July 13, 1943. E. C. WEISKOPF 2,324,122

AUTOMATIC IMMERSION APPARATUS

Filed Feb. 20, 1941 4 Sheets-Sheet 1

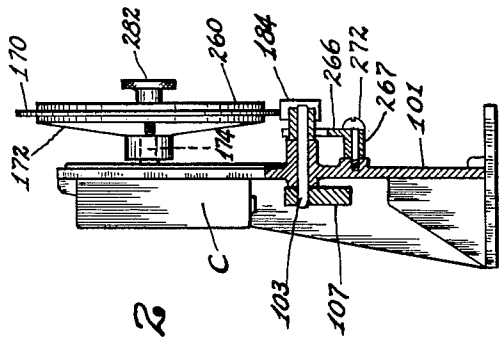


Fig. 2

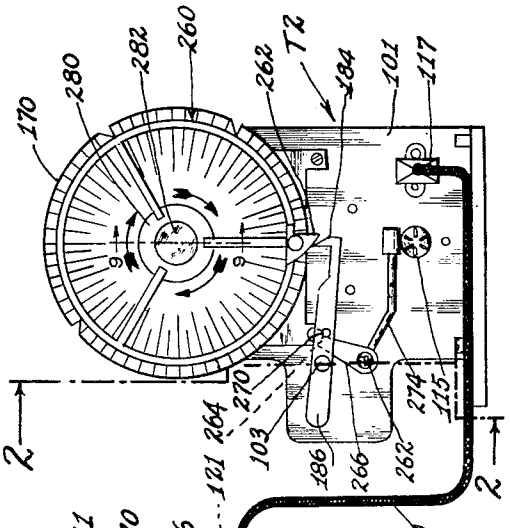
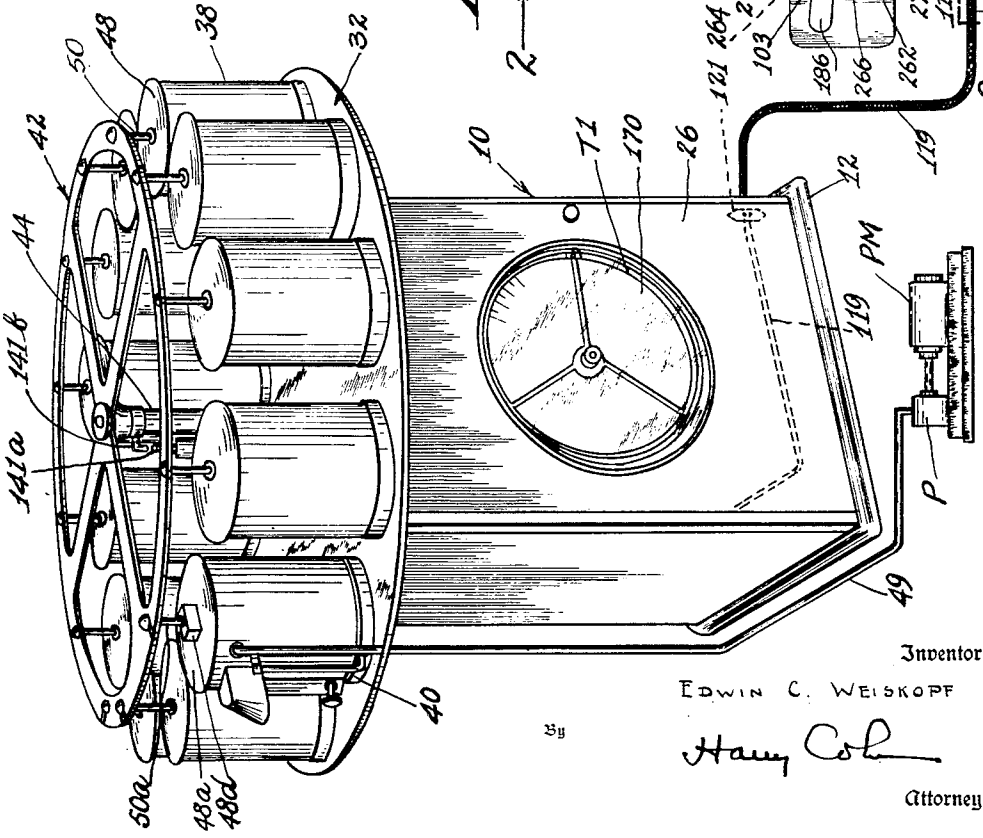


