July 10, 1951 A. AIELLO ET AL 2,559,921

AUTOMATIC MACHINE FOR SEQUENTIALLY IMMERSING MACHINE PARTS IN SUCCESSIVE CLEANING LIQUIDS

Filed March 20, 1943 10 Sheets-Sheet 1

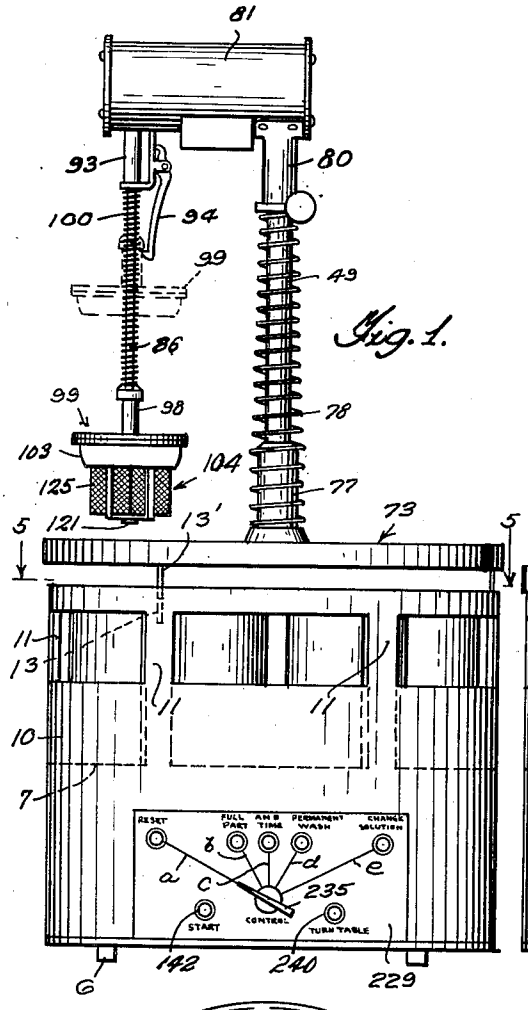


Fig. 1.

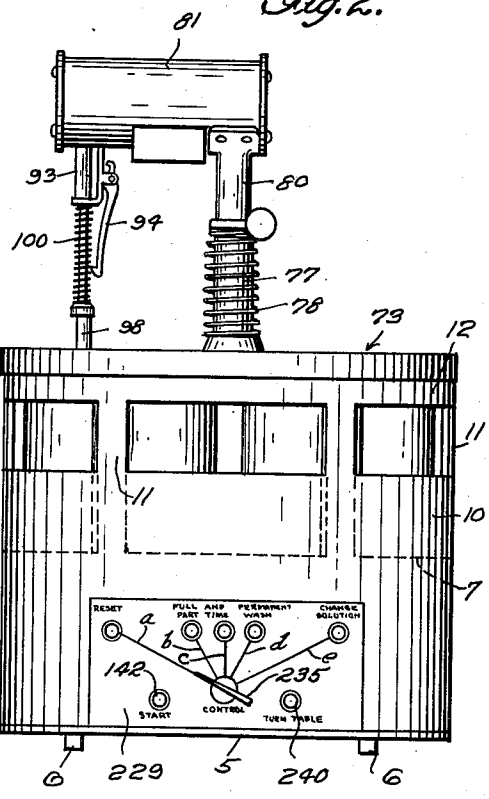


Fig. 2.

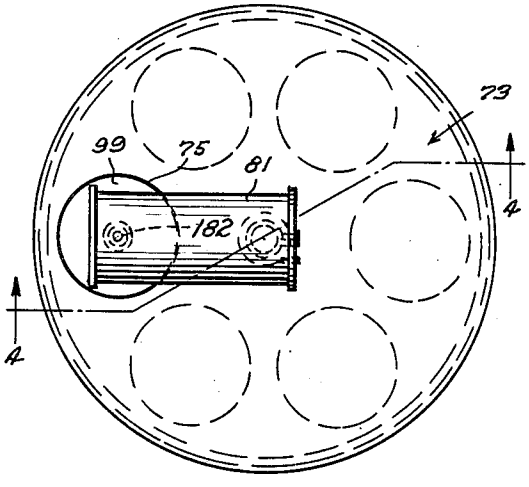


Fig. 3.

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July 10, 1951 A. AIELLO ET AL 2,559,921

AUTOMATIC MACHINE FOR SEQUENTIALLY IMMERSING MACHINE PARTS IN SUCCESSIVE CLEANING LIQUIDS

Filed March 20, 1943 10 Sheets-Sheet 2

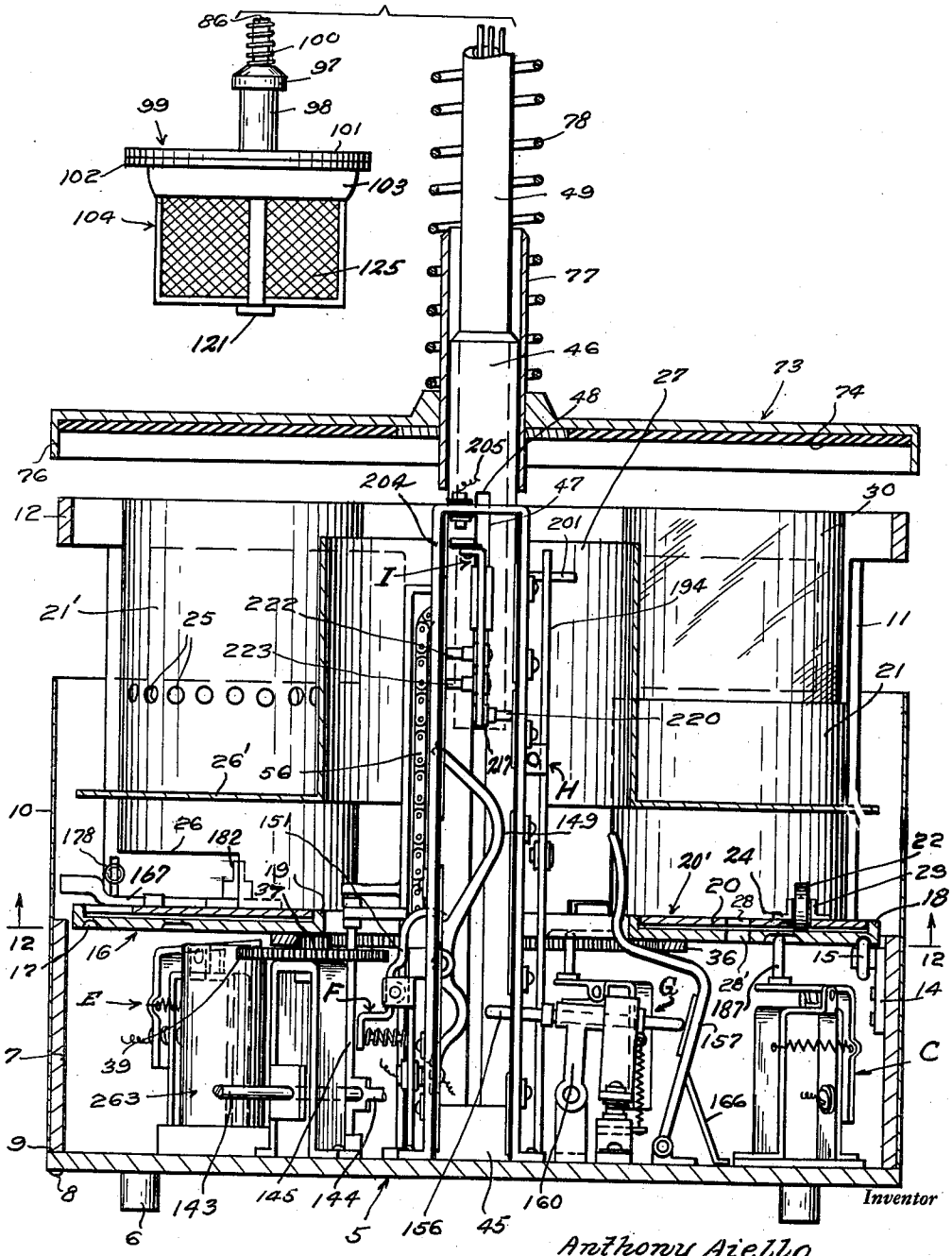


Fig. 4.

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July 10, 1951 A. AIELLO ET AL 2,559,921

AUTOMATIC MACHINE FOR SEQUENTIALLY IMMERSING MACHINE PARTS IN SUCCESSIVE CLEANING LIQUIDS

Filed March 20, 1943 10 Sheets-Sheet 3

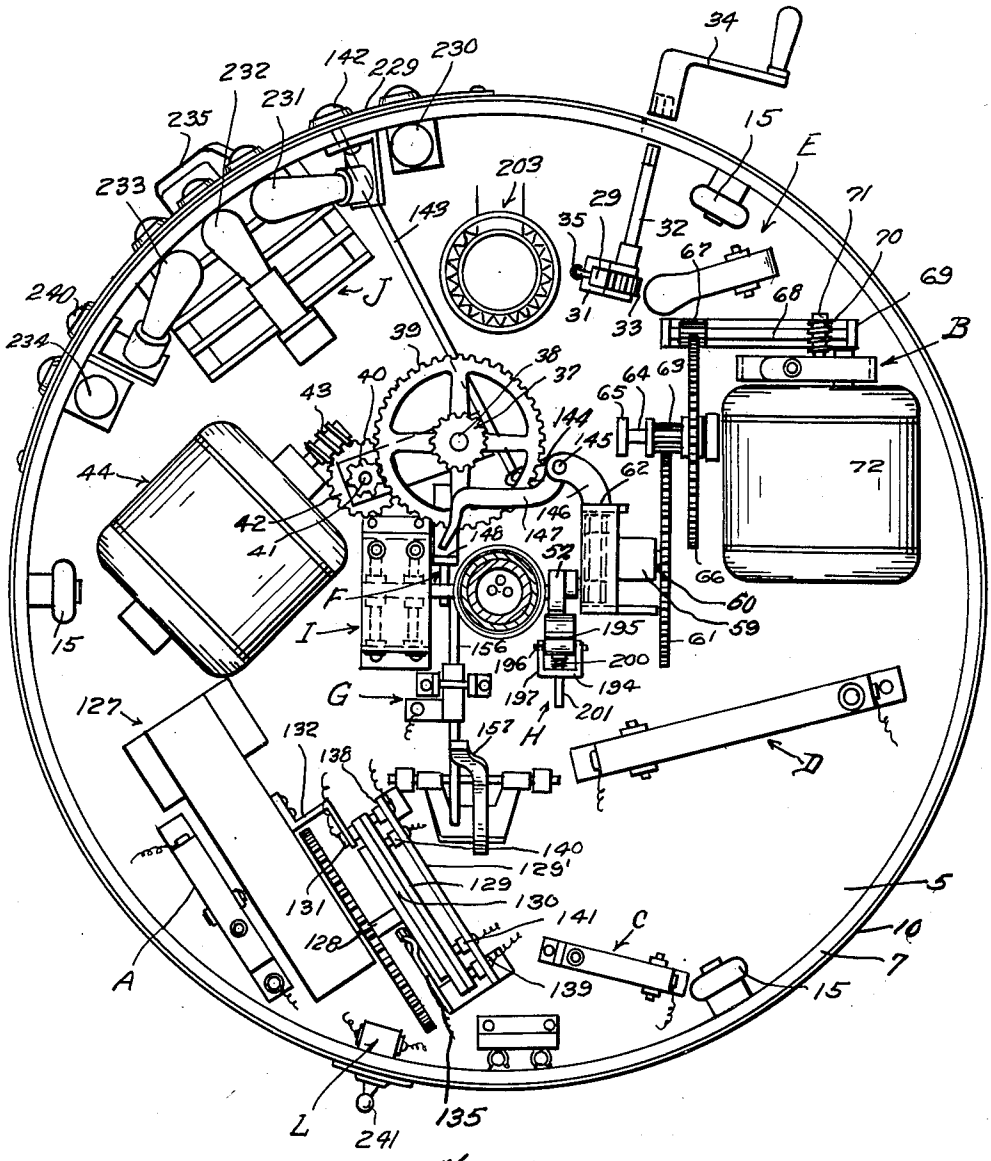


Fig. 5.

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July 10, 1951 A. AIELLO ET AL 2,559,921

AUTOMATIC MACHINE FOR SEQUENTIALLY IMMERSING MACHINE PARTS IN SUCCESSIVE CLEANING LIQUIDS

Filed March 20, 1943 10 Sheets-Sheet 4

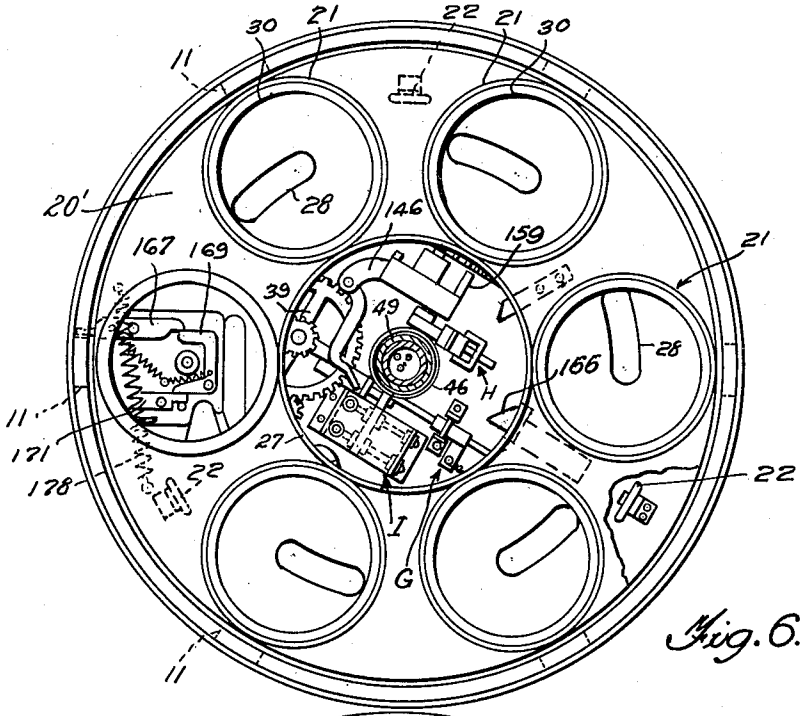


Fig. 6.

