Aug. 11, 1942. D. HAYS 2,292,833

WASHING MACHINE

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Fig. 1.

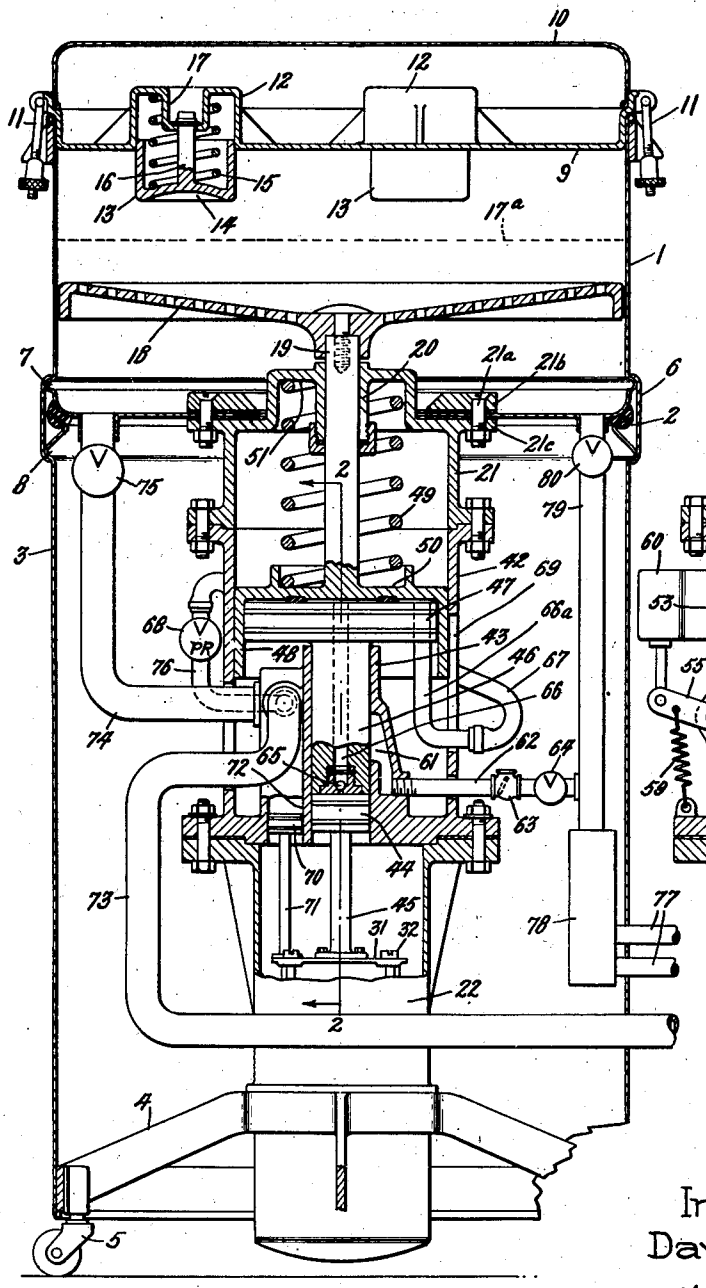
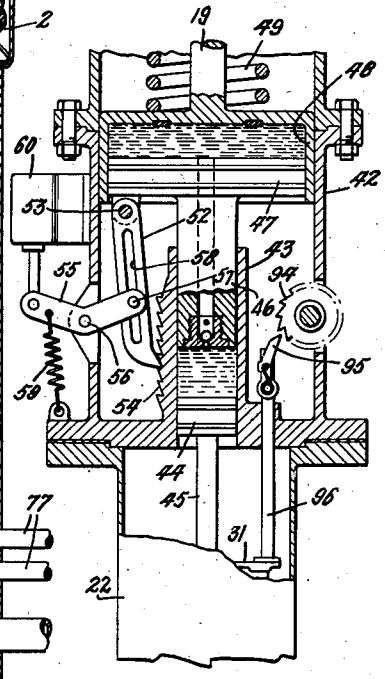


Fig. 2.



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Fig. 3.

