March 16, 1965 K. LANE 3,173,352

METHOD OF AND APPARATUS FOR DEVELOPING PHOTOGRAPHIC FILM

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Fig. 1.

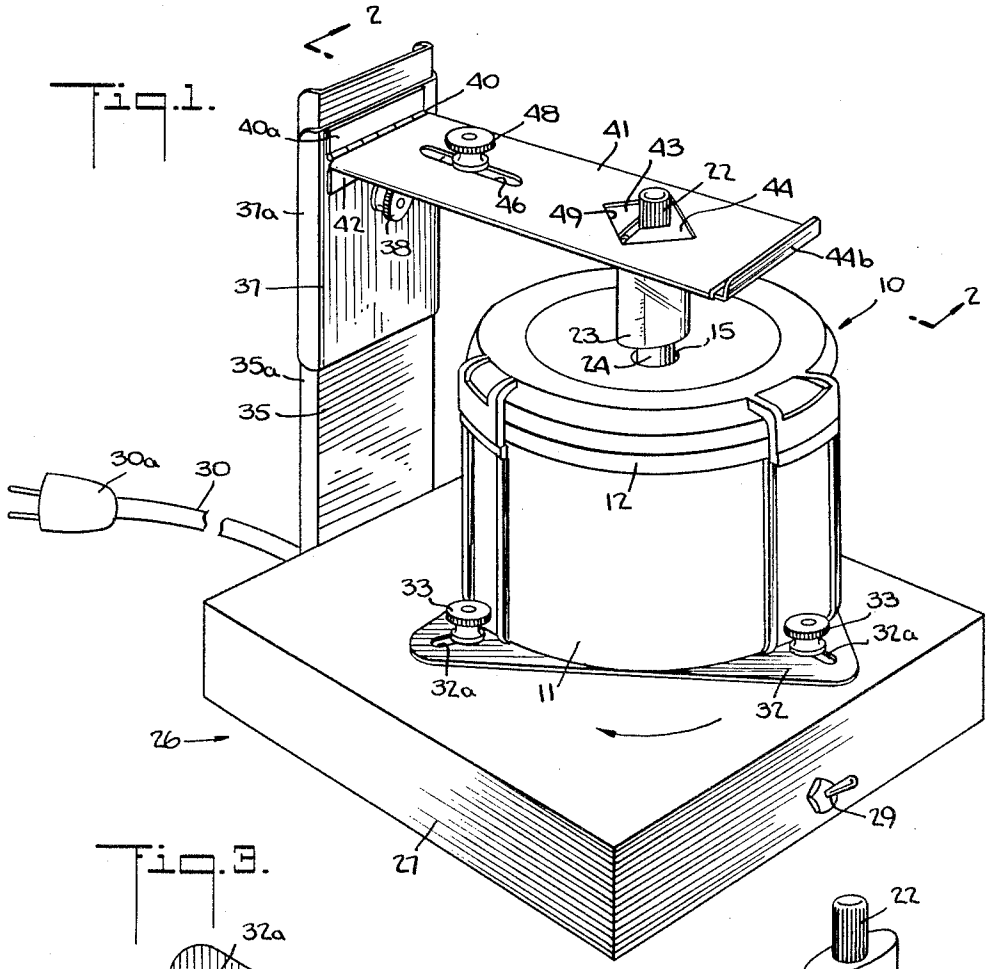


Fig. 3.