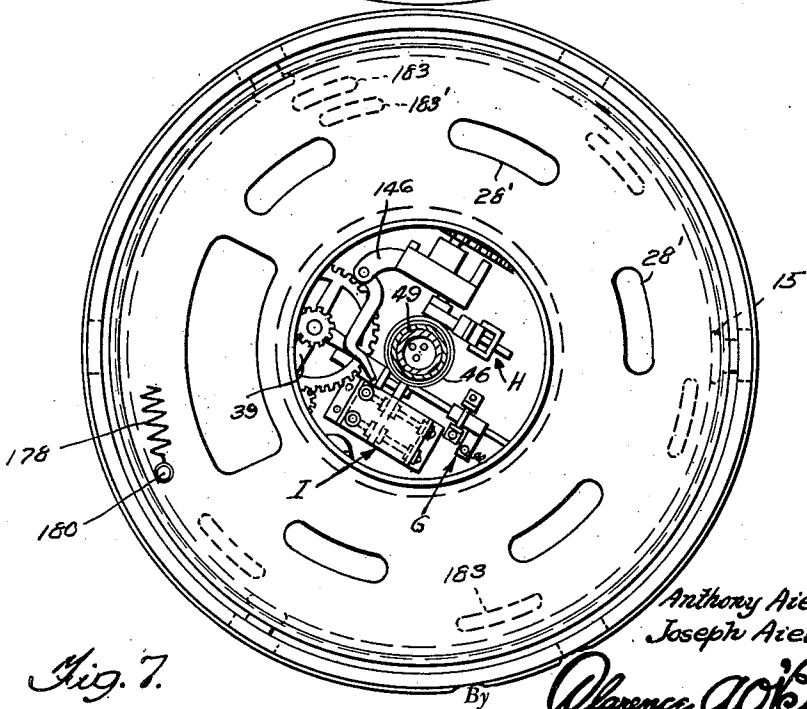


Fig. 7.

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July 10, 1951 A. AIELLO ET AL 2,559,921

AUTOMATIC MACHINE FOR SEQUENTIALLY IMMERSING MACHINE PARTS IN SUCCESSIVE CLEANING LIQUIDS

Filed March 20, 1943 10 Sheets-Sheet 5

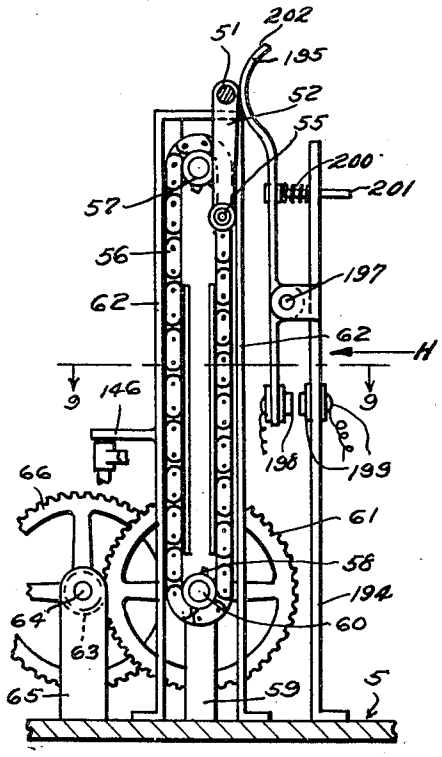


Fig. 8.

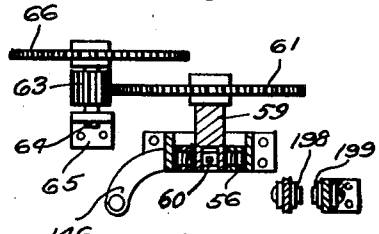


Fig. 9.

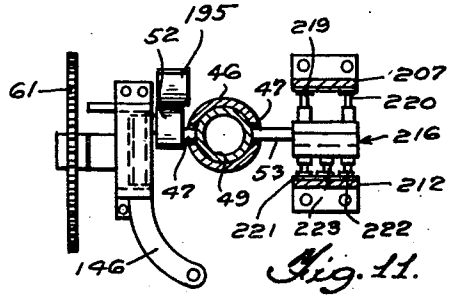


Fig. 11.

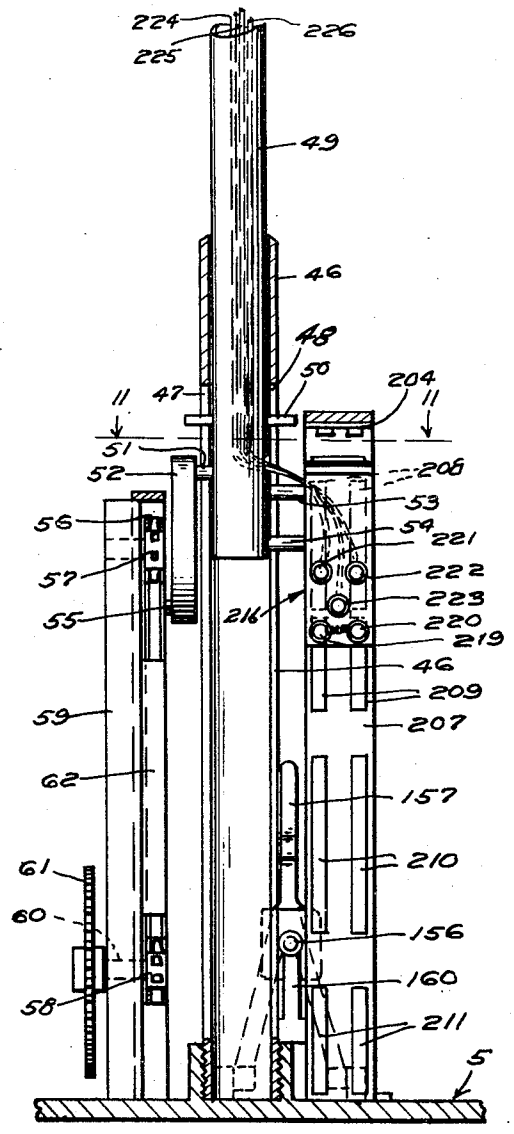


Fig. 10.

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AUTOMATIC MACHINE FOR SEQUENTIALLY IMMERSING MACHINE PARTS IN SUCCESSIVE CLEANING LIQUIDS

Filed March 20, 1943 10 Sheets-Sheet 6

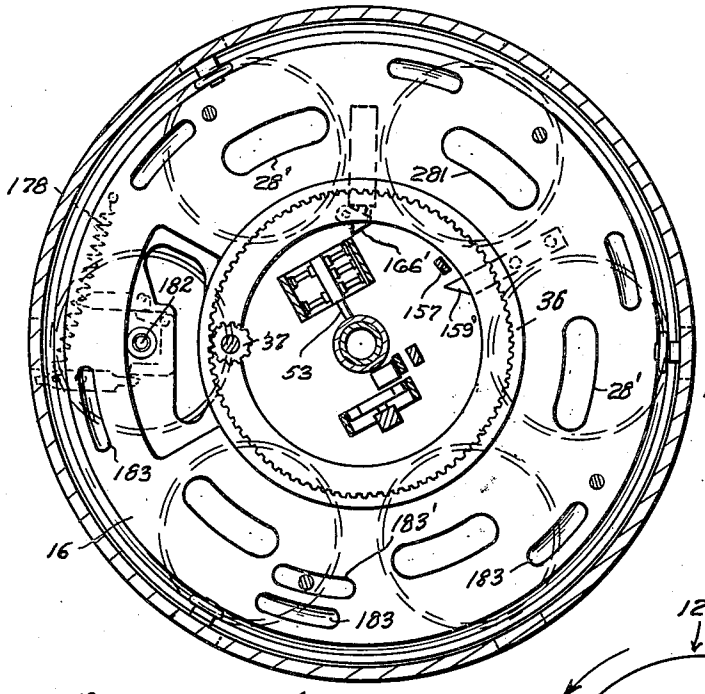


Fig. 12.

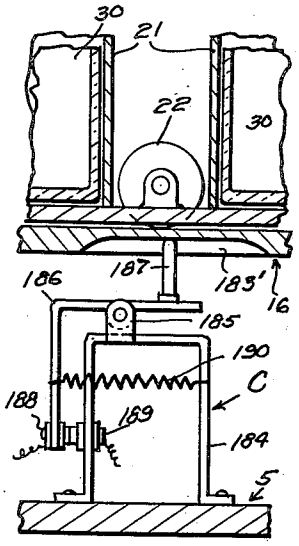


Fig. 14.

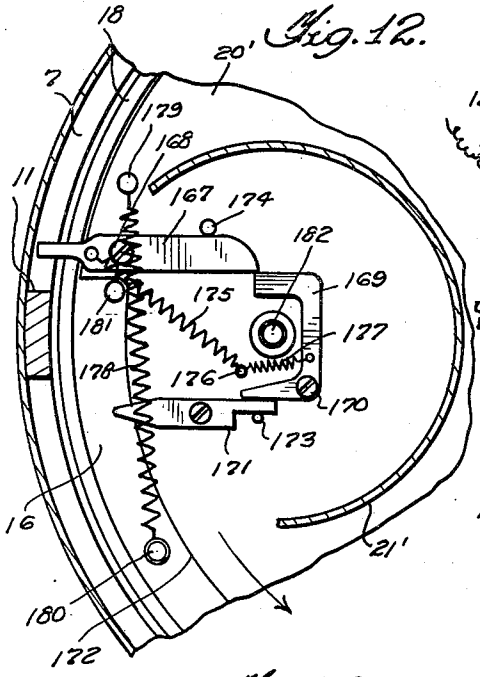


Fig. 13.

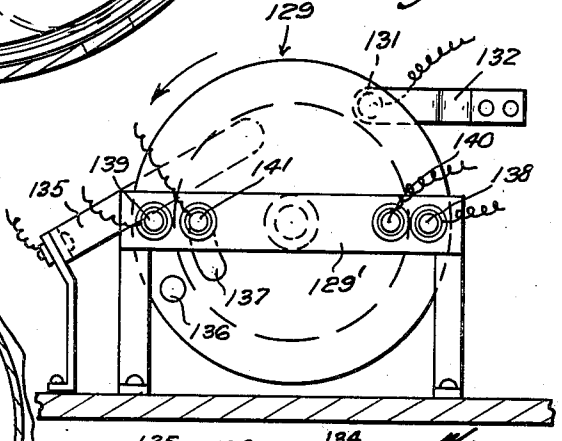


Fig. 15.

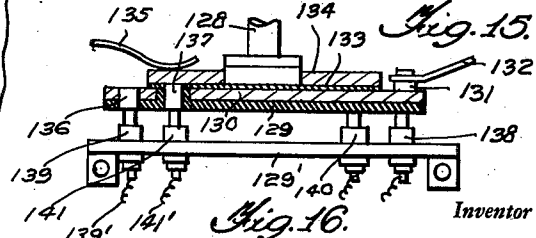


Fig. 16.

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AUTOMATIC MACHINE FOR SEQUENTIALLY IMMERSING MACHINE PARTS IN SUCCESSIVE CLEANING LIQUIDS

Filed March 20, 1943 10 Sheets-Sheet 7

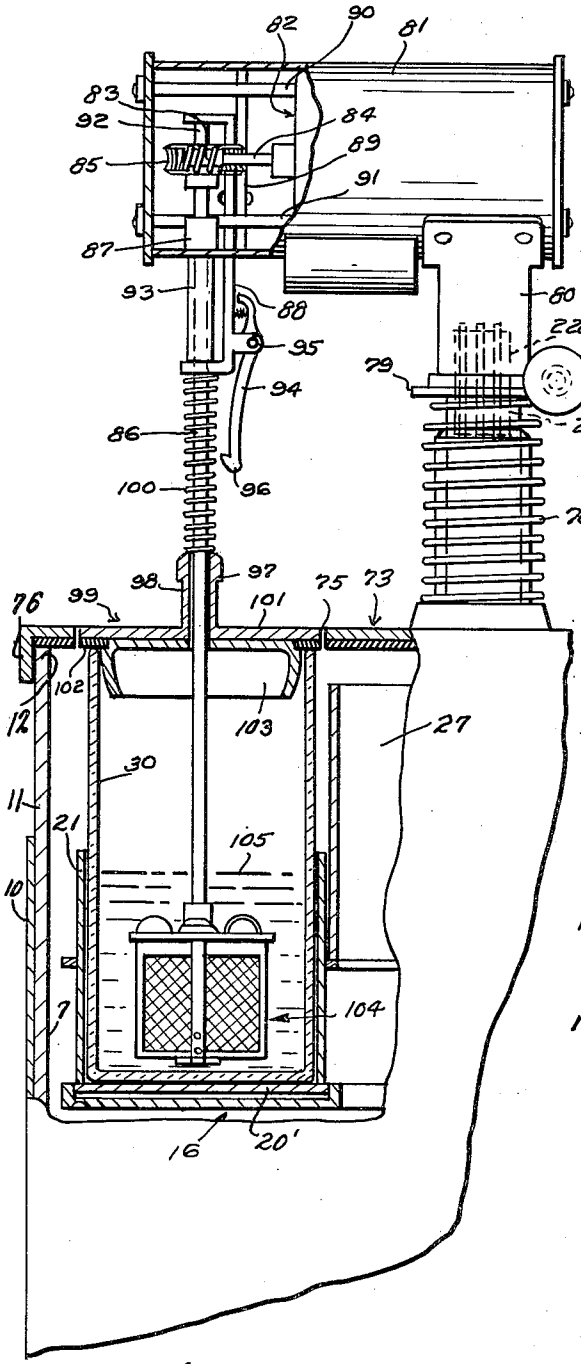


Fig. 17.

