July 2, 1940. L. PIERCE 2,206,330

CONTROL MECHANISM FOR WASHING MACHINES

Filed March 18, 1938 5 Sheets-Sheet 1

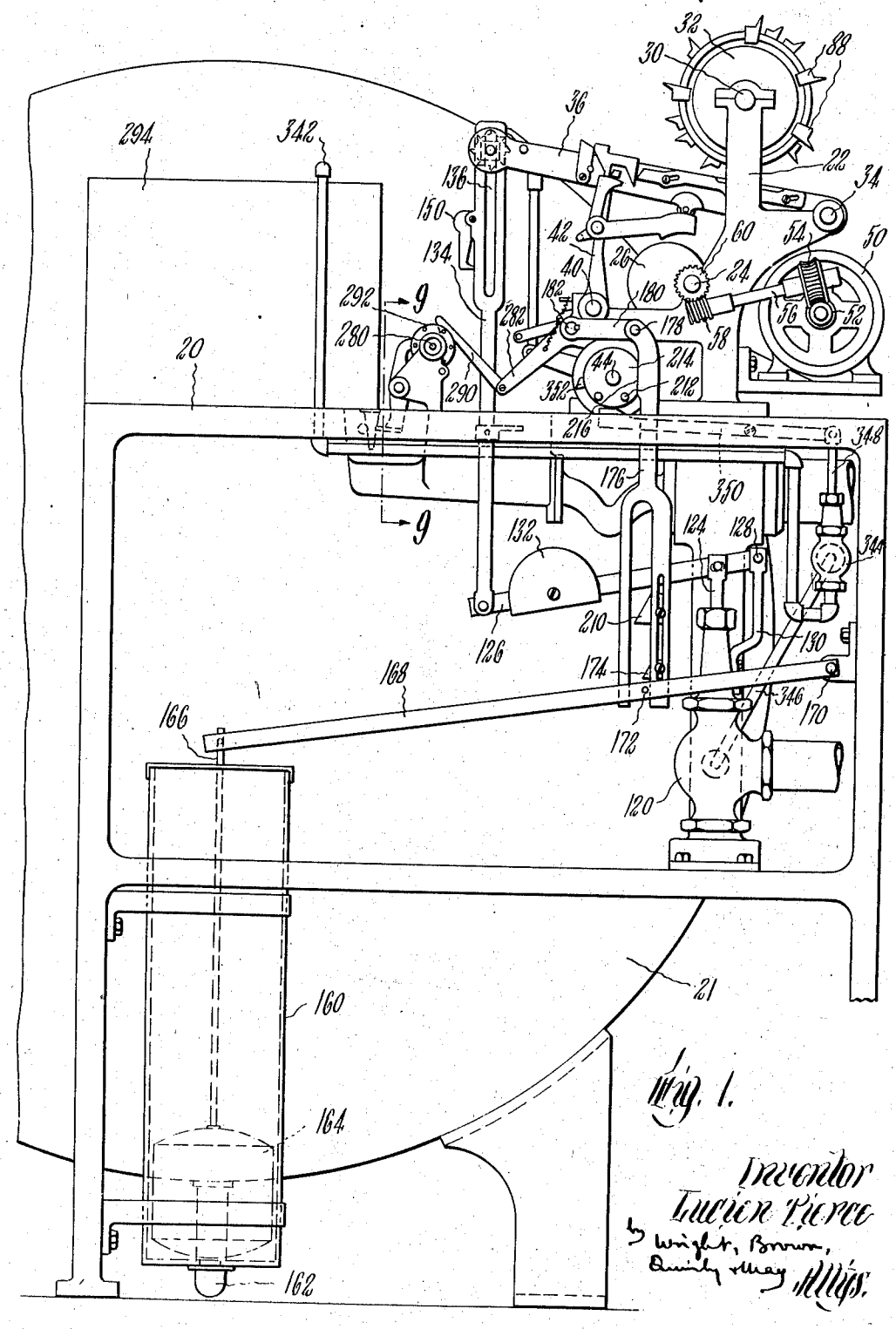


Fig. 1.

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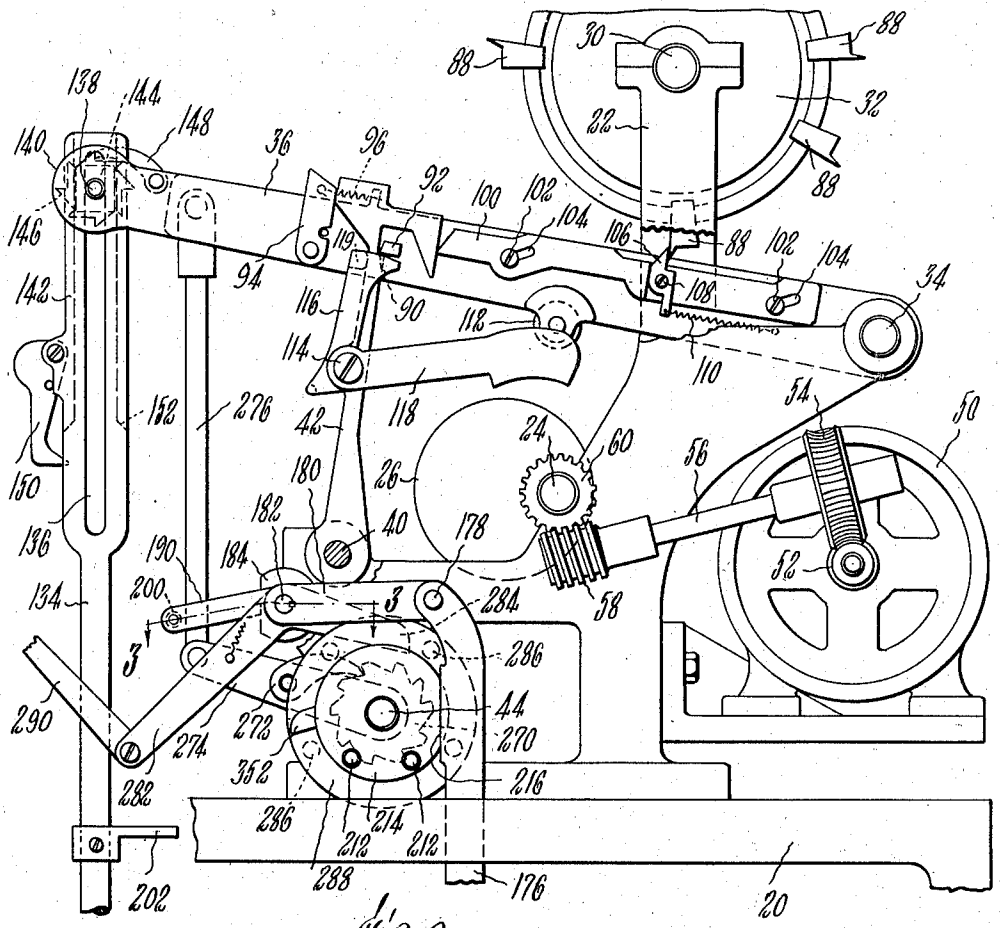


Fig. 2.