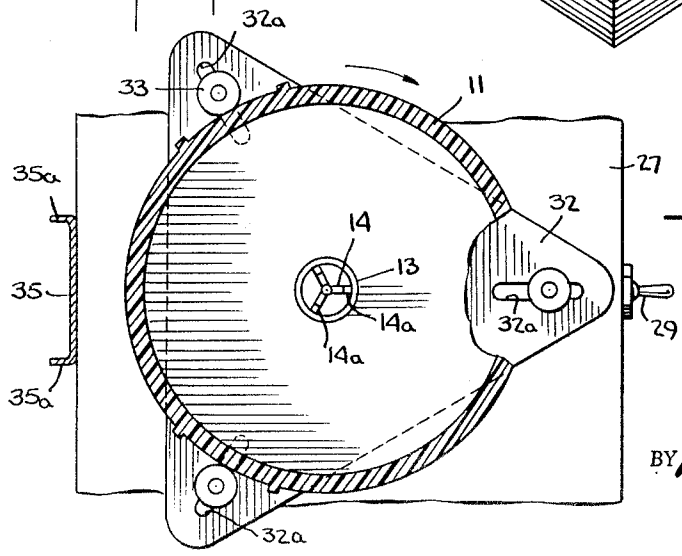
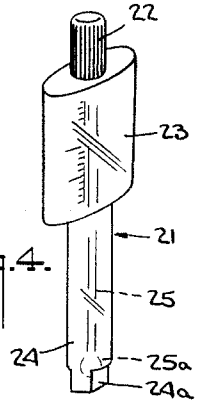


Fig. 4.



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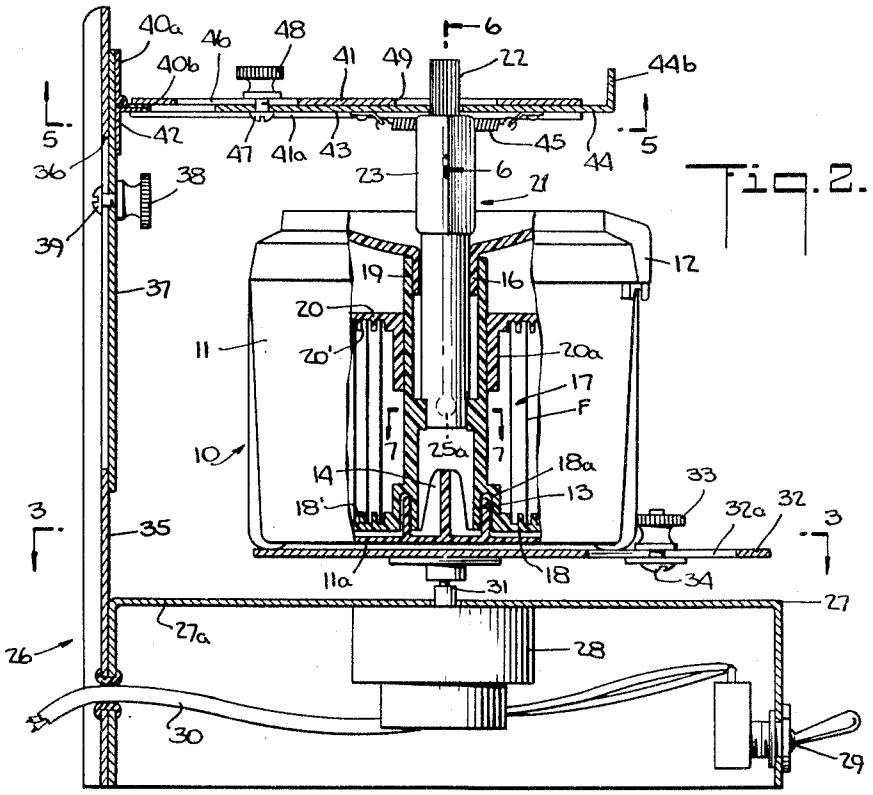


Fig. 2.

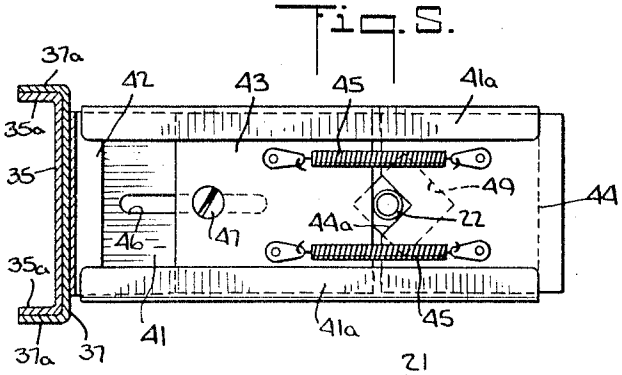


Fig. 5.

