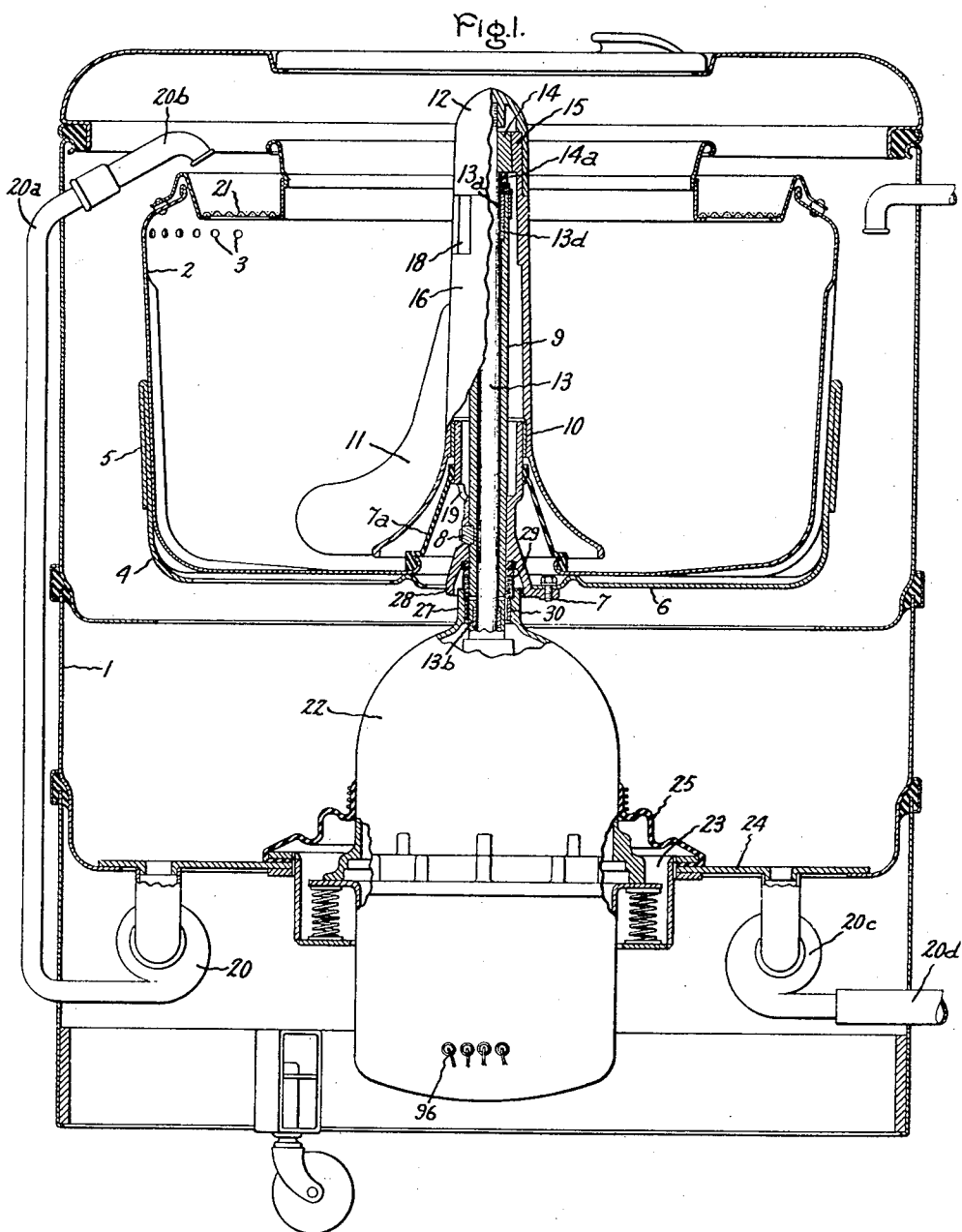


Nov. 6, 1951 C. A. RUBANO 2,574,418
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TYPE WASHING MACHINES AND THE LIKE
Filed Aug. 25, 1944 2 SHEETS—SHEET 1

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Inventor:
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His Attorney.

