Dec. 30, 1947. E. L. SCHULTZ 2,433,532

APPARATUS FOR CIRCULATING SOLUTIONS

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Fig. 1

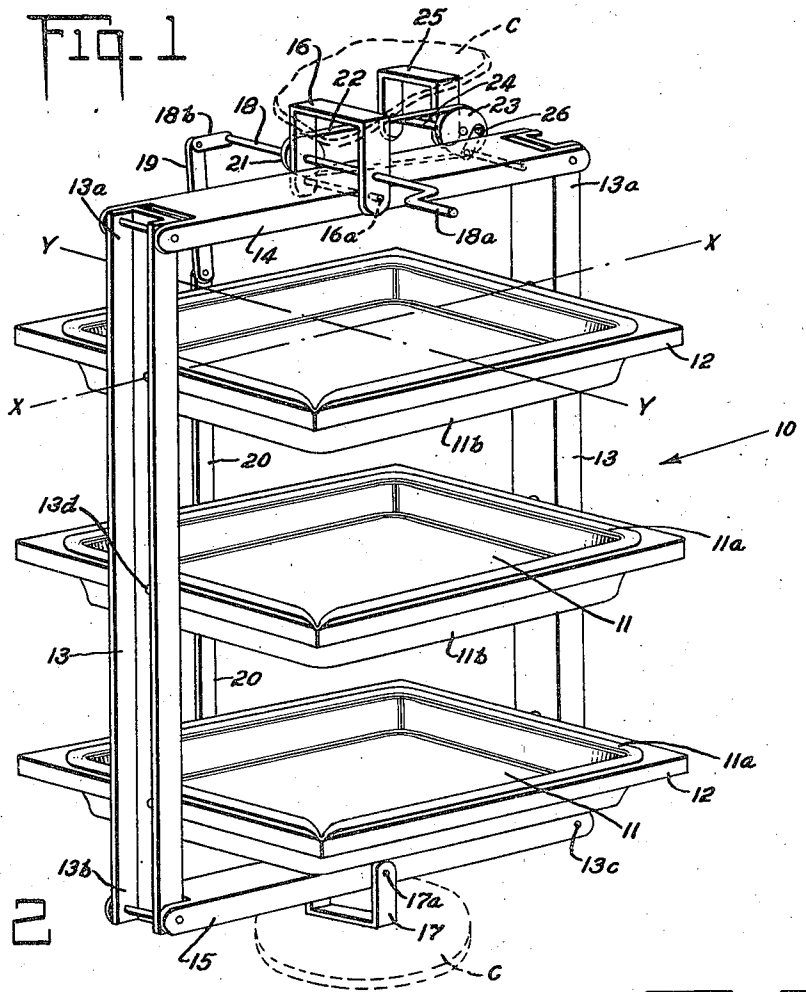


Fig. 2

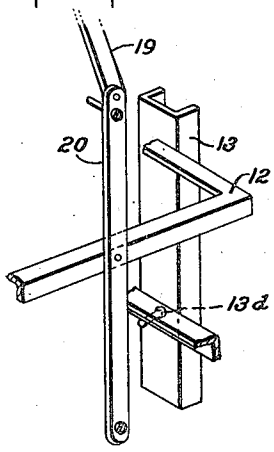


Fig. 3

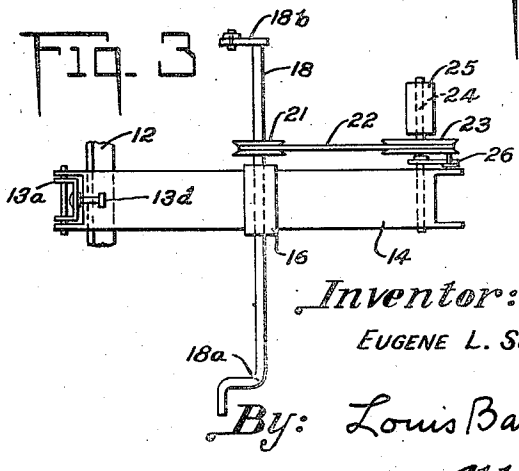


Fig. 2a



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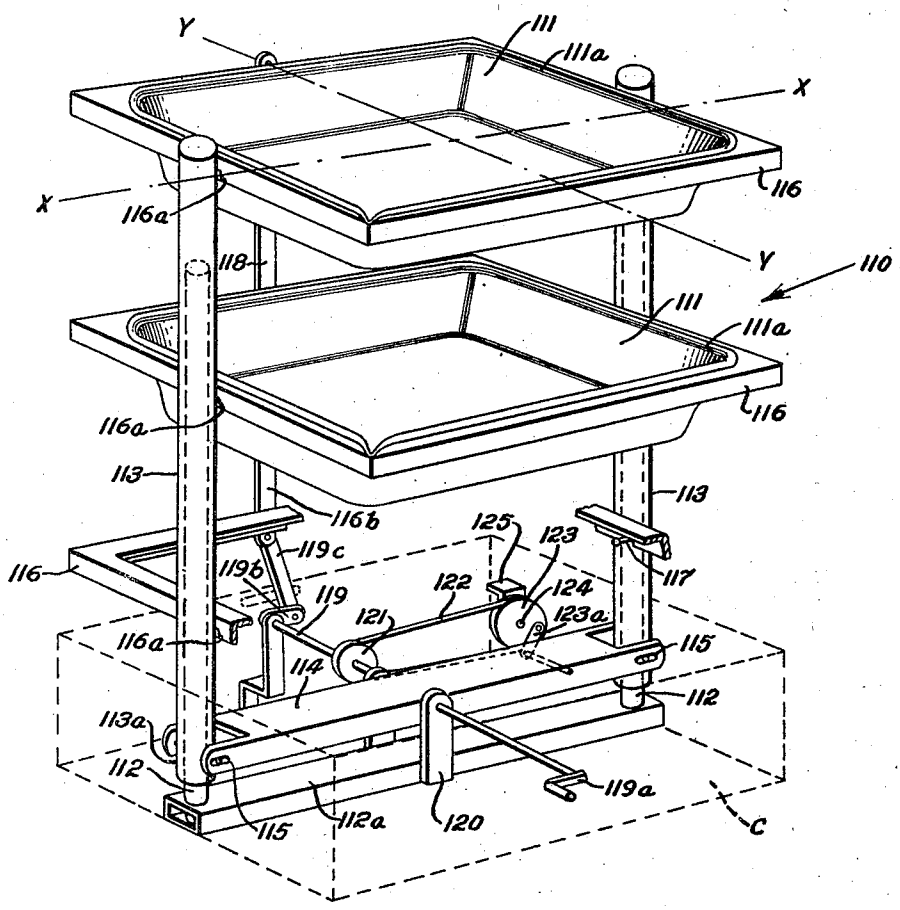
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APPARATUS FOR CIRCULATING SOLUTIONS

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Fig. 4



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APPARATUS FOR CIRCULATING SOLUTIONS

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Application May 16, 1945, Serial No. 593,987

6 Claims. (Cl. 259—54)

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This invention relates to liquid circulators or stirrers, such as solution agitators, and more particularly is directed to an improved apparatus for circulating solutions in processing photographic films and papers whereby such solutions are kept in constant motion and thoroughly mixed so as to expose the film or paper prints emersed therein to the action of a continuous uniformly effective chemical treatment.

Among the objects of the invention is to generally improve apparatus of the character described, which apparatus shall comprise a few simple parts that are readily assembled to form a rugged yet neat and attractive structure, which shall be practical and efficient to a high degree in use.

Other objects of this invention will in part be obvious and in part hereinafter pointed out. The invention accordingly consists of features of construction and method, combinations of elements, arrangements of parts and steps in the method which will be exemplified in the construction and method hereinafter described and of which the scope of the application will be indicated in the following claims.

In the accompanying drawings in which are shown various possible illustrative embodiments of this invention.

Fig. 1 is a prospective view of a multi-tray agitator apparatus adapted to be used in photographic processing constructed to embody the invention.

Fig. 2 is a fragmentary prospective view of the tray agitator with parts removed showing portion of the pin and slot connector and vertically extending rod.

Fig. 2*a* is a prospective view showing a fragmentary portion of the rack or shelf and portion of the pin and slot connector.

Fig. 3 is a top plan view of a portion of the agitating apparatus showing the driving means thereof.