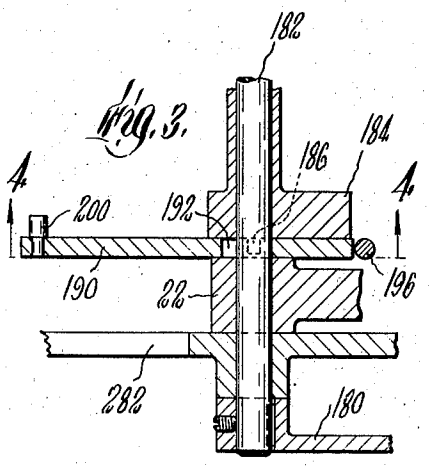


Fig. 3.

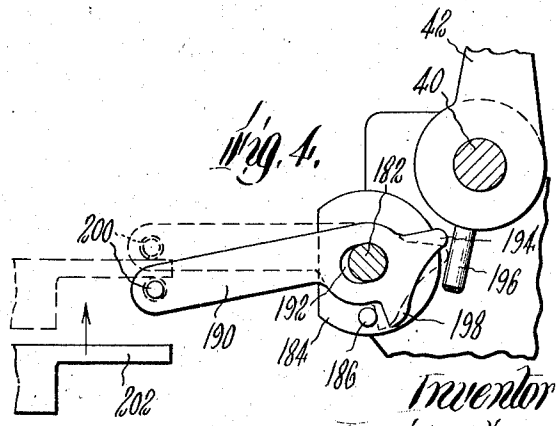


Fig. 4.

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CONTROL MECHANISM FOR WASHING MACHINES

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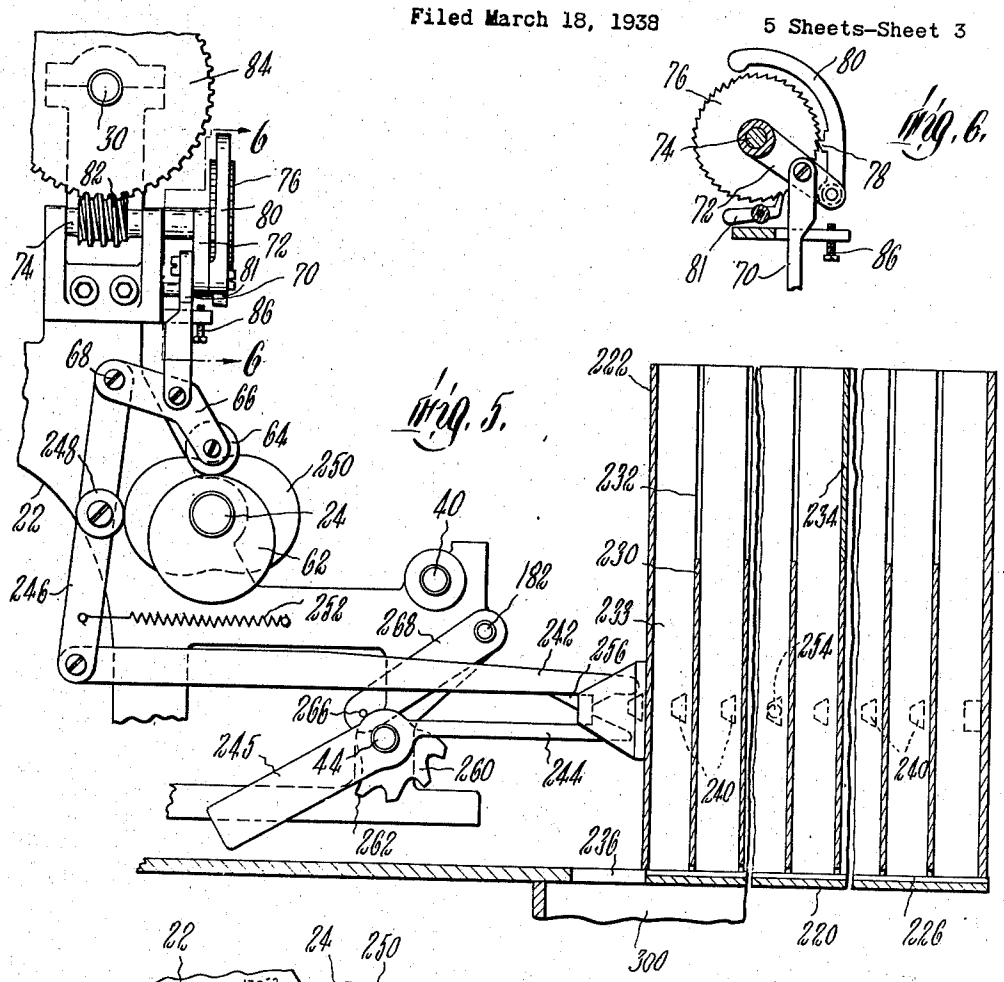


Fig. 5.

Fig. 6.

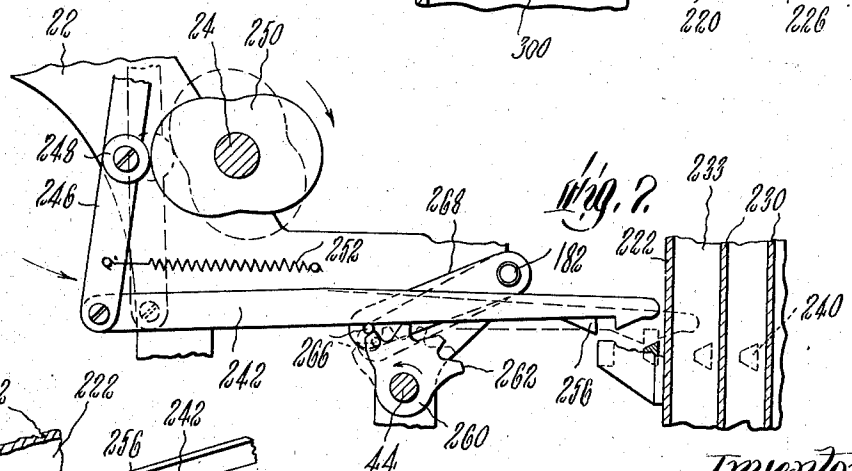


Fig. 7.

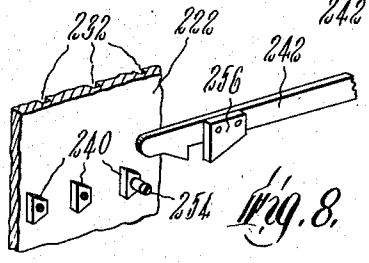


Fig. 8.

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CONTROL MECHANISM FOR WASHING MACHINES

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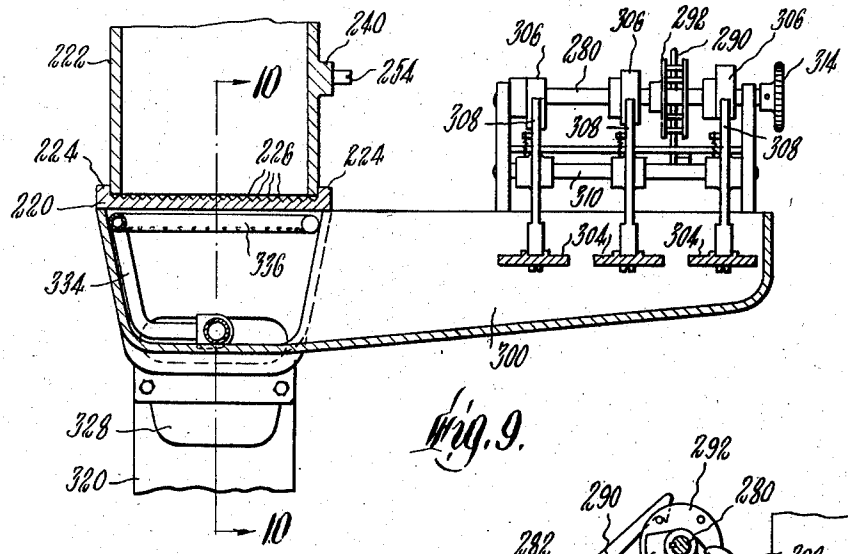


Fig. 9.