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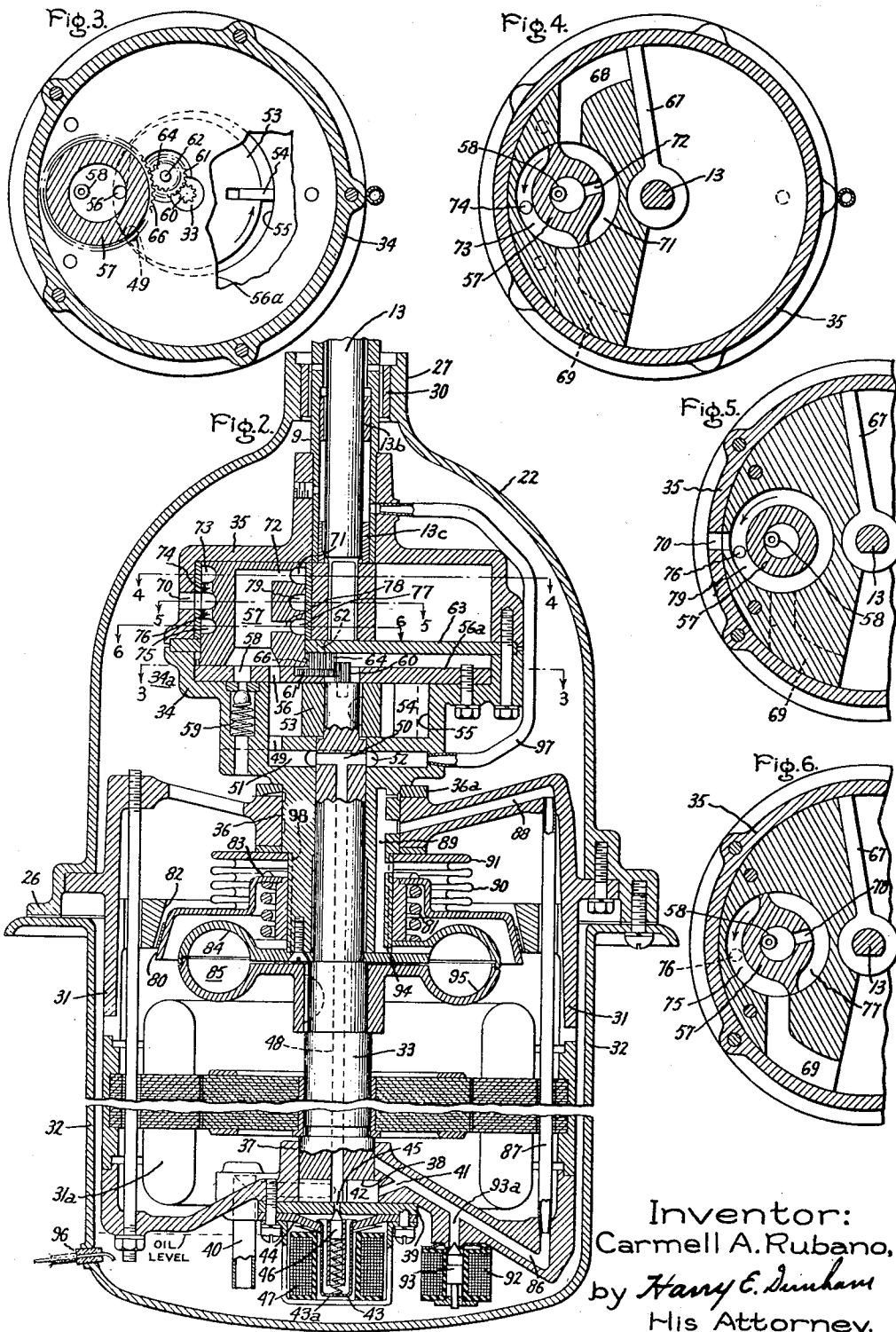
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2 SHEETS--SHEET 2



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UNITED STATES PATENT OFFICE

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HYDRAULIC MOTOR ACTUATED MECHANISM FOR SPINNER TYPE WASHING MACHINES AND THE LIKE

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16 Claims. (Cl. 60-53)

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The present invention relates to washing and drying machines and is particularly concerned with a hydraulic driving mechanism adapted for mounting within a sealed casing containing a lifetime supply of oil.

The object of my invention is to provide an improved construction and arrangement in washing machines of this type, and for a consideration of what I believe novel and my invention attention is directed to the following description and the claims appended thereto.

In the accompanying drawing, Fig. 1 is a sectional elevation of a washing machine embodying my invention; Fig. 2 is a sectional elevation of the driving mechanism; and Figs. 3, 4, 5, and 6 are sectional views taken on lines 3-3, 4-4, 5-5, and 6-6 of Fig. 2.