Fig. 4 is a prospective view of another form of an improved agitator construction shown partly broken away and having power operating means enclosed in a base casing.

Referring in detail to the drawing 10 denotes generally, a hand operated multiple tray type of solution circulating apparatus constructed to embody the invention for agitating one or a plurality of spaced flat pans or trays 11. As here shown, each of said trays 11 is adapted to contain a suitable solution used in processing photograph films and prints immersed therein for the well understood purposes.

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Said trays 11 may be of any suitable metallic or nonmetallic material and may be of conventional construction. As here shown, each tray 11 is rectangular in shape and is provided with an outwardly extended rim flange 11*a* surrounding the body or container portion 11*b*, the latter being seated to extend through a horizontally disposed shelf or frame rack 12 with the tray flange 11*a* resting thereon as shown in Fig. 1.

Preferably apparatus 10 may be constructed to accommodate a plurality of trays 11 which may be arranged in tiers, that is, in superimposed spaced apart relation, each tray 11 being seated on its individual shelf or frame rack 12 so as to be readily demounted or interchanged as desired. The multiple frame racks or shelves 12 with the trays 11 may be supported between a pair of spaced upright members 13, which may be of U-shaped section, the upper and lower ends 13*a* and 13*b*, respectively, of members 13 being interconnected by top and bottom horizontally extending cross bars 14 and 15, respectively, through suitable corner hinge or pivoting means 13*c*.

Each of said racks 12 has the opposite ends 12*a* along the central long axis X—X thereof pivotally secured to the members 13 by suitable means such as pin and slot engaging connectors 13*d*. The latter may have the pins formed with ball heads engaging in button hole shaped slots to permit ready assembly and to provide sufficient looseness for the required play at said connectors 13*d* during relative rocking or swiveling movements of the racks 12 with respect to the upright members 13.

The top and bottom crossbars 14 and 15, may be pivotally mounted by U-shaped yoke brackets 16 and 17, respectively, from suitable stationary or rigid support means, as for example by a suitable casing C only a fragmentary portion of which is shown in dotted lines. Such casing C may be constructed in any well understood manner for partially enclosing apparatus 10 and in which the latter is appropriately secured for operation as hereinafter described. Said casing C may be constructed and arranged when made to totally enclose the apparatus 10, with demountable or swinging side walls to give convenient access to the apparatus 10, when in use, in any well understood manner.

The U-shaped yoke brackets 16 and 17 are located to have their pivotting portions 16*a* and 17*a*, respectively, centrally between the spaced ends 13*a* of upright members 13, respectively. As seen in Fig. 1, the top yoke bracket 16 may also

serve as a bearing in which a manually operated drive shaft 18 is journalled having a suitable crank handle 18a at one end and a crank pin 18b at the other end thereof. Crank pin 18b pivotally connects with one end of a link 19 which has the other end pivoted to a vertically extending rod 20. The latter joins the several superimposed racks 12 at one mid-point along the short axis Y—Y of each as shown in Fig. 2, by means of a loosely secured swivelling connection to allow required sufficient play during relative rocking movements of the racks 12 with respect to the extension rod 20.

Mounted to turn with drive shaft 18, there may be provided a pulley 21 which through a suitable power transmission belt 22 drives a crank disc 23, said disc 23 being mounted for rotations to overhang a suitable counter-shaft 24 supported by bracket or hanger 25 from an upper portion of the casing C at a spaced distance from upper yoke bracket 16 as shown in Fig. 1.

The crank disc 23 through a link or arm 26 connects with the upper crossbar 14 serves to lift and lower an end of said bar 14 and thereby move the racks 12 and trays 11 in and out of a normal horizontal plane across said short axis Y—Y, the upright members 13 and cross bars 14 and 15 forming a linkage which rocks on the pivoting portion 16a and 17a of the yoke brackets 16 and 17 as shown in Fig. 1.