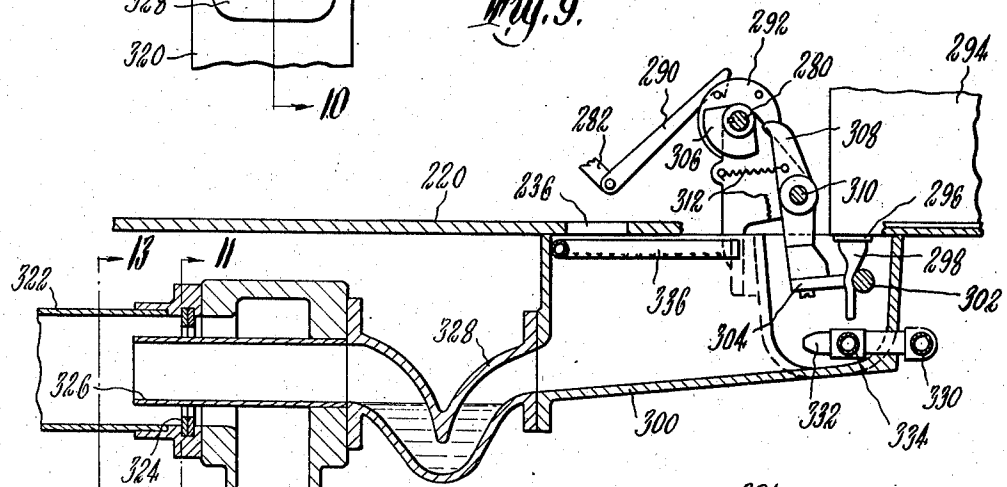


Fig. 10.

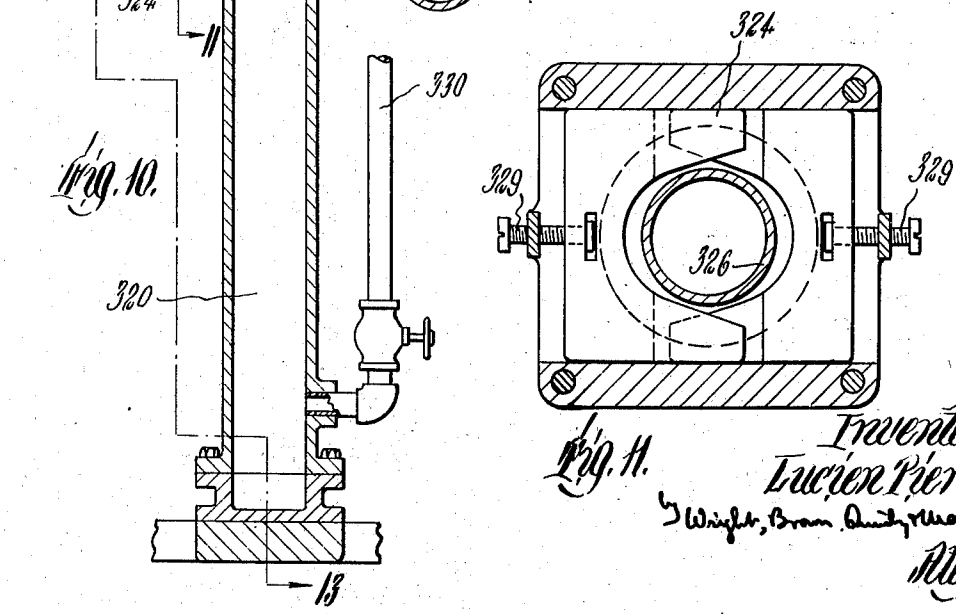


Fig. 11.

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CONTROL MECHANISM FOR WASHING MACHINES

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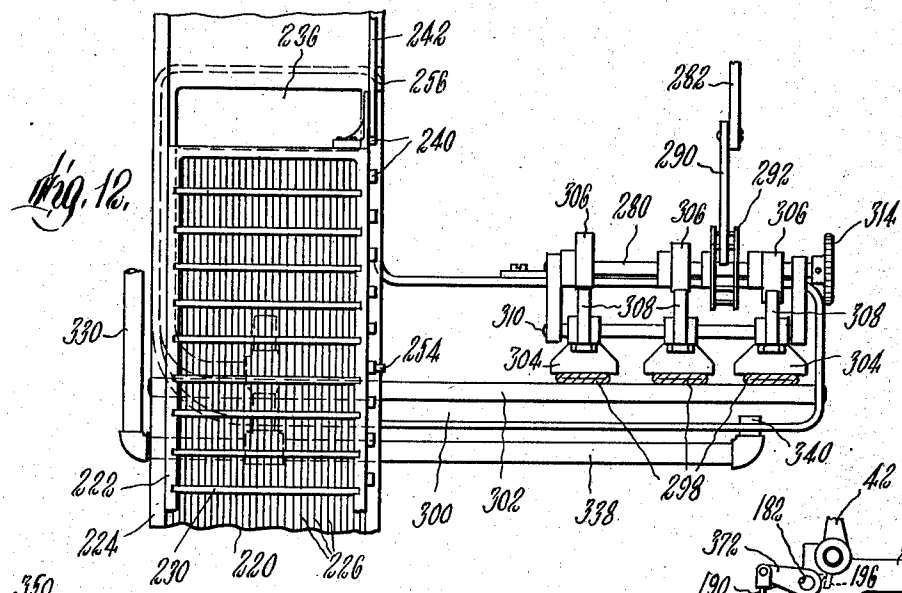


Fig. 12.

