

Feb. 8, 1944.

E. C. WEISKOPF

2,341,198

AUTOMATIC IMMERSION APPARATUS

Filed March 3, 1943

6 Sheets-Sheet 1

FIS. I.

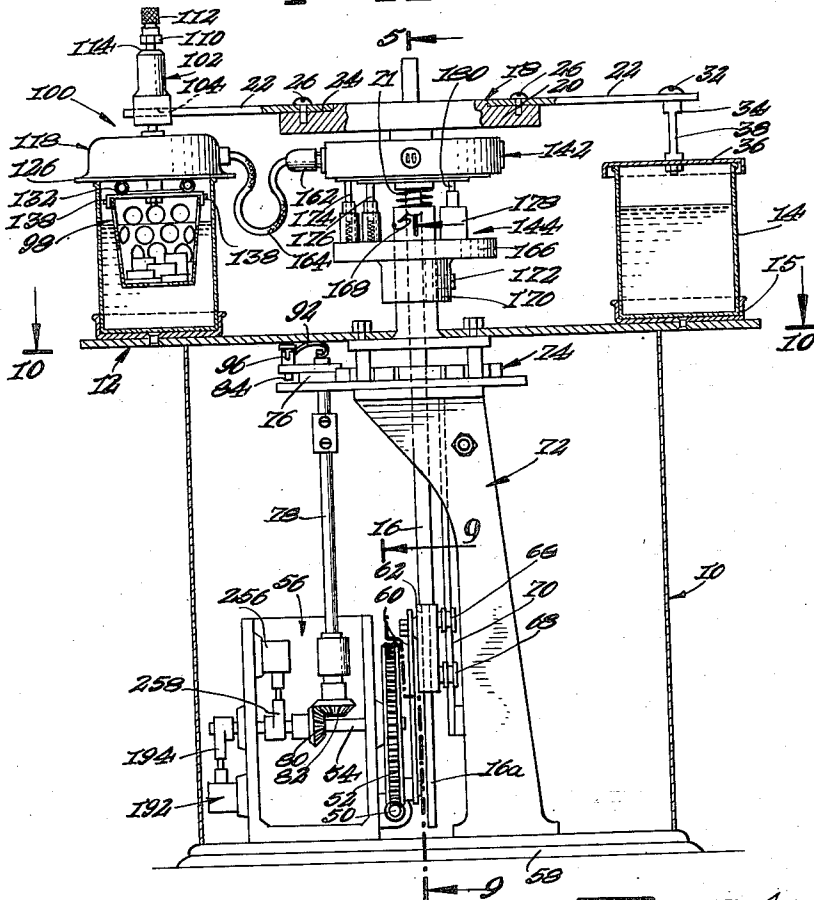


FIG. 4.

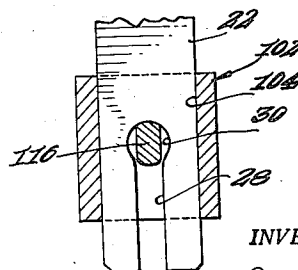
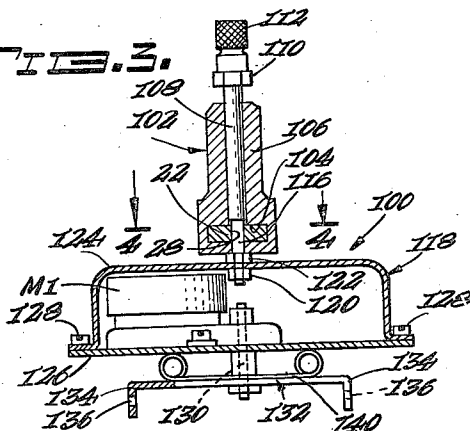


FIG. 3.



INVENTOR.

BY Edwin C. Weiskopf

Harry Cohen

ATTORNEY.

Feb. 8, 1944.

E. C. WEISKOPF

2,341,198

AUTOMATIC IMMERSION APPARATUS

Filed March 3, 1943

6 Sheets-Sheet 2

FIG. 2.

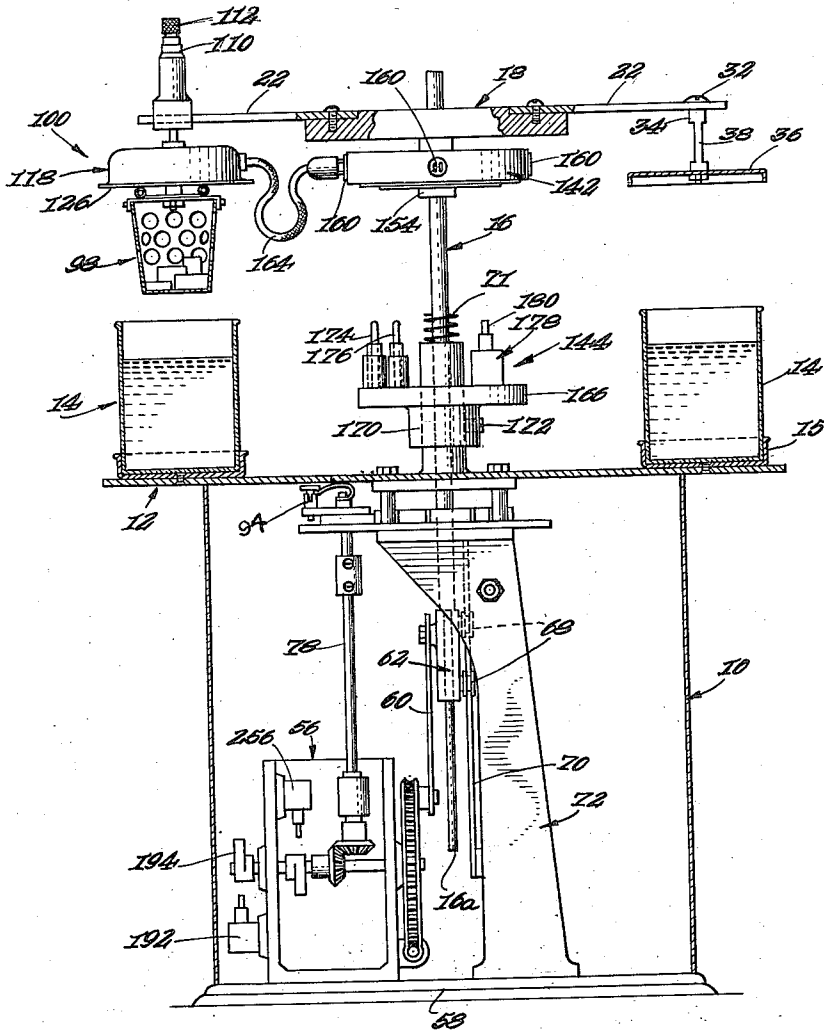
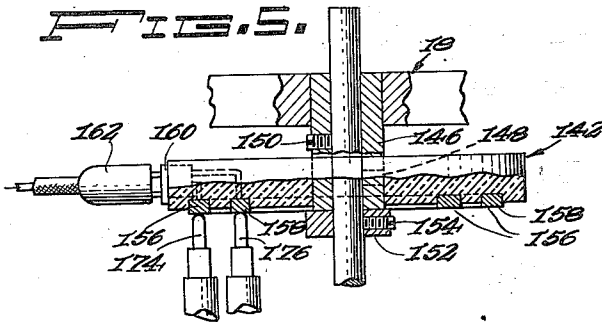


FIG. 5.