After construction and assembling apparatus 10 as described above and shown in Figs. 1 to 3, the improved operation and method for use in photographic developing work will be at once apparent. A suitable developer, fixer, toner or washing solution is placed into the trays 11 partially filling same and a film or print immersed in each for processing in the usual manner. The trays 11 may then be seated in the racks 12. Now starting with the solution in each tray 11 in a relatively level normal horizontal plane, the crank handle 18 may be rotated. The drive through belt 22, crank disc 23 and the arm 26, and the linkage framework formed by upright members 13 and cross bars 14 and 15, will cause each rack 12 with tray 11 to be rocked or tilted in and out of the normal horizontal plane across an axis Y—Y in a plane passing through pivoting portions 16a and 17a. Simultaneously the turning of crank handle 18a through extension rod 20, will cause each rack 12 and tray 11 to be tilted or rocked in and out of the normal horizontal plane across axis X—X in a plane passing through pin and slot connections 13d at right angles to axis Y—Y.

The solution in each tray 11 will therefore be subjected to the combined action of two rocking movements in and out of the normal horizontal plane across the long and short axis of each tray 11 and will be caused to circulate in trays 11 to flow in a continuous swirl over the film or prints immersed therein. By making the ratio of the tilting cycle time on the long axis X—X to that on the short axis Y—Y unequal, that is, at different rates when using conventional shaped rectangular trays, a constant flow of well mixed solutions to all parts of the trays and over the films or prints is obtained. With standard sized trays 12 for processing standard 8" x 10" pictures or films, rotation of the crank handle 18 at about 30 R. P. M. for tilting the trays 12 across the short axis X—X and arranging for tilting of said trays 12 on the long axis Y—Y at a rate corresponding to 20 R. P. M. have been found to give satisfactory results.

It is to be understood that suitable power means such as an electric motor drive with or without speed reduction means, (not shown) can be provided to replace the crank handle 18a, in any well understood manner.

In Fig. 4, a modified construction of applicant's invention is shown in the form of apparatus 110 which also utilizes the improved method. Said apparatus 110 is seen to include a pair of rigidly supported uprights or stanchions 112 upstanding from the opposite ends of a U-shaped beam 112a. Each of said stanchions 112 has loosely mounted for reciprocation thereon a sleeve member 113, the latter terminating short of the lower ends of said stanchions 112 which are fixed to said beam 112a. The lower ends 113a of said sleeves 113 may be interconnected by a horizontally extending cross bar 114 which has suitable loose fastening means, such as slot and pin end connections 115, as shown in Fig. 4.

Spaced to normally lie in a horizontally disposed plane between said members 113 are movable shelves or frame racks 116 which are pivotally supported at opposite ends thereof as at 116a to pairs of stud pins 117 extending from said members 113 so that the racks 116 normally lie in a horizontal plane in spaced superimposed relation and can each be tilted or rocked on said pins 117 in and out of said normally horizontal position on relative movement of members 13. Each rack 116 is made to form a seat for engaging the rim flange 111a of pan 111, which extends through the frame rack 116 as is clearly shown in Fig. 4. The pins 117 engage mid-portions of opposite sides 116a of the racks 116, so that symmetrical portions of each pan 111 and rack 116 can be rocked on an axis X—X at right angles through a line extended between said pivots on sides 116a during relatively opposite movement of members 113.

The racks 116 are also interconnected by a vertically movable tilting bar 118 which may be pivotally connected to each of the spaced racks 116 as at 116b so that racks 116 with the seated pans 11 each can be tilted on an axis Y—Y passing through pivots on sides 116a.

As seen in Fig. 4, there is provided at the base of apparatus 110, for moving cross bar 114 and tilting bar 118, a suitable power means, and as shown is hand operated. Said power means may include, as in apparatus 10 above described, a drive shaft 119 journalled in a yoke bracket 120 firmly secured to the beam 112a, said shaft 119 having a crank handle 119a at one end and a crank pin 119b at the other, the latter pivotally connecting to reciprocate the tilting bar 118 through link 119c.

A pulley 121 is mounted to turn with shaft 119 and through belt 122 turns a crank disc 123 which turns on shaft 124 suitably mounted on hanger bearing means 125 from the casing top as shown in Fig. 4. The crank disc 123 through link 123a pivotally connects with cross bar 114.

As indicated in dotted lines, a suitable casing C may be provided to enclose the power drive means above described for apparatus 110 with the crank handle 119a extending to the exterior thereof, rotation of crank handle 119a being effective to tilt the trays 112 across the axes X—X and Y—Y in the same manner as described above for apparatus 10.