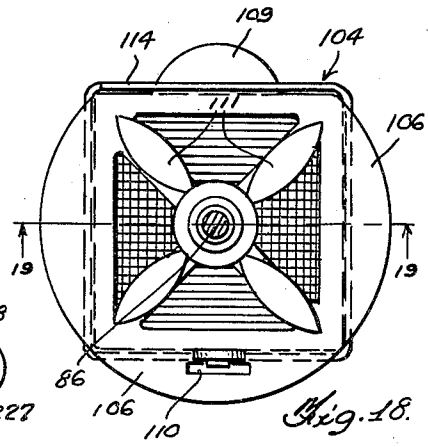


Fig. 18.

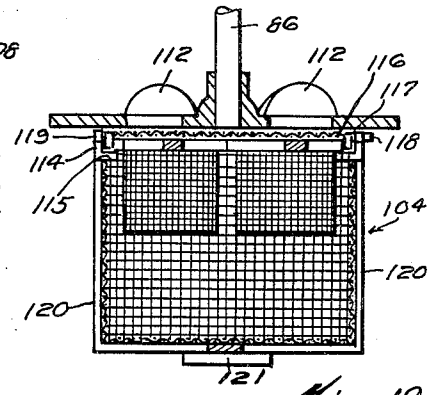


Fig. 19.

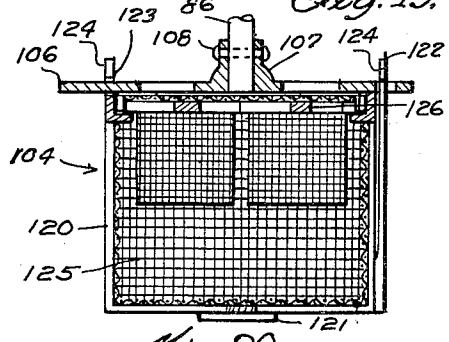


Fig. 20.

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AUTOMATIC MACHINE FOR SEQUENTIALLY IMMERSING MACHINE PARTS IN SUCCESSIVE CLEANING LIQUIDS

Filed March 20, 1943 10 Sheets-Sheet 8

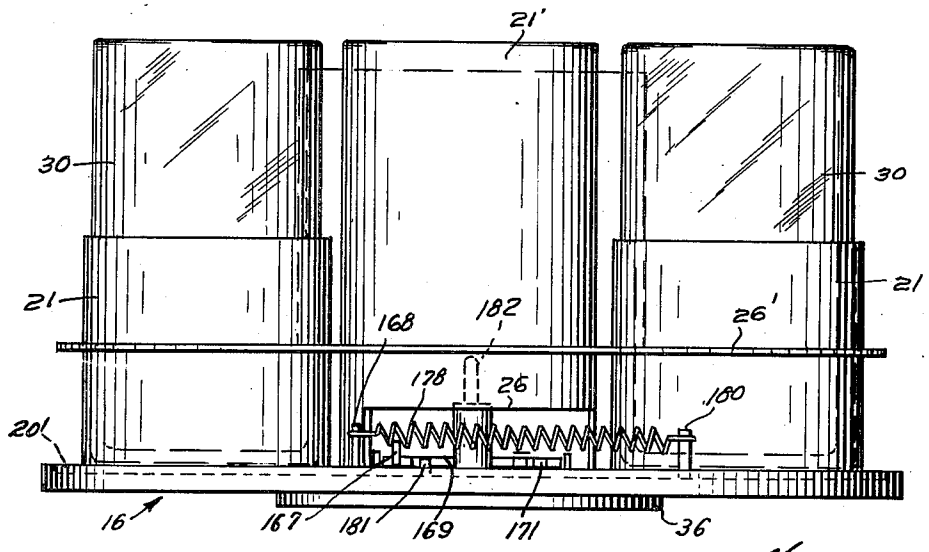


Fig. 21.

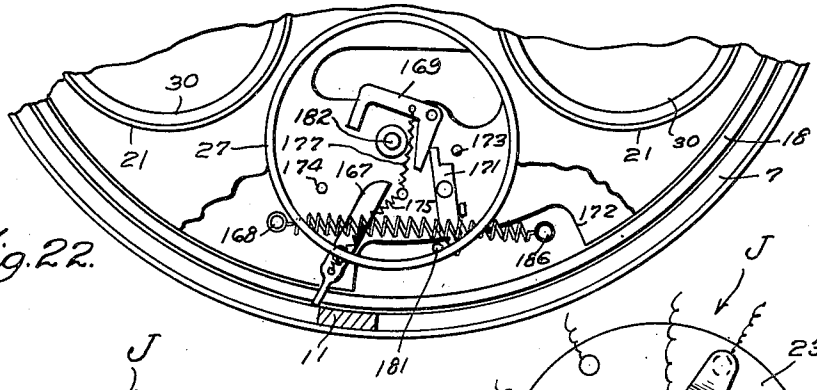


Fig. 22.

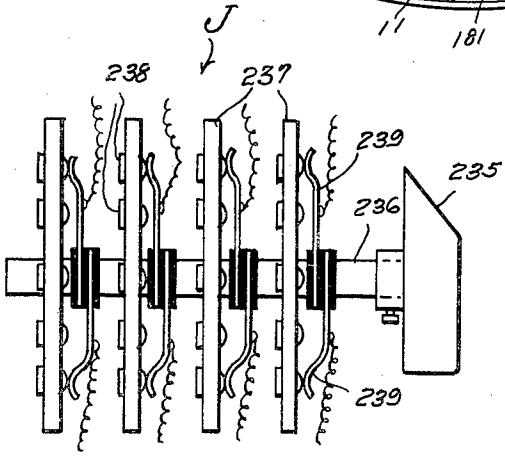


Fig. 23.

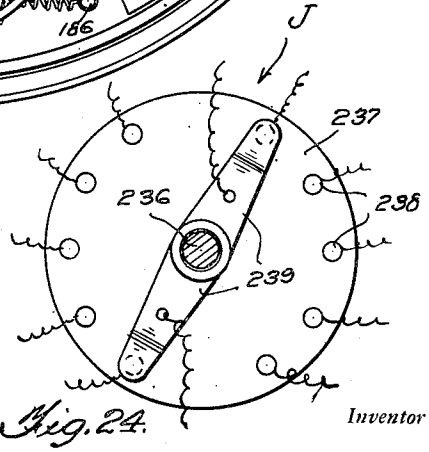


Fig. 24.

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AUTOMATIC MACHINE FOR SEQUENTIALLY IMMERSING MACHINE PARTS IN SUCCESSIVE CLEANING LIQUIDS

Filed March 20, 1943 10 Sheets-Sheet 9

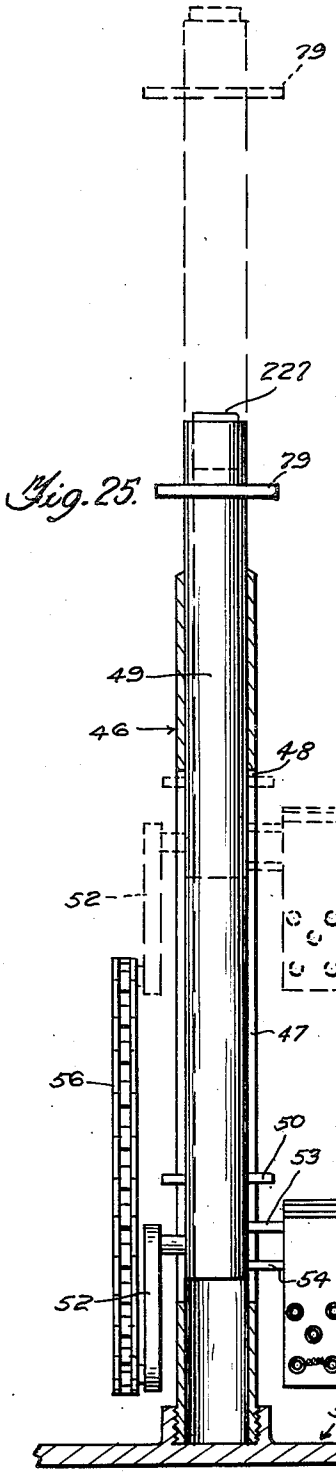


Fig. 25.

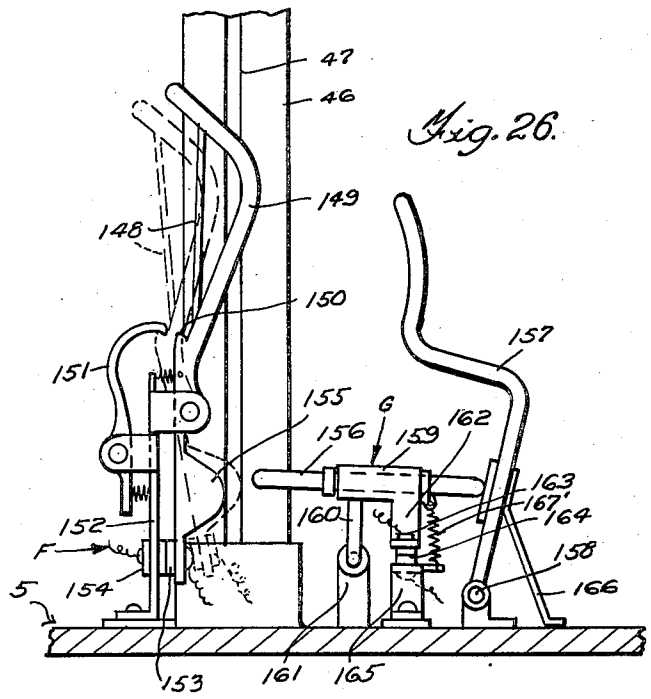


Fig. 26.

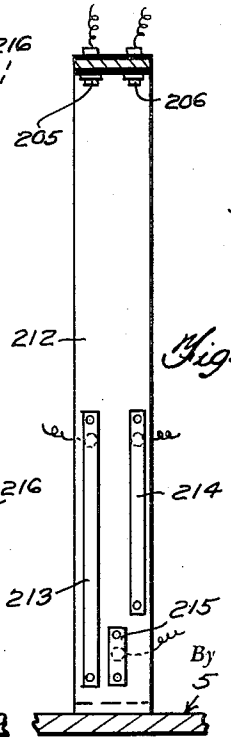


Fig. 27.

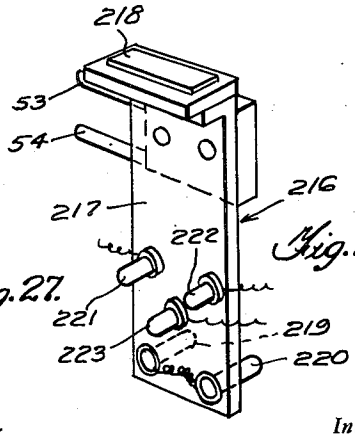


Fig. 28.

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AUTOMATIC MACHINE FOR SEQUENTIALLY IMMERSING MACHINE PARTS IN SUCCESSIVE CLEANING LIQUIDS

Filed March 20, 1943 10 Sheets-Sheet 10

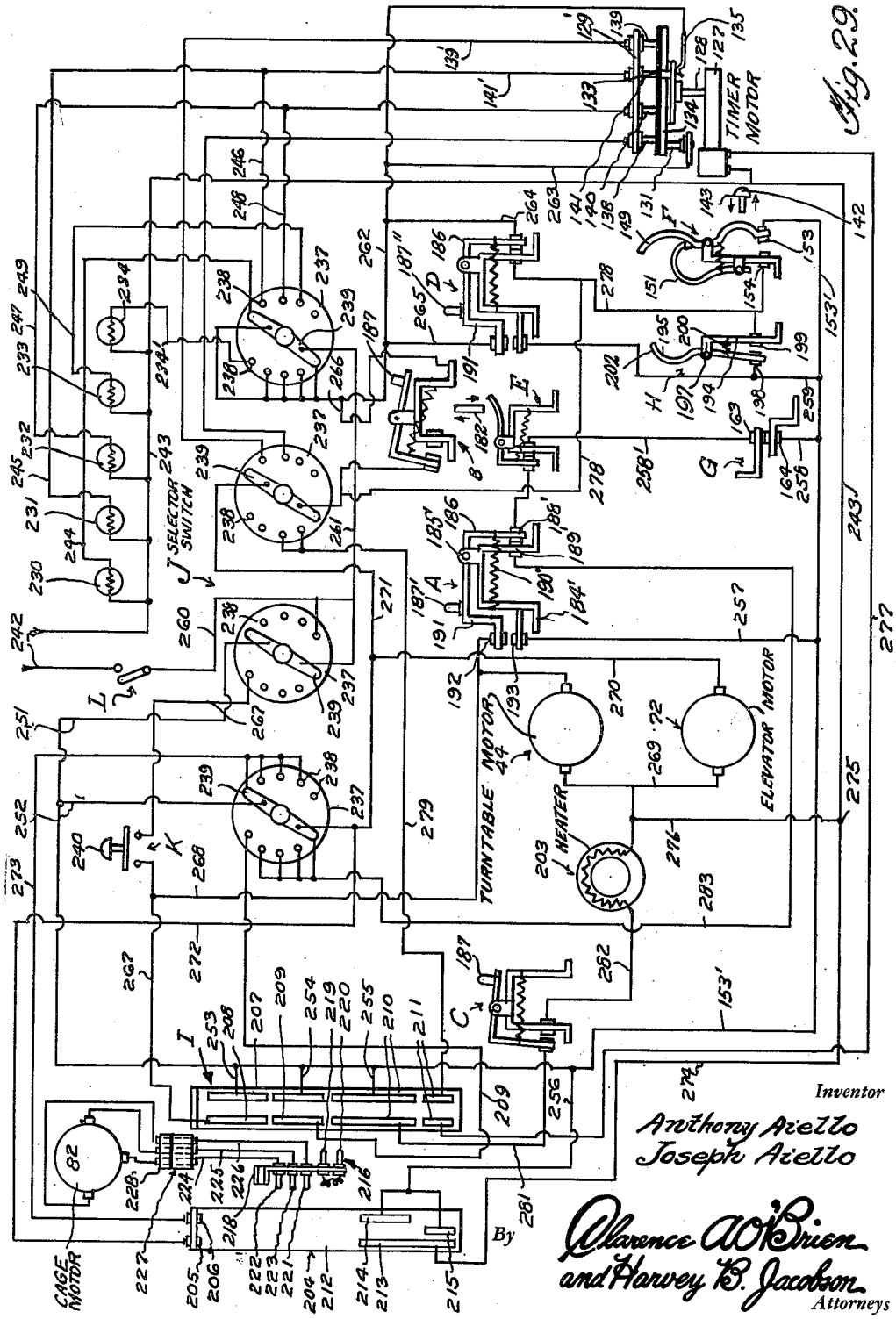


Fig. 2.9.