INVENTOR.

Edwin C. Weiskopf

BY

Harry Cohen

ATTORNEY.

Feb. 8, 1944.

E. C. WEISKOPF

2,341,198

AUTOMATIC IMMERSION APPARATUS

Filed March 3, 1943

6 Sheets-Sheet 4

FIG. 8.

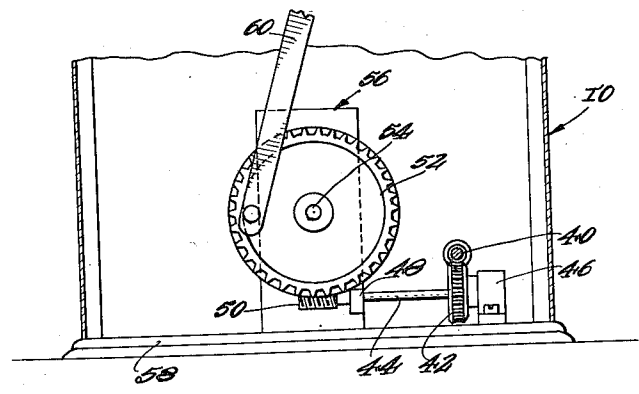
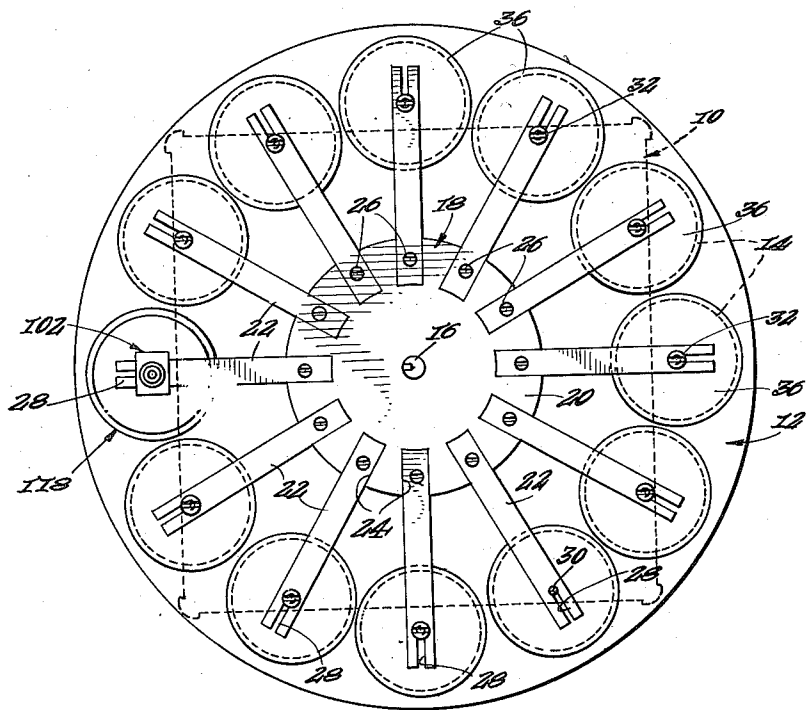


FIG. 9.

INVENTOR.
Edwin C. Weiskopf
BY
Harry C. Cole
ATTORNEY.

Feb. 8, 1944.

E. C. WEISKOPF

2,341,198

AUTOMATIC IMMERSION APPARATUS

Filed March 3, 1943

6 Sheets-Sheet 5

FIG. 10.

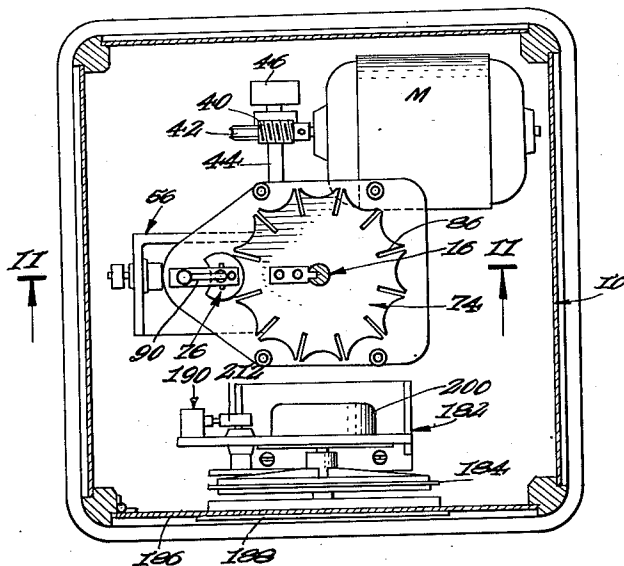


FIG. 11.

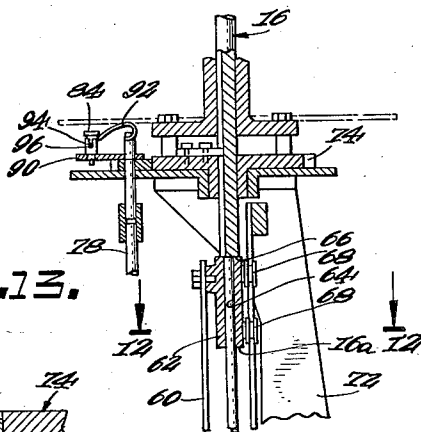


FIG. 13.

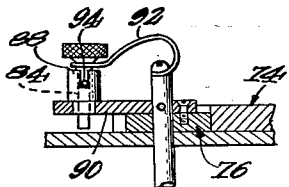


FIG. 12.

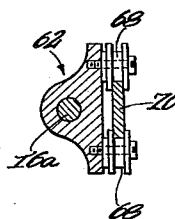
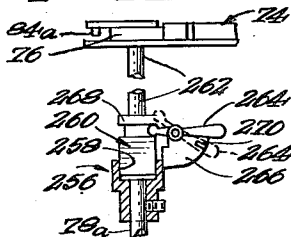


FIG. 14.



INVENTOR.

Edwin C. Weiskopf

BY

Harry Cohn

ATTORNEY.

Feb. 8, 1944.