Referring to Fig. 1 of the drawing, there is shown a washing machine of the construction disclosed in application S. N. 551,096, Woodson, filed August 25, 1944, now Patent No. 2,527,238, having an outer casing or tub 1 in the upper part of which is located a spinner basket 2 having centrifugal discharge openings 3 at the region of greatest diameter which during washing are at or slightly above the liquid level. The spinner basket is non-rotatably seated in a carrier 4 having annular walls 5 surrounding the basket and serving as a balance ring and having radial arms 6 bolted to a hub 7 fixed by a clamp 8 to a tubular shaft 9 for driving the spinner basket. The space between the basket and the hub is sealed by a rubber sleeve 7a having its upper end fixed to the hub and its lower end fixed to the basket. At the upper end of the hub is a bearing 10 for the lower end of a bladed agitator 11 fastened by a nut 12 to the upper end of a drive shaft 13 journaled in bearings 13a, 13b in the spinner shaft 9. An oil retaining felt ring 13d is associated with the bearing 13a. The shaft 13 has fixed thereto an agitator drive nut 14 fitting in a complementary socket 15 in the agitator hub 16. A shaft seal 14a is provided between the upper ends of the spinner and agitator shafts 9 and 13.

In the agitator hub 16 at or slightly below the wash water level in the spinner basket are drain passages 18 leading to the space between the spinner shaft 9 and the agitator hub 16. The water draining through these passages flows through the space between the shaft 9 and the agitator hub and through passages 19 in the carrier hub 7 to the bottom of the outer casing 1 whence it is pumped onto an annular filter 21 on the rim of the spinner basket by a circulating pump 20. The pump has its inlet connected to

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the lowermost part of the casing and its discharge connected to a conduit 20a having a nozzle 20b directed onto the filter. The pump is operated during washing so the wash water is continually withdrawn from the spinner basket through the passages 18 and 19 (and possibly openings 3) and returned to the basket through the filter 21. The continuous circulation and filtering of the water removes lint and other particles and keeps the wash water clean. The amount of wash water flowing through the passages 18 and 19 automatically adjusts itself to the capacity of the pump 20 by slight variation of the wash water level. If the pump should fail to operate, the wash water level would fall only slightly below the lower edges of the openings 18 which is only slightly less than the desired water level for washing. There is also provided a drain pump 20c having its inlet connected to the lowermost part of the outer casing 1 and its discharge connected to a conduit 20d leading to a drain.

The concentric spinner and agitator drive shafts 9 and 13 are driven by mechanism enclosed within a sealed casing 22 having its upper end projecting through opening 23 in the bottom wall 24 of the outer casing. The space between the casing 22 and the wall 24 is sealed by a flexible annular rubber ring 25 having its inner edge clamped to the casing 22 and its outer edge clamped to the wall 24. The ring 25 serves not only as a seal but as a flexible connection preventing the transmission of vibrations to the outer casing. The upper end of the casing 22, which is above the maximum water level in the outer casing 1, is provided with a reduced hub 27 which projects within a skirt 28 at the lower end of the hub 7 and is provided with a seal 29 and a sleeve bearing 30 for the spinner shaft 9.

During both washing and centrifugal drying the upper part of the gear casing 22 is cooled by the wash water. During washing, the wash water falls onto the upper end of the gear casing from the passages 19. During centrifugal drying, the wash water discharged through the centrifugal discharge openings 3 falls into the bottom of the outer casing and partially submerges the upper end of the gear casing.

The driving motor 31a for the machine is carried in a frame 31 fastened to the under side of a flange 26 at the center of the gear casing 22 and enclosed by a shell 32 (also fastened to the flange 26) which forms the lower part of the gear casing. The motor shaft 33 is journaled at its upper end in the cylinder of a hydraulic motor 34a. The lower half 34 of the motor cylinder is

journaled in a bearing 36 in the motor frame 31 and the upper half 35 is fixed to the spinner shaft 9. The weight of the spinner basket and contents is carried on a thrust washer 35a at the upper end of the bearing 36. The lower end of the motor shaft 33 is journaled in a bearing 37 in the frame 31. The lower end of the bearing 37 is provided with an eccentric bore 38 closed by a plate 39 and forming the housing of a vane type rotary oil pump. The oil pump housing is connected with a sump at the bottom of the shell 32 by a suction intake 40 and is provided with a pressure discharge passage 41