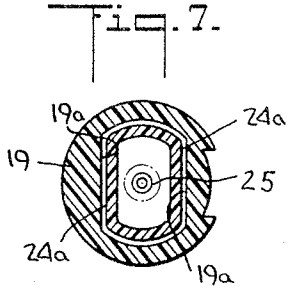


Fig. 7.

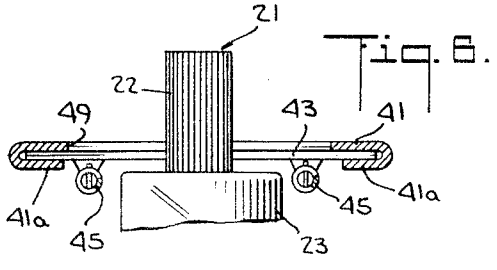


Fig. 6.

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METHOD OF AND APPARATUS FOR DEVELOPING PHOTOGRAPHIC FILM

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4 Claims. (Cl. 95—90.5)

This invention relates to the art of developing photographic film, and in particular to a novel method of and apparatus for treating such film during the developing thereof.

One of the currently favored methods of developing photographic film involves the use of a class of specially constructed developing tanks and film-holding reels, for example of the type known in the trade by the name "Anscomatic." When a tank and reel of this type are used, the exposed film is first fed into the reel so that the lateral edges of the film are received and held in spiral guide tracks at the inner faces of the reel end plates or flanges. In this manner, the convolutions of the film are spaced from one another. The reel, with the film so retained thereby, is then placed endwise into the developing tank which is closed to render it light-tight, whereupon the film-treating liquid, i.e. developer, hypo or hypo eliminator, is poured into the tank through a passageway defined by the hollow center of the vertical reel axle, an opening in the tank cover a bushing of which extends downwardly in a light-tight manner but loosely into the top end of the reel axle, and a vertically upwardly extending bushing which is provided on the bottom of the tank and loosely receives the lowermost end of the reel axle so as to form a light trap. An elongated rod member, which preferably is hollow and houses a small thermometer, is then inserted into the said passageway from above into driving engagement with the interior surface of the reel axle. Rotation of the said rod member thus effects a concurrent rotation of the reel in the stationary tank to move the film through the developer or other film-treating liquid. It will be apparent that such film movement considerably agitates the said liquid, which especially in the case of developer and hypo acts to prevent any settling of the chemicals out of the respective solutions and to the bottom of the tank.

At the present time, the required rotation of the reel is almost always effected by hand, i.e. the person developing the film grips the drive rod member at its top end and rotates it by a twirling action so as to rotate the reel. As will be readily understood, this is a procedure which is extremely disadvantageous from a number of standpoints. Primarily, the twirling of the said drive rod member is inherently incapable of resulting in a constant and uniform movement of the film; quite to the contrary, the resulting film movement is jerky, of uneven durations and speeds, and repeatedly interrupted. As a consequence thereof, the flow of the agitated film-treating liquid is also not even and is, in fact, quite turbulent and splashy, whereby the probability that the ultimate negative may turn out to be unevenly developed is fairly high. Furthermore, manually rotating the reel as just described is a tedious and tiring procedure, especially when it must be continued for long periods of time such as during the initial treatment of the film with developer, and it also effectively ties the person doing the developing down and prevents him from performing other tasks while the film is being developed.