Fig. 1



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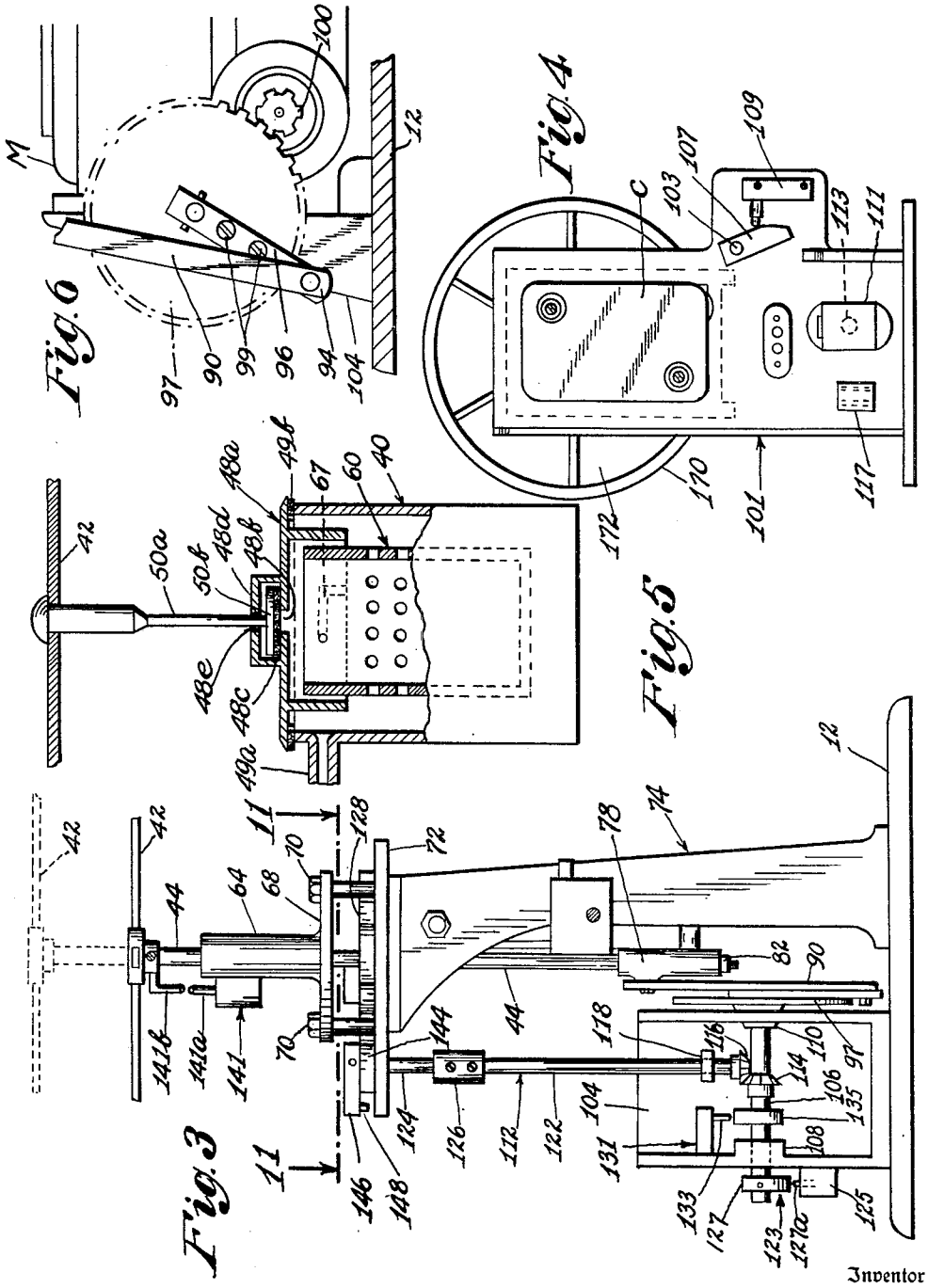
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AUTOMATIC IMMERSION APPARATUS

Filed Feb. 20, 1941 4 Sheets-Sheet 2



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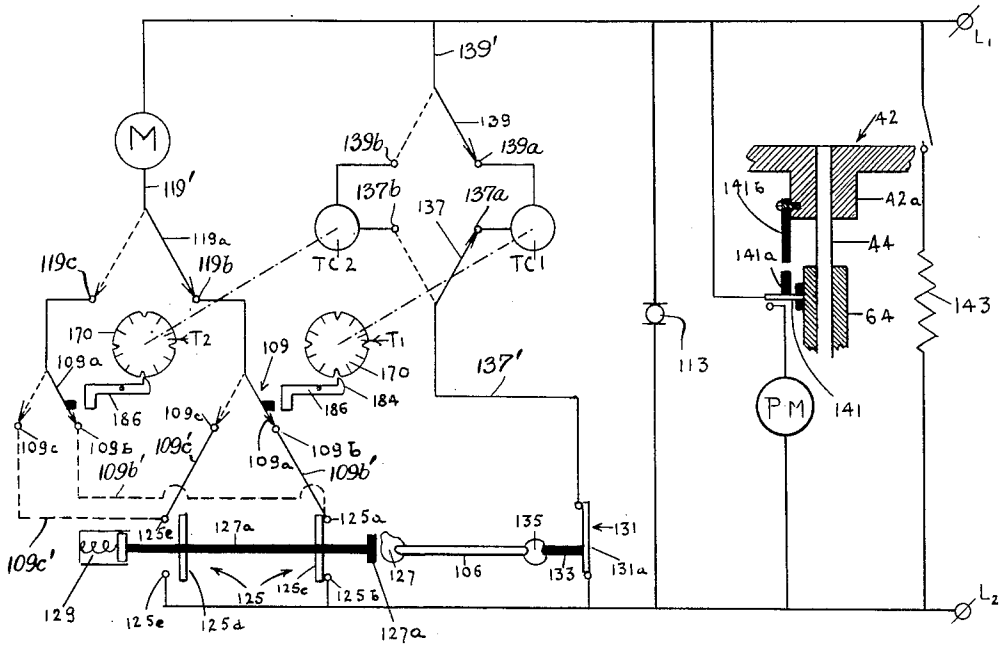
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AUTOMATIC IMMERSION APPARATUS