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Patented July 10, 1951

2,559,921

UNITED STATES PATENT OFFICE

2,559,921

AUTOMATIC MACHINE FOR SEQUENTIALLY IMMERSING MACHINE PARTS IN SUCCESSIVE CLEANING LIQUIDS

Anthony Aiello and Joseph Aiello, Pittsburgh, Pa., assignors of one-third to Hyman Landaw and Harry Landaw, trading and doing business as Landaw Brothers, Pittsburgh, Pa.

Application March 20, 1943, Serial No. 479,948

21 Claims. (Cl. 134—58)

1

The invention relates to a machine for cleaning machine parts and the like wherein the parts are successively subjected to washing and rinsing solutions, and more particularly to a machine of this character which is suitable for construction in different sizes to accommodate different types and sizes of parts, from relatively large parts such as components of firearms and the like to relatively small parts of such as aeroplane instruments, watches, and the like.

The present application is a continuation-in-part of our co-pending application Serial No. 354,720, filed August 29, 1940, for Watch Cleaning Machine, and now abandoned.

The primary object of the invention is to provide a more efficient machine of the type indicated wherein the cycle from initial washing, through several rinsings, to final drying of the parts being cleaned, is performed automatically without attention from the operator, and wherein the duration of the initial washing operation may be predetermined by a simple adjustment.

Another important object of the invention is to provide a machine of this type wherein the washing solution jar and the desired number of rinsing solution jars are tightly covered during the washing, rinsing and drying operations, so that the inflammable solutions used are confined to the jars and prevented from being splashed out by the action of the machine or by motion of the support on which the machine rests, thereby eliminating the fire-hazard characteristic of former machines, and making the present machine safe for use in places wherein exposure to ignition is likely.

Another important object of the invention is to provide a machine of the character indicated, wherein the action and cooperation of the parts is precise and accurate, so that the machine operates smoothly and dependably through its cycle without undue strain or wear upon the component parts.

In accordance with the present invention, provision is made for manually starting the machine; for then causing it to automatically perform a predetermined cycle of operations; and for then causing it to stop until conditioned and manually started to repeat the same cycle of operations. When the machine stops, the immersing unit thereof is in a nearly completely raised position above the drying chamber and has raised the closure cap therefor, but the cover for all of the chambers is in lowered closed position. When the machine is started, raising of the unit is completed and the cover is raised, whereupon the

2

chambers are moved horizontally relative to the unit to bring a washing chamber into vertical alignment with a motor-driven rotary parts containing cage of said unit. Horizontal movement of the chambers is then stopped, whereupon the unit is lowered through the cover and placed into operation to enter the cage into the aligned chamber and to rotate the cage. After the rotating cage has remained in the aligned chamber for a predetermined length of time, the unit is completely raised to also raise the cover, and the unit is thrown out of operation, whereupon the chambers are moved horizontally to bring the next chamber into vertical alignment with the cage. This cycle is repeated until the cage has been successively entered into and withdrawn from all of the chambers and the machine arrives and becomes inoperative at the original starting position. Power means is provided to reciprocate the unit between raised and lowered positions, and a second power means is provided to horizontally move the chambers. Motor-operated timing means is provided to render the first power means inoperative for a predetermined period of time when the unit reaches its lower limit of movement at the washing and drying stations, and to then render the same operative again. Switch means, responsive to the first power means, is provided to energize the cage-driving motor when the unit is lowered and to de-energize it when the unit is raised. Further switch means, responsive to said first power means, is provided to energize the operating motor of the timing means when the unit is lowered at the washing and drying stations and to de-energize it at the expiration of the predetermined period of time.

Other important objects and advantages of the invention will be apparent from a reading of the following description and the appended drawings, showing a preferred embodiment of the invention, for illustrative purposes.

In the drawings:

Figure 1 is a side elevational view of the machine showing the parts-containing cage in the elevated position to which it moves automatically as the drying operation is completed, the dotted lines showing manual elevation of the jar stopper above the cage and its engagement with a detent to hold the stopper to enable opening or removal of the cage.

Figure 2 is a similar view of the machine showing the combined elevator structure and cage driving motor unit depressed during the drying operation.

Figure 3 is a top plan view of either Figure 1 or Figure 2, showing in dotted lines the locations of the rinsing jars and the washing jar beneath the safety cover.

Figure 4 is a general transverse vertical sectional view on an enlarged scale and taken approximately on the line 4—4 of Figure 3 and showing the starting switch elements in operated position.

Figure 5 is a horizontal sectional view taken through the upper part of Figure 4, with the safety cover and turntable with its jars and drying chamber removed, and looking downwardly.

Figure 6 is a top plan view showing the turntable with its washing jar, rinsing jars, and drying chamber in place thereon.

Figure 7 is a top plan view with the upper section of the turntable removed.

Figure 8 is a fragmentary vertical transverse sectional view taken through the base of the machine casing alongside of the sprocket chain elevating mechanism.

Figure 9 is a horizontal sectional view taken through Figure 8 along the line 9—9 and looking downwardly in the direction of the arrows.

Figure 10 is a transverse vertical sectional view taken through the casing base and through portions of the elevator and the associated "switchboard" operated by a component of the elevator.

Figure 11 is a horizontal sectional view taken through Figure 10 along the line 11—11 and looking downwardly in the direction of the arrows.

Figure 12 is a horizontal sectional view taken through Figure 4 and looking upwardly along the line 12—12 and showing the underside of the lower section of the turntable.

Figure 13 is an enlarged fragmentary horizontal sectional view taken through the machine casing side wall and through the drying chamber and looking down upon the upper section of the turntable and upon the mechanism which is shown locking the upper section of the turntable relative to a post on the side wall of the said casing, while permitting the lower driven section of the turntable to overrun the upper section as the turntable is rotated into a new jar position and returned to coincidence with the upper section by spring retraction.

Figure 14 is a fragmentary vertical transverse sectional view taken through the turntable and adjacent jar holders and jars and alongside of the turntable operated switch C, and showing one of the depressions in the underside of the lower section of the turntable which permits the switch to close and then be restored to open position during the rotation of the turntable.

Figure 15 is a side elevational view of the rotary timing switch which is operated by clockworks and has positions to predetermine a half-time or a full-time initial washing period in the inital or washing jar.

Figure 16 is a horizontal sectional view taken through Figure 15.

Figure 17 is a fragmentary side elevational view, on an enlarged scale, of the machine with the elevator in depressed position, and broken away to show the operative position of the parts containing cage in one of the jars, and to show details of the cage driving mechanism and associated constant speed electric motor, as well as the stoppering position of the jar stopper carried by the cage shaft, relative to the jar and the single access opening in the safety cover.

Figure 18 is a top plan view of the parts containing cage.

Figure 19 is a transverse sectional view taken through Figure 18 along the line 19—19 and looking in the direction of the arrows.

Figure 20 is a view similar to Figure 19 but taken at right angles thereto.

Figure 21 is a side elevation of the complete turntable including jar holders and jars and drying chamber.

Figure 22 is a fragmentary horizontal sectional view taken through the upper part of the machine casing and looking downwardly as upon Figure 21, and showing the upper turntable arresting mechanism in released position in contrast to the locked position shown in Figure 13.

Figure 23 is a side elevational view of the four-gang rotary manual control switch whose operating handle is exposed at the side of the machine casing as shown in Figures 1 and 2.

Figure 24 is a transverse vertical sectional view taken through Figure 23 between two of the disks.

Figure 25 is a transverse vertical sectional view taken through the base of the machine and portions of the outside tube of the elevator mechanism and showing the inner elevatable tube and the "switchboard" contactor block operated thereby in depressed position, the dotted lines showing these components in elevated position.

Figure 26 is a fragmentary side elevational view of the associated switches F and G and showing the switch F in operated or closed position in full lines and in initial or open position in dotted lines, and showing the switch G in initial or closed position.

Figure 27 is a transverse vertical sectional view taken through the "switchboard" and showing the opposite side from that shown in Figure 10.

Figure 28 is a perspective view of the "switchboard" contactor and the pins which operatively connect it with the inner or elevatable tube of the elevator, and,

Figure 29 is a schematic wiring diagram showing the electrical connections between the various electrical elements, and showing the construction of the double-acting switches A and D contrasted with the construction of the single-acting switches B, C and E.

Referring in detail to the drawings, the machine comprises a base consisting of a flat circular plate 5, supported on feet 6, from the edges of which plate rises a cylindrical wall 7 which is bolted at 8 to the plate 5, the wall 7 being slightly inset to provide a rest 9 for the lower edge of the cylindrical shell 10 which rises above the wall 7.

Integral with and rising from the wall 7 are the circumferentially spaced posts 11 which are surmounted by an integral ring 12. The posts 11 are exactly equally circumferentially spaced from each other, and in the illustrated embodiment six such posts are necessitated. In the top of the ring 12 are three holes 13 to receive the depending positioning pins 13' on the cover, as described hereinbelow.

Brackets 14 are equally spaced and secured to the inner side of the wall 7 and carry rollers 15 projected radially inwardly. The tops of the rollers, three in this case, are substantially on a level with the top of the wall 7, and their function is to rotatably support the turntable 16.

The turntable 16 is a heavy annulus formed with a groove 17 in its bottom to conformably receive the rollers 15 with a smooth running fit, with the edge of the turntable running close

to the top of the wall 7. The top of the turntable has a shallow flat-bottomed channel defined by the outside rim 18 and the inside rim 19.

Rotatably supported in the channel in the top of the turntable and bearing against the inner rim 19 is the annular base 20' on which the five cylindrical receptacle holders 21 and the single cylindrical drying chamber 21' are mounted. The base 20' is supported on the floor of the channel 20 by circumferentially spaced rollers 22 carried by brackets 23, the rollers depending through slots 24 formed in the base 20', whereby the base 20' is slightly spaced upwardly from the base 16.

The receptacle holders 21 are equally circumferentially spaced with respect to each other and with respect to the drying chamber 21', each being of the same diameter and height and each secured to the top of the base 20'. The drying chamber 21' is taller than the holders 21 and it has ventilating holes 25 in its sides, and is cut away at 26 along the outer side of its bottom to accommodate mechanical parts to be described. A spacer 26' having holes therein fitting the holders 21 and the drying chamber 21' is frictionally held in place to reinforce and protect the holders and chamber. A large diameter cylinder 27 rests on the spacer 26' and rises above the holders to provide protection for parts to be described and is concentric with respect to the center opening in the base 20' and in the turntable 16.

The portion of the base 20' within each holder 21 is formed with a circumferential slot 28 which is always somewhat in registry with and can be completely registered with complementary slots 28' formed in the turntable 16. The slots 28 and 28' are provided to enable the elevator rack bar 29 to rise therethrough and push against the bottom of the glass receptacles 30 which are seated in the holders 21 and elevate them out of the holders for manual removal.

The rack bar 29 is slidably mounted in a channel support 31 in which is journaled one end of a radial horizontal rotary shaft 32 having secured thereon a pinion 33 in mesh with the bar, the shaft being operable by a key crank 34 applicable to the shaft through a hole in the walls 7 and 10. A retracting spring 35 stretched from the rack bar 29 to the base of the support 31 returns the rack bar to depressed inoperative position.

The turntable 16 has a ring gear 36 attached concentrically to its bottom and spaced around the opening in the turntable. With this ring gear is meshed a pinion 37 fixed on a shaft 38 which also has fixed thereon the gear wheel 39, which in turn is meshed with a small pinion 40 fixed on a shaft 41 mounted vertically and parallel to the shaft 38 in bearings of two U-shaped frames which are bolted together on the plate 5 in an eccentric position with respect to the opening in the turntable.

The shaft 41 has on its lower part a worm wheel 42 which is meshed with a worm 43 fixed on the shaft of a small 2200 R. P. M. electric motor 44 whose base is secured to the base plate 5, and whose manner of energization for turning the turntable 16 is explained hereinafter.

Mounted in a central socket 45 on the base plate 5 is a heavy metal tube 46 which rises to a point somewhat above the ring 12 of the housing. The tube 46 has diametrically opposed slots 47 extending from its lower end to a point 48 at least as high as the top of the ring 12. Slidably telescoped in the tube 46 is another tube 49 which adjacent its lower end has projecting from both sides thereof the pin 50 whose ends work in the slots 47 in the outer tube 46. (See Figure 10.)

Below the pin 50 a pin 51 extends through one of the slots 47 and turns in a hole in the inner tube 49, a link 52 being fixed to the outer end of the pin 51. On the opposite side of the inner tube 49 and below the pin 51, two vertically spaced pins 53 and 54 are fixed to project from the tube 49 through the adjacent slot 47.

The depressed end of the link 52 is pivoted on an extension 55 of one of the link pins of a sprocket chain 56 which is trained over upper and lower sprocket wheels 57 and 58 which are mounted on shafts projecting from a post 59 which is fastened to rise from the base plate 5. The lower shaft 60 has fixed thereon a relatively large gear wheel 61. Guide plates 62 are arranged on opposite sides of the vertical flights of the sprocket chain and are suitably mounted on the post 59.

The gear wheel 61 is meshed with a small pinion 63 fixed on a shaft 64 mounted horizontally on a support 65 fixed on the plate 5, the shaft carrying a large gear wheel 66. The wheel 66 meshes with a small pinion 67 on a horizontal shaft 68 carried by a support 69 on the plate 5, the shaft 68 having a worm wheel 70 meshed with a worm 71 on the shaft of a small 2200 R. P. M. electric motor 72 which has its base fixed to plate 5 on the opposite side of the plate from the motor 44. Although the speed and power rating of the motors may be changed, the speed of the two motors should be the same for proper operation of the machine. The manner of energization of the motor 72 to elevate and depress the inner tube 49 by operating the sprocket chain 56 is described hereinafter.