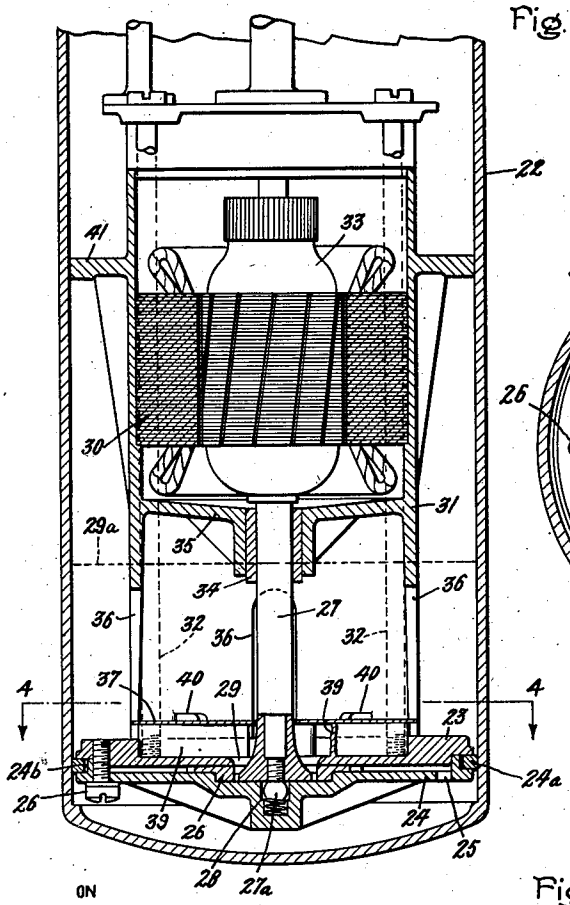


Fig. 4.

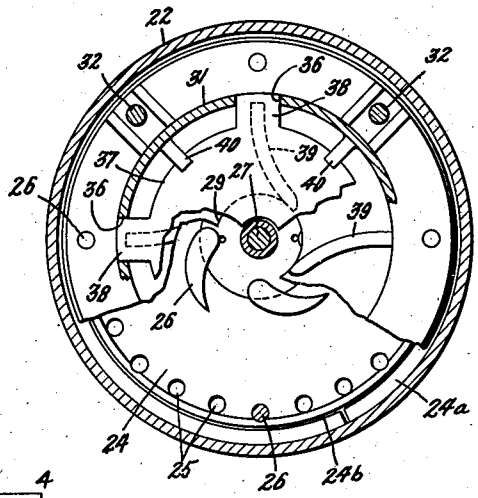
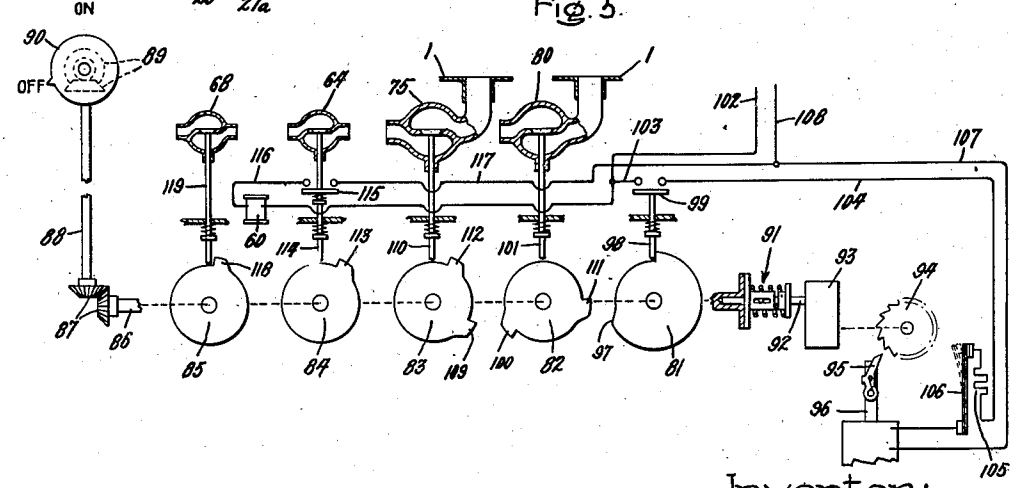


Fig. 5.