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FIG. 7



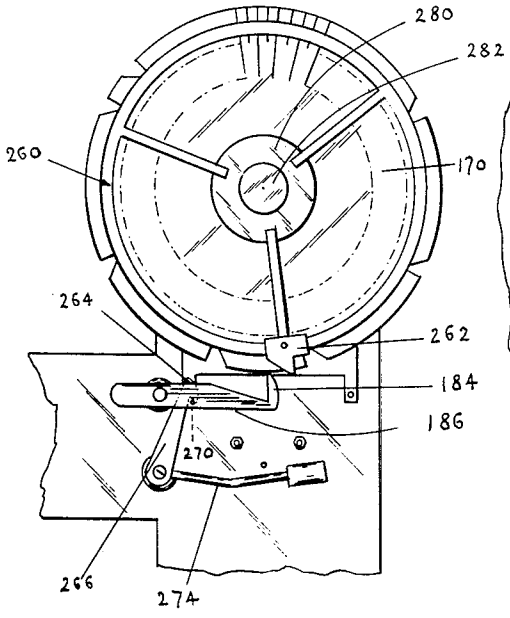


FIG. 8

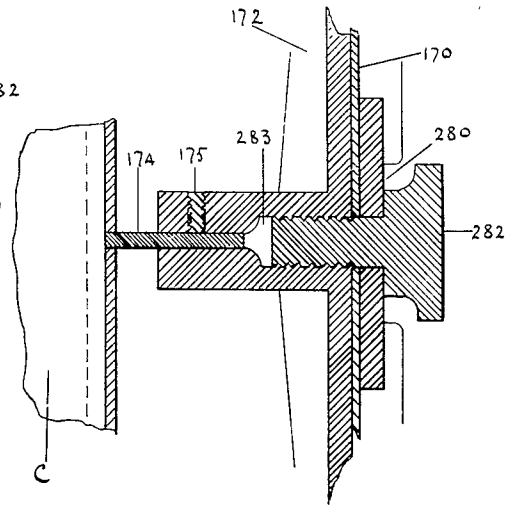


FIG. 9

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AUTOMATIC IMMERSION APPARATUS

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Fig. 10

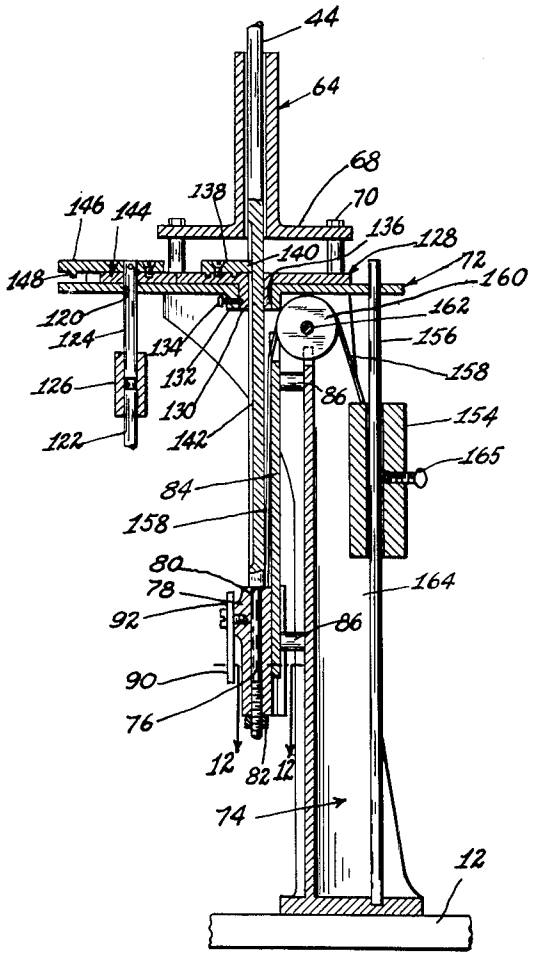


Fig. 11

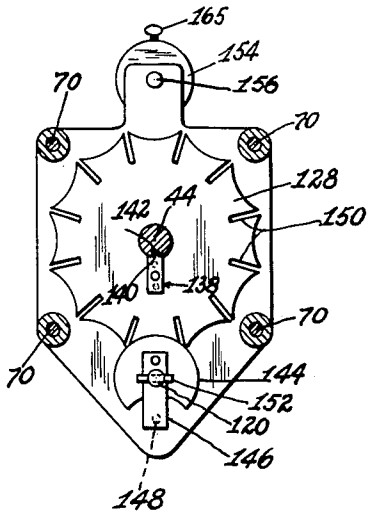
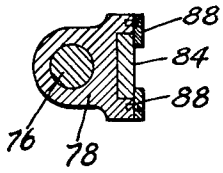


Fig. 12



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UNITED STATES PATENT OFFICE

2,324,122

AUTOMATIC IMMERSION APPARATUS

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

Application February 20, 1941, Serial No. 379,800

5 Claims. (Cl. 214—17)

This invention relates to automatic immersion apparatus of the type shown in United States Letters Patent No. 2,157,875, granted to me May 9, 1939. The present invention is concerned with improvements in and additions to the apparatus disclosed in said patent.