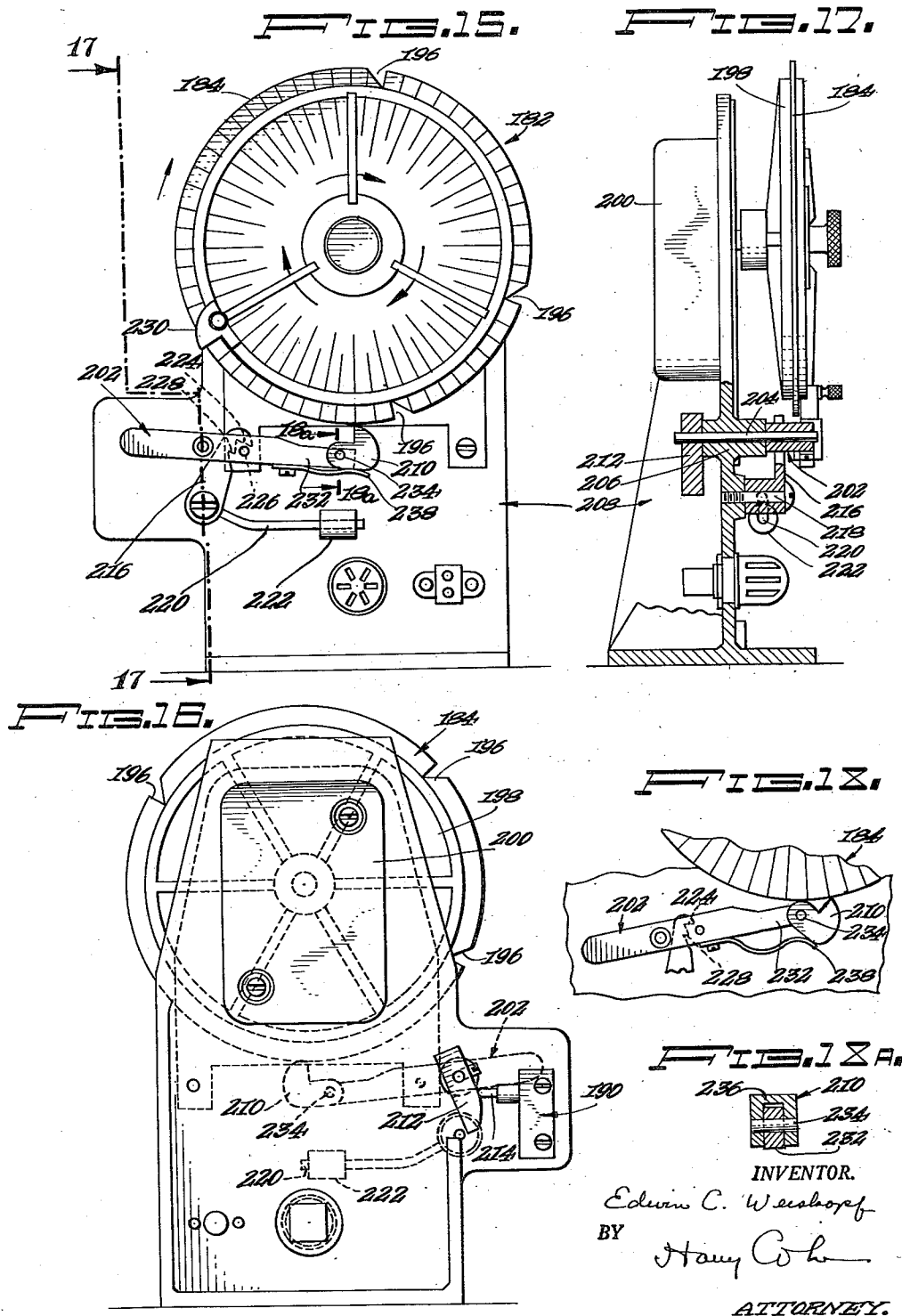
E. C. WEISKOPF

2,341,198

AUTOMATIC IMMERSION APPARATUS

Filed March 3, 1943

6 Sheets-Sheet 6



UNITED STATES PATENT OFFICE

2,341,198

AUTOMATIC IMMERSION APPARATUS

Edwin C. Welskopf, New York, N. Y.

Application March 3, 1943, Serial No. 477,793

17 Claims. (Cl. 91-46)

This invention relates to automatic immersion apparatus of the type disclosed in my United States Letters Patent No. 2,157,875 granted May 9, 1939, and the present application is a continuation in part of my application, Ser. No. 402,787 filed July 17, 1941 for Automatic immersion apparatus.

In the apparatus of the present invention, provision is made for immersing the tissue or other materials or articles in various liquids and for rotating the tissue or other material container in the liquid or liquids whereby to improve the action of the liquids on the tissue or other materials as set forth in my above mentioned prior application. In accordance with the present invention, the means for rotating the tissue or other material holder in the liquid container is more directly associated with the tissue holder. Also, in accordance with this invention, provision is made in the apparatus for locating the holder rotating means at any one of a number of selected points, that is at any one of a number of liquid receptacles. Further, in accordance with the present invention, provision is made for the rotation of a plurality of holders in a plurality of liquid receptacles, respectively.

As described in my above mentioned Letters Patent, the operation of the apparatus for moving the tissue or other material holder from one receptacle into another is accomplished by a vertical upward movement of the main shaft, to raise the holder above the top of the receptacle in which the holder was positioned, a turning movement of said shaft, for positioning the holder over the receptacle in which the holder is to be next positioned, and a downward vertical movement of the shaft for lowering the holder into said last mentioned receptacle where said holder remains until the next operating cycle which is initiated under the control of a timing device. In accordance with the present invention, provision is made for operating the apparatus to raise and lower the holder without an intervening turning movement of the main shaft when, as is sometimes the case, such turning movement is not desired.

Also in accordance with the present invention, provision is made for preventing damage to the apparatus in case of excessive resistance to the downward movement of the main vertical shaft which might possibly be encountered, for example, when the tissue holder is being immersed in the paraffin bath at a time when the paraffin is not sufficiently liquefied, or, for example, in case the tissue holder is accidentally out of align-

ment with the open top of any receptacle during the downward movement of said shaft.

Further, in accordance with the present invention, provision is made for operating the apparatus independently of the timing device when, as is sometimes the case, it is necessary or desirable to have the apparatus operate before the time predetermined by the setting of the device.

The above and other objects, features and advantages of the present invention will be more fully understood from the following description, reference being had to the accompanying drawings.

In the drawings:

Fig. 1 is a view, partly in elevation and partly in section, of an automatic immersion apparatus embodying the present invention, showing the position of the parts when the tissue holder is immersed in one of the liquid receptacles;

Fig. 2 is a view similar to Fig. 1 showing the position of the parts in which the tissue holder is raised above the receptacle to permit transfer thereof to another liquid receptacle or to obtain access to the holder;

Fig. 3 is a sectional view, on a larger scale, of the device for supporting and rotating the tissue holder;

Fig. 4 is a detail sectional view on the line 4-4 of Fig. 3;

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

Fig. 6 is a front view of the apparatus;

Fig. 7 is a circuit diagram;

Fig. 8 is a top view of the apparatus;

Fig. 9 is a view taken along the line 9-9 of Fig. 1, one of the movable parts being in a different position for clearness of illustration;

Fig. 10 is a top plan view, partly in section, on the line 10-10 of Fig. 1;

Fig. 11 is a sectional view on the line 11-11 of Fig. 10;

Fig. 12 is a detail sectional view on the line 12-12 of Fig. 11;

Fig. 13 is a sectional view on a larger scale of parts of the mechanism illustrated in Fig. 11;

Fig. 14 is a view similar to Fig. 13 showing a modification;

Fig. 15 is a front view of the timing device;

Fig. 16 is a rear view thereof;

Fig. 17 is a sectional view on the line 17-17 of Fig. 15 but shows the cam of the timing disk in a different position;

Fig. 18 is a front view of part of the timing device illustrated in Fig. 15, showing the position of certain of the parts, when the device is oper-

ated independently of the notches in the timing disk;

Fig. 18A is an enlarged detail sectional view on the line 18a-18a of Fig. 15.