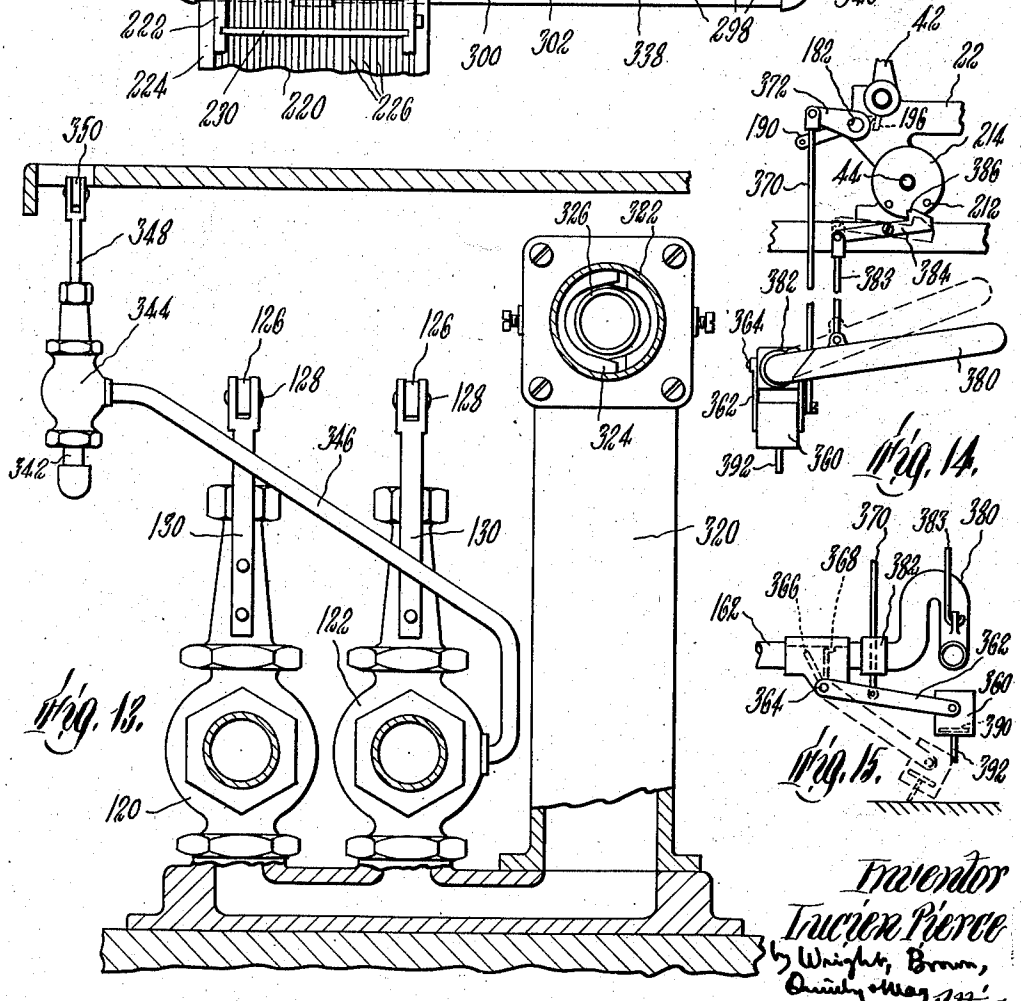


Fig. 13.

Fig. 14.

Fig. 15.

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Patented July 2, 1940 2,206,330

UNITED STATES PATENT OFFICE

2,206,330

CONTROL MECHANISM FOR WASHING MACHINES

Lucien Pierce, Malden, Mass.

Application March 18, 1938, Serial No. 196,689

11 Claims. (Cl. 137—68)

This invention relates to improvements in control apparatus for washing machines such as is described and illustrated in Letters Patent No. 1,982,320 issued to me on November 27, 1934.

It is an object of the invention to provide a more simple and positive control means for regulating the release of the several drop arms described in said Letters Patent. It is another object of the invention to provide improved means for introducing comminuted soap into the washing machine in predetermined quantities and at predetermined times. It is a further object of the invention to provide improved means for supplying other laundry materials such as blue, bleach and sour to the machine at predetermined times. It is a further object of the invention to provide improved means for operating the water supply valves by which water for successive pools for washing or rinsing is introduced into the machine. It is a further object of the invention to provide improved means for operating the several devices included in the mechanism so that a predetermined schedule of operations is accurately carried out.

Further improvements will be apparent to one skilled in the art from the description of the invention which follows, and from the drawings of which

Figure 1 is an elevation of a washing machine with mechanism embodying the invention.

Figure 2 is a similar elevation of a portion of the mechanism shown in Figure 1, on a larger scale.

Figure 3 is a section on the line 3—3 of Figure 2.

Figure 4 is a section on the line 4—4 of Figure 3.

Figure 5 is a fragmentary elevation of the control mechanism viewed from the side opposite to that shown in Figure 1.

Figure 6 is a section on the line 6—6 of Figure 5.

Figure 7 is a fragmentary elevation of a portion of the apparatus shown in Figure 5, showing some of the parts in different positions of operation.

Figure 8 is a perspective fragmentary view of elements shown in Figure 7.

Figure 9 is a section on the line 9—9 of Figure 1.

Figure 10 is a section on the line 10—10 of Figure 9.

Figure 11 is a section on the line 11—11 of Figure 10.

Figure 12 is a fragmentary plan view of apparatus shown in Figure 9.

Figure 13 is a section on the line 13—13 of Figure 10.

Figure 14 is an elevation of a modified form of one feature of the invention.

Figure 15 is a side elevation of the mechanism shown in Figure 14.

The control mechanism herein shown and described is power driven and is entirely automatic in controlling the operation of a washing machine through an entire cycle of washing. Such a cycle includes the use of a number of pools of water successively collected in and drained from the casing of the machine, some containing soap in different quantities, and some containing washing materials such as bleach, blue or sour. These pools are also preferably at different temperatures according to the purpose of each. The mechanism described herein completely and automatically controls the various steps of a washing cycle, thus economizing in power employed and the time of the washing cycle, each step of the washing cycle being automatically timed so as to last an optimum period and no longer.

The control mechanism illustrated on the drawings is mounted on a suitable base or frame 20 adjacent to the washing machine 21 and includes a pair of fixed standards 22. Journaled in these standards are a shaft 24 on which is mounted a cylinder 26 to oscillate up and down as the shaft rotates, a shaft 30 on which is mounted a timing drum 32, a shaft 34 on which are rockably mounted a number of drop arms 36, a shaft 40 on which are rockably mounted a corresponding number of supporting members 42 for the several drop arms 36, and an auxiliary shaft 44 on which are mounted several members hereinafter described. As indicated in Figures 1 and 2, a small electric motor 50 may be mounted on the frame 22 to drive the entire control apparatus. As shown, this motor is connected by a worm 52 and worm gear 54 to a connecting shaft 56 on which is a worm 58 meshing with a worm gear 60 on the end of the shaft 24 which is thus constantly driven, preferably at a speed of approximately eight R. P. M. At the opposite end of the shaft 24, as indicated in Figure 5, is an eccentric cam disk 62 on which rides a cam follower 64 mounted on a lever 66 which is pivoted on a pin 68 so as to be rocked by the cam 62 as the shaft 24 revolves. A rod 70 connects the lever 66 with a crank arm 72, the latter being loosely mounted on a shaft 74. As indicated in Figure 6,

a ratchet wheel 76 is mounted on the shaft 74 and is driven by a pawl 78 mounted on an arm 80 which is pivotally attached to the end of the crank arm 72. The arm 80 is extended and weighted so as to hold the pawl 78 yieldingly against the teeth of the ratchet wheel 76 so that the ratchet wheel is advanced step-by-step as the connecting rod 70 is reciprocated, reverse rotation being prevented by a detent pawl 81. As shown in Figure 5, a worm 82 is mounted on the shaft 74 and meshes with a worm gear 84 mounted on the shaft 30. Thus the timing drum 32 is driven by small steps, the rate being such as to complete one rotation of the timing drum in approximately the total time required for a complete washing cycle, usually between an hour and an hour and a half. The amount of rotation of the ratchet wheel 76, and hence of the timing drum 32, for each rotation of the shaft 24 may be varied by adjusting a setscrew 86 so as to limit the movement of the pawl 78. On the timing drum 32 are adjustably secured a number of tripping lugs 88 which release the several drop arms 36 to cause operation of various portions of the apparatus at predetermined times during a washing cycle.