In using the apparatus, the times of the cycles of operation vary depending upon the particular treatments to which the tissue or other material is subjected. For example, the time of the cycle of operation of the machine may vary from one day or more to one hour or less. As the timing device is preferably a unitary device including an electric motor of the electric clock type, it is advantageous to provide a plurality of such timing devices selectively operable to control the time of the cycle of operation of the apparatus in such manner that the apparatus is operated under the sole control of the selected timing device. Thus, for example, one timing device designed to effect the cycle of operations in a period of one day is provided with an electric clock which is effective to rotate the disk of the timing device one revolution in a period of one day while a timing device designed for a different time cycle is provided with an electric clock which is effective to rotate the timing disk one revolution corresponding to the desired period of time, for example, one hour.

It is frequently important that the periods of immersion of the tissue or other material in the several liquids or other media be accurately controlled. On the other hand, in the case of a timing device provided with a timing disk which makes a complete revolution within a relatively short time, for example, one hour, the time which passes during the actuation of the apparatus for transferring the material from one receptacle into another, there being a plurality of such transfers, is relatively large in relation to the total period of the operation of the machine, with the result that the material does not remain for the proper length of time in each receptacle. It is, therefore, one of the objects of the present invention to obviate this objection and for that purpose to provide a timing device which accurately determines the period during which the material is subjected to treatment in each of the receptacles and maintains the treatment for the full periods, without, however, requiring that the timing disk be rotated more than one revolution. Briefly described, this result is accomplished in accordance with the present invention by interrupting the rotation of the timing disk, preferably by interrupting the operation of the clock motor during the intervals of time when the material is being transferred from one receptacle to another. In other words, the timing disk rotates only while the material is immersed in the liquid or other media for the treatment thereof.

Provision is made in the apparatus of the above mentioned patent for immersing the tissue or other material in a paraffin bath. For obtaining a more effective impregnation of the tissue with paraffin or for otherwise improving the treatment of the tissue in the paraffin bath a vacuum is provided in the paraffin-bath receptacle. One of the objects of the present invention is to provide the apparatus with means for automatically subjecting the paraffin bath to the action of a vacuum during the time the tissue is in the paraffin-bath receptacle.

A further object is to relieve the vacuum automatically preliminary to the removal of the tissue from said receptacle whereby to facilitate removal of the cover from said receptacle.

The above objects of the invention and other objects which might hereinafter appear will be more fully understood from the following description considered with reference to the accompanying drawings.

In the drawings:

Fig. 1 is a perspective view of the automatic immersion apparatus embodying the present invention;

Fig. 2 is a side view of one of the timing devices, partly in section on the line 2—2 of Fig. 1;

Fig. 3 is a front view of certain parts of the apparatus, the cabinet and other parts being omitted for the purpose of illustration, this figure corresponding to Fig. 6 of said Patent No. 2,157,875;

Fig. 4 is a rear view of the timing device;

Fig. 5 is a side view, partly in elevation and partly in section of the paraffin-bath receptacle showing the tissue container positioned therein;

Fig. 6 is a view on the line 6—6 of Fig. 3, and is similar to Fig. 9 of said Patent No. 2,157,875;

Fig. 7 is a circuit diagram;

Fig. 8 is a front view, on a larger scale, of part of the timing device;

Fig. 9 is a fragmentary sectional view on a larger scale on the line 9—9 of Fig. 1;

Fig. 10 is a vertical sectional view of part of the mechanism illustrated in Fig. 3;

Fig. 11 is a sectional view on the line 11—11 of Fig. 3;

Fig. 12 is a sectional view on the line 12—12 of Fig. 10.

Referring now to the drawings in detail, the automatic immersion apparatus of the present invention is constructed and operates substantially in the same way as the automatic immersion apparatus shown and described in the above mentioned Patent No. 2,157,875, with the additions and modifications hereinafter described. In general, the apparatus comprises a receptacle table or support 32 mounted on top of the cab-

inet 10. A plurality of receptacles 38 and a receptacle 40 are supported on table 32 in equispaced circumferential relation, said receptacle 40 being a paraffin-bath receptacle. The rotary conveyor 42 is raised, turned and lowered by the shaft 44 at predetermined times by the mechanism described in said patent. Covers 48 are provided for the receptacles and are movable with conveyor 42 by rods 50, as described in said patent, for covering and uncovering said receptacles.

A special cover 48a is associated with the rod 50a, said cover and rod serving to support the tissue container or carrier 60 from the rim of conveyor 42. Said carrier is detachably connected to cover 48a by a bayonet-slot joint 67 (Fig. 5). The paraffin-bath receptacle 40 is connected to a vacuum pump P operated by the electric motor PM, the conduit from said pump to said bath being indicated at 49 in Fig. 1, said conduit being in the form of a tube which is connected to the nipple 49a (Fig. 5) with which the paraffin bath is provided. The top of the receptacle 40 is provided with a packing ring 49b on which cover 48a is seated to provide a vacuum-tight joint or fluid-sealing closure therewith. Said cover is provided with a central opening or port 48b which, when uncovered permits air to pass into the receptacle. Said port 48b is opened and closed by a valve 48c carried by the stem 50a by which the cover 48a is connected to conveyor 42. The lower end 50b of stem 50a is provided with the valve 48c which, upon the upward movement of conveyor 42, engages the chamber-forming part 48d fixed to said cover for moving the same pursuant to the movement of said conveyor. When cover 48a is seated on the paraffin-bath receptacle 40, valve 48c closes opening 48b. When the apparatus is actuated for removing the tissue from the paraffin bath valve 48c is raised from its seat on the cover thereby permitting air to enter the paraffin bath for breaking the vacuum therein in order to facilitate movement of cover 48a off of the paraffin-bath receptacle, the air breaking the vacuum being supplied from chamber-forming part 48d into which the air enters in any suitable way as through the central opening 48e through which stem 50a projects. As hereinafter described the vacuum pump motor PM is actuated only at predetermined times automatically through the control of means provided for that purpose.