If desired a motor drive (not shown) of any conventional construction may be substituted for the manual drive, and where electric power is supplied, switch buttons or the like can be used

for controlling the operation of the apparatus 10 or 110.

The improved method for circulating a solution in trays as seen from the above comprises tilting each tray with the solution in and out of a horizontal plane to normally cause a flood or wave flow of the solution back and forth relative to one axis X—X and tilting each tray to normally cause a flood or wave flow of the solution back and forth relative to the other axis Y—Y at right angles to said first axis, but by concurrent tiltings a circulation of the solution keeps the same in a constant swirling motion thoroughly mixed so as to expose a film or print immersed therein to a continuous uniformly effective chemical treatment.

Where the trays used are rectangular in shape the tilting time cycle across the shorter axis Y—Y may be made relatively shorter than across the longer axis X—X for giving improved circulating effect of the solution throughout the trays.

It should be noted that in practicing the invention, as here shown, the trays may be considered to be supported on a three-point suspension, namely at opposite ends of the long axis X—X and at one end of the shorter axis Y—Y, opposite ends of the trays with the solutions being moved relatively in up and down directions across the short axis Y—Y and also up and down simultaneously across the long axis X—X. The overall effect is to subject each solution to a circulation movement particularly suitable for photographic processes.

It is therefore seen that there is provided an improved article of manufacture in which the several objects of the invention are achieved and which are well adapted to meet the conditions of practical use.

As various other possible embodiments of the invention may be made in the above invention and as various changes may be made in the embodiments above set forth, it is to be understood that all matters herein set forth and shown in the accompanying drawings are to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. An apparatus of the character described comprising a pivoting frame linkage structure, including spaced upright members, racks supported on said structure between said upright members, trays mounted on said racks in superimposed spaced relation, means connecting with said upright members for moving the frame structure with the racks to tilt the trays in and out of their horizontal positions across one axis, and means connecting with said racks and cooperating with said first mentioned means to tilt the trays in and out of their horizontal position across a second axis.

2. An apparatus as defined in claim 1 in which said cooperating means includes an interconnecting drive for making the tilting rate on said axes unequal.

3. An apparatus for constantly circulating a solution in a tray comprising a rack for removably mounting a tray, a first tilting means including two independent movable supporting members pivotally secured to opposite ends of the rack, means for alternately raising and lowering said members to tilt the rack and trays upon one axis through the trays, and second tilting means attached to one side of the rack and concurrently operable to tilt the rack and tray on a transverse axis through the tray to effect circulation of the solution in the tray.

4. An apparatus as defined in claim 3 in which said supporting means have a plurality of racks for receiving a plurality of trays in spaced superimposed relation for movement by both first and second mentioned tilting means simultaneously.

5. An apparatus of the character described comprising a normally horizontally disposed tray for circulating a solution therein, three-point suspension means for supporting said tray for movement thereon, means for moving one point of said suspension means upwardly while moving another of said points downwardly to tilt the tray in and out of the horizontal plane across one axis, and means cooperative with said first mentioned moving means including an interconnecting bar for moving the third suspension point in an up and down direction at a different rate and concurrently with said other tilting tray movement in and out of the horizontal plane across another axis, said three-point suspension means including a pair of spaced members, a pivotal mounting between said spaced members for mounting the tray, said cooperative means including an interconnecting drive for reciprocating said three suspension points in continuous cycles of movement.

6. An apparatus of the character described comprising a normally horizontally disposed tray for circulating a solution therein, three-point suspension means for supporting said tray for movement thereon, means for moving one point of said suspension means upwardly while moving another of said points downwardly to tilt the tray in and out of the horizontal plane across one axis, and means cooperative with said first mentioned moving means including an interconnecting bar for moving the third suspension point in an up and down direction at a different rate and concurrently with said other tilting tray movement in and out of the horizontal plane across another axis, said three-point suspension includes a pair of spaced relatively fixed stanchions, and sleeve members movably mounted on said stanchion between which the tray is pivotally mounted, said cooperative means including driving means for reciprocating said three suspension points in continuous cycles of movement.

EUGENE L. SCHULTZ.

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