As described in my said Letters Patent No. 1,982,320, a sufficient number of drop arms are provided to control independently various portions of the apparatus. For example, a separate drop arm is preferably provided for the control of the cold-water supply valve, the hot-water supply valve, the steam valve (not shown), the dump valve (not shown), and the auxiliary mechanism for controlling the supply of soap etc. to be introduced into the machine with various charges of washing or rinsing water. Each of the arms 36 is supported by a corresponding support member 42, these members being rockable on the shaft 40. As indicated in Figure 2, each member 42 is provided with a narrow shoulder 90 on which rests a lug 92 projecting laterally from the corresponding arm 36. The member 42 is normally pressed toward the right by a lever 94 pivotally mounted on the arm 36 and actuated by a spring 96. This maintains the member 42 yieldingly in arm-supporting position as shown in Figure 2. At predetermined times in the washing cycle, each member 42 is rocked toward the left to release its arm 36. To this end, a bunting member 100 is slidably mounted on a side of the arm 36, the member being supported by a pair of pins 102 which ride in corresponding slots 104 in the member 100. The member 100 carries a pawl 106 which is pivotally mounted thereon as at 108 and is held in the position shown in Figure 2 by a spring 110, one end of this spring being secured to the pawl 106 and the other end to the arm 36 so that the spring serves the double purpose of maintaining the pawl in the position shown and of retracting the member 100 toward the right. When the pawl 106 is engaged by a lug 88 on the slowly rotating drum 32, the member 100 is advanced toward the left and rocks the corresponding member 42 until the shoulder 90 is moved clear of the lug 92 so that the shoulder 90 no longer supports the arm 36. An auxiliary supporting member is rockably mounted on each member 42 as at 114. This auxiliary support is in the form of a bell crank having a vertical arm 116 on the upper end of which the lug 92 may rest if the bell crank is in the position shown in Figures 1 and 2. The bell crank also has an approximately horizontal arm 118 projecting out over the eccentric cam drum 26 and engageable by said drum, when the drum reaches its uppermost position, to rock all of these bell cranks simultaneously so as to release any drop arm which may at the moment be supported solely by the vertical arm 116 of a bell crank. A lug 119 is provided on each bell crank to hold the horizontal arm clear of the cylinder 26 when the latter is in any position other than in or near its uppermost position. When the cylinder 26 reaches its uppermost position, it engages and slightly lifts a series of rollers 112 carried by respective drop arms 36, so that the drop arms are also raised slightly at each revolution of the cylinder 26. The bell cranks are rocked at this moment so that the support of any arm carried by a bell crank is shifted to the roller 112 and the arm is free to descend with the cylinder 26. The cam 62, by which the timing drum 32 is driven, moves the drum a step ahead each time the cylinder 24 revolves. Thus the movements of the drum 32 take place when the cylinder 26 reaches a definite point in its revolution about its axis, such point being determined by the angular relation between the cylinder 26 and the cam 62, both of which are mounted on the shaft 24. In the embodiment illustrated, it is preferred that the forward movements of the drum 32 take place when the cylinder 26 is in or near its lowermost position, but any other timing may be had in adjusting the angular position of the cam 62 on the shaft 24. With the timing adjusted as described, the shifting of the support of an arm 36 from the shoulder 90 to its corresponding member 42 takes place when the corresponding bell crank arm 116 is in position to take the support of the drop arm. Thus, when the cylinder 26 next reaches its uppermost position and rocks the bell crank, the support of the drop arm is transferred from the arm 116 to the cylinder 26. The drop arm then descends at a speed which is limited and controlled by the rotation of the cylinder 26 since the roller 112 rides on the surface of the cylinder 26. Since the cylinder is rotated eccentrically at a constant angular speed, the descending and subsequent ascending movements of the arm are approximately simple harmonic motion, that is, like the swing of a pendulum, slow at the ends of each stroke and fast in the middle. This type of movement is particularly appropriate for the actuation of the various mechanisms connected to the several arms 36.

The supply of water to the washing machine is controlled through a pair of valves indicated in Figure 13, one of these valves 120 being for cold water and the other valve 112 being for hot water. These valves are preferably of a type having a longitudinally movable valve stem 124. As the operating mechanism for the two valves is similar, a description of one will suffice for both. For the actuation of each valve, the stem is connected to a rocking lever 126 pivoted at 128 to a bracket 130, as indicated in Figure 1. The lever 126 is preferably provided with a weight 132 tending to rock its lever toward closed valve position. At the free end of the lever 126 is connected a vertical rod 134 by which the valve may be opened. The upper portion of the rod 134 is slotted as at 136. In this slot rides a pin 138 which is mounted on the forked end 140 of the corresponding arm 36. The upper portion of the rod 134 is provided with a pair of spaced ridges 142 between which slidably fits a squared member 144 rotatably mounted on the pin 138. Also mounted on this pin is a ratchet wheel 146 engaged by a pawl 148 mounted on the arm 36. A tripping pawl 150 is

pivotally mounted on the rod 134 in a position to engage the ratchet wheel 146 when it ascends from the lower end of the slot 136. In order to open the hot or cold water valve, its corresponding drop arm 36 is released and permitted to descend as the cylinder 26 rotates. When the pin 138 reaches the lower end of the slot 136, the arm 36 starts to rise again. As it does so, the pawl 150 engages a tooth of the ratchet wheel 146 and causes it to turn one-eighth of a revolution. This changes the position of the squared member 144 so that it presents its diagonal dimension to the channel between the ridges. Thus, instead of riding between the ridges 142, it engages the lower ends 152 of these ridges, causing the rod 134 to be raised by the arm 36 so as to open the corresponding water valve. It is usually desirable to maintain one or both water valves open until some predetermined condition is attained, for example, until the pool accumulated in the container of the washing machine reaches a certain predetermined level. This cannot be successfully accomplished, as a general rule, by metering the water since more water is required to form the first pool than to form succeeding pools of the same depth, owing to the water absorbed and retained by the fabrics which are being washed in the machine. Hence, it is desirable that the shutting off of the water valves be controlled by the water level in the machine. To this end, the machine may be connected to an upright hollow cylinder 160 as by a pipe 162 so that the water in the cylinder 160 is always at the same level as the water in the washing machine 21. Within the cylinder 160 is a float 164 having a stem 166 which is attached to a lever arm 168 pivoted at 170. The lever arm 168 carries a pin 172 which engages a lug 174 adjustably mounted on a forked member 176 as the rising float 164 swings the lever 168 upward. The forked member 176 is suspended as at 178 from an arm 180 which is mounted at its other end on a shaft 182. Also mounted on this shaft is a disk 184 having a pin 186 projecting therefrom (Figures 3 and 4). A trip arm 190 is loosely mounted on the shaft 182, having a slightly elongated aperture 192 which permits a limited longitudinal movement of the trip arm 190. The trip arm is provided with a nose 194 which is adapted to engage against a pin 196 projecting downward from the lower end of the supporting member 42. The trip arm 190 is also provided with a second nose 198 which is engageable by the pin 186 on the disk 184. At the opposite end of the arm 190 is a pin 200 engageable by a lug 202 carried by the vertical rod 134. When the rod 134 is in its lower position, the lug 202 is out of contact with the pin 200, the arm 190 being in the position shown in full lines in Figure 4. Under these conditions, if the disk 184 is rocked by elevation of the member 176, the pin 186 moves toward the right against the nose 198 but does not have any effect on the member 42. When the rod 134 is elevated so as to open a water valve, the lug 202 engages the pin 200 and swings the arm 190 to the dotted position shown in Figure 4, wherein the nose 198 engages the pin 186 and the nose 194 engages the pin 196, thus conditioning the arm for actuation of the member 42. When the arm 190 is in such position and the member 176 is raised, the resulting rocking movement of the disk 184 causes the pin 186 to push the arm 190 longitudinally against the pin 196 so as to impress on the member 42 a torque tending to swing this member toward the left (Figure 4). Since the member 42 is at this time supporting the considerable weight of the drop arm 36, the rod 134 and the members connected thereto including the weight 132, the relatively small pressure of the arm 190 against the pin 196 is insufficient to move the member 42 until the revolving cylinder 26 next reaches its uppermost position, slightly elevating the drop arm 36 and taking the weight of the arm and the members supported thereby off the member 42. The member 42, being thus released, is rocked toward the left by the pressure of the arm 190 against the pin 196. This releases the arm 36 at the moment when the roller 112 carried by this arm is on contact with the cylinder 26. As the cylinder continues to revolve, the arm 36 is lowered, permitting the weight 132 to close the corresponding water valve. Since the cylinder 26 imparts a simple harmonic motion to the descending arm 36, the rate of movement of the arm is decreased as the arm approaches its lowermost position so that the slamming of the water valve on its seat by the momentum of the water flowing through the pipe is thus positively prevented. When the arm 36 starts to swing up again to its elevated position, one of the teeth of the ratchet wheel 146 catches on the pawl 150 so that the squared member 144 turns one-eighth of a revolution to the position shown in Figure 2, two of its sides being parallel to the ridges 142 so that it can enter the channel between the ridges. The arm 36 is thus free to rise to its uppermost position without raising the rod 134. The water valve is thus left closed until the next actuation of the arm 36.