The means for actuating shaft 44 to move carrier 42 vertically and rotatably will now be described. As illustrated in Figs. 3 and 10, said shaft is mounted for longitudinal and rotary movement in a guide bearing 64 having a lower circular flange 68 secured by means of bolts 70 in spaced relation above the plate or top surface 72 of a standard 74 secured to and upstanding from the cabinet base 12. Said shaft has a reduced lower end portion 76 (Fig. 10) secured to and rotatably mounted in a cross head 78. The reduced shaft portion 76 provides a shoulder 80 which engages one end of said cross head, and the free end of said reduced shaft portion is threaded for engagement by a nut 82 which engages the other end of said cross head to fix the shaft longitudinally in relation to said cross head while permitting rotation of the shaft therein. Cross head 78 is guided for longitudinal movement on a guide bar 84 fixed to standard 74 by bolts and spacing members 86, said cross head being removably secured in relation to said guide bar by side straps 88 fixed thereto and overlapping guide bar 84 as illustrated in Fig. 12.

Cross head 78 and shaft 44 fixed thereto are reciprocated by a link or connecting rod 90 pivotally secured at one end 92 thereof to said cross head and pivotally secured at its other end 94 to a crank rod 96 fixed to a rotary gear 97 in any suitable way, as by screws 99. Gear 97 meshes with and is rotated by a gear 100 (Fig. 6) operated by motor M. Said motor is carried by a standard 104 fixed to and upstanding from cabinet base 12. Gear 97 is fixed to and rotates a shaft 106 (Fig. 3) which is journalled in bearings 108 and 110 on standard 104. A rotary shaft 112 is operated during the rotation of shaft 106 by gear 97 through bevelled gears 114 and 116 fixed to shafts 106 and 112, respectively. Shaft 112 is journalled for rotation adjacent its ends in a bearing 118 carried by standard 104 and in a bearing opening 120 formed in plate 72. As here shown, shaft 112 comprises sections 122 and 124 adjustably coupled together by a coupling sleeve 126.

It will be understood that the rotation of gear 97 is effective to move shaft 44 longitudinally and also, as will now be described, rotation of shaft 112 is effective to cause the intermittent rotation of shaft 44. The mechanism provided for this purpose comprises a Geneva gear 128 (Figs. 10 and 11) which surrounds shaft 44 and through which said shaft is longitudinally movable. Said Geneva gear rests on the surface of standard plate 72 and has a bearing on said surface. Said gear is provided with a hub 130 which has a bearing in a depending flange 132 of plate 72 for rotation therein and is held against longitudinal movement by a pin 134 which is threaded in flange 132 and engages hub 130 in a peripheral groove 136. Gear 128 is provided with a plate 138 fixed thereto. Said plate has a projection 140 which engages shaft 44 in a longitudinal groove 142 provided in said shaft whereby rotation of gear 128 is effective to rotate shaft 44. Gear 128 is rotated by shaft 112 through a cooperating gear 144 of the Geneva gear movement. Said cooperating gear 144 is provided with a plate 146 fixed thereto and carrying a pin 148 arranged to enter the radial slots 150 of gear 128, whereby upon continuous rotation of cooperating gear 144 Geneva gear 128 is caused to rotate intermittently for a part of a revolution thereby to similarly cause shaft 44 to rotate intermittently or to move for a corresponding part of a revolution. As here shown, gear 128 is provided with twelve radial slots 150 to accomplish twelve partial rotations of said shaft for moving carrier 42 to position the holder 60 in relation to twelve receptacles provided in the apparatus here shown, but it will be understood that the number of slots in said gear may be varied depending upon the number of different immersions or treatments to which the specimen is subjected or depending upon the intended use of the apparatus. It will be observed that cooperating gear 144 is rotatably mounted on plate 72 and is secured to the upper end of shaft 112, more specifically to the upper shaft section 120, by a pin 152.