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UNITED STATES PATENT OFFICE

2,292,833

WASHING MACHINE

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Application September 24, 1940, Serial No. 358,119

8 Claims. (Cl. 68—21)

The present invention relates to washing machines of the type in which clothes are washed and dried in a single compartment.

The object of my invention is to provide an improved construction and arrangement in machines of this type in which washing and drying are effected by a piston-like member which has a squeezing action on the clothes.

For a consideration of what I believe novel and my invention, attention is directed to the following description and the drawings appended thereto.

In the accompanying drawings, Fig. 1 is a sectional elevation of a washing machine embodying my invention, the parts being in position for washing; Fig. 2 is a fragmentary sectional view taken on line 2—2 of Fig. 1, the parts being in the position for wringing or drying; Fig. 3 is a sectional elevation of the power unit for operating the machine; Fig. 4 is a sectional view taken on line 4—4 of Fig. 3 partly broken away to show the construction of the impeller and its casing; and Fig. 5 is a diagrammatic view of the automatic control for the washing machine.

Referring to the drawings there is shown a washing machine having a tub 1 resting at its lower edge on a rubber bead 2 on the upper end of a skirt 3, enclosing the driving mechanism for the machine. At the lower end of the skirt is fixed a frame 4 in which are carried casters 5. The tub 1 is fastened to and wedged against the upper edge of the skirt by a clamping band 6 cooperating with beads 7 and 8, respectively, on the tub and skirt.

The upper end of the tub is closed by a cover comprising a casting 9 and a sheet metal part 10, enclosing the upper side thereof. The cover is held on the tub by suitable catches 11. In the casting 9 are a plurality of cylindrical sockets 12 slidably receiving agitating members 13, the lower ends 14 of which are concave so as to serve as suction cups. The agitating members are biased downwardly by coil springs 15 surrounding stems 16 on the agitating members which are slidably carried in projections 17 in the top walls of the sockets 12. The agitating members 13 when in their lowered position are slightly above the normal water level in the tub, which is indicated by the dotted line 17a.

In the lower part of the tub is a perforated disk 18 carried by a piston rod 19 guided in a bearing 20 in a cylinder 21 fixed to the bottom of the tub by bolts 21a extending through a clamping ring 21b and a flange 21c on the cylinder 21. During washing the piston rod 19 is reciprocated toward and away from the agitating members 13 by mechanism hereinafter described alternately squeezing and releasing the clothes therebetween. On the up-stroke some of the liquid is drained through the perforations in the disk 18, but enough of the liquid remains between the disk and the agitating members so that the clothes are suspended therein. On the down-stroke of the disk 18, the concave surfaces 14 of the agitating members act as suction cups tending to hold a portion of the clothes in contact therewith and thereby produce a change in distribution or turnover of the clothes in the washing liquid. In effect the cover 9 is an abutment against which the clothes are squeezed. At the conclusion of the washing operation the disk 18 is moved upward by mechanism hereinafter described under a steady pressure to squeeze the clothes against the cover 9 and remove the liquid. During this operation the disk 18 is above the liquid level in the tub and the liquid squeezed from the clothes accordingly drains through the perforations in the disk. The pressure is sufficient to move the agitating members to the bottom of the sockets 12 in which position they are substantially flush with the lower surface of the cover.