Referring now to the drawings in detail, the automatic immersion apparatus embodying the present invention comprises, as disclosed in my above mentioned patent, a cabinet 10 on which a receptacle table or support 12 is mounted for supporting a plurality of receptacles 14 for the various liquids in which the tissue or other material subjected to treatment thereby is immersed. Said receptacles are removably positioned in the trays 15 which are fixed to table 12. As illustrated in Fig. 8, said receptacles are arranged in a circle on support 12. A vertical shaft 16 is mounted at the center of said circle for longitudinal and rotary movement and has fixed thereto near its upper end a frame 18 which is raised and lowered by the vertical upward and downward movements, respectively, of said shaft, and which is turned with said shaft during the rotation thereof. Said frame comprises a circular plate or disk 20 to which is secured a plurality of arms 22 which are circumferentially spaced and extend radially from the center of the circle. The inner ends of said arms are fitted in companion grooves 24 in which they are secured in any suitable way as by screws 26. The outer ends of arms 22 extend to positions in which they lie over the receptacles 14, and the outer end of each of said arms is provided with a slot 28 which terminates at its inner end in an enlarged circular part 30, as illustrated in Fig. 8, from which the head 32 of one of the receptacle-cover supporting rods 34 has been omitted in order to illustrate the shape of said slot. (See also Fig. 4.) As shown in the drawings, the rods 34 which carry the receptacle covers 36 are provided with reduced portions 38 to permit the attachment and removal of said rods 34 to and from the companion arms 22, substantially as described in my above mentioned patent.

The mechanism for operating shaft 16 for moving the same vertically and for turning the same between the upward and downward movements in said shaft is operated by the electric motor M (Fig. 10). The rotary shaft of said motor is provided with a worm gear 40 which meshes with a worm wheel 42 fixed to a shaft 44 which is journaled for rotation in bearings 46 and 48 (Fig. 9). A worm gear 50 is fixed to shaft 42 and meshes with a worm wheel 52 fixed to a shaft 54 journaled for rotation in a frame 56 mounted on the base 58 of the cabinet. A link 60 is pivotally connected at its opposite ends to worm wheel 52 and to a cross head 62. Said cross head 62 has a circular tubular opening 64 in which the lower circular portion 16a of shaft 16 is slidably and rotatably movable. Said lower portion 16a of shaft 16 is of reduced diameter providing said shaft with a shoulder 66 (Fig. 11) which is engaged by the upper edge of cross head 62. It will be understood that when cross head 62 is moved upwardly by link 60, shoulder 66 of shaft 16 is engaged by the upper end of cross head 62 and the shaft is thereby raised as is also the frame 18 which is carried thereby. On the other hand, when cross head 62 is moved downwardly by link 60, shaft 16, said frame 18 and the parts carried by said frame and by said shaft move downwardly by gravity, without any downward pull on said shaft by cross head 62. Accordingly, in the event of excessive resistance to the downward movement of shaft 16, the power

operated cross head 62, being movable downwardly independently of said shaft, exerts no downward pull thereon. It will be understood that by reason of this relation between shaft 16 and the power operated cross head 62, the possibility of damage to various parts of the apparatus is eliminated or substantially reduced in the event that the normal downward movement of shaft 16 is opposed. Cross head 62 is provided with rollers 68 which engage a guide bar 70 fixed in the standard 72, said rollers 68 and bar 70 constituting means for guiding cross head 62 in its vertical up and down movements. A compression spring 71 is provided to ease the shock in the event that shaft 16 is suspended above cross head 62 out of supporting relation therewith.

Shaft 16 is rotated intermittently by a Geneva gear mechanism as explained in my above mentioned patent. Said Geneva gear mechanism comprises a gear 74 which surrounds shaft 16 and through which said shaft is longitudinally movable. Gear 74 is rotated by a cooperating Geneva gear member 76 which is actuated by the vertical shaft 78 from shaft 54 through the companion bevel gears 80 and 82. This Geneva gear mechanism is of the same construction and operates in the same way as the Geneva gear mechanism illustrated and described in my above mentioned patent, but in the present construction provision is made for preventing rotation of shaft 16 during any cycle of operation of the apparatus, as may be desired. For this purpose, the pin 84 which is fixed to and is operated by the cooperating Geneva gear member 76 and which normally engages in the slots 86 of gear 74 for imparting a partial rotation thereto between the raising and lowering of the shaft, is retractable to prevent its engagement in said slots when a turning movement of shaft 16 is not desired. For this purpose, pin 84 is mounted for movement in a bracket 88 which is fixed to the bar 90 rotated by gear 76 (Fig. 13). Pin 84 is held in normal position by a spring 92 for engagement with slots 86 during the rotation of gear 76 for rotating gear 74, and is movable to a retracted position in which said pin is located above the upper surface of gear 74 so that it is incapable of engaging in the slots 86 of said gear. Pin 84 is provided with a cross pin 94 which engages the top of bracket 88 when the pin is moved to its retracted position and given a partial turn to bring said cross pin 94 out of registry with the slot 96 provided in bracket 88 (Fig. 11). Thus, when it is desired to prevent rotation of shaft 16, pin 84 is moved upwardly to a point above the upper edge of bracket 88, cross pin 94 moving out of slot 96, and pin 84 is turned so that it is supported by the upper edge of said bracket, and when it is desired to restore the rotary operation of shaft 16, said pin 84 is turned so that its cross pin 94 registers with slot 96 whereupon spring 92 moves pin 84 downwardly to its normal projected position for engagement with slots 86 during the rotation of gear 76.