From the above description, it will be understood that when gear 97 is rotated for a complete revolution upon actuation of motor M and motor gear 100, shaft 44 is moved longitudinally upwardly for the full longitudinal travel thereof and longitudinally downwardly for the full distance of its travel and that during the rotation of gear 97 for effecting the reciprocation of shaft 44 upwardly and downwardly, shaft 112 makes

one complete revolution. It will also be understood that the Geneva gear movement is such that during the initial upward movement of shaft 44 pin 148 does not engage any of the slots 150, and cooperating gear 144 is therefore ineffective to rotate Geneva gear and shaft 44. However, when shaft 44 has been moved upwardly a sufficient distance to move holder 60 completely out of the receptacle to clear the top of the latter, pin 148 engages Geneva gear 128 in a slot 150 causing said gear and shaft 44 to rotate whereby to move holder 60 over the next receptacle. During the rotation of shaft 44 as just described the upward movement of said shaft is continued to the end of its travel and at about the time the rotary movement of said shaft is completed to center the holder 60 over the next receptacle, the shaft is moved downwardly to position the holder within said next receptacle. Thus it will be seen that the gearing arrangement is such that shaft 44 is actuated to raise holder 60 out of its receptacle, then to move said holder to position and center the same over the next receptacle by a partial rotation of said shaft and then to move said holder downwardly into the next receptacle whereupon the movement of the shaft is interrupted for the time being until the next operation thereof for moving the holder out of the last mentioned receptacle and into the next receptacle.

Provision is made for balancing the upward and downward movement of the shaft 44 whereby to obtain a more uniform longitudinal movement of said shaft in said up and down directions. For this purpose, there is provided a counter-weight 154 (Fig. 10) guided for up and down movement on a rod 156 fixed in standard 74. Said counter-weight 154 is connected to one end of a chain or belt 158 which passes over a rotary pulley 160 and is connected at its other end to cross head 78. Pulley 160 is mounted for rotation on a shaft or rod 162 secured at its ends in the sides 164 of standard 74. The arrangement of the parts is such that said counter-weight is raised to the limit of its upward movement when shaft 44 is at the limit of its downward movement. A set screw 165 is provided for securing weight 154 against movement during shipment of the apparatus. It will be understood that shaft 44 makes one revolution during each cycle of operation of the apparatus. The intermittent operation of shaft 44 for transferring the carrier 60 and the tissue or other material carried therein from one receptacle to another at predetermined times for subjecting the tissue to the action of the various liquids or other media in the several receptacles 38 and in the paraffin bath 40 is controlled by timing devices which will be described presently. The timing devices are, in general, of the type illustrated in said above mentioned patent and each includes a timing disk 170 as disclosed therein and a final-interruption device 260 which operates in substantially the same way as the device similarly numbered in said patent for stopping the operation of the apparatus at the end of the cycle.

A feature of the present invention is the provision of a plurality of timing devices as indicated at T1 and T2 so that the operation of the apparatus can be placed selectively under the sole control of either of these timing devices. The devices have different timing characteristics, i. e., the time of one revolution is different in each device, for example, one day in the case of timer T1, and one hour in the case of time T2. It will be understood that more than two timing devices can be provided, each having a different timing characteristic. One of the timing devices, here shown as the timing device T1, is positioned within the cabinet 10 of the apparatus, and can remain permanently in fixed position therein while the other timing device T2 is positioned externally of the cabinet, suitable means being provided for disconnecting one or the other of said timing devices to the companion switches and for connecting the selected timing device to said switches. As both timing devices are or can be of T1, and one hour in the case of timer T2. It will the same construction it is necessary to describe only one of them in further detail. Accordingly, referring now to Figs. 1 to 4, 8 and 9 of the drawings it will be observed that the timing device comprises a supporting panel 101 at the back of which is mounted an electric clock C of the proper construction for rotating the time disk 170 one revolution in a predetermined period of time. Said disk 170 is a cardboard disk, suitably calibrated as described in said patent, and is carried by a plate 172 fixed to the shaft 174 of the clock in any suitable way as by a setscrew 175. Said disk 170 is secured in fixed relation to plate 172 by the central part or hub 280 of the interrupting device 260, the latter being adjustably clamped in position by the head 281 of screw 282 which is threaded into the central bore 283 of the hub 285 of plate 172 (Fig. 9).

The control part 184 of the arm 186 which engages successively in the notches in disk 170 and which is engaged by the cam 262 of the interrupting device 260 is fixed to the front end of a pivot pin 103 mounted for turning movement in a bearing portion 105 provided in panel 101. A switch operating arm 107 is fixed to the rear end of pin 103 at the back of the panel in position to actuate a double throw micro-switch 109 mounted at the back of said panel. At the end of the operation of the apparatus arm 186 is moved by cam 262 to a retracted position in which it is held by the arm 266 which is fixed to the sleeve 267 mounted for pivotal movement on the pivot pin 272. Said sleeve has a weighted arm 274 connected thereto and tending to rotate said arm 266 so that the notched end 264 of the latter is engageable with a pin 270 fixed to arm 186. Thus, when arm 186 is moved by cam 262 arm 266 engages pin 270 for holding switch operating arm 186 in retracted position. Panel 101 of the timer is also provided with a lamp socket 111 positioned at the back of the panel for a telltale lamp 113 contained within a protective member 115 at the front of the panel. Also an electrical receptacle 117, having a plurality of terminals, is mounted at the front of the panel for engagement with the terminals 137 and 139 of wires 137' and 139' (shown in Fig. 7) of a cable 119 by which the electric circuit including the switches thereof are placed under the control either of timer T1 or T2. In other words, the terminals of cable 119 are connected to the receptacle of either timer T1 or timer T2 for placing the apparatus under the control of the selected timer. An opening 121 is provided in the side of the cabinet to permit the cable 119 to be projected therefrom for connection to timer T2 which, as explained above, can be connected to control the apparatus even though said timer is positioned externally of the cabinet. Opening 121 is provided so that the door 26 of the cabinet can be kept closed and

locked during the operation of the apparatus. It will be understood that timer T2 may be kept in its own individual cabinet and sealed therein by providing the cabinet with a door which can be locked to prevent tampering with the timing device during the operation of the apparatus under its control. Thus, to place the apparatus under the control of timer T2, it is only necessary to disconnect cable 119 from timer T1 and connect said cable to timer T2 by plugging the terminal end of said cable into the terminal receptacle 117 on the timer panel of the timer T2. The manner in which this is accomplished by means of cable 119 will be subsequently described in detail with reference to Fig. 7 of the drawings.