The machine is operated by a hydraulic power unit carried in a cylinder 22 supported in the frame 4. As shown in Figs. 3 and 4, the power unit has a piston head in the lower part of the cylinder 22 comprising an upper disk 23 and a lower disk 24. The disk 24 is provided with a plurality of openings 25 around its periphery, through a suitable number of which extend studs 26a for clamping the disks 23 and 24 together. A piston ring 24a is carried in a groove 24b between the disks 23 and 24. The disks 23 and 24 are spaced apart at the center to provide a housing for a centrifugal impeller 26 mounted on a shaft 27. The impeller is supported between the disks by a spring-pressed ball thrust bearing 27a arranged in a socket 28 in the disk 24. The upper disk 23 is provided with an inlet opening 29 around the shaft 27. The openings 25 in the lower disk 24 serve as discharge openings. The cylinder 22 is filled to a level indicated by the dotted line 29a with a liquid which is preferably a light lubricating oil. When the impeller is rotated, oil is drawn in from the upper side of the piston head through the inlet opening 29 and is discharged through the openings 25 on the lower side of the piston head, causing the piston head to be moved upward until the resistance to further upward movement balances the

pressure created by the impeller. When the impeller is stationary, oil flows back through the impeller from the under side of the piston head, allowing the piston head to move downward in the cylinder.

The impeller is rotated by an electric motor comprising a stationary member 30 carried in a cylindrical housing 31 fixed to the upper side of the disk 23 by through bolts 32 and a rotating member 33 carried on the shaft 27. The shaft is guided at its lower end in a bearing 34 carried in a wall 35 which serves as a bottom closure for the motor. When the piston head is in its lower position, as illustrated in Fig. 3, the lower end of the bearing 34 is submerged in the oil contained in the cylinder 22. This serves to lubricate the bearing. The housing 31 is provided with inlet openings 36 through which the oil flows to the impeller. Swirling of the oil above the inlet to the impeller is prevented by a baffle plate 37 having tongues 38 fitting in the inlet openings 36. The baffle plate 37 rests on deflectors 39 integral with the upper side of the disk 23 and is held in this position by projections 40 on the housing 31 which extend over the upper surface of the baffle 37 and clamp the baffle against the deflectors. The upper end of the housing 31 is provided with a guide flange 41 which prevents tilting of the piston in the cylinder 22 during its reciprocation.

Between the cylinders 21 and 22 is a cylinder 42 fixed at its upper end to the cylinder 21 and at its lower end to the cylinder 22. The cylinders 21, 42, and 22 accordingly constitute a rigid frame connected between the bottom of the tub 1 and the frame 4 at the lower end of the skirt 3. Integral with the lower end of the cylinder 42 is a cylinder 43 slidably receiving a piston 44 connected by a rod 45 to the upper end of the housing 31. Also slidably received in the cylinder 43 is a hollow cylinder 46 fixed at its upper end to a piston 47. The piston 47 is received in a cylinder 48 which is slidable in the cylinder 42 and is fixed to the lower end of the rod 19. During washing, a coil spring 49 surrounding the rod 19 and arranged between a seat 50 in the upper side of the cylinder 48 and a seat 51 in the cylinder 21, biases the cylinder 48 downward and holds the cylinder 48, piston 47, the cylinder 46, and the piston 44 together so that these parts move as a unit. When the motor of the hydraulic power unit is energized, the rod 19 and the disk 18 attached thereto are accordingly moved toward the top of the tub 1 until the resistance to further movement balances the pressure created by the impeller 26. When the motor is deenergized, the spring 49 returns the parts to the lowered position. The reciprocating movement of the disk 18 may accordingly be effected by merely opening and closing the motor switch.

During wringing, the disk 18 must be forced upward under a much heavier pressure than that required for washing. It is accordingly necessary that some means be provided for multiplying the pressure developed by the hydraulic power unit. In the present construction this is accomplished by locking the piston 47 in its raised position at the end of the up-stroke during washing and thereafter using the reciprocation of the piston 44 to pump liquid through the hollow cylinder 46 of the piston 47 to the space between the piston 47 and the cylinder 48. Due to the larger area of the piston 47 the pressure transmitted to the disk 18 is multiplied. This is accomplished by a pawl 52 pivoted at 53 on the under side of the piston 47. The pawl is moved toward and away from ratchet teeth 54 on the cylinder 43 by a lever 55 pivoted intermediate its ends at 56 on the cylinder 42 and having a pin 57 at one end cooperating with a slot 58 in the pawl. A spring 59 connected to the opposite end of the lever 55 biases the lever in the direction to move the pawl away from the ratchet teeth 54. The pawl is moved into engagement with the ratchet teeth by a solenoid 60 which, when energized, overcomes the force of the biasing spring 59 and pivots the lever 55 in a clockwise direction as viewed in Fig. 2.