Provision is made for rotating the tissue or other material holder 98 (Figs. 1 and 2) in the various liquid receptacles 14. The means for accomplishing this result pursuant to the present invention will now be described. As illustrated in Figs. 1 and 2, the holder 98 is carried by the supporting and rotating device indicated generally by the numeral 100 in Figs. 1, 2 and 3. Said device is mounted on and is movable with frame 18 being

removably secured to one of the arms 22 of said frame. Said device 100 comprises a bracket 102 which is provided with an opening 104 in which the slotted end of the companion arm 22 removably fits when the bracket is mounted thereon. Said bracket is also provided with a tubular opening 106 in which a pin 108 of circular cross section is longitudinally and rotatably movable. The upper end of pin 108 is provided with adjustable nuts 110 and 112, nut 110 engaging the upper edge 114 of bracket 102 when pin 108 is in its normal position. The lower end of pin 108 is provided with a reduced portion 116 which is small enough to pass through the narrow part of slot 28 to permit bracket 102 to be mounted on and removed from the companion carrying arm 22. It will be understood that the part of the pin 108 above the said reduced portion 116 thereof is too large to pass through slot 28 but fits in the inner larger end portion of said slot and thus releasably holds bracket 102 against movement longitudinally of arm 22. It will be understood that when it is desired to remove bracket 102 from arm 22, pin 108 is raised to the position illustrated in Fig. 3 in which pin portion 116 is in alignment with slot 28, so that bracket 102 can be moved outwardly of arm 22. Conversely, when it is desired to assemble bracket 102 on any one of the arms 22, pin 108 is raised to align portion 116 thereof with slot 28, thus allowing the bracket to be moved longitudinally inwardly of the outer end of arm 22 to a position in which the pin engages the inner end of the slot, after which pin 108 is lowered in the larger part 30 of slot 28 for holding the bracket releasably in correct position on arm 22 and against movement longitudinally of said arm in either direction.

A motor-carrier 118 is supported by the lower end of pin 108 being removably secured to said pin by nuts 120 and 122 threaded on the lower end of said pin and positioned at opposite sides of the cover 124 of said motor-carrier 118. Said carrier is in the form of a housing for the electric motor M1 and includes in addition to the cover 124 a plate 126 to which said motor is fixed. Cover 124 is secured to plate 126 in any suitable way as by screws 128 and completely encloses said motor. A vertical shaft 130 is rotated by motor M1 through suitable reduction gearing and extends through plate 126 in which it is rotatable independently of said plate. A bracket 132 is fixed to and rotatable by shaft 130. Said bracket is provided with down turned end portions 134 provided with apertures 136 in which laterally projecting pins 138 carried by holder 98 are removably engaged. A spring member 140 is fixed to bracket 132 and imparts sufficient resiliency to said bracket to allow end portions 134 thereof to be sprung over pins 138 and to permit the disengagement of said pins from the apertures 136 of the bracket for connecting and disconnecting holder 98 to and from bracket 132.

Provision is made in the apparatus for controlling the operation of motor M1 which rotates the holder 98 in the various receptacles 14, and more particularly to operate said motor only when the holder 98 is positioned in the liquid receptacle pursuant to a predetermined downward movement of shaft 16 and frame 18 carried thereby. For this purpose motor M1 is connected to an electric outlet device 142 which is supplied with current through a switching and control device 144. The outlet device 142

is in fixed relation to shaft 16. Preferably, as here shown, outlet device 142 is secured to the hub portion 146 of frame 18 in any suitable way as by set screws 148, said hub portion being secured to shaft 16 by set screws 150. A collar 152 is secured to shaft 16 by said screws 154 below outlet device 142 for limiting the downward movement of frame 18 on said shaft 16 and thereby assisting in the positioning of said frame on said shaft and of the outlet device 142, and assisting screws 150 in holding frame 18 against movement downwardly of said shaft. Outlet device 142 is provided with a pair of relatively insulated continuous metal rings 156 and 158 which are electrically connected in parallel to a plurality of outlet sockets 160. An electric plug 162 at the end of an electric cord 164 connected to motor M1 is receivable in any one of said sockets for connecting said motor to a source of power when the outlet device is energized through device 144 as will now be described. The switching and control device 144 is mounted in fixed position below the outlet device 142. More particularly, said device 144 comprises a horizontal plate 166 which fits over and is fixed to the stationary guide bearing 168 in which shaft 16 is movable. Said part 166 of device 144 has an integral collar 170 which is fixed to shaft guide 168 in any suitable way, as by one or more set screws 172. A pair of spring projected metal pins 174 and 176 are carried by plate 166 in position to engage conductor rings 156 and 158 of outlet device 142 when shaft 16 is moved downwardly and is near the end of its downward travel, and a switch 178 is carried by plate 166 in position to be operated by the bottom of outlet 142 when shaft 16 is at the end of its downward travel. Said switch is a normally open switch and as here shown is provided with a pin 180, which is moved downwardly against the action of a spring (not shown) contained in said switch. It will be understood that contact pins 174 and 176 are in series with the contacts of switch 178 so that an electric potential is applied to said contact pins 174 and 176 when switch 178 is closed. Further it will be understood that when contact rings 156 and 158 engage pins 174 and 176, respectively, and switch 178 is closed, which is the condition illustrated in Fig. 1 of the drawings, current is supplied to the outlet device 142 for application to motor M1 for rotating the holder 98. Accordingly, when shaft 16 is lowered for positioning holder 98 in a receptacle 14, said holder is thereupon rotated in said receptacle until shaft 16 is raised preliminary to transferring the holder 98 from said last mentioned receptacle into another receptacle 14. It will be understood that just before shaft 16 reaches its lowermost position, conductor rings 156 and 158 engage the companion contact pins 174 and 176 and that upon a further downward movement of said shaft the switch actuating pin 180 is engaged by the bottom of outlet device 142 for closing said switch. It will be understood that pins 174 and 176 are engaged before switch 178 is closed and are disengaged after switch 178 is opened, thus eliminating sparking at the contacts between the conductor rings 156, 158 and the companion contact pins 174, 176. It will be noted that while as shown the apparatus is provided with only one holder rotating and supporting device 100, there is provision for utilizing additional holder rotating and supporting devices so that if desired a plurality of holders may be simultaneously positioned in different receptacles, respec-

tively, and rotated in said receptacles if desired. This can be readily accomplished by removing one or more of the cover-supporting rods 34 and the covers carried thereby from the desired number of arms 22 and by substituting therefor the corresponding number of holder supporting and rotating device 100. Further, it will be noted that the plate 126 of the motor-carrier 118 constitutes a cover for the receptacle in which the companion holder 98 is positioned. Also it will be noted, that when the carrier 118 is moved downwardly pursuant to the downward movement of frame 18 by shaft 16, the lower surface of plate 126 may engage the top edge of the companion receptacle, and this can occur before the downward movement of shaft 16 is completed, since motor-carrier 118 is supported by the pin 108 which is slidable in bracket 102.

The apparatus is operated under the control of a timing device 182 having a notched control disk 184, as described in my above mentioned Letters Patent. Said timing device 182 is positioned within cabinet 10 (Figs. 6 and 10) and the cabinet is provided with a hinged door 186 having a transparent window 188 through which timing disk 184 and other parts of the timing device are visible. The circuit of motor M is completed and interrupted at the proper times by the timing devices 182 substantially in the same way as described in my above mentioned patent, except that in lieu of the mercury switches disclosed in said patent there are utilized in the present apparatus double-throw micro-switches 190 and 192, switch 190 being operated by the timer 182 and switch 192 being operated by a cam 194 rotated by shaft 54. The timing disk 184 is provided with peripherally spaced notches 196 separated by continuous peripheral or circumferential edge portions of the disk. Said timer disk is removably secured to a plate 198 which is rotated by the shaft of an electric clock-motor 200.