Switch 109 which is controlled by the timer device on the panel of which said switch is mounted operates in conjunction with a switching mechanism 123 (Fig. 3) actuated by shaft 106. Said switching mechanism comprises a double throw switch 125 operated by a cam 127 fixed to and rotated by shaft 106, said double throw switch 125 and the relation thereof to operating cam 127 being illustrated more or less diagrammatically in Fig. 7. Switch 109 and switch 125 operate jointly to control the circuit of motor M for operating shaft 44. This joint operation will be understood from an inspection of the circuit diagram shown in Fig. 7. Assuming that the timer T1 is connected to the circuit for controlling the operation of the apparatus, and assuming that the operation of the apparatus is started, the part 184 of arm 186 being in a notch of the timer disk 170, a circuit is completed through motor M from one side L1 of the line through the connection 119a of the means which connects the circuit through the timer to switch 109 of said timer, the movable arm 109a of said switch being in engagement with the stationary terminal 109b which is connected to the stationary terminal 125a of switch 125. Said terminal 125a and a companion terminal 125b are bridged by a movable contact member 125c fixed to the rod 127a which is engaged and actuated by cam 127. From terminal 125b the current passes to the other side L2 of the line.

When the circuit of the motor is closed conveyor 42 is actuated for transferring the tissue carrier 60 from one receptacle to the next receptacle and during this time shaft 106 makes one revolution. At the end of the revolution of shaft 106 cam 127 actuates switch 125 through the engagement thereof with rod 127a for disengaging movable contact member 125c from the stationary contact members 125a and 125b and at the same time moves the movable contact member 125d of the switch into engagement with the stationary contact members 125e for bridging the latter, and simultaneously breaking the circuit through the motor and interrupting the operation of the apparatus for the time being. It will be observed that one of the terminals 125e is connected to a terminal 109c of switch 109, but at this time movable switch member 109 is out of engagement with said terminal 109c, so that the circuit is not completed through said switch when cam 127 actuates switch 125 to interrupt the same at the contacts 125a and 125b. However, during this time part 184 of arm 186 is in the notch of the timing disk 170 which continues to rotate and shortly after the actuation of switch 125 by cam 127, part 184 of arm 186 is moved out of the notch and is engaged by the edge of the disk and thereby actuates arm 186. Switch 109 is at this time actuated for disengagement of the movable contact 109a thereof from contact 109b and the engagement thereof with contact 109c, thus completing the circuit of the motor through contacts 125e and said contact 109c. The motor is thus effective to actuate shaft 106 but only for a fraction of a turn, i. e., only until cam 127 disengages the switch operating member 127a permitting the spring 129 to move switch 125 to its initial position for disengaging bridging member 125d from stationary contacts 125e, thus again interrupting the circuit of the motor M. While bridging contact 125c is engaged with stationary contacts 125a and 125b and the switch is thus conditioned for the next operation of the motor, the circuit through the motor is not completed since it is interrupted through the switch 109 which remains in engagement with contact 109c until subsequently operated by arm 186 when the part 184 of said arm enters into a notch brought into registry therewith when the timing disk 170 has rotated a predetermined distance. It will also be understood that only a small degree of rotation is necessary to disengage cam 127 from the switch operating mechanism to permit closing of contacts 125a and 125b by bridging member 125c thus placing the switching device in condition for completing the circuit through the motor when switch 109 is next actuated under the control of timing disk 170.

As explained above when the cycle of operation of the apparatus is of short duration the time consumed by the several actuations of the apparatus for transferring the tissue from one receptacle to another may constitute a substantial part of the total time of the complete cycle of operation, thus appreciably cutting down the periods during which the tissue is subjected to treatment in the several receptacles. Accordingly, a feature of the present invention resides in eliminating this objection without, however, requiring more than one revolution of the timing disk 170. In the form of the invention herein disclosed this result is accomplished by interrupting the electric clock motor of the timing device during the several actuations of the apparatus within the cycle of operation thereof. Accordingly, provision is made for interrupting the circuit through the electric clock of the timing device during the rotation of shaft 106. The means provided for this purpose comprises a micro or other suitable switch 131 mounted in stationary position in relation to shaft 106 and provided with an actuating pin 133 adapted to be operated by a cam 135 fixed to and rotated by said shaft 106. Cam 135 is designed so that it holds switch 131 open except when shaft 106 is stationary during each of the several rest periods of the shaft actuating mechanism when the tissue is immersed in the several receptacles. Switch 131 comprises a movable spring contact member 131a which is biased to circuit closing position but which is held open by cam 135 during the rotation of shaft 106. Cable 119 which connects the apparatus for control optionally under timer T1 or T2 consists of wires 137', 139', 119', 109b' and 109c'. As shown in Fig 7, wire 139' is connected to one side L1 of the line and wire 137' is connected to the other side L2 of the line through switch 131. Wires 137' and 139' terminate in plug-in terminals shown as switches 137 and 139, respectively, in