The glass receptacles or jars 30 are to contain the solution for the cleansing of the watch parts and the like, the first jar containing a wash solution and the succeeding four jars containing gasoline or similar rinse, the jars being tall enough so that when half-filled with solution the revolving parts containing cage to be described can be immersed in the solution when depressed, and will have room in the jar above the solution when elevated to throw off the solution by centrifugal force without splashing the solution on the surrounding structure and mechanism, thereby preventing fire danger etc.

In its depressed position (shown in Figure 2) the elevatable safety cover 73 has a lining 74 of felt or the like to rest upon the tops of the jars 30 (as indicated in Figure 17) thereby closing all of the jars except that one in registry with the operating opening 75 in the cover to prevent inflammable fluid from splashing out and creating fire danger. The cover consists of a flat circular plate with a depending peripheral rim 76 arranged to go down around the ring 12 in the depressed position of the cover. The opening 75 is slightly larger in diameter than the jars so that the jars can be elevated and removed therethrough for changing the solution therein or for other purposes.

The cover has centrally fixed therein a short guide or slide tube 77 which slidably mounts the cover on the outside tube 46. The opposite projections of the pin 50 engage the lower end of the guide tube 77 to raise and lower it. A helical spring 78 surrounds the guide tube 77 and abuts the top of the cover and when compressed

has its upper end abutted with a cross pin 79 adjacent the upper end of the inner tube 49. The pin 79 fits in slots in the lower end of tube 80 of the basket motor assembly to prevent relative rotation of the assembly and the tube 49. The upper end of the spring 78 also sockets loosely in the lower end of the tube 80.

Fixed to extend laterally from the upper end of the structural tube 80 is the horizontal cylindrical motor housing 81 in which is axially confined a small electric motor 82, including a worm 83 on its shaft 84 and a worm wheel 85 in mesh with the worm. The worm wheel is fixed on a depending shaft 86 which is mounted in a bearing 87 on the bottom wall of the motor housing and in the upper and lower arms of the U-shaped brace 88 which is fastened to a disk 89 which is mounted on the longitudinal rods 90 and 91 which project from the motor. To eliminate unwanted axial movement of the shaft 86 tubes 92 and 93 are placed on the shaft 86. The tube 92 is located between the upper arm of the brace 88 and the top of the worm wheel 85 while the lower tube 93 extends between the lower arm of the brace 88 and the lower side of the housing 81.

A spring-pressed latch 94 is pivoted at 95 on the brace 88 and has a hook 96 on its lower end to hook under a ledge 97 on a head 98 rising from the cap 99. A helical spring 100 is circumposed on the shaft 86 and expands between the lower arm of the brace 88 and the head 98.

The cap 99 and the head 98 slide on the shaft 86 under the downward tension of the spring 100, the cap comprising the disk 101 which substantially closes the opening 75 in the cover 73 with an annular compressible washer 102 to engage the top of the jar 30. As shown in Figure 17 the cap includes the inverted tapering cup 103 adapted to enter and center itself in the mouth of the jar during the running of the shaft and the working of the cage 104 in the jar in and out of the solution 105 which half fills the jar.

The cage 104 comprises a disk 106 which has a central tubular boss 107 rising therefrom and surrounding the lower end of the shaft 86, with a cross pin 108 passing through both the boss and the shaft and riveted at both ends.

One side of the disk 106 is mutilated to define a tongue 109. The diametrically opposite part of the disk has a chordally arranged slot 110.

Around the central portion thereof the disk 106 is cut away at four equally circumferentially spaced distances to define the truncated triangular openings shown in Figure 18 of the drawings, and to define four diametrically opposed webs 111 which have the major portion of the length thereof turned upwardly and longitudinally curved to define concavo-convex petal-shaped vanes or blades 112. The blades are tilted at an angle of about 45° with the horizontal to throw the solution downwardly through the triangular openings into the cage 104.

The square cage 104 comprises a frame including a rectangular upper element 114 with an inside ledge 115 to support a screen cover 116 which is stretched on a square frame 117 from opposite sides of which project positioning lugs 118 which seat in notches 119 formed in the element 114. From the middle of the four sides of the element 114 depend L-shaped bars 120 whose feet terminate at the center of the bottom of the basket and are secured together by a button 121. One of the bars 120 has a circular spring tongue 122 extending above the element 114 to snap through the slot 110 in the disk 106 when the tongue 109 of the disk has been inserted hinge-wise into a slot 123 formed above the element 114 in a basket-wide extension projecting above the main plane of the element 114. The tongue 122 has an inside projection 124 defining a stop against the underside of which the disk 106 engages after the disk 106 has been snapped home, so that the disk will be held assembled with the basket. The wire netting 125 in the form of a square box with open top is secured to the inner sides of the elements 120 and the element 114.

For segregating different parts in the basket a battery of two heavy screened and two fine screened cups is provided in a four-eyed frame 126 which rests upon the ledge 115, with the screen cups depending below the frame 126 and at a substantial distance above the bottom of the cage. The frame 117 of the screen cover depends below the screen part of this cover so as to close the tops of the cups while the frame 117 rests on the ledge 115.

The timing of the length of the operation of the cage in the first or washing jar and in the drying chamber 21' is produced by an electric clock operated timing switch which is mounted on the base plate 5 adjacent the motor 44. The period which the clock times is that which commences when the cage reaches the bottom of the washing jar or the bottom of the drying chamber and which ends when the predetermined period of time has elapsed for the cage to remain at the bottom position. When this time period expires the other mechanism of the machine takes care of the elevating of the cage to intermediate position above the solution in the jar wherein the rotation of the cage continues a sufficient predetermined number of revolutions to throw off excess solution by centrifugal force.

The timing means comprises an ordinary electric clock motor, generally designated 127, which includes a second hand shaft 128 on which is fixed a dielectric disk 129 backed up by a metal disk 130 against which bears a brush 131 which is insulated from the clock frame as is the disk 130, the brush being mounted on the frame by a bracket 132. Backing up the insulated metal disk 130 is a dielectric disk 133 which insulates the disk 130 from the shaft and from a smaller insulated metal disk 134 against which bears another insulated brush 135.

The disk 130 has a cylindrical contact 136 extending forwardly through the dielectric disk 129 for engagement by contactors to be described. The smaller metal disk 134 has an elongated arcuate contact 137 extending through the disks 133, 130 and 129 and insulated from the disk 130 and exposed at the face of the disk 129 for engagement by certain contactors. With respect to the contact 136 the contact 137 is elongated in a direction of rotation of the disk to prolong the engagement of one of the contactors with the contact 137 beyond the engagement of the contactors with the contact 136, necessary because of the fact that when the clock motor is deenergized its momentum carries the disk 129 beyond the point at which deenergization of the clock motor took place and it is necessary that the position indicating light circuit remain energized beyond the deenergization of the clock motor, to indicate to the operator the position of rotation of the disk 129 with respect to the contact 136 and the contactors.

The contactors mentioned are supported in diametrically opposed pairs in alignment and

insulated from a horizontal bar 129' supported from the base plate at the front of the disk 129, the outer contactors 138 and 139 being in the path of the small contact 136 and the inner contactors 140 and 141 being in the path of the elongated contact 137.

The first manual operation performed to start the machine into operation consists in pressing inwardly on a button 142 (see Figure 5) located on the outside of the casing, and which is attached to a push rod 143 whose inner end then freely engages and swings an arm 144 on the lower end of a rock shaft 145 which is mounted at upper and lower ends in a bracket 146 projecting from the sprocket chain guard and in a socket in the plate 5, respectively. The upper part of the rock shaft 145 has a crooked arm 147 whose free end is pressed by the described movement of the shaft 145 against a flat vertical bar 148 which is fastened at its ends (see Figure 26) across the bight of a bent switch lever 149 of the switch F, the lever having a notch 150 for engagement by a spring-pressed hooked detent 151 when the lever is in its initial position shown by dotted lines in Figure 26. The detent and the lever are pivoted on opposite sides of a support 152 which is secured to the base plate 5. When engaged with the notch the detent holds the lower part of the lever 149 and its insulated contact 153 away from the stationary insulated contact 154 on the support 152 thereby breaking the circuit of the elevator motor 72. When the lever is pushed toward the right, as seen in Figure 26, by the push rod 143 the detent not only comes free from the lever but also assists in throwing the lever over and engaging its contact 153 with the contact 154 so as to energize the motor 72.

The upper part of the switch lever 149 is bent as shown so as to reach across the slot 47 of the outer tube of the elevator assembly so that when the inner tube and consequently the pin 50 descends, the pin 54 will cam the lever 149 back into circuit breaking position and thereby deenergize the elevator motor and stop the descent of the inner tube and the cage carried by it at the correct level.

The lower arm of the lever 149 has a projection 155 for engagement by a horizontal longitudinally spring-pressed rod 156 which is adapted to be pushed toward the left in Figure 26 against the tension of an internal spring (not shown), by the lever 157 which is pivoted on the base plate 5 at 158, when the lever 157 is inwardly displaced by a cam 159' fixed to project radially inwardly from the rotary annulus 20' into the central opening thereof. The left hand swing of the lever 157 projects the left-hand end of the rod 156 across the slot 47, so that as the pin 54 on the inner tube comes down after kicking over the switch lever 149, the pin 54 will strike the rod 156 and tilt it downwardly.

It is to be noted that as the pin 54 descends and cams back the lever 149, the pin 50 merely passes by the lever. At the bottom of the reciprocation the pin 54 engages the cam lobe 155 on the lever 149 thereby causing the upper portion of lever 149 to move again to a position across the slot 47 as the tube 49 descends. On the upstroke of the reciprocation the pin 50 pushes the lever 149 toward the left (see Figure 26) into the cocked position shown in dotted lines in Figure 26 in which the associated switch is open.

The rod 156 is mounted in a tubular housing 159 which has a leg 160 pivoted in a bracket 161 on the base plate to permit the mentioned tilting. The housing 159 constituting a part of the switch G, has a foot 162 carrying an insulated contact 163 which disengages from a companion insulated contact 164 on a post 165 on the base plate, as a result of the tilting, thereby breaking the circuit to the elevator motor 72, and thereby keeping the inner tube and the cage in the extreme depressed position. The arm 166 is merely a stop to keep the lever 157 from falling too far toward the right. A helical spring 167' is stretched between the housing 159 and the bracket 165 to yieldably hold the housing and the rod 156 in horizontal position. In descending the pin 54 holds the rod 156 tilted downwardly as described until the clock makes its cycle and starts the elevator motor again, thereby raising the inner tube 49 and lifting the pin 54 from the rod 156 so as to release it to horizontal position.

The lever 157 is again tilted and is then held in the left hand tilted position by the radially yielding spring-pressed cam 166' which is mounted on the annulus 20 (see Figure 12) and whose operating face is angulated similarly to the cam 159'. The operative engagement of the second cam 166' with the lever 157 takes place as the jar carrier comes into first jar position and the cage descends into the first jar, the separated condition of the contacts 163 and 164 resulting from the tilting and the holding of lever 157 then providing for deenergization of the elevating motor so that the cage can remain and operate for the prescribed period in the lower solution filled portion of the first jar.

The cam 159' is provided as described to cause the machine to finish the final or drying stage when the cam 159' trips the switch F as it pushes the lever 157. Otherwise, the machine would be stopped at the top of the reciprocation of the drying stage when the pin on the arm of the switch D pushes into the corresponding depression in the underside of the turntable. Finally, the switch H stops the machine upon completion of the drying stage.

In the rotation of the turntable 16, means is provided whereby each successive jar will be exactly positioned with respect to the opening 75 in the cover 73 and with respect to the axis of vertical reciprocation of the cage, through compensation for any overrunning of the turntable or of the annulus 20' due to any mechanical and electrical imperfections in operation. This means comprises (as shown in Figure 13), a locking assembly comprising a substantially radial lever 167 pivoted intermediate its ends at 168 to the annulus or annular base 20' to project therebeyond to engage the appropriate one of the posts 11 on the casing. The inner end of the lever 167 overlaps one arm of a U-shaped lever 169, which is pivoted at 170 to the annulus 20', and has its other arm overlapped by the radially inward end of a trip lever 171. The trip lever 171 is pivoted intermediate its ends to the annulus 20' and projects radially outwardly beyond a cut-out 172 formed in the edge of the annulus beyond the lever 167. A stop lug 173 engaged with the inner end of the lever 171 prevents the lever 171 from disengaging from the adjacent arm of the lever 169. Another stop 174 is located outwardly of the inner end of the lever 167 to limit swinging of the latter under the influence of spring 175 or away from the upper arm of lever 169.

A positioning spring 175 is stretched between the outer end of the lever 167 and the point 176 on the annulus 20'. A second spring 177 is stretched between the point 176 and the intermediate part of the lever 169. A heavy spring 178 is stretched between the point 179 on the annulus 20' and the point 180 on the base plate 16 of the turntable, relative to which the annulus can turn. A trip pin 181 for the lever 171 rises from the base plate 16.

As the turntable rotates to a position of a succeeding jar the outer end of the lever 167 will engage the appropriate one of the posts 11 and the annulus 20' is thereby stopped in exact position by the engagement of the levers 167 with the lever 169, the engagement of lever 169 with lever 171, and the engagement of lever 171 with pin 173, thereby holding the lever 167 against yielding. At the same time the base plate 16 flexibly connected to the annulus 20' only by the spring 178 is permitted to travel further than the annulus. However, the tension of the spring 178 will then return the base plate 16 to the original relation with the annulus 20' with the pin 181 engaging the end of the cut-out 172, the annulus having been stopped as described in such position that the appropriate jar is exactly correctly positioned with respect to the cover hole 75 and the cage. As the relative movement of the annulus 20' and base plate 16 takes place due to the drag of the plate 16 after the motor 44 stops, the pin 181 will strike the trip lever 171 and upset the locking relationship of the levers 171, 169 and 167 so that the springs 175 and 177 can restore the levers to initial position and in the process permit the lever 167 to pass the post 11 so that the turntable can turn to carry the next succeeding jar into working position. As the inner end of lever 167 is rounded, it is only necessary to make the spring 175 stronger than spring 177 in order that the inner end of lever 167 may be forced past the adjacent end of lever 169 after the latter has been restored to its initial position of Figure 13.