From one aspect, the piston 47 and the associated parts comprise a jack by means of which the relatively light pressure of the piston rod 45 is multiplied to the relatively heavy pressure required for wringing. From this aspect, the piston 47 and the cylinder 48 are the pressure transmitting members of the jack and the piston 44 is the operating member.

The ratchet teeth 54 permit the pawl to move upwardly relative thereto, but prevent any downward movement. Accordingly, if the pawl engages the ratchet teeth before the piston rod 45 reaches its uppermost position, the piston 47 is moved upwardly until the resistance offered to further upward movement of the disk 18 balances the pressure exerted by the piston rod 45 and the piston 47 is thereafter held in this position by the pawl 52. On the down-stroke of the piston rod 45, liquid is supplied to the space between the upper end of the piston 44 and the lower end of the cylinder 46 through a port 61 in the cylinder 43. The liquid is conducted to the port 61 through a conduit 62 having a check valve 63 and a shut-off valve 64 therein. On the succeeding up-stroke of the piston rod 45, the liquid between the piston 44 and the lower end of the cylinder 46 is forced upward through a ball check valve 65 at the lower end of a passage 66 extending up through the cylinder 46 to the space between the upper end of the piston 47 and the cylinder 48. The ball check valve 65 prevents the reverse flow so by successive reciprocations of the piston 44 the cylinder 48 is moved upward in the cylinder 42 under a relatively heavy pressure to squeeze the liquid from the clothes. The relative areas of the pistons 44 and 47 are preferably so related that the maximum pressure exerted on the cylinder 48 cannot exceed a safe value. However, to take care of excessive pressures which might be developed under some conditions, the space between the piston 47 and the cylinder 48 is connected by a conduit 66*a* carried by the piston 47 and a flexible hose 67 to a pressure relief valve 68. The conduit 66*a* extends out through a slot 69 in the cylinder 42.

The reciprocation of the hydraulic power unit is also used to operate a pump for emptying the tub. This pump comprises a piston 70 connected by a piston rod 71 to the upper end of the reciprocating housing 31 of the hydraulic power unit. The piston fits in a cylinder 72 integral with the cylinder 42. Upon reciprocation of the piston 70, liquid is pumped to a drain through a conduit 73. The pump is connected to the bottom of the tub through a conduit 74 having a valve 75 therein and is also connected to the discharge side of the pressure relief valve 68 by a conduit 76.

Liquid is supplied to the washing machine from hot and cold water pipes 77 through a thermostatic mixing valve 78 to a conduit 79 connected through a valve 80 to the bottom of the tub.

Between the valves 78 and 80 the conduit 79 is connected to the conduit 62 which supplies the liquid for developing the wringing pressure.

The washing machine is controlled by a series of cams 81, 82, 83, 84, and 85 fixed to a cam shaft 86 connected through bevel gears 87, shaft 88, and bevel gears 89 to a dial 90. The shaft 86 is also connected through a friction clutch 91 to a shaft 92 rotated through a gear train 93 driven by a ratchet wheel 94. Upon each upward stroke of the hydraulic power unit, a pawl 95 carried on the upper end of a rod 96 connected to the housing 31 engages the ratchet wheel 94 and moves it through an angle corresponding to one tooth of the ratchet wheel. On the down-stroke of the hydraulic power unit, the pawl slips over the inclined faces of the ratchet teeth, and the ratchet wheel accordingly remains stationary. The rotation of the cam shaft 86 and of the dial 90 is accordingly proportional to the number of strokes of the hydraulic power unit.