Fig. 7 and are connected optionally to the terminals 137a and 139a, respectively, of timer T1 or to the terminals 137b and 139b, respectively, of timer T2. Thus, switch 131 is connected optionally to the circuit of clock TC1 of timer T1 or to the circuit of clock TC2 of timer T2. Wire 119a' terminates in a plug-in terminal shown as a switch 119a in Fig. 7, and is connected optionally either to terminal 119b of switch 109 of timer T1 or to a similar terminal 119c of switch 109 of timer T2. Wire 109b' terminates in a plug-in terminal which is connected either to terminal 109b of timer T1 or to the similar terminal 109b of timer T2, and wire 139c' terminates in a plug-in terminal which is connected either to terminal 109c of timer T1 or to the similar terminal 109c of timer T2 for connecting terminals 125a and 125e, respectively, of switch 125 to terminals 109b and 109c, respectively, of either timer T1 or timer T2. Wires 109b' and 109c' leading to timer T2 are shown in dotted lines in Fig. 7, since as shown in this figure of the drawings timer T2 is disconnected from the apparatus, the latter being at this time under the control of timer T1. It will be understood that receptacle 117 of each timer is provided with terminals in which said plug-in terminals of cable 119 are respectively received.

It was explained above that when the tissue is immersed in the paraffin-bath receptacle 40 the interior of said receptacle has a vacuum produced therein, for which purpose a vacuum pump P is connected to said paraffin-bath receptacle. The electric motor PM for operating the vacuum pump is started and stopped automatically at predetermined times, that is, at the time the tissue is immersed in the paraffin bath and at the time said tissue is removed therefrom. For accomplishing this result an automatically operated switch 141 is provided in the circuit of the pump motor PM for controlling the latter. Said switch 141 is mounted in stationary position on the fixed guide bearing 64 of shaft 44 and is provided with an operating pin 141a in position to be actuated by a member 141b fixed to and movable with the spider 42a of conveyor 42. Thus, when the conveyor is lowered for bringing the tissue into receptacle 40 switch 141 is closed and completes the circuit through the vacuum pump motor PM. Said switch 141 is biased to open position so that when the conveyor is raised for removing the tissue from the paraffin bath the circuit through the vacuum pump motor is broken thus interrupting the action of the vacuum pump. As explained above in order to facilitate removal of cover 48a from the paraffin bath-receptacle when the conveyor moves upwardly provision is made for breaking the vacuum, this being accomplished by the movement of valve 48c upwardly in chamber-forming part 48d, as illustrated in Fig. 5, when the conveyor starts to move upwardly. It will be understood that the time during which the vacuum pump motor PM operates is controlled by the timing disk 170, which is provided with a peripheral notch for this purpose. The heater for the paraffin-bath receptacle is indicated at 143 in Fig. 7.

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 shown or described, and it will be also understood that in the embodiment of the invention herein disclosed certain changes may be made and will occur to skilled artisans particularly in view of my disclosure herein. Therefore, I do not wish to be limited to the invention as herein specifically 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 an automatic immersion apparatus, a plurality of receptacles, a movable carrier, intermittently operable means for moving said carrier into and out of said receptacles with intervening rest periods in said receptacles, timing means for controlling the operations of said carrier-moving means, said timing means including a motor, and means operable in response to the operation of said carrier-moving means for interrupting said motor during the periods of movements of said carrier.

2. In an automatic immersion apparatus, a plurality of receptacles, a movable carrier, intermittently operable means for moving said carrier into and out of said receptacles with intervening rest periods in said receptacles, timing means for controlling the operations of said carrier-moving means, said timing means including an electric motor and a circuit therefor, a switch for controlling the electric circuit of said motor, and means operable in response to the operation of said carrier-moving means to actuate said switch to interrupt said motor circuit during movement of said carrier and to close said circuit during said rest periods.

3. In an automatic immersion apparatus, a plurality of receptacles, a movable carrier, intermittently operable means for moving said carrier into and out of said receptacles with intervening rest periods in said receptacles, timing means for controlling the operations of said carrier-moving means, said timing means including a rotary timing member and means for rotating said timing member, and means operable to render said last mentioned means inoperative to rotate said timing member when said carrier is being moved from one container into another container.

4. In an automatic immersion apparatus, a plurality of receptacles, a movable carrier, intermittently operable means for moving said carrier into and out of said receptacles with intervening rest periods in said receptacles, timing means for controlling the operations of said carrier-moving means, and means operable under the control of said carrier-moving means for interrupting the operation of said timing means during the times when said carrier is being moved from one receptacle into another.

5. In automatic immersion apparatus comprising a plurality of receptacles, a rotary and vertically movable conveyor, a carrier supported by said conveyor and movable by the latter into and out of said receptacles with intervening rest periods during which the carrier is positioned in said receptacles, respectively, means for operating said conveyor, and means for timing the duration of said rest periods comprising a rotary disk, means for rotating said disk, and means for interrupting the operation of said disk-rotating means during the operation of said conveyor.

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