In the usual cycle of operations followed in laundering a batch of clothes or the like, it is desirable that some of the pools of water be deeper than others, according to the several purposes of the successive pools. To this end, in addition to the lug 174 which is mounted on the forked member 176, I may provide an additional lug 210 which, as indicated in Figure 1, is adjustably mounted above the lug 174 and projects out beyond the lug 174. In order to render the lug 174 temporarily inoperative when it is desired to have the pin 172 engage the upper lug 210, the forked member 176 is swung to the right a sufficient distance to move the lug 174 out of the path of the rising pin 172. To this end, one or more pins 212 are mounted on a disk 214 which in turn is mounted on the shaft 44. These pins 212 are located so that prior to the opening of the water valves to form deep pools, one of the pins 212 bears against an edge portion 216 of the forked member 176 and swings the member 176 toward the right. The float 164 must then rise a sufficient distance to move the pin 172 into contact with the lug 210 in order to shut off the water valves. As the mechanism herein described for operating one of the water valves is preferably duplicated for the other, both valves are simultaneously tripped when the desired level of the water in the pool is reached.

In the ordinary washing cycle, a number of laundering materials are employed with the charges of water, some of these being customarily in liquid form, such as bluing, bleach and sour. Next to water itself, soap in one form or another is the most important substance used in washing fabrics. Soap may be supplied in liquid form by the use of either alcohol or heat, but liquid soap is expensive and open to various practical objections. According to the present invention, mechanism is provided for automatically and reliably supplying comminuted dry soap, that is,

soap in the form of powder, granules or flakes. Such a mechanism may include a horizontal platform 220 on which slides a box 222 having an open top and bottom, the platform 220 serving as the bottom of the box. The platform is provided with a pair of side rails 224 between which the box 222 fits so that the box is guided thereby when it is moved along the platform 220. The upper surface of the platform 220 is preferably grooved as indicated in Figure 9, these grooves extending in a direction of motion of the box and forming a series of sharp parallel ridges 226 on which the box 222 rides. This prevents the formation of a packed film of soap on the surface of the platform 220. Although soap may pack in the grooves, the sharp ridges 226 remain clear. Since it has been found by experience that comminuted soap is liable to cake when heaped in a box, the box 222 is provided with a series of partition members 230 which are parallel to the end walls of the box and which form narrow transverse compartments 233 approximately three-fourths of an inch in width. For convenience in cleaning, the partition members 230 may be removably held in vertical slots 232 formed in the inside walls of the box 222. These partition members effectively prevent caking of powdered or granulated soap within the box. As indicated in Figure 5, the partition members 230 extend from points near the bottom of the box to about two-thirds of the way to the top of the box. Auxiliary partition members 234 may be employed to separate the successive batches of soap to be introduced into the washing machine, each batch filling a number of individual compartments. In the platform 220 a transverse aperture 236 is provided, this aperture having a width somewhat greater than that of a narrow compartment 233. Mechanism is provided for imparting step-by-step movement to the box 222 so as to bring the several compartments 233 successively over the aperture 236. To this end, the box 222 may be provided with a series of tapering ratchet teeth 240 on one of its side walls (Figures 5 and 8), these teeth being engageable by a reciprocating pawl 242 and a detent 244 to prevent reverse movement of the box during advancing movement of the pawl 242. The pawl rests on the teeth 240 by its own weight. The detent 244 is pressed upward against the teeth by a counterweight 245. As shown in Figure 5, the pawl may be connected to a rocking lever 246 which swings about the pivot 68. The lever 246 carries a cam roller 248 which rides on the edge of a cam 250 mounted on the constantly rotating shaft 24. As indicated in Figure 5, the shaft 250 is shaped so as to rock the arm 246 twice for each revolution of the shaft 24, but it is obvious that the cam may be shaped to rock the lever any number of times for each revolution of the shaft. The roller 248 is held against the cam 250 by any convenient means such as a spring 252. Each time the shaft 24 makes half a revolution, the pawl 242 advances to the next tooth 240 and drags the box 222 along the platform 220 during the retracting movement of the pawl. Thus the compartments 233 are successively moved over the opening 236 so that their contents may fall through the opening. Since two or more batches of soap are usually required for a complete washing cycle, it is desirable to supply all of the batches in the single box 222. The individual batches may be segregated by the auxiliary partition members 234 as shown in Figure 5. In order to stop the advancing movement of the box when the compartment 233 which immediately precedes one of the partition members 234 is moved over the aperture 236, a setscrew 254 is inserted into a tooth 240 suitably related to the partition element 234. When the pawl 242 engages this tooth 240, a lug 256 engages the setscrew 254, so that, after the following retractive movement of the pawl which pulls the box along to a position in which the partition element 234 is at the edge of the opening 236, the pawl is held in retracted position by the lug 256 and the cam 250 thereupon revolves idly without moving the pawl. The pawl is thus held in an inoperative position until the time comes for the introduction of the next batch of soap into the washing machine. In order to accomplish this, the pawl 242 is lifted so as to move the lug 256 clear of the setscrew 254, thus permitting advancing movement of the pawl to engage the next successive tooth 240. Thereupon the cam 250 becomes effective to reciprocate the pawl 242 until the lug 256 engages the next setscrew 254. Mechanism for releasing the pawl is illustrated in Figures 5 and 7 and consists of a cam member 260 mounted on the shaft 44. This cam has a series of high points 262 which successively engage a pin 266 mounted on a rocking arm 268. When the pin 266 rides up on one of the high points of the cam 260, as illustrated in Figure 7, the pin engages the under edge of the pawl 242 and raises the pawl so that the lug 256 clears the setscrew 254. The shaft 44 is soon advanced another step so as to lower the pin 266, permitting the lug 256 to engage the next setscrew 254 when it is reached as the box 222 is moved along the platform 220.