A lever 202 is secured to a spindle 204 which is mounted for turning movement in a bearing 206 in the frame 208 of the timing device. Said lever has a part 210 which engages the peripheral edge of timing disk 184 and which is movable successively into notches 196 during the rotation of said timing disk of clock-motor 200. An arm 212 is fixed to spindle 204 (Figs. 16 and 17) and is engaged by the slidable operating pin 214 of the micro-switch 190, said switch 190 having the usual spring which resiliently presses pin 214 outwardly in engagement with arm 212, and thus biases lever 202 in a direction to resiliently hold part 210 in engagement with the peripheral edge of disk 184 and to bias said part 210 for movement into notches 196, when the latter are in alignment with the adjacent end of part 210. An arm 216 is mounted for turning movement on a fixed pivot pin 218 and has fixed thereto a weighted arm 220, the weight being indicated at 222, which tends to turn arm 216 in a clockwise direction viewing Fig. 15. Said arm 216 is provided with a notch 224, in which a pin 226 carried by lever 202 is engaged for limiting the pivotal movement of lever 202 in a counter-clockwise direction. Said arm 216 is also provided with a notch 228 in which pin 226 is engaged when lever 202 is moved to its retracted position by the cam 230 at the end of one rotation of cam disk 184, that is at the completion of the operation of the apparatus as described in my above mentioned patent.

It is sometimes necessary or desirable to op-

erate motor M for raising shaft 16 before part 210 of lever 202 is in a position to move into a notch 196. Provision is made in the apparatus of the present invention for accomplishing this result. For this purpose part 210 of lever 202 is pivotally connected to the adjacent end of the main part 232 of said lever by a pivot pin 234. As illustrated in Fig. 18A, part 210 has a recessed portion 236 in which the adjacent end of part 232 is pivotally connected by said pin 234. A spring 238 fixed to part 232 bears on part 210 for holding the latter in normal position. When it is desired to actuate motor M for raising shaft 16 before part 210 engages the timing disk 184 in a notch thereof, lever 202 is turned counter-clockwise, part 210 being pivoted downwardly against spring 238 allowing lever 202 to move in a counter-clockwise direction by the amount necessary to permit the operation of micro-switch 190, this operation being the equivalent of the operation of said switch 190 when part 202 engages in a notch 196 in the timing disk. Thus the apparatus can be operated, if desired, before a notch of the disk is aligned with part 210 of lever 202. Further, it will be understood that when it is desired to raise the shaft 16 before part 210 engages in a notch 196, it may be desired to prevent rotation of shaft 16 which normally occurs after the shaft is raised to lift the holder 98 out of the receptacle 14 in which it is positioned, since in the normal operation of the apparatus the holder 98 after being raised out of the receptacle is moved laterally of that receptacle to a position over another receptacle into which the holder is lowered by the subsequent downward movement of shaft 16. Accordingly, it will be understood that when shaft 16 is raised, pursuant to the movement of part 210 of lever 202 to the position illustrated in Fig. 18 for raising said shaft before said part engages in a notch 196 of the timing disk and a turning movement of said shaft is not desired, the pin 84 of the Geneva gear mechanism will be moved to its retracted position so that shaft 78, although rotated by gear wheel 52 when motor M is actuated, would be ineffective to actuate the Geneva gear mechanism for turning shaft 16.

When the motor M is set into operation by the movement of lever part 210 to the position illustrated in Fig. 18, the cycle of operations is the same as that which occurs when said part engages the disk in a notch 196 thereof. Thus, referring to the circuit diagram illustrated in Fig. 7, it will be noted that in the normal operation of the apparatus, when lever part 210 is in engagement in the normal position thereof with the peripheral edge of timing disk 184, the circuit through motor M is interrupted by reason of the fact that the movable contact member 240 of micro-switch 190 and the movable contact member 242 of the cam actuated switch 192 are in the positions illustrated in full lines in Fig. 7. When movable contact member 240 is moved from its stationary contact member 244 to its other stationary contact member 246, that is to its dotted line position, a circuit is completed through said movable contact member 240, the stationary contact member 246, from the latter over the wire connection 248 to the stationary contact member 250 of switch 192, which is then engaged by the movable contact member 242 of switch 192, it being understood that the dotted line position of movable contact member 240 of switch 190 illustrates the position thereof when part 210 of lever 202 engages disk 184 in a notch

196. As soon as movable contact member 240 of switch 190 is in the dotted line position illustrated in Fig. 7 and a circuit is completed through motor M, gear wheel 52 is rotated, thereby actuating link 60 for raising shaft 16 and actuating shaft 54 for rotating the shaft 78 which actuates the Geneva gear for turning shaft 16. It will be understood that the Geneva gear by reason of its construction and operation is effective to turn shaft 16 only after said shaft has raised holder 98 out of the receptacle, and that as soon as this occurs said Geneva gear operates to turn said shaft for moving holder 98 laterally to a position over the next receptacle, after which further turning movement of shaft 16 is interrupted and said shaft descends by gravity to move holder 98 into said last mentioned receptacle. Just before cross head 62 descends to its lowermost position, cam 194 actuates the double-throw micro-switch 192, resulting in the movement of the movable contact member 242 of said switch to the dotted line position illustrated in Fig. 7, in which said movable contact member engages the companion stationary contact member 252 which is connected by the wire 254 of the stationary contact member 246 of switch 190. Accordingly, the circuit through motor M is maintained and shaft 54 which operates cam 194 continues to rotate until part 210 of lever 202 is moved out of the notch of the timing disk, and by this time cam 194 has disengaged the micro-switch 192 so that the latter is moved automatically by its spring action from the dotted line position illustrated in Fig. 7, to the full line position thereof, thus interrupting the circuit through the motor at which time the parts are positioned for the next operating cycle of the apparatus. The same operation takes place when, instead of part 210 of lever 202 moving into a notch 196 of the timing disk, said part 210 is moved to the position illustrated in Fig. 18, which as heretofore stated is the equivalent of the movement of said part 210 into a notch of the disk.

In Fig. 14 of the drawings, there is illustrated a different form of device for rendering the Geneva gear mechanism inoperative for turning shaft 16. In the construction illustrated in Fig. 14, provision is made for moving the Geneva gear 76 and the pin 84a which normally engages the main Geneva gear 74 to positions in which said gear 76 and the pin 84a are out of cooperative relation with the Geneva gear 74. For this purpose, shaft 78a which corresponds to the shaft 78 described above is provided with a coupling member or socket 256 having a square or other non-circular recess 258 in which the coupling member 260 of shaft 262 is releasably engageable, said coupling member 260 being preferably of the same cross sectional configuration as the recess 258 of coupling 256 and being slidable into and out of said recess. The upper end of shaft 262 is fixed to the gear 76, and when coupling member 260 is engaged with coupling member 256 operated by shaft 78a, shaft 262 is rotatable by shaft 78a for operating the Geneva gear mechanism in the normal way. In the event, however, that it is desired to render the Geneva gear mechanism ineffective to turn shaft 16, shaft 262 is raised for disconnecting coupling 260 from coupling 256 and for moving gear 76 and the slot-engaging pin 84a to positions above Geneva gear 74. For this purpose, a lever 264 is pivotally mounted on an arm 266 fixed to coupling 256 and engages under a collar 268 fixed to shaft

262 so that by moving said lever downwardly to the dotted line position illustrated in Fig. 14, coupling member 260 is disengaged from coupling member 256, and gear 56 and the slot-engaging pin 84a are moved out of operative relation to gear 74. Any suitable means may be provided for releasably holding lever 264 in its dotted line position to which it has moved for rendering the Geneva gear mechanism inoperative to turn shaft 16. For example, as here shown, this means may comprise a projection 270 on arm 266 which engages over the upper edge 272 of lever 264 when said lever is depressed, there being sufficient play between the parts to permit the disengagement of projection 270 from lever 264 when it is desired to restore the mechanism to its normal condition.

