retaining the gasket 42. Lugs 55 accept the tongues 56 of the clips 43, insuring a permanently tight fit. The center of the cover is provided with a rim surface 12, which, in this case and for purposes of illustration of the principle, consists of a screw surface with threads 57 adapted to fit over the threaded mouth of a solution jar 14, although it could be any one of various types of such liquid-tight unions commonly used.

The standard 18, comprising a relatively narrow strip of metal or the like, is adapted to support the weight of the tank, film, developing solution, container, and table, on the pivot 58 through bearing surface 52 placed approximately beneath the center of gravity of the tank 10. A lower member 59 of standard 18 carries the pivot 58. The standard 18 supports arm 60, and the motor 19, its lower section 59 being wide enough to render the whole stable, and perforated to permit attachment to the case 20 by the lugs 61 and 62.

The motor drive 19 may be electrical, mechanical, pneumatic, or manual; and for the purpose of illustration, a spring-wound motor is shown. It desirably consists of a case 63 and cover 64 containing a coil spring 65 wound by the key 66, which drives a gear train and escapement 68 which in turn imparts an irregular circular drive to the arm 67. As the spring is wound, a small indicator 69 shows the number of minutes of agitation for which the motor is wound. A bell 70 is set to ring just before the spring is completely run down. Since the mechanism of the motor 19 is based on well-known principles, it is not elaborated here.

The portable supporting and temperature controlling container or case 20 consists of a liquid-tight shell 71 of any suitable material. Several containers are held firmly in place as by belts 72 and are desirably secured by quick opening clamps 73 of any standard design. The belts 72, case 71, and cover 76 preferably are padded with a resilient material 74. Further strength to hold the containers 14 in place is given by the shallow trough formed in the bottom of the case 20 by the U-shaped member 75, Figure 4.

The largest compartment, as indicated in Figure 4, is large enough to hold the entire standard 18, table 17, tank 10, and motor 19, during operation. Threaded holes in the case 20 (not shown) provide for draining, filling, and overflow when in use as a temperature controlling bath, and for attachment of the case 20 to any source of controlled temperature fluid. A removable cover 76 attaches to the case or shell 71 in a conventional manner. A handle 77 is attached to the shell 71 for convenience in carrying. The level of the temperature controlling water bath is indicated by 78 in Figure 1. The level of the solution is indicated by 79 in Figure 1.

Operation of the unit is as follows:

The necessary solutions are mixed and placed in their respective labeled jars 14 in their proper compartments in the supporting and temperature controlling case 20. After removing the tank 10 with reel 15 and septum 16, water 78 of the proper temperature is admitted to the case 20 to the overflow level to bring all the solutions to exactly the same and correct desired temperature.

The film 33 is loaded in the dark into the reel 15 by hand or by any of the several mechanical means designed for this purpose. The reel 15 is then placed in the tank 10, the septum 16 set in, and the cover 11 clamped on by means of the clips 43. The remainder of the development may now take place in the light.

The loaded tank 10 is inverted over the first solution container 14, and secured tightly thereto by the coupling of screws 12 and 13. The container 14 is loosened by releasing the clamp 73, and it and the tank 10 are then inverted and set on the table 17. The solution in the container 14 then runs down into the tank 10, filling it completely, by force of gravity. The key 66 is wound until the indicator 69 shows the necessary minutes of development as determined by time and temperature graphs. The wound spring turns the arm 67, which imparts an irregular and non-cyclic but gentle agitation to the contents of the tank 10. Since the tank 10 is immersed in the water bath 78 during agitation, there will be no undesired change of temperature, and the weight of the tank and contents is so buoyed that relatively little energy from the motor is necessary for proper agitation. The container 14 remains attached to the tank 10 during agitation by the coupling of screws 12 and 13, and screws the triple purpose of keeping the system air-tight, raising the center of gravity of the system high enough so that the tank tends to over-balance and slide to the low point of the plate 44 twice on each rotation of arm 67 (thus contributing to non-cyclic agitation) and being ready for instant draining of the tank 10 at the conclusion of the time of action of the solution. Since the plate 44 is of larger diameter than the tank 10, and since the angle of the plate 44 with the horizon-

tal is sufficient to allow the tank 10 to slide by force of gravity on the incline of plate 44 as constantly changed by the changing position of arm 67, the tank will tend to bump gently back and forth against various parts of the rim 45, which bumping motion contributes to non-cyclic agitation and tends to remove any air bubbles remaining inside the tank.