It has been proposed to overcome these disadvantages either by mechanically driving the thermometer-enclosing drive rod member of an "Anscomatic" type tank by means of an overhead drive mechanism, or by constructing a tank with a built-in reel-driving arrangement disposed in a compartment adjacent the liquid-containing developing

chamber. To-date, however, these proposals have not gained any appreciable acceptance in the trade and by the public, principally due to the fact that drive systems of these types are usually quite complex in construction and thus much too expensive for the average photographer to purchase, install and maintain. Moreover, these mechanisms invariably require moving the reel in the liquid and relative to the stationary tank, i.e., the relative motion between the film and the film-treating liquid in the tank is always a result of a movement of the film through the liquid, so that even with a continuous driving of the reel the previously mentioned conditions of non-uniform and turbulent flow of the liquid exist, together with the possibility of uneven developing of the film.

It is, therefore, an important object of the present invention to provide, for a tank and reel type film developing apparatus, a novel method of obtaining the desired relative motion between the film to be developed and the film-treating liquid in the tank, which permits the said liquid to flow evenly and with relatively little turbulence over the entire surface area of the exposed film held by the reel and thus is conducive to the production of better negatives.

It is also an object of the present invention to provide an apparatus uniquely designed for practicing the aforesaid method, which apparatus is of greatly simplified construction and thus is inexpensive to manufacture and may be purchased by the average photographer at sufficiently low cost to render it economically worth-while.

A related object of the present invention is the provision of means in such an apparatus for rendering the latter adjustable for use with tanks of different heights and outside diameters and for use with reel-engaging spindles or rod members of different thicknesses and lengths.

These and other objects of the present invention, as well as the structural characteristics of the apparatus and the advantages accruing from its use, will be more clearly understood from the following detailed description when read in conjunction with the accompanying drawings, in which:

FIG. 1 is an elevational view, in perspective, of an apparatus embodying the principles of the present invention and illustrated in use with an "Anscomatic" developing tank;

FIG. 2 is a sectional view taken along the line 2—2 in FIG. 1;

FIG. 3 is a sectional view taken along the line 3—3 in FIG. 2;

FIG. 4 is a perspective elevational view of the thermometer-encasing rod member usually associated with the "Anscomatic" tank as a drive spindle but employed in a different capacity in the instant apparatus; and

FIGS. 5, 6 and 7 are sectional views taken, respectively, along the lines 5—5, 6—6 and 7—7 in FIG. 2, the latter two being drawn to an enlarged scale.

For the purpose of illustrating the implementation of the principles of the present invention, the following description is specifically drawn to set forth the application of these principles to an "Anscomatic" developing tank, but it is to be understood that the said principles and especially the method aspects thereof are applicable as well to other types of reel-enclosing developing tanks.

Referring now more particularly to FIGS. 1 to 4 and 7, the "Anscomatic" developing tank 10 is, as is well known, composed of a main, open-topped body 11 of circular cross-section and a cover 12 which may be rotatively locked to one another by means of respective sets of circumferentially extending ledges (not shown). Both the tank body 11 and the cover 12 are made of any suitable material, which may be a metal such as stainless steel or the like but preferably is an opaque synthetic

resin such as "Bakelite" or the like. Disposed interiorly of the tank body and extending upwardly from the tank bottom 11*a* centrally thereof is a hollow bushing 13 within the confines of which is located a liquid-diverting structure 14 of Y-shaped cross-section (see FIGS. 2 and 3) from the bottom of which three spaced ribs 14*a* extend to the inner surface of the bushing 13. Correspondingly, the cover 12 is provided with a central opening 15 which is continued in a downwardly depending bushing 16. Adapted to be received in the tank 10 is a film-holding reel 17 having a bottom end plate 18 integral with a central, vertical, hollow axle 19 about which slidably extends a top end plate 20, the latter being adapted to be axially adjusted along and clamped to the upper region of the reel axle 19 by any suitable means not shown associated with the bushing 20*a* of the plate 20. The inner diameter of the reel axle 19 is sufficient to receive the bushing 16 of the cover 12 freely but closely, while the bottom end plate 18 of the reel is provided with an annular groove 18*a* in which the bushing 13 of the tank body 11 is received when the reel 17 is placed into the tank 10. Thus, when the reel is in the tank and the cover 12 is secured to the body 11, as shown in FIG. 2, the interior of the tank is light-tight despite the presence of the opening 15 in the cover. The passageway defined by this opening and the bushing 16, the hollow interior of the reel axle 19, the groove 18*a* and the space between the walls of this groove and the bushing 13 permits the film-treating liquid to be poured into the tank while the same remains closed.