Provision is made for optionally interrupting the operation of the timing device when the shaft 16 is operated, so that the timing disk is not rotated at the times when the holder is being transferred from one of the receptacles 14 to another. This interruption of the timing device may be desirable when the clock-motor is a one-hour or other short period clock, so that the disk makes one revolution in a comparatively short period and the time consumed in moving the holder from one receptacle to another is large in comparison to the time of one revolution of the timing disk. Accordingly, a normally closed switch 256 (Fig. 1) is provided in the circuit of clock-motor 200, and is held closed by a cam 258 operated by shaft 54. As soon as shaft 54 begins to rotate, at the start of the cycle in which shaft 16 is actuated, said cam disengages said switch 256 and the latter opens thereby interrupting the circuit of clock-motor 200, and at the completion of one rotation of shaft 54, i. e., at the end of the cycle of operation of shaft 16, cam 258 engages switch 256 and closes the same, thus completing the circuit through motor 200 for operating the timing device. Preferably a by-passing switch 260 is provided in the circuit of motor 200 (see Fig. 7). This switch is normally open so that motor 200 is controlled by switch 256, but when it is desired to eliminate the control of switch 256, switch 260 is closed and the timing device is in that case operated continuously.

While I have shown and described the preferred embodiment of my invention, it will be understood that the latter may be embodied otherwise than as herein specifically disclosed, and that in the illustrated embodiment certain changes in the details of construction and in the arrangement of parts may be made without departing from the invention. Accordingly, I do not wish to be limited to the construction herein illustrated or described except to the extent which may be required by the scope of the appended claims.

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

1. In apparatus of the class described comprising a plurality of receptacles, a holder movable into and out of said receptacle, and means for effecting relative vertical and lateral movements of said holder and receptacle for conveying said holder out of one of said receptacles and into another of said receptacles; means for rotating said holder in one of said receptacles when the holder is positioned therein comprising a carrier mounted for movement laterally of said receptacles and toward and away from said receptacles in vertical line therewith, respec-

tively, a motor mounted on said carrier and movable therewith to positions over and in line with said receptacles, a vertical shaft mounted for rotation in said carrier and connected to said motor for rotation thereby, and means for connecting said holder to said shaft for rotation thereby.

2. In apparatus of the class described comprising a plurality of receptacles, a holder movable into and out of said receptacles, and means for effecting relative vertical and lateral movements of said holder and receptacle for conveying said holder out of one of said receptacles and into another of said receptacles, means for rotating said holder in one of said receptacles when the holder is positioned therein comprising a carrier mounted for movement laterally of said receptacles and toward and away from said receptacles in vertical line therewith, respectively, a motor mounted on said carrier and movable therewith to positions over and in line with said receptacles, a vertical shaft mounted for rotation in said carrier and connected to said motor for rotation thereby, and means for connecting said holder to said shaft for rotation thereby, said carrier comprising a plate adapted to seat upon and cover the receptacle in which said holder is positioned.

3. In apparatus of the class described comprising a plurality of receptacles arranged in a circle, a shaft disposed vertically at the center of said circle and mounted for rotation and for vertical movement, a member extending radially from said shaft above said receptacles and movable by said shaft toward and away from said receptacles and laterally thereof, and a holder movable under the control of said member into and out of said receptacles; means for rotating said holder when the latter is positioned in one of said receptacles comprising a carrier mounted on said member and movable therewith to positions over said receptacles, respectively, in vertical alignment therewith, a motor supported on said carrier, a vertical shaft mounted for rotation in said carrier and rotatable by said motor, and means for connecting said holder to said last mentioned shaft for rotation thereby when said holder is positioned in one of said receptacles.

4. In apparatus of the class described comprising a plurality of receptacles arranged in a circle, a shaft disposed vertically at the center of said circle and mounted for rotation and for vertical movement, a member extending radially from said shaft above said receptacles and movable by said shaft toward and away from said receptacles and laterally thereof, and a holder movable under the control of said member into and out of said receptacles; means for rotating said holder when the latter is positioned in one of said receptacles comprising a carrier mounted on said member and movable therewith to positions over said receptacles, respectively, in vertical alignment therewith, a motor supported on said carrier, a vertical shaft mounted for rotation in said carrier and rotatable by said motor, and means for connecting said holder to said last mentioned shaft for rotation thereby when said holder is positioned in one of said receptacles, said carrier comprising a plate adapted to cover the receptacle in which said holder is positioned.

5. In apparatus of the class described comprising a plurality of receptacles arranged in a cir-

cle, a shaft disposed vertically at the center of said circle and mounted for rotation and for vertical movement, a member extending radially from said shaft above said receptacles and movable by said shaft toward and away from said receptacles and laterally thereof, and a holder movable under the control of said member into and out of said receptacles; means for rotating said holder when the latter is positioned in one of said receptacles comprising a carrier mounted on said member and movable therewith to positions over said receptacles, in vertical alignment therewith, respectively, a motor supported on said carrier, a vertical shaft mounted for rotation in said carrier and rotatable by said motor, and means for connecting said holder to said last mentioned shaft for rotation thereby when said holder is positioned in one of said receptacles, said carrier comprising a plate adapted to cover the receptacle in which said holder is positioned, said plate being engageable with said last mentioned receptacle and vertically movable in relation to said member whereby when said plate engages said receptacle pursuant to downward movement of said first mentioned shaft, further downward movement of said last mentioned shaft is ineffective to force said plate against the receptacle.

6. In apparatus of the class described comprising an open-top receptacle, a holder mounted for movement into and out of said receptacle through said open-top thereof, said holder being also mounted for rotation in said receptacle; means for rotating said holder and for supporting the same, comprising a bracket, a frame supported by said bracket, a motor carried by said frame, a shaft mounted for rotation in said frame and rotatable by said motor, and means for connecting said holder to said shaft for rotation thereby.

7. In apparatus of the class described comprising an open-top receptacle, a holder mounted for movement into and out of said receptacle through said open-top thereof, said holder being also mounted for rotation in said receptacle; means for rotating said holder and for supporting the same comprising a horizontal arm mounted for vertical movement, a bracket removably supported by said arm, a frame supported by said bracket, a motor carried by said frame, a shaft mounted for rotation in said frame and rotatable by said motor, and means for connecting said holder to said shaft for rotation thereby.