In Figure 13 is also shown the plunger 182 which is engaged and depressed by the button 121 on the bottom of the basket 104. The plunger is located directly under the drying chamber 21' and when depressed by the descent of the basket operates a switch to be described to deenergize the elevator motor to permit the cage to continue to operate in depressed drying position for a full cycle of the clock operated switch already described. When this cycle is completed the clock switch starts the elevator motor again so as to elevate the cage out of the drying chamber after a predetermined drying period has elapsed.

On the bottom of the turntable plate 16 are six equally circumferentially spaced arcuate depressions 183, one for each of the five jars and one for the drying chamber as shown in Fig. 12. These depressions are arranged in an outer circle. On an inner circle is a single depression 183' which is approximately radially aligned with the depression 183 relating to the first or washing jar. The outside circle of depressions 183 operate only the double switch A. The single depression 183' of the inner circle operates the remaining switches B, C and D.

The switches A, B, C and D are mounted on the base plate 5 in suitable circumferentially spaced position. The B and C switches are single action switches, while the A and D switches are double action switches. The single action switches comprise a U-shaped frame 184 having a pivot lug 185 (see Figures 14 and 29) on its upper part on

which is pivoted the intermediate part of the horizontal arm of the rocker 186, which carries a displacing pin 187 which ordinarily slides along the bottom of the turntable plate 16 but which rides into and out of the depression 183' as it arrives and leaves during the rotation of the turntable. The depending arm of the rocker 186 has a contact 188 opposed to a contact 189 on the adjacent leg of the frame 184. A spring 190 is stretched between the dependent leg of the rocker and the remaining leg of the frame to move the rocker to close the contacts when the depression 183' comes into position. Both of the single switches B and C operate in this manner.

The double action switches A and D are similar, each consisting of a U-shaped frame 184' having an upper pivot lug 185', and a rocker 186. Here, however, the rockers have an additional dependent leg, one leg 191 being laterally projected to carry a contact 192 related to a contact 193 on an arm on a leg of the frame, while the straight depending leg has a lateral contact 188' opposed to a contact 189' on the remaining leg of the frame. It is obvious that the spring 190' stretched between the straight depending leg and the remote leg of the frame is provided for the purpose of rocking the rocker to disengage the contacts 192 and 193, which are normally engaged, and engage the contacts 188' and 189', when the displacing pin 187' can rise off the bottom of the turntable into one of the depressions.

The normally closed switch E is generally similar in structure to the single action switches but is devoid of a displacement pin 187 and is operated open instead by the plunger rod 182 which is depressed by the descent of the basket in the drying chamber.

Another switch not already described comprises the switch H (see Figure 8) which when opened stops the elevator motor with the cage in the elevated position when the cage comes out of the drier chamber at the completion of the part cleaning operation. The switch H comprises a post 194 which rises from the base plate 5 alongside the sprocket chain and guard to almost the height thereof. A lever 195 is pivoted intermediate its ends at 196 on a pair of arms 197 projecting laterally from the post 194. The lower end of the lever has a contact 198 opposed to a contact 199 on the said post, the contacts being open until the machine is placed in operation, when they close and open successively as the cage is reciprocated upwardly and downwardly. A spring 200 on a pin 201 on the lever expands between the lever and the upper end of the post 194, through which the pin projects, to tension the lever 195 toward contact closing position. The upper end of the lever 195 has a curved part 202 which reaches toward the link 52 into position to be operatively engaged by the latter as the inner tube 49 ascends toward upper position, whereby the switch H is opened.

Referring now to the switch I (see Figures 10, 11 and 27) which has four positions: In the first or top position of its contactor assembly it maintains the turntable motor circuit. In its second position (immediately below the first position and shown in Figure 10) all of the circuits are open except the elevator motor circuit which remains energized to elevate the cover 73 to allow the solution to be changed in the jars. In the third position of the contactor assembly the heater circuit is energized as the last jar before the drier chamber comes into position. As the cage leaves the last jar the heater circuit is cut off by switch

C, the drying chamber being sufficiently heated for a predetermined time by that time to perform the drying operation as the cage is lowered into and remains in the lower part of the drying chamber, with the heater circuit cut off.

In the last or lowest position of the contactor assembly of the switch I the clock motor circuit may be closed to operate the timing means and thereby determine the point at which the elevator motor will be reenergized to raise the cage out of the heater chamber. The drying chamber has substantially beneath it a circular electrical heating element 203 which supplies the timed drying heat thereto.

Structurally the switch I comprises an inverted U-shaped frame 204 secured to the base plate 5 and having two depending insulated contacts 205 and 206, respectively, on its bight portion (see Figures 10, 11, 27 and 29). The legs of the frame 204 have insulation along the inner sides thereof. On the insulation of the leg 207 are the top pair of parallel contact strips 208, the second pair of contact strips 209 spaced therebelow. Spaced below the strips 209 are the pair of heater strips 210 and spaced below these are the clock circuit strips 211.

Along the lower part of the insulation of the leg 212 are the parallel cage motor circuit strips 213 and 214 and between them the short strip 215. The strip 213 is substantially longer and depends below the strip 214, alongside of the short strip 215. The strips 213 and 215 provide for reversing the cage motor when the cage is in a depressed position, for the purpose of breaking up the solution before the cage resumes rotation in the usual direction preparatory to elevation of the cage from its depressed position.

The contactor assembly 216 (see Figure 28) comprises the inner tube pins 53 and 54 to which is fixed a vertical flat plate 217 having an insulated flat horizontal electrical bridge element 218 on its upper end for bridging the contacts 205 and 206. Adjacent the lower end of the plate 217 there project therefrom the horizontally spaced and aligned electrically connected brushes 219 and 220 for engaging the pairs of strips on the leg 207 of the frame 204. Projecting from the opposite side of the plate 217 and above the level of the brushes 219 and 220 there project the brushes 221 and 222 for engaging the strips 214 and 213, respectively, on the frame leg 212; and the middle brush 223 for engaging the short strip 215. As already indicated the contactor assembly is carried up and down by the movement of the inner tube 49. Flexible conduits 224, 225 and 226 enclosing appropriate wires leading from the brushes 221, 222, and 223 are led through the slot in the outer tube 46 into the interior of the inner tube 49 and these wires connect with a three-point plug 227 mounted in the upper end of the inner tube.

The tubular part 80 of the cage motor assembly has a plug or socket member 228 making electrical connection with the three points of the plug 227 (Figures 17 and 29), the member 228 having appropriate electrical connection to the cage motor 82 to run the motor in both forward and reverse directions.

The selector switch J has for its purpose to select electrically the appropriate sections of the eight different circuits of the machine to accomplish five distinct operations of the machine. On the outside of the casing is an indicator plate 229 which has thereon five radiating indicator lines, radiating to lens covered indicator bulbs 230, 231, 232, 233, and 234, respectively, which are suitably mounted in the casing (see Figure 5) behind the lenses, the bulbs being energized individually from the circuit selected. A pointer handle 235 on a rotary switch shaft 236 passing through the casing wall is mounted at the center of the radiating lines to be turned by hand to coincide with any one of the lines. The switch J can take the form of an ordinary radio hand selector switch involving four circular insulators 237 with circumferentially spaced contacts 238 thereon, the dual diametrically opposed spring brushes 239 to engage those contacts being fixed on the shaft 236 and insulated from each other (see Figures 23 and 24).

Operation

The said five different operations of the machine mentioned above, with respect to the indicator lines, *a*, *b*, *c*, *d* and *e* and the handle 235 are as follows:

(*a*) With the handle turned from line *e* to coincide with indicator line *a*, the bulb 230 lights and the machine operates to reset itself after having been put into solution changing position wherein the cover 73 is elevated and the last jar registered with opening 75. In resetting, the cover comes down to normal position after the turntable turns so as to place the drying chamber under the cage, and when the cover is lowered the cage goes down into the drying chamber and then out again, at which stage the machine stops and is set to begin a normal cycle of washing, several successive rinses, and a drying. The bulb 230 stays it until the handle 235 is moved to some other position. Upon turning handle 235 to line *a* as mentioned, the same operations take place as those described with respect to the last rinsing stage, except that clock motor 127 is not energized because the cage and its motor unit is removed and therefore plunger 182 is not depressed.

(*b*) The handle is moved to coincide with indicator line *b* when, the maching having been reset, it is desired to commence and carry through a full time complete cycle of the machine from washing to drying. In this position the bulb 231 lights and the brushes 239 are turned clockwise the distance of one contact from the positions of Figure 29.

At this time, button 142 is pushed in to close switch F, and current flows from the left line wire 242 through switch L (which has been closed), wires 260 and 261 to the lower brush 239 of the fourth disc 237 and the contact 238 engaged thereby. The current then flows through wires 265, the right hand contacts of switch D (which is in the position of Figure 29), wire 278, the contacts of switch F, wires 153' and 258, the contacts of switch G, wire 258', the contacts of switch E, the right hand contacts 188' and 189' of switch A, wire 283, the left hand contact of the first disc 237 engaged by the lower brush 239 of the latter, wire 271, and wire 270 to one terminal of motor 72. From the other terminal of motor 72, current flows through wires 269, 276 and 243 back to the right line wire 242, thereby completing the circuit of motor 72 and placing it in operation. Motor 72 then drives chain 56 to complete elevation of tube 49 and the cage and its driving motor unit which are carried thereby. At this time, pin 50 raises the cover 73 so as to free it from the receptacles 30 and allow movement of the turn table 16. When the cover 73 is raised, the contactor assembly 216 is also

raised so as to cause element 218 to bridge the contacts 205 and 206 and thereby place motor 44 in operation to move the turn table so as to bring the first receptacle 30 into registry with the opening 75 of cover 73. Upon engagement of element 218 with contacts 205 and 206 and engagement of brushes 219 and 220 with strips 208, current flows from the left line wire 242 through switch L, wires 260 and 261, the lower brush 239 of the fourth disc 237, wire 265, the left hand contacts of switch D, wire 153', switches G and E, the right hand contacts of switch A, wire 283, the lower brush 239 of the first disc 237, and wire 272 to contact 205, plate 218, contact 206, wire 273, upper brush 239 of the first disc 237, wires 252 and 253, plates 208, and wires 267 and 268 to one terminal of motor 44. From the other terminal of motor 44, current flows through wires 276 and 243 to the right line wire 242, completing the circuit of motor 44 so that the latter drives the turn table as previously mentioned. As soon as the turn table starts to turn, the pin 187' rides out of the adjacent depression 183 so as to open the right hand contacts of switch A and close the left hand contacts thereof. Although this opens the circuit of motor 72 at one point, such circuit is closed across the strips 208 so that said motor 72 continues to run. Also, while disengagement of plate 218 from contacts 205 and 206 has opened the circuit of motor 44 at one point, closing of the left hand contacts of switch A has closed it at another point so that the motor 44 also continues to run. Riding of brushes 219 and 220 downwardly off of strips 208 then opens the circuit of motor 72 to stop lowering of the cage and cover 73, thereby allowing the turn table to continue moving until the first receptacle 30 has been brought into registry with opening 75. When the first receptacle has been brought into registry with opening 75, the pin 187' of switch A will have entered the adjacent depression 183, thereby opening the circuit of motor 44 by permitting separation of the left hand contacts of switch A and allowing the receptacle to remain in such registered position with respect to opening 75. In addition, entry of the pin 187' in the depression allows the right hand contacts of switch A to close the circuit of motor 72, thereby causing the tube 49 and the cage motor unit to resume lowering so that the cover 73 lowers onto the receptacles 30 and the cage passes downwardly through opening 75 and into the registered receptacle. As the cage approaches its lower limit of movement, cam 166' forces lever 157 of switch G inwardly so as to force pin 156 across slot 47, whereupon pin 54 depresses the adjacent end of pin 156 and separates contacts 163 and 164 so as to stop the motor 72 to allow the cage to remain in the washing solution. Prior to this stopping of motor 72, brushes 221 and 222 will have engaged strips 213 and 214 to close the circuit of motor 82 and thereby cause rotation of the cage in one direction. When the circuit of motor 82 is thus closed, current flows from the left line wire 242 through switch L, wires 260 and 261, on 239 of the fourth disc 237, wire 262, right contacts of switch D, wire 278, switch F, wire 153', wire 256, strip 214, brush 221, and wire 226 to one terminal of motor 82. The current then returns from another terminal of motor 82 through wire 224, brush 222, strip 213, wires 274 and 243 to the right line wire 242. As the basket continues to lower, brush 221 rides off of strip 214 and brush 223 rides onto strip 215, reversing motor 82 so as to rotate the cage in an opposite direction for a more efficient washing action. This happens just prior to tilting of pin 156 by pin 54. The circuit of motor 82, when reversed, is the same except that the current flows to a third terminal of the motor through wire 225 instead of through wire 226. When the motor 82 is reversed, brushes 219 and 220 ride onto strips 211 to close the circuit of clock motor 127 so that the latter rotates disc 130 until contacts 136 and 137 move in an anticlockwise direction from the position of Figure 15 back to the same point. In doing this, the contacts 136 and 137 engage contactors 139 and 141 when the washing operation has taken place for a given period of time, thereby closing the circuit or motor 72 to cause the cage and its motor unit to start upwardly and the lamp 231 to light again. This causes pin 54 to rise and allow the contact 163 to engage contact 164 so that the circuit of motor 72 will be closed at this point even though it is opened at another point by drifting of contact 136 slightly past contactor 139. When contacts 136 and 137 engage contactors 139 and 141, current flows from the left line wire 242 through switch L, wires 260 and 261, lower arm of the fourth disc 237, wire 262, brush 135, disc 134, contactor 141, wire 141' and lamp 231 to the right line wire 242. The current also flows from wire 262 through wire 263, brush 131, disc 130, contact 136, contactor 139, wire 139', upper arm 239 of the third disc 237, and wires 271 and 270 to one terminal of motor 72. From the other terminal of motor 72, the current flows through wires 269, 276 and 243 to the right line wire 242. When contact 136 leaves contactor 139 and contact 163 engages contact 164 of switch G, the current flows as described when starting the machine by pushing button 142. When brushes 219 and 220 rode onto strips 211 to close the circuit of clock motor 127, current flowed from left line wire 242 through wires 260 and 261, the engaged contacts of the fourth disc 237, wire 266, switch B, the engaged contacts of the third disc 237, wire 279, brushes 219 and 220, strips 211, and wire 277 to one side of motor 127. From the other side of motor 127, current flowed through wire 243 to the right line wire 242. Shortly after the cage starts to rise and while it is still in the solution, motor 82 is reversed again by passing of brush 223 off of strip 215 and riding of brush 221 onto strip 214, thereby enhancing the washing action. The speed of motor 82 is faster in the partly elevated position of the cage and in the completely lowered position thereof, because it has a lower R. P. M. when initially reversed. The cage continues to rise and pass out of the washing solution and, due to the higher speed of motor 82, the solution is effectively thrown off the washed parts and from the cage while still in the receptacle so that little dirty washing solution remains to mix with the solution used in the subsequent rinsing operation. Upon further upward movement of the cage, brushes 221 and 222 leave strips 213 and 214, thereby stopping motor 82 and rotation of the cage after the cage passes out of the washing solution into the upper portion of the receptacle 30. Still further upward movement causes the cage to enter the cup 103 and thereby raises the cap 99 as said cage passes upwardly through opening 75 above the cover 73. This is followed by engagement of pin 50 with cover 73 to raise the latter, after which plate 218 engages contacts 205 and 206 to close the circuit of motor 44, so that it rotates the turn table and brings the next recep-