As previously stated, in the conventional use of such a developing tank, the reel 17, in the spiral end plate tracks 18' and 20' of which the opposite lateral edges of the film F to be developed are received and held, must be rotated through the film-treating liquid in the tank. To this end, there is provided a drive rod member 21 which is hollow and has a knurled top end portion 22, an intermediate, relatively wider scale-containing portion 23, and an elongated bottom portion 24. The member 21 houses a thermometer 25 the bulb 25*a* of which is located at the open bottom end of the said member, and the temperature-responsive fluid of which is adapted to move past the aforesaid scale in the portion 23. At its bottom end, the member 21 is provided with a pair of external flats 24*a* which correspond to a pair of flats 19*a* provided interiorly of the reel axle 19. It will be apparent, therefore, that when the portion 22 of the rod member 21 is twirled by the fingers of a person, the said member entrains the reel 17 into rotation within the tank.

The disadvantages of this procedure in terms of human fatigue, tediousness, etc. and in terms of the possibility of uneven film developing have already been set forth hereinbefore, as have the disadvantages, i.e. complexity, excessive cost, etc., of several types of apparatus heretofore employed or proposed for dealing with these problems. The present invention aims at overcoming and eliminating all of the said disadvantages of prior devices and developing procedures.

Generally speaking, the goals and objectives of the present invention are attained by the provision of a completely novel concept and technique of effecting the desired relative motion between the film being developed and the film-treating liquid. In accordance with is concept, the present invention requires that the reel 17 and the film F held thereby be kept stationary and that the tank 10 containing the film-treating liquid be rotated about the reel. This ensures that the said liquid is also moved about and along the surfaces of the spaced film convolutions. Due to the fact, however, that it is the liquid which is being moved, its movement past the film is slow, gentle and relatively uniform. As a result, there is achieved a more uniform developing action over the entire surface area of the exposed film, which leads to the ultimate formation of a better negative and consequent improved photographs.

Referring again to the drawings, the apparatus 26 according to a preferred embodiment of the present invention for implementing the aforesaid novel concept of treating film during the developing thereof comprises a base 27 which, for reasons of economy, is an open-bottomed rectangular or square structure made of sheet metal suitably shaped and rigidified. Disposed within the confines of the base 27 and affixed to the underside of the top wall 27*a* thereof is a small electric motor 28 connected by suitable wiring to an "on-off" switch 29 and to a power cord 30 the plug 30*a* of which may be connected into any standard house socket. If desired, a timing mechanism (not shown) may be connected to the motor and switch so as to enable the motor to be turned off automatically after a preset time interval. The vertical output shaft 31 of the motor 28 is secured to the center of a turntable 32 which, in the preferred form of the invention, is also composed of a single sheet or plate of metal and has the shape of an equilateral triangle. The turntable 32 is provided in the regions of its apices with three radial slots 32*a* in which respective nuts 33 and bolts 34 are adjustably retained. It will be apparent, therefore, that the said nuts and bolts and their associated slots (which may be associated with suitable scales) constitute means for centering the tank 10 on the turntable so that the axis of the reel axle 19 is vertically aligned with the shaft 31 of the motor 28, and that the said centering means are adjustable to accommodate tanks of different diameters. Concurrently, the said nuts and bolts serve as means for securing the tank body 11 to the turntable 32 so as to ensure that the tank rotates with the turntable.

Affixed, as by welding, to the rear of the base 27 is a vertical standard or frame member 35. A vertical elongated slot 36 is provided in the upper half of the central web of the standard 35. Slidably juxtaposed to the said standard at the front face thereof is a frame member 37 which is adjustably secured to the standard 35 by means of a nut 38 and bolt 39, the latter extending through and riding along the slot 36. As clearly shown in FIGS. 1 and 5, the lateral flanges 37*a* of the frame member 37 closely embrace the lateral flanges 35*a* of the standard 35 so as to ensure that when the nut and bolt 38–39 are tightened, the frame member 37 cannot wobble or cant.