The shaft 44 is driven by any suitable mechanism. As shown in Figure 2, a ratchet wheel 270 is mounted thereon and is engaged by a pawl 272 pivoted on an arm 274 which is loosely mounted on the shaft 44. The arm 274 is connected by a rod 276 to a drop arm 36 provided for the purpose of driving the shaft 44. When this drop arm is released by a corresponding lug 88 on the timing drum 32, it swings down and up again in contact with the cylinder 26. This operation serves to advance the shaft 44 by an angle corresponding to one tooth of the ratchet wheel 270.

In addition to controlling the depth of the several pools in the washing machine by moving the pins 212 into contact with the member 176, the rotation of the shaft 44 has other functions including the periodic rotation of a shaft 280 to operate means for supplying blue, bleach and sour to the washing machine. To this end, a bell crank 282 is loosely mounted on the shaft 182, this bell crank having an arm 284 located in the path of a number of pins 286 mounted on a disk 288 which is secured to the shaft 44. As the shaft and disk rotate, the successive pins 286 rock the bell crank 282 and thus reciprocate a pawl 290 which engages a ratchet wheel 292 mounted on the shaft 280. Rotation of the shaft 280 controls the supply of liquid laundering materials such as blue, bleach and sour, to the washing machine. Suitable quantities of such liquids may be placed in a tank 294 on the frame 20. This tank is provided with partitions forming three separate compartments, or three individual tanks may be employed. Each compartment or individual tank has an outlet 296 through its bottom communicating with a soft rubber tube 298 which projects into a trough 300. In the apparatus illustrated, this trough is L-shaped and extends under the aperture 236 in the

platform 220 so as to receive the soap which falls through this aperture from the box 222. The three discharge tubes 298 are normally pinched between a fixed rod 302 and a series of pressers 304 so as to retain the several liquids in the tank 294 until needed in the washing machine. Mounted on the shaft 280 are cam elements 306 which are adapted to rock corresponding levers 308 which are loosely mounted on a shaft 310 and which carry at their lower ends the respective presser elements 304. Springs 312 may be employed to press the elements 304 against the respective discharge tubes 298, as indicated in Figure 10. The cam elements 306 are arranged at different angles on the shaft 280, so that, when step-by-step rotation is imparted to the shaft 280 by the pawl 290, the cam elements are successively brought into operative contact with their respective levers 308 so that the three tubes 298 are successively released at the proper times in the washing cycle. The presser elements are retained in their retracted positions, after the tubes 298 have all been released, until the tank has been rinsed as hereinafter described, so that all of the tubes are open for the escape of the rinse water from all of the compartments of the tank. A hand wheel 314 may be mounted on the shaft 280 to facilitate setting the shaft 280 in its proper angular position at the beginning of a washing cycle.

As indicated in Figures 10 and 13, the water supply which passes through the valves 120 and 122 for the washing machine enters a vertical up-take 320 and passes into a horizontal delivery pipe 322 through a constriction in the pipe formed by an apertured diaphragm 324. The pipe 322 leads into the washing machine casing 21. A nozzle 326 is connected through a suitable trap 328 to the trough 300 and projects centrally through the aperture in the diaphragm 324. The trap prevents the escape of steam or moist vapor from the washing machine into the trough 300. As indicated in Figure 11, the diaphragm 324 consists of a pair of overlapping plates which slide in grooves and are adjustable toward and from each other by means of adjusting screws 329 so as to vary the clearance between the edges of the opening and the nozzle 326. The plates of the diaphragm 324 are initially adjusted when a machine is installed, in order to adapt the opening in the diaphragm to the local water pressure. No further adjustment is then required if pressure conditions in the supply system remain the same. The arrangement of the nozzle 326 results in a hollow cylinder of water flowing past the end of the nozzle when washing materials are being supplied therethrough from the trough 300. In order to carry the soap effectively to the nozzle 326, a pipe 330 is led from the up-take 320 to a nozzle 332 in the trough 300 directed toward the trap 328. A branch pipe 334 is also connected to the pipe 330 and leads to a spray pipe 336 arranged along the upper edges of the trough 300 in the vicinity of the aperture 236. Another branch 338 of the pipe 330 leads to an outlet 340 at the upper end of the trough 300 so as to wash down the liquid materials which are discharged into the trough from the tank 294. Since the pipe 330 leads from the up-take 320, it is evident that the water supplied therethrough for flushing the trough 300 flows only when the valve 120 or 122 is open. The timing mechanism on the machine is arranged so that the washing materials, such as soap and the like, are discharged into the trough 300 only during such times as water is being supplied to the machine.

In order to rinse out the tank 294 at the close of the washing cycle, a spray pipe 342 is located over the tank. This pipe is connected to an auxiliary water valve 344 (Figures 1 and 13), this valve being connected by a supply pipe 346 to the hot-water supply. The valve 344 is opened by a reciprocable stem 348 attached to a lever 350. This lever is rocked by a cam lug 352 mounted on the shaft 44 so as to rotate therewith. During this rinsing of the tank, all of the tubes 298 are open for the escape of the rinse water.

In Figures 14 and 15 is illustrated a modified form of mechanism for tripping the water valves when the water level in the pool has reached its desired height. The apparatus illustrated in Figure 1 for this purpose is effective, but the water which enters the cylinder 160 to raise the float 164 is entirely wasted since it is not useful in the washing operation. The aggregate amount of the water thus wasted is considerable in the course of a day's operation. In order to avoid such waste the pipe 162 is led horizontally from the washing machine at the level of the surface of the shallowest pool to be employed in the machine. This pipe has an open end under which is supported a small cup 360. The cup is supported at the end of a pair of arms 362 which are adapted to rock about a pivot 364. A flap valve 366 is located within the pipe 162 and is connected to the arms 362, so that, when the cup is in the elevated position shown in Figure 15, the flap 366 is open, but, when the cup descends to the position shown in dotted lines, the flap valve closes the pipe 162 and engages a fixed lug 368 within the pipe. In the operation of the machine, when the water in the washing machine casing reaches the level of the pipe 162, it begins to trickle through this pipe into the cup 360. When the cup is nearly full, the weight of the water therein is sufficient to rock the levers 362 and to pull down a rod 370 connected therewith. As indicated in Figure 14, the rod 370 is connected to an arm 372 mounted on the shaft 182. Thus the shaft 182 is rocked as hereinbefore described so as to cause the supporting members 42 for the drop arms 36 controlling the water valves to be rocked for the release of these arms, whereby the water valves are closed. To provide for the formation of deeper pools in the washing machine, as for rinsing or the like, the end portion of the pipe 162 is in the form of a U-bend 380 which is normally in a substantially horizontal plane. This end portion is swiveled as at 382 so that it can be swung upwardly to a position such as is shown in dotted lines in Figure 14. When in such elevated position, the water must rise to a correspondingly greater height before it can flow past the bend of the U-shaped portion and enter the cup 360. Automatic control of the U-shaped portion 380 may be had by means of mechanism illustrated in Figure 14, comprising a rod 383 attached to the U-shaped portion 380 at one end and to a rocking lever 384 at its upper end. The lever 384 is provided with a nose 386 engageable by the cam pins 212 on the disk 214. Thus, when the shaft 44 is rotated so as to bring any of the pins 212 into engagement with the nose 386 of the lever 384, the U-shaped portion 380 of the pipe 162 is elevated to provide for a deeper pool in the washing machine. The cup 360 is preferably provided with an aperture in its bottom normally

closed by a valve element **390**. This valve element has a stem **392** projecting downwardly therefrom and arranged to hit against the floor or other stationary object when the cup descends. This permits the accumulated water within the cup **360** to drain therefrom. The empty cup is then ready to be raised to its elevated position by the engagement of the lug **202** with the pin **200** on the arm **190** (Figure 4) when the rod **134** is next raised to open a water supply valve.