tacle 30 into registry with the opening 75 of cover 73. This cycle of operation is then automatically repeated with respect to all of the remaining rinsing receptacles, except that the cage moves up and down continuously and does not remain in its lowermost position for a period of time, because the cam 166' only functions during the washing stage. During the last rinsing stage, the pin 187 of switch C has entered the depression 183' so as to allow this switch to close the circuit of heater 203 at one point. Upon lowering of the cage during this stage, brushes 219 and 220 engage strips 210 to close the heater circuit at another point and thereby complete the circuit so that the heater is energized. The heater circuit remains closed until brushes 219 and 220 ride off of strips 210 during downward and upward movement of the cage, the circuit being opened to render the heater inoperative as the cage rises during completion of the last rinsing stage. Sufficient heat remains for the subsequent drying stage after the heat is turned off. When switch C is thus closed and brushes 219 and 220 thus engage strips 210, the current flows from left line wire 242 through switch L, wires 260 and 261, lower arm 239 of the fourth disc 237, wire 265, left contacts of switch D, wires 259 and 153', right strip 210, brushes 220 and 219, left strip 210, wire 281, contacts of switch C and wire 282 to one side of heater 203. From the other side of heater 203, the current flows through wires 276 and 243 to the right line wire 242. When the cage is completely elevated and the cover 73 is raised at the end of the last rinsing stage, plate 218 engages contacts 205 and 206 to close the circuit of motor 44 as previously described and thereby cause movement of the turn table so as to bring the drying chamber 21' into registry with the opening 75 of cover 73, the stopping of the turn table in proper position being effected as before outlined with respect to the washing stage. This is followed by lowering of cover 73 and downward movement of the cage through opening 75 into the drying chamber in the same way as these acts took place with respect to the first or washing solution receptacle 30. The cage is caused to remain in the drying chamber for a period of time at this stage, because the cage depresses the plunger 182 so as to open switch E and thereby stop the motor 72. As the cage approaches its lower limit of movement in this stage, brushes 219 and 220 bridge strips 211 to close the circuit of the clock motor 127. The timing means which includes this clock motor closes the circuit of motor 72 after the drying operation has taken place for a given period of time, whereupon the cage and its motor unit are elevated, but the cover 73 is not raised, the operation of motor 72 occurring exactly as described after completion of the washing operation. Just before the cage reaches its uppermost limit of movement, link 52 actuates lever 195 of switch H so as to separate contact 198 from contact 199 and thereby stop motor 72. The cleaned and dried parts are then removed from the cage, and the machine is then back to its original condition ready for a new set of washing, rinsing and drying operations. When the brushes 219 and 220 last bridged the strips 211, the current flowed from left line wire 242 through switch L, wires 260 and 261, lower arm 239 of the fourth disc 237, wires 262 and 264, right contacts of switch D, wire 273', lower arm 237 of the third disc 237, the next to the lowest left contact 238 of the latter disc, wire 279, right strip 211, brushes 220 and 219, left strip 211, and wire 277 to one side of motor 127. From the other side of motor 127, the current flowed through wire 243 to right line wire 242.

(*c*) When the handle is moved to coincide with line *c*, part-time washing operation is produced, as well as lighting of the bulb 232, the washing operation having approximately half or some other desired duration less than full time. Lighting of bulb 232 occurs because current flows from left line wire 242 through wires 260 and 261, upper arm 239 of the fourth disc 237, wires 248 and 247, and lamp 232 to right line wire 242. Turning of handle 235 to line *c* breaks connection of brush 139 with the upper arm 239 of the third disc 237 and establishes connection of brush 138 therewith so that engagement of contact 136 with brush 138 closes the circuit of motor 72 to effect elevation of the cage upon partial rotation of disc 130 instead of upon complete rotation thereof. Obviously, this provides the part-time or shorter period of washing, which will be sufficient if the parts are in such condition that they can be cleaned in the shorter period. The full time in the drying operation is always necessary and occurs accordingly regardless whether the machine is set for full or part-time washing operation.

It is to be noted that if the handle 235 is left in the *c* position after a part-time run, the next run will automatically be a full-time run, unless the handle is turned to the *b* position. To tell from then on whether the succeeding run will be part-time or full time it is necessary to note whether one or both of the lights 231 and 232 are lit. If both are lit the run will be full-time without changing the position of the handle or if only one light is lit the run will be part-time, so that it is necessary to appropriately change the position of the handle to predetermine the run desired.

(*d*) In the *d* position of the handle the machine operates in the wash position until the handle 235 is turned to some other position. When the handle 235 is in this position, the lower arm 239 of the third disc 237 is on a contact 238 not connected to wire 279, so that clock motor 127 is not energized and there is no timing of the washing operation. It is thus obvious, that handle 235 must be moved to position *b* or position *c* in order to again time the washing operation.

(*e*) If after completion of a run of the machine with handle 235 in any of the other positions (the machine having come to a stop in the drying position) it is desired to change dirty solution in the jars, the handle is turned to the *e* position, thereby causing the cover 73 to rise and stop at top position, thereby exposing the jars for removal and replacement. In this position, current flows from left line wire 242, through wires 260 and 261, engaged contacts of the fourth disk 237, wire 234', lamp 234, and wire 243 to the right line wire 242, so that lamp 234 is lighted. When handle 235 is turned to coincide with indicator line *e* current flows from left line wire 242 through wire 260 to wire 251, through engaged contacts of the second disc 237, wire 254, brushes 219 and 220 and strips 209, wire 209', engaged contacts of the first disc 237, wires 271 and 270 to one side of motor 72. From the other side of motor 72, current flows through wires 269, 276 and 243 to the right line wire 242. This places motor 72 in operation to complete elevation of the cage motor unit and simultaneously raise cover 73. When this is done, brushes 219 and 220

ride off of strips 209 and stop the motor 72. The switch button 240 which is exposed through the indicator plate 229, is then pushed in to close the switch K, which closes the turntable motor circuit. As a result, as long as the button 240 is held in, the turntable will keep revolving. Releasing the button 240 stops the turntable at the desired point in rotation so that the desired jar can be removed through the opening 75 in the cover 73 for replacement or for changing the solution therein. When button 240 is thus pushed in, current flows from left line wire 242 through wire 260, engaged contacts of the second disc 237, wire 267, through switch K, and wire 268 to one side of motor 44. From the other side of motor 44, current flows through wires 276 and 243 to the right line wire 242. As soon as motor 44 is thus started, pin 187' rides out of the adjacent depression 183 so as to close switch A whereby this motor will continue to run even though button 40 is released, until pin 187' rides into the next depression 183 to open the left side of switch A and stop motor 44 when the first or washing solution receptacle 30 is registered with the opening 75 of cover 73. When button 240 is released, current flows from left line wire 242 and wire 260 through engaged contacts of the second disc 237, wires 251, 153' and 257, and left contacts of switch A to one side of motor 44, the current flowing from the other side of motor 44 to right line wire 242 by way of wires 276 and 243. Upon removal of the cage motor unit, the registered washing solution receptacle 30 may be removed from the machine, and the operation may be repeated to gain access to and effect removal of the successive remaining rinsing solution receptacles. As previously mentioned, rack bar 29 is elevated to raise and effect removal of the receptacles through the opening 75 of cover 73.

A toggle 241 operating the switch L is provided on the side of the machine casing to cut on and off the supply current from the supply lines 242 to operate the machine.

Reference to the diagram of Figure 29 shows the operative electrical connections of the various switches and motors, including the clock. One side of the current supply 242 is connected by the wires 243 and 274 to the long contact 213 on one side 212 of the "switchboard" I. One side of the lamps 230, 231, 232, 233 and 234 are also connected to the wire 243. The remaining side of the lamp 230 is connected by the wire 244 with the first one of the contact points 236 on the fourth disk 237 of the multiple switch J. The remaining side of the lamp 231 is connected by the wire 245 to the clock switch contact 141 and to the branch 246 leading to the second contact 238 of the mentioned disk. The remaining side of the lamp 232 is connected by the wire 247 with the contact 140 of the clock switch and by the branch 248 with the third contact point 238 on the said disk 237. The wire 249 connects the remaining side of the lamp 233 with the fourth contact point 238 on the said disk. The remaining side of the lamp 234 is connected by the wire 234' with the top or first left hand contact 238 of the fourth disk 237. The contact 153 of the switch F is connected by wire 153' with branch wires 251, 252, 253, 254, 255, 256, 257, 258 and 259 leading therefrom and connecting respectively with one of the spring brushes 239 on the second disk of the switch J, the contactor 239 of the first disk, the right hand contact strips 208, 209 and 210 of the "switchboard" I, the upper and lower contact strips 214 and 215 of the "switchboard's" opposite side, the contact 193 of the switch A, the contact 154 of the switch G, the contact 198 of the switch H, and the lower contact of the switch D.

The blade side of the switch L is connected by the wire 260 with the lower right hand point 238 of the second disk of the switch J, and with wire 261 which connects the contacts of the second and fourth disks of the switch J. The second, third and fourth left hand points of the said fourth disk are all connected to the wire 262 which connects with the brush 135 of the time switch. A branch 263 connects the wire 262 with the contactor 131 of the time switch. To the left of the wire 263 branches 264 and 265 connect the wire 262 with the corresponding rocker contacts of the main elevator switch D, and to the left of the wire 265 the wire 266 connects the wire 262 with the contactor of the third disk of the rotary switch J through switch B.

The upper left point of the second disk of the switch J is connected by the wire 267 with one side of the switch K whose remaining side is connected to the left hand contact strip 208 on the "switchboard" I. A branch wire 268 connects the wire 267 to the left of the switch K with the rocker contact 192 of the switch A. A branch from the wire 268 connects with one side of the motor 44, whose remaining side is connected by the wire 269 with one side of the motor 72. The remaining side of the motor 72 is connected by the wire 270 with a wire 271 which connects the contactor 239 of the third disk of the switch J with the contactor of the first disk. A branch wire 272 connects the wire 271 with the contact 205 of the "switchboard" I. A wire 273 leads from all of the right hand points on the first disk of the switch J, except the lowermost point, to the companion contact 206.

The switchboard contact strip 213 is connected by a wire 274 which joins the wire 243 at the junction 275, from which the wire 276 leads to the wire 269 and to one side of the electrical heater 203. One side of the electric clock motor 127 is connected to the wire 243 with the remaining side connected to the wire 277 which leads to the lower left contact strip 211 of the switch board I. The switch B has its stationary contact connected to wire 266, and its movable contact is connected to motor 127 through engaged contacts of the third disk 237, wire 279, bridged contacts 211, and wire 277. Wire 278 leads from the right hand stationary contact of the switch D to the stationary contacts of the switches H and F.

A wire 281 connects the left hand strip 210 of the "switchboard" I to the rocker contact of the switch C, whose stationary contact is connected by the wire 282 with the remaining side of the heater 203.

The terminals of the constant speed cage rotating motor 82 are connected through the three wire plug 227 with the contacts 221, 222, and 223 of the contactor assembly 216. All but one of the left-hand contacts 238 of the first disk of the rotary switch J are connected by the wire 283 with the stationary contact 189' of the switch A.

It is to be observed that the switches B, C and D are operated by the inside single depression 193', whereas the outside track of six depressions 183 operate the switch A. The switch E is operated by the plunger 132.

It is to be understood that the scope of the invention is not limited to the precise arrangement

herein disclosed but that variations may be made within the scope of the subjoined claims.

Having described the invention, what is claimed as new is:

1. In a machine for cleaning parts, a substantially cylindrical casing, a cover assembly including a safety cover closing the top of the casing, a turntable assembly axially supported for rotation in the casing, a washing solution jar, at least one rinsing solution jar, and a drying chamber circumferentially mounted on said turntable assembly, said cover closing the jars and the drying chamber to prevent escape of fluid therefrom, said cover being formed with a single opening with which one of the jars or the drying chamber is adapted to be registered at a time, operating means arranged to turn the turntable assembly to register the jars or the drying chamber with the opening in the cover, and vertical axis motor driven rotary cage means including a reticulated cage for containing the parts to be cleaned, said cage being arranged to be depressed through the opening in the cover to operate in one of the jars or the drying chamber.