Fixedly supported by the slidable frame member 37 adjacent the top end thereof, as by welding, is one member 40*a* of a hinge 40. The other hinge member 40*b* is welded to the underside of an elongated plate 41, the opposite ends of the hinge member 40*b* preferably being received in one end of each of a pair of channels defined by a pair of bent-over flanges 41*a* at the sides of the plate 41. To the bottom face of the hinge member 40*b* is welded one web of a rigid angle member 42 the other web of which extends therefrom at right angles to the plane of the plate 41. The function of the angle member 42 is to ensure that the plate 41, when in the position shown in FIGS. 1 and 2, is precisely horizontal and parallel to the turntable 32.

The plate 41 and certain adjuncts thereof still to be described serve as the means by which the hereinbefore stated novel procedure according to the present invention, i.e. the immobilizing of the reel 17 relative to the rotatable tank 10, is put into practice. To this end, there are slidably received in the channels or tracks defined by the flanges 41*a* of the plate 41 a pair of plates 43 and 44 which are biased toward one another by means of a pair of tension springs 45 (see especially FIG. 5). The plate 41 is provided adjacent its rear end with an elongated slot 46 through which extends a bolt 47 carried by the plate 43. A nut 48 is threaded onto the bolt 47 above the plate 41 and thus enables the plate 43 to be adjusted longitudinally of the plate 41 and locked in any desired adjusted position for a purpose to be more fully explained presently. The plate 41 is further provided, at a location overlying the shaft 31 and thus the center of the

turntable 32, with a relatively large opening 49 which, in the illustrated form of the invention, is shown as square but may have any desired configuration.

As clearly shown in FIGS. 1 and 5, the forwardmost edge of the plate 43 is straight and perpendicular to the longitudinal dimension of the plate 41, while the adjacent edge of the plate 44 is provided with a V-shaped cutout or notch 44*a*. Thus, there is defined between the plates 43 and 44 a susbtantially triangular opening which is smallest when these plates are in edge to edge contact with one another and the size of which can be increased merely by pulling the plate 44 away from the plate 43 with the aid of an upturned end flange or gripping portion 44*b* provided on the former. In the use of the apparatus of the present invention with the "Anscomatic" tank 10, it is this variable size triangular opening which receives the knurled end of the thermometer-encasing rod member 21, and the plates 43 and 44 accordingly serve to clamp the said rod member and prevent the same from rotating. As a consequence thereof, the rod member 21, which under the old methods functioned to connect the drive mechanism to the reel or to provide the means through the intermediary of which the reel could be manually rotated, now serves a diametrically opposed purpose, namely to couple the reel 17 to the stationary framework of the apparatus 26 and thereby to ensure that the reel remains stationary while the tank 10 rotates therearound.

It will be understood that when the tank is being rotated, it is essential that the vertical axis of the rod member 21 be in alignment with the axis of the turntable shaft 31, and that this condition must obtain for all such rod members, regardless of size. This is rendered easily feasible by the construction of the clamping means 43–44–45. Thus, for any given rod member, when the plate 41 is dropped down over the knurled rod portion 22 the first time, the operator of the apparatus need merely press with one hand against the flange 44*b* to hold the plate 44 away from the plate 43 and the said rod portion, while with the other hand he releases the nut 48 slightly and adjusts the plate 43 until the straight front edge thereof just touches the vertical rod portion 22. The nut is then tightened again to lock the plate 43 in position, whereupon the flange 44*b* is released to permit the notch or V-edge 44*a* of the plate 44 to be pulled against the rod portion 22 by the springs 45. No further adjustments will be needed for the same rod member 21 or for others having knurled portions 22 of the same diameter. If a rod member having a knurled portion of different diameter is employed thereafter, however, for example if a different size tank is used, the plate 43 will have to be adjusted again in order that its rod-contacting point be located at the proper normal distance from the common axis of the shaft 31, the reel axle 19 and the new rod member 21. In any case, the provision of the notch 44*a* has the advantage of causing the application, to the rod portion 22, of clamping forces each of which has a component directed across or oppositely to a corresponding component of the other force, whereby the possibility of lateral movement of the reel-immobilizing rod member during rotation of the tank is substantially eliminated.