8. In apparatus of the class described comprising an open-top receptacle, a holder mounted for movement into and out of said receptacle through said open-top thereof, said holder being also mounted for rotation in said receptacle; means for rotating said holder and for supporting the same comprising a horizontal arm mounted for vertical movement, a bracket removably supported by said arm, a frame supported by said bracket, a motor carried by said frame, a shaft mounted for rotation in said frame and rotatable by said motor, and means for connecting said holder to said shaft for rotation thereby, said arm having a slotted part, said bracket having an opening in which the slotted part of the arm fits, said bracket having another opening extending at right angles to said first mentioned opening, a member carried by said bracket and having a limited movement in said other opening, said member having a part which is narrow enough to pass through said nar-

row part of said slot and a wider part which cannot pass through said narrow part of said slot but which can project through said wider part of said slot, said member being movable in said other opening of the bracket to one position in which said narrow part of the member is in line with said narrow part of the slot for movement therein and to a position out of line with said narrow part of the slot.

9. In apparatus of the class described comprising an open-top receptacle, and a holder mounted for movement into and out of said receptacle through said open-top thereof, said holder being also mounted for rotation in said receptacle; means for rotating said holder and for supporting the same comprising a horizontal arm mounted for vertical movement, a bracket removably supported by said arm, a plate carried by said bracket and adapted to engage at one side thereof the top of the receptacle when said holder is positioned therein, a motor positioned at the other side of said plate, a shaft operated by said motor extending through said plate to said first mentioned side thereof, and means at said first mentioned side of said plate for connecting said holder to said shaft for rotation thereby.

10. In apparatus of the class described, the sub-combination comprising an arm having a slot in its end, said slot having a narrow part extending inwardly from the end of said arm to a wider part at the inner end of the slot, a bracket supported by said arm and having an opening in which the slotted part of the arm fits, said bracket having another opening extending at right angles to said first mentioned opening, a member carried by said bracket and having a limited movement in said other opening, said member having a part which is narrow enough to pass through said narrow part of said slot and a wider part which cannot pass through said narrow part of said slot but which can project through said wider part of said slot, said member being movable in said other opening of the bracket to one position in which said narrow part of the member is in line with said narrow part of the slot for movement therein and to a position out of line with said narrow part of the slot, said bracket being removable from said arm in said first position of said member and held against removal from said arm in the second position of said member.

11. In an automatic immersion apparatus, a shaft mounted for rotation and for vertical movement, means for rotating said shaft, and means for raising said shaft, said last mentioned means including a part with respect to which said shaft is longitudinally movable and which in a predetermined relative position of said shaft and said part is engageable with said shaft for raising the same, said part being movable upwardly for raising said shaft and movable downwardly longitudinally of said shaft in relation thereto whereby said part is prevented from exerting a downward force on said shaft when said part moves downwardly faster than said shaft.

12. In an automatic immersion apparatus, a shaft mounted for rotation and for vertical movement, means for rotating said shaft, and means for raising said shaft, said last mentioned means including a part with respect to which said shaft is longitudinally movable and which in a predetermined relative position of said shaft and said part is engageable with said shaft for raising the same, said part being movable up-

wardly for raising said shaft and movable downwardly longitudinally of said shaft in relation thereto whereby said part is prevented from exerting a downward force on said shaft when said part moves downwardly faster than said shaft, said shaft being normally supported by said part, and means for resiliently opposing the downward movement of said shaft when said part is moved out of supporting relation thereto.

13. In apparatus of the class described comprising a timing disk having a peripheral edge provided with peripherally spaced edge notches and a switch, operable under the control of said disk; means actuated by said disk for actuating said switch comprising a pivotally mounted member having a part engageable with said disk in said notches and with the peripheral edge portions of the disk between said notches, means biasing said member to hold said part in engagement with said disk, said member having a part to which said disk-engaging part is movably secured for movement relatively to said last mentioned part in directions toward and away from the peripheral edge of the disk, and means biasing said disk-engaging part for movement relatively to said last mentioned part toward the peripheral edge of said disk.

14. In apparatus of the class described comprising a timing disk having a peripheral edge provided with peripherally spaced edge notches and a switch operable under the control of said disk; means actuated by said disk for actuating said switch comprising a pivotally mounted member having a part engageable with said disk in said notches and with the peripheral edge portions of the disk between said notches, means biasing said member to hold said part in engagement with said disk, said member having a part to which said disk-engaging part is pivotally secured for movement relatively to said last mentioned part in directions toward and away from the peripheral edge of the disk, and spring means biasing said disk-engaging part for movement relatively to said last mentioned part toward the peripheral edge of said disk.

15. In an automatic immersion apparatus having a shaft mounted for rotation and for vertical movement, means for moving said shaft in a vertical direction, and means including a Geneva gear mechanism for intermittently turning said shaft in timed relation to the vertical movement thereof, means for rendering said Geneva gear mechanism inoperative to turn said shaft whereby said shaft is movable vertically but not rotatably, said last mentioned means comprising companion parts of said Geneva gear mechanism mounted for relative vertical movement from positions in which said parts are engageable with each other for turning said shaft to positions in which said parts are in inoperative relation.

16. In an automatic immersion apparatus having a shaft mounted for rotation and for vertical movement, means for moving said shaft in a vertical direction, means for imparting a rotary movement to said shaft in timed relation to the vertical movement thereof, and means for actuating both of said shaft-moving means, means for rendering said last mentioned means inoperative to actuate said shaft rotating means but without rendering the same inoperative to actuate said first mentioned shaft moving means whereby the shaft is movable vertically without rotation thereof, said means for rendering said

actuating means inoperative as aforesaid comprising a rotary member actuated by said actuating means, a companion rotary member normally in engagement with and rotated by said first mentioned rotary member and movable out of operative engagement therewith, and means for moving said companion rotary member out of operative engagement with said first mentioned rotary member.

17. Apparatus of the class described comprising a plurality of receptacles arranged in a circle, a shaft mounted vertically at the center of said circle for rotation and for vertical movement upwardly and downwardly, a horizontal frame fixed to and movable with said shaft, said frame comprising an arm extending radially from said shaft toward said receptacles, an electric-outlet device carried by said shaft below said frame, said outlet comprising a pair of slip rings and a socket connected thereto, a switching

device positioned in fixed position below said outlet device, said switching device comprising a switch which is opened and closed by upward and downward movements, respectively, of said shaft, said switching device comprising also a pair of conductors electrically connected to said switch and engageable with and disengageable from said slip rings when said shaft moves downwardly and upwardly, respectively, a motor supported by said arm and connected to said socket of the outlet device, and a holder supported by said arm and rotatable by said motor, said holder being movable by said arm out of one receptacle and into another by vertical and rotary movements of said shaft and rotatable in the receptacle by said motor when said switching device is closed pursuant to a downward movement of said shaft.

EDWIN C. WEISKOPF.