In the use of the machine, the cover 9 is removed and the clothes to be washed are loaded in the tub while the dial 90 is in the "Off" position as illustrated in Fig. 5. After the cover has been fastened in place, the control knob is turned in a clockwise direction until the pointer 96 of the dial is opposite "On." This rotation of the control knob causes the cam shaft 86 to be rotated in a clockwise direction, bringing a projection 97 on the cam 81 beneath a plunger 98 of a switch 99, lifting the plunger and thereby moving the switch to the closed position. At the same time a projection 100 on the cam 82 lifts a plunger 101 to open the valve 80 controlling the inlet conduit 79. Water accordingly flows into the tub from the hot and cold water pipes 77. The closure of the switch 99 completes a circuit to the motor of the hydraulic power unit extending from a conductor 102 connected to one side of a power line through conductor 103, switch 99, conductor 104, heater element 105, and a thermostatic switch 106 to the motor and from the motor through conductor 107 and conductor 108 to the other side of the power line. The motor rotates the impeller 26, drawing oil in through the inlet 29 and discharging the oil through the discharge openings 25, causing an upward movement of the piston of the hydraulic power unit, which upward movement continues until the resistance balances the fluid pressure created by the impeller. The closing of the motor circuit energizes the heating element 105 which, after a short interval, causes the opening of the thermostatic switch 105 to open the motor circuit. The opening of the thermostatic switch preferably occurs after the hydraulic operator has reached its uppermost position. Upon opening of the motor circuit, the hydraulic operator is returned to its lowermost position, partly by gravity and partly by the force of the coil spring 49. During the return movement, oil flows in through the openings 25 through the impeller and out through the opening 29 to the upper side of the piston head. The opening of the motor circuit deenergizes the heating element 105, allowing cooling of the thermostatic switch so that it returns to the closed position. The rate of reciprocation of the hydraulic power unit is determined by the heating and cooling of the thermostatic switch 106 which serves as a timer. On each upward stroke of the hydraulic power unit the pawl 95 engages the ratchet wheel 94 and turns it through an angle corresponding to that occupied by one tooth. The ratch wheel 94 acting through the gear train 93 and the shaft 92 causes a corresponding rotation of the cam shaft 86 in a clockwise direction as viewed in Fig. 5. The filling of the tub continues until the projection 100 is moved clear of the plunger 101, permitting the closure of the valve 80. At this time the tub is filled to the proper level with water and the clothes are washed by the reciprocating movement of the disk 18 toward and away from the cover of the machine. It is noted that the reciprocating movement of the disk 18 starts at the same time as the admission of water to the machine. While the washing action is not as effective until the machine is filled to the proper level, the clothes will not be damaged. The clothes are washed until a projection 109 on the cam 83 engages a plunger 110 and opens the drain valve 75, permitting the liquid in the tub to flow through the conduit 74 to the cylinder 72 whence it is pumped through conduit 73 to a drain by the reciprocation of the piston 70. When the projection 109 is moved clear of the plunger 110, the drain valve 75 is closed and at the same time the inlet valve 80 is opened by a projection 111 on the cam 82. The opening of the inlet valve admits fresh water for rinsing. When the rinsing operation is completed, drain valve 75 is again opened by a projection 112 on the cam 83, and the valve 64 is opened by a projection 113 on the cam 84 which engages a plunger 114. The plunger 114 also carries a switch 115 which is moved to the closed position when the valve 64 is opened, energizing the solenoid 60 through a circuit which extends from conductor 102 to the solenoid and from the solenoid through conductor 116, switch 115, and conductors 117 and 108. The solenoid moves the pawl 52 into engagement with the ratchet teeth 54 and holds the piston 47 in its uppermost position. During the continued reciprocation of the hydraulic power unit, liquid is drawn in through the valves 63 and 64 and the conduit 62 and is pumped through the passage 66 to the space between the piston 47 and the cylinder 48. This causes upward movement of the disk 18 under an increased pressure. During the downward movement of the hydraulic power unit, the cylinder 48 is held in its raised position by the ball check valve 65 which prevents reverse flow. Since the drain valve 75 is open, any liquid squeezed from the clothes will be pumped to the drain. When the wringing operation is over, the valve 68 is opened by a projection 118 on the cam 85 which cooperates with a plunger 119. The opening of the valve 68 conducts the liquid from the space between the cylinder 47 and the piston 48 to the cylinder 72, whence it is pumped to the drain. After the projection 118 is moved clear of the plunger 119, the projection 97 on the cam 81 moves clear of the plunger 97 of the switch 99, opening the motor circuit. The machine is now in the "off" position and, after removal of the clothes which have been washed and dried, is ready for a succeeding cycle of operations.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a washing machine, a tub for receiving liquid and clothes, an abutment extending across the tub above the bottom thereof, a suction cup movable relative to the abutment toward and away from the bottom of the tub, said suction cup occupying only part of the area of the abutment, spring means biasing the suction cup toward the bottom of the tub, and means for reciprocating the liquid and clothes toward and