In using the herein described apparatus, the operator puts the box **222** in the position indicated in Figure 5 and fills the same with comminuted soap. Liquid laundering materials in suitable quantities are put in the proper compartments of the tank **294**. The shafts **30** and **280** are manually turned, if necessary, to the angular positions they should have at the beginning of a washing cycle. Assuming that the articles to be washed have been already put in the machine, the motor **50** is started. The operation of the mechanism from that time until the end of the complete cycle is entirely automatic. The setting of the lugs **88** on the timing drum **32**, together with the rate of drive of the timing drum, determines the intervals between the operations of various parts of the mechanism. Pools of water are successively formed in and discharged from the machine, the means for supplying the laundering materials being timed to introduce such materials only at such times as water is flowing into the machine. The machine is preferably supplied with a stopping device (not shown) which acts automatically to stop the motor **50** at the conclusion of a complete cycle, such devices being well known. Thus, when the machine is once started, it needs no attention on the part of the operator until the washed articles are ready to be removed therefrom.

It is evident that various modifications and changes may be made in the apparatus herein shown and described without departing from the spirit or scope of the invention defined in the following claims.

I claim:

1. In a washing machine control mechanism having a cylinder rotating about an eccentric horizontal axis, a pivoted drop arm above said cylinder and engaged thereby when the cylinder reaches its maximum elevation in rotating about said axis, and a supporting member having a shoulder normally engaged under a lug on said arm to support the arm in elevated position; means for synchronizing the release of said arm with the rotation of said cylinder, said means including a rockable bell-crank having one portion engageable by said cylinder to rock the bell-crank with each revolution of the cylinder and a second portion movable by rocking of the bell-crank to and from an arm-supporting position beneath said lug, and means for moving said supporting member at predetermined intervals to disengage said shoulder from said lug, whereby upon such disengagement the arm is temporarily supported by the bell-crank unless said disengagement occurs at the moment when said cylinder is at its maximum elevation.

2. In a washing machine control mechanism having a cylinder rotating about an eccentric horizontal axis and a pivoted drop arm above said cylinder and engaged thereby when the cylinder reaches its maximum elevation in its rotation about said axis; support means for said arm comprising an upright lever pivoted below said arm, said lever having a shoulder engaging said arm to support the same in elevated position, and an auxiliary support member consisting of a bell-crank pivotally mounted on said lever, one portion of said bell-crank being engageable by said cylinder to rock the bell-crank each time the cylinder reaches its maximum elevation, said bell-crank having another portion normally in position to support said drop arm but movable from and to said supporting position by rocking movement of the bell-crank.

3. In a washing machine control mechanism having a drop arm pivoted at one end and with an operative connection at the other end, and an up-and-downwardly oscillating member engageable by said arm to lower and raise said arm; a supporting member on which said arm normally rests to maintain said arm in an elevated position, and an auxiliary supporting member moving in synchronism with said oscillating member to and from an arm-supporting position, said members being timed so that said auxiliary member momentarily moves away from its arm-supporting position each time the oscillating member reaches its uppermost position.

4. In a washing machine control mechanism having a drop arm pivoted at one end and with an operative connection at the other end, and an up-and-downwardly oscillating member engageable by said arm to lower and raise said arm; a supporting member on which said arm normally rests to maintain said arm in an elevated position, and an auxiliary supporting member normally in arm-supporting position but momentarily moved from such position by said oscillating member each time said oscillating member reaches its uppermost position.

5. Apparatus of the class described, comprising a water valve having a stem movable longitudinally to open and close the valve, means yieldably tending to move said stem to close the valve, a continuously driven oscillating member normally disconnected from said stem, and connecting means including an element engageable by said member to move said stem to open valve position during a predetermined single stroke of said member in one direction, said connecting means being effective during a predetermined single stroke of said member in the opposite direction to limit positively the rate of closing movement of the valve.

6. Apparatus of the class described, comprising a water valve having a part movable in opposite directions to open and close the valve, means yieldably tending to move said part to close the valve, a continuously driven oscillating member normally disconnected from said valve, and automatic means for operatively connecting said member and part during a predetermined single stroke of said member in one direction to open said valve and during a predetermined single stroke of said member in the other direction to limit positively the rate of closing movement of said valve.

7. Apparatus of the class described, comprising a water valve having a stem movable longitudinally to open and close the valve, means yieldably tending to move said valve toward closed position, and means for operating said valve, said operating means including a power-driven member having an oscillating movement and means for operatively connecting said member with said valve stem for positive valve-opening movement of said stem during a stroke of said member and permissive valve-closing movement of said stem

at a limited rate during a reverse stroke of said member and for automatically disconnecting said member and valve stem at the conclusion of each said stroke.

8. Apparatus of the class described, comprising a water valve having a stem movable longitudinally to open and close the valve, operating means for imparting to said stem simple harmonic opening and closing movements, and means for automatically causing said operating means to open the valve at a predetermined time and to close the valve when a predetermined condition is attained by means of the water discharged from said valve.

9. In control mechanism for a washing machine including a container for a pool of wash water and a water supply valve; a cylinder rotating on an eccentric horizontal axis, a drop arm engaged by said cylinder each time it reaches its maximum elevation in rotating about said axis, means connectible with said arm to open said valve when said arm with said means connected thereto is raised to an elevated position by said cylinder and to hold said valve open until said arm and means are lowered, means normally supporting said arm in said elevated position, and means responsive to the rising of the water in said pool to a predetermined level to release said supporting means.

10. A control mechanism for a washing machine having a container for a pool of washing water, a water supply valve and means for operating said valve; means responsive to the rising of the water in said pool to a predetermined level to cause valve-closing operation of said operating means, said responsive means including a rocking lever, a small receptacle supported on said lever and adapted to rock said lever when filled with water, means automatically operating upon the rocking of said lever to empty said receptacle, and means for automatically restoring said lever and receptacle to their original position after a predetermined interval of time.

11. In a control mechanism for a washing machine having a container for a pool of washing water, a water supply valve and means for operating said valve; means responsive to the rising of the water in said pool to predetermined levels to cause valve-closing operation of said operating means, said responsive means including a rocking lever, a small receptacle supported on said lever and adapted to rock said lever when filled with water, a U-shaped length of pipe having one end swivelly connected to said container and the other end in line with the axis of the swivel connection and immediately above said receptacle, and means for adjustably elevating the elbow of said pipe to different levels.

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