2. In the machine recited in claim 1 the inclusion in said cage means of a lid above the cage to close the said opening in the cover and the top of the jar or drying chamber registered therewith while the cage is depressed in operating position.

3. In the machine recited in claim 1 the inclusion in said motor driven cage means of a constant speed electric motor actuating the cage.

4. A machine according to claim 1 wherein said turntable assembly comprises an upper annulus carrying the jars and the drying chamber, and a lower annulus mounted below said upper annulus and with which said operating means is operatively connected, resilient stop means connecting said upper and lower annuli and permitting said lower annulus to overrun the upper annulus when the upper annulus is halted, circumferentially spaced stop posts on said casing corresponding in spacing to the jars and the drying chamber, said resilient stop means including a latch member arranged to engage the stop posts to halt the upper annulus to exactly register the jars and the drying compartment with the said opening in the cover while permitting the lower annulus some overrun due to the residual functioning of said operating means and momentum of the lower annulus, after the operating means is deenergized.

5. A machine according to claim 1 wherein said turntable assembly comprises an upper annulus carrying the jars and the drying chamber, and a lower annulus mounted below said upper annulus and with which said operating means is operatively connected, resilient stop means connecting said upper and lower annuli and permitting said lower annulus to overrun the upper annulus when the upper annulus is halted, circumferentially spaced stop posts on said casing corresponding in spacing to the jars and the drying chamber, said resilient stop means including a latch member arranged to engage the stop posts to halt the upper annulus to exactly register the jars and the drying compartment with the said opening in the cover while permitting the lower annulus some overrun due to the residual functioning of said operating means and momentum of the lower annulus, after the operating means is deenergized, said resilient stop means including spring means to return the lower annulus into initial relation to said upper annulus.

6. A machine according to claim 1 wherein said turntable assembly comprises an upper annulus carrying the jars and the drying chamber, and a lower annulus mounted below said upper annulus and with which said operating means is operatively connected, resilient stop means connecting said upper and lower annuli and permitting said lower annulus to overrun the upper annulus when the upper annulus is halted, circumferentially spaced stop posts on said casing corresponding in spacing to the jars and the drying chamber, said resilient stop means including a latch member arranged to engage the stop posts to halt the upper annulus to exactly register the jars and the drying compartment with the said opening in the cover while permitting the lower annulus some overrun due to the residual functioning of said operating means and momentum of the lower annulus, after the operating means is deenergized, said resilient stop means including spring means to return the lower annulus into initial relation to said upper annulus, said stop means further including latch member releasing means operable by relative movement of the upper and lower annuli to release said latch member to permit said latch member to pass the stop post engaged and move toward the next stop post as said operating means resumes functioning and moves the turntable assembly.

7. A machine according to claim 1 wherein said motor driven cage means comprises a reversible electric motor, and wherein energizing circuits are provided for said motors, the cage motor circuit including stop and reversing switches and the turntable operating motor circuit including a stop switch, a switchboard incorporating said switches comprising a switch base comprising a stationary element comprising contact elements, and a vertically movable multiple contactor for engaging some of the contact elements in different vertical positions of the contactor, and means for vertically reciprocating said contactor in conformance with the rise and fall of said cage, the cage motor circuit being arranged to be reversed in a partially elevated position of the cage.

8. In a machine according to claim 1, a jar lifter comprising a pinion operated rack supported within said casing and vertically extensible through opening means in the turntable assembly beneath the said opening in the safety cover, and handle means extending outside of the casing for operating the pinion to force the rack against the bottom of a jar to elevate the jar through the said opening to enable removal and replacement of the jar with respect to the turntable assembly.

9. In a machine for cleaning parts, a substantially cylindrical casing, a cover assembly including a safety cover closing the top of the casing, a turntable assembly axially supported for rotation in the casing, a washing solution jar, at least one rinsing solution jar, and a drying chamber circumferentially mounted on said turntable assembly, said cover closing the jars and the drying chamber to prevent escape of fluid therefrom, said cover being formed with a single opening with which one of the jars or the drying chamber is adapted to be registered at a time, operating means arranged to turn the turntable assembly to register the jars or the drying chamber with the opening in the cover, and vertical axis motor driven rotary cage means including a reticulated cage for containing the parts to

be cleaned, said cage being arranged to be depressed through the opening in the cover to operate in one of the jars or the drying chamber, said turntable assembly comprising a lower annulus, rollers on the casing revolubly supporting said lower annulus, an upper annulus, rollers on the lower annulus revolubly supporting the upper annulus on the lower annulus.

10. In a machine for cleaning and drying parts, a substantially cylindrical casing, a safety cover for closing the top of the casing, a column rising centrally from the casing and through the cover, said safety cover being formed with a single eccentrically located opening, a turntable in the casing below said safety cover, at least one washing fluid jar and at least one rinsing solution jar and a drying chamber carried circumferentially by said turntable for individual registry with said single opening in the cover, said column comprising slidably telescoped tubes one of which is fastened to the casing, a motor driven rotary cage means carried by said slidable tube including a vertical rotary shaft and reticulated parts containing cage adapted to be depressed to enter a jar or the drying chamber through the said opening in the cover, and spring means effectively expanding between the motor-driven cage means and the cover to depress the cover into closing relation to the casing and the tops of the jars and the drying chamber and to counterbalance the weight of said motor driven cage means.

11. In a machine for cleaning parts, a support, a turntable on the support, operating means for cyclically turning the turntable and halting it at selected points of rotation with respect to said support, at least one washing solution jar and at least one rinsing jar and a drying chamber circumferentially distributed around and carried by said turntable, cage means including a rotary reticulated parts containing cage and an electric motor driving the same, said cage being adapted to be depressed into the jars and the drying chamber in different positions of rotation of the turntable, an electric heater on said support beneath the turntable and over which said drying chamber is adapted to be registered by rotation of the turntable from another position of rotation involving a rinsing solution jar immediately preceding said drying chamber, energizing means for said electric heater, and control means for said energizing means operated in consonance with said turntable whereby said heater is energized during the preceding rinsing solution jar position of the turntable and is deenergized as the turntable moves into the drying position, whereby said drying chamber is sufficiently heated for drying the parts in the cage as the cage is depressed into and for the period of time the cage remains in the drying chamber.

12. A machine according to claim 11 wherein said operating means includes control means effectively connected to said cage to time the depression of the cage in said drying chamber and then elevate the cage out of the chamber and stop the cage motor.

13. In a machine for cleaning parts, a support, a turntable on the support, operating means for cyclically turning the turntable and halting it at selected points of rotation with respect to said support, said operating means including a source of energy for the cage motor, at least one washing solution jar and at least one rinsing jar and a drying chamber circumferentially distributed around and carried by said turntable, cage means including a rotary reticulated parts containing cage and an electric motor driving the same, said cage being adapted to be depressed into the jars and the drying chamber in different positions of rotation of the turntable, an electric heater on said support beneath the turntable over which said drying chamber is adapted to be registered by rotation of the turntable from another position of rotation involving a rinsing solution jar immediately preceding said drying chamber, energizing means for said electric heater, and control means for said energizing means operated in consonance with said turntable whereby said heater is energized during the preceding rinsing solution jar position of the turntable and is deenergized as the turntable moves into the drying position, whereby said drying chamber is sufficiently heated for drying the parts in the cage as the cage is depressed into and for the period of time the cage remains in the drying chamber, elevating means including an electric motor for depressing and elevating said cage, said operating means further including an electric motor driving the turntable, timing means and stop switch means in circuit with the elevator and turntable motors, said stop switch means being operated by the turntable as the latter is moved by its motor from a starting position into the washing solution jar position to deenergize said motor to halt the turntable in the washing solution jar position, and allow the elevator motor to depress the cage into the washing solution jar to be therein rotated for a substantial period of time determined by the operation of said timing means, said timing means being arranged to reenergize the elevator motor at the end of said period of time to raise the cage out of the jar, and switch means responsive to elevation of the cage for deenergizing the cage motor to halt rotation of the cage as it comes out of the jar, and then reenergize the turntable motor so as to move the first rinsing jar into position to receive the cage.

14. In a machine for cleaning parts, a support, a turntable on the support, operating means for cyclically turning the turntable and halting it at selected points of rotation with respect to said support, said operating means including a source of energy for the cage motor, at least one washing solution jar and at least one rinsing jar and a drying chamber circumferentially distributed around and carried by said turntable, cage means including a rotary reticulated parts containing cage and an electric motor driving the same, said cage being adapted to be depressed into the jars and the drying chamber in different positions of rotation of the turntable, an electric heater on said support beneath the turntable over which said drying chamber is adapted to be registered by rotation of the turntable from another position of rotation involving a rinsing solution jar immediately preceding said drying chamber, energizing means for said electric heater, and control means for said energizing means operated in consonance with said turntable whereby said heater is energized during the preceding rinsing solution jar position of the turntable and is deenergized as the turntable moves into the drying position, whereby said drying chamber is sufficiently heated for drying the parts in the cage as the cage is depressed into and for the period of time the cage remains in the drying chamber, elevating means including an electric motor for depressing and elevating said cage,

said operating means further including an electric motor driving the turntable, timing means and stop switch means in circuit with the elevator and turntable motors, said stop switch means being operated by the turntable as the latter is moved by its motor from a starting position into the washing solution jar position to deenergize said motor to halt the turntable in the washing solution jar position, and allow the elevator motor to depress the cage into the washing solution jar to be therein rotated for a substantial period of time determined by the operation of said timing means, said timing means being arranged to reenergize the elevator motor at the end of said period of time to raise the cage out of the jar, and switch means responsive to elevation of the cage for deenergizing the cage motor to halt rotation of the cage as it comes out of the jar, and then reenergize the turntable motor so as to move the first rinsing jar into position to receive the cage, said operating means further comprising means producing automatically depression of the cage into said first and succeeding rinsing solution jars and the drying chamber, followed immediately by elevation of the cage therefrom, accompanied by corresponding rotation of the turntable to carry the jars and the drying chamber into correct positions.

15. In a machine for cleaning watch parts and the like, the combination of an immersing unit including a cage for containing the parts to be cleaned and a reversible motor for rotating the cage, a first power means for reciprocating said unit between raised and lowered positions, receptacle means providing a series of treating chambers, a second power means to produce relative horizontal movement between said receptacle means and said unit while the latter is in raised position to successively bring said chambers into vertical alignment with said cage, and switch means for controlling and reversing said motor, said switch means being responsive to said first power means to drive said motor in one direction and then reverse it when the unit is lowered and to again drive said motor in said one direction and then de-energize it when the unit is raised.

16. In a machine for cleaning watch parts and the like, the combination of an immersing unit including a cage for containing the parts to be cleaned and a motor for rotating the cage, a first power means for reciprocating said unit between raised and lowered positions, receptacle means providing a series of treating chambers, a second power means to produce relative horizontal movement between said receptacle means and said unit while the latter is in raised position to successively bring said chambers into vertical alignment with said cage, switch means for controlling said motor, said switch means being responsive to said first power means to energize said motor when the unit is lowered and to de-energize it when the unit is raised, a timing switch including an operating motor, and further switch means responsive to lowering of said unit by said first power means to render the latter inoperative and to energize said operating motor of the timing switch, said timing switch being adapted to re-energize said first power means after a predetermined period of time to raise said unit.

17. In a machine for cleaning watch parts and the like, the combination of an immersing unit including a cage for containing the parts to be cleaned and a motor for rotating the cage, a first power means for reciprocating said unit between raised and lowered positions, receptacle means providing washing, rinsing and drying chambers, a second power means to rotate said receptacle means relative to said unit while the latter is in raised position to successively bring said chambers into vertical alignment with said cage, switch means responsive to said first power means to energize said motor when the unit is lowered and to de-energize it when the unit is raised, a cover for said chambers having an opening vertically aligned with said cage and through which the latter moves, yieldable means to press said cover downwardly onto the chambers, and means to elevate said cover after withdrawal of the cage upwardly through said opening by raising of said unit.

18. The construction defined in claim 17, in combination with a cap for the chamber aligned with said opening, and yieldable means to press said cap onto the latter chamber when the unit is lowered, said cage being engageable with said cap to raise it off of said latter chamber when said unit is raised.

19. In a machine for cleaning watch parts and the like, the combination of an immersing unit including a cage for containing the parts to be cleaned and a motor for rotating the cage, a first power means for reciprocating said unit between raised and lowered positions, receptable means providing washing, rinsing and drying chambers, a second power means to rotate said receptacle means relative to said unit while the latter is in raised position to successively bring said chambers into vertical alignment with said cage, switch means responsive to said first power means to energize said motor when the unit is lowered and to de-energize it when the unit is raised, a timing switch including an operating motor, and further switch means responsive to lowering of said unit by said first power means to render the latter inoperative and to energize said operating motor of the timing switch, said timing switch being adapted to re-energize said first power means after a predetermined period of time to raise said unit, and other switch means to render said further switch means inoperative when the unit is lowered to enter the cage into the rinsing chamber.

20. In a machine for cleaning watch parts and the like, the combination of an immersing unit including a cage for containing the parts to be cleaned and a motor for rotating the cage, a first power means for reciprocating said unit between raised and lowered positions, receptacle means providing successive washing, rinsing and drying chambers, a second power means to rotate said receptacle means relative to said unit while the latter is in raised position to successively bring said chambers in vertical alignment with said cage, switch means responsive to said first power means to energize said motor when the unit is lowered and to de-energize it when the unit is raised, an electrical heater for the drying chamber, and switch means to energize said heater when the cage is lowered into the rinsing chamber and to de-energize the same when the unit is raised to withdraw the cage from said rinsing chamber.

21. In a machine for cleaning watch parts and the like, the combination of an immersing unit including a cage for containing the parts to be cleaned and a motor for rotating the cage, a first power means for reciprocating said unit

between raised and lowered positions, receptacle means providing washing, rinsing and drying chambers, a second power means to rotate said receptacle means relative to said unit while the latter is in raised position to successively bring said chambers into vertical alignment with said cage, switch means responsive to said first power means to energize said motor when the unit is lowered and to de-energize it when the unit is raised, and switch means responsive to movement of the unit to a position just below its upper limit of movement to de-energize said first power means.

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