away from the suction cup and abutment whereby the clothes are squeezed against the abutment and suction cup.

2. In a washing machine, a tub for receiving liquid and clothes, an abutment extending across the tub above the bottom thereof and having a downwardly facing recess therein, an agitating member retractable into said recess, spring means biasing said member out of said recess, and means for reciprocating the liquid and clothes in the tub toward and away from said abutment.

3. In a washing machine, a tub for receiving liquid and clothes to be washed, an abutment in the tub, a member in the tub reciprocable toward and away from the abutment, a reciprocating piston, a connection between said piston and said member comprising a larger piston and cylinder, means for holding said larger piston and cylinder together during washing whereby said member is reciprocated toward and away from said abutment to alternately squeeze and release the clothes therebetween, and means effective during wringing for utilizing the reciprocation of said first piston to build up a fluid pressure between said larger piston and cylinder to move said member toward said abutment under a relatively high pressure.

4. In a combined washer and wringer, a tub for receiving liquid and clothes, means including a reciprocable member for alternately squeezing and releasing the clothes for washing, means for reciprocating said member including a reciprocating power member, jack means connected between said members for utilizing the reciprocation of said power member to build up a steady relatively high pressure on said reciprocable member to squeeze the clothes for wringing, and means for holding said jack and said members together during washing whereby said members reciprocate as a unit during washing.

5. In a washing machine, a tub for receiving liquid and clothes to be washed, a closed top for the tub, a perforate member in the tub, a reciprocating piston, a connection between said piston and said member comprising a larger piston and cylinder, means for holding said larger piston and cylinder together during washing whereby said member is reciprocated toward and away from the top to alternately squeeze and release the clothes therebetween, and means effective during wringing for utilizing the reciprocation of said first piston to build up a fluid pressure between said larger piston and cylinder to move said member toward the top of the tub under a relatively high pressure.

6. In a washing machine, a tub having a closed top, a reciprocatory member in the tub movable toward and away from the top of the tub for agitating the clothes, a piston below the tub connected to said member for reciprocating the same, an electric motor driven fluid pump arranged when energized to develop a fluid pressure to move said piston and when deenergized to release said fluid pressure, means for intermittently opening and closing the motor circuit, a timer for controlling the washing machine, a ratchet drive for the timer, and means operated by said piston for driving said ratchet.

7. In a washing machine, a tub having a closed top, a reciprocatory member in the tub movable toward and away from the top of the tub for agitating the clothes, a piston below the tub connected to said member for reciprocating the same, an electric motor driven fluid pump arranged when energized to develop a fluid pressure to move said piston and when deenergized to release said fluid pressure, and means for intermittently opening and closing the motor circuit.

8. In a washing machine, a tub for receiving liquid and clothes to be washed, an abutment in the tub, a member in the tub reciprocable toward and away from said abutment to alternately squeeze and release the clothes therebetween, a reciprocating power member, jack means having a pressure transmitting member connected to said reciprocable member, a second pressure transmitting member connectible to the tub, and an operating member connected to said power member, means for holding said jack means and said members together during washing whereby said reciprocable member is reciprocated toward and away from said abutment to alternately squeeze and release the clothes therebetween, and means for connecting said second pressure transmitting member to the tub during wringing whereby said reciprocable member is jacked toward said abutment under a relatively high pressure.

DAVID HAYS.