It will be noted, furthermore, that the adjustability of the framework 37–41 etc. along the frame member or standard 35 renders the apparatus 26 adaptable for use with tanks of different heights and reel-immobilizing rod members of different lengths. Thus, since the accommodation of tanks of different widths or diameters is taken care of by the means 32*a*–33–34, the apparatus according to the present invention is seen to be of a universal character and consequently capable of being used with a wide range of photographic tank-type developing equipment. Moreover, despite its simplicity and low cost, the apparatus is extremely sturdy and capable of withstanding the rigors of long-continued periods of use, it is light in weight and can be easily moved about and yet does not need to be anchored down when in use, and its useful life without repairs is substantially unlimited since even the motor 28 is subject only to such limited wear and tear that it may never have to be replaced.

While there has been described herein a preferred form of the film-treating method and apparatus according to the present invention, the description and accompanying illustrations are deemed to be representative only, and it is clear that a number of changes and modifications may be made in the manner and means of implementing the principles of the present invention without any departure from the spirit and scope thereof as defined by the appended claims.

Having thus particularly described my invention, what I claim and desire to secure by Letters Patent is:

1. Apparatus for use in the treatment of exposed photographic film during the developing thereof in a developing tank containing a film-treating liquid and equipped with a film-holding reel loosely located in said tank and immersed in said liquid and with a rod member drivably coupled to said reel within the confines of said tank and having a portion extending upwardly out of said tank coaxially with the latter; said apparatus comprising a base, a turntable supported by said base for rotation about a vertical axis, an electric motor mounted on said base and operatively connected to said turntable for rotating the same, radially adjustable means connected with said turntable and adapted for gripping said tank when the later is on said turntable so as to locate said tank in a centered position on said turntable and so as to ensure rotation of said tank with said turntable, an upright standard affixed to said base, a frame member slidably supported by said standard for vertical movement therealong, means for releasably locking said frame member to said standard in selected adjusted positions, a plate member hinged at one end to said frame member and arranged for angular movement between a vertical position and a horizontal position overlying said turntable, and clamping means carried by said plate member and adapted when said plate member is in said horizontal position thereof for gripping said portion of said rod member so as to immobilize the same against rotary movement, whereby when said tank is on said turntable and rotating therewith upon actuation of said electric motor, rotation of said reel and film with said tank and said liquid is inhibited by said clamping means.

2. Apparatus according to claim 1, said plate member being provided with a pair of lateral parallel tracks and with an aperture located so that its center substantially coincides with said axis of rotation of said turntable when said plate member is in said horizontal position thereof, said clamping means comprising first and second longitudinally aligned plates having their respective opposite side edges slidably received in said tracks, means connected to said plate member and said first plate for adjustably locking the latter in position on the former so as to dispose the clamping edge of said first plate across a portion of said aperture, spring means connected to both said plates for biasing said second plate toward said first plate so that when said portion of said rod member extends through said aperture it is engaged at spaced peripheral locations by the clamping edges of said first and second plates, and a handle element connected with said second plate to enable the latter to be manually pulled away from said first plate preparatory to the clamping or releasing of said portion of said rod member.

3. Apparatus according to claim 2, at least one of said clamping edges being provided with a V-shaped recess adapted to receive said portion of said rod member.

4. Apparatus according to claim 2, said clamping edge of said first plate being substantially straight, and said clamping edge of said second plate being provided with

a V-shaped recess adapted to receive said portion of said rod member.

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