Upon completion of the proper agitation time, the bell 70 rings, the operator lifts the tank 10 and container 14 off the table 17, inverts them and places the container 14 back in its proper compartment. The solution drains from the tank 10 down into the container 14 by gravity. The tank 10 is then uncoupled from the container 14 and is transferred to the next container in order, where the process is contined until development is complete. Washing may then be accomplished by removing the cover 11, septum 16 and passing the wash water down the center of the cylinder 21, up through the film 33 through perforations in the reel 27, and out over the side of the tank 10. Or, where wash water quality, quantity, or temperature, is critical, more containers 14 filled with wash water may be used for repeated, agitated, controlled washing in the same manner as the solutions.

The devices herein generally referred to as portable apparatus for treating film or the like may be used for other purposes, and it is not intended to limit them solely to this purpose. Alterations in details may be made to the specific form of the invention as herein shown and described without departing from the spirit and intent of the invention or the scope of the claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. Apparatus for treating film or the like comprising a support, a pivot member on said support, a film treating tank, means mounting said tank for movement on said pivot member, means mounted on said support and connected to said tank mounting means for agitating said tank mounting means on said pivot, a solution container having means for liquid-tight connection to said tank when either one is inverted in relation to the other, said tank having cooperating means for providing said liquid-tight connection with said solution container, said solution container when disposed in inverted connection with said tank providing solution by gravity for treating film or the like in the tank and adapted to be agitated with said tank by said agitating means, said tank mounting means comprising a table member having a socket cooperating with said pivot member, said table supporting said tank, said table having an upstanding arm portion, a standard on said support carrying said agitating means at its upper end, an arm on said standard, said arm portion of said table having a slot therein for slidable pivotal engagement with said standard arm, said agitating means including a rotary drive arm rotating in a plane inclined in respect to the plane of the support, the end of said rotary drive arm being pivotally connected to the upper end of said upstanding arm portion of the said table for imparting agitation thereto.

2. Apparatus for treating film or the like comprising a support, an upstanding pivot member on said support, a film treating tank, a table receiving said film treating tank, said table having a central pivot portion engaging said upstanding pivot member and thereby mounting said tank carrying table for tilting agitating movement in any direction upon said support, drive means mounted on said support and connected to said tank carrying table for controlling the agitating movement thereof in varying directions, a container for treating solution mounted on said tank on said table, said tank containing solution from said solution container, the said connected drive means and table being constructed and arranged in relation to the elevated center of gravity of the said combined tank and solution container to provide requisite tilting and agitating motion in varying directions with a minimum of energy from the drive means, said table being of greater dimension than said tank to permit sliding motion of said combined tank and container on said table during said agitation, said connected table and drive means being constructed to provide sufficient motion including tilting of the table to cause said combined tank and solution container to slide on said table, and stop means at the edges of said table for arresting the sliding movement of said tank on said table and contributing to the agitation.

3. Apparatus for treating film or the like comprising a support, an upstanding pivot member on said support, a film treating tank, a table receiving said film treating tank, said table having a central pivot portion engaging said upstanding pivot member and thereby mounting said tank carrying table for tilting agitating movement in any direction upon said support, drive means mounted on said support and connected to said tank carrying table for controlling the agitating movement thereof in varying directions, a container for treating solution mounted on said tank on said table, said tank containing solution from said solution container, the said connected drive means and table being constructed and arranged in relation to the elevated center of gravity of the said combined tank and solution container to provide requisite tilting and agitating motion in varying directions with a minimum of energy from the drive means, said support comprising a container, temperature controlling fluid in said supporting container, said tank and the surmounted solution container being so constructed that said tank is substantially immersed in said fluid and buoyed thereby, with said solution container extending substantially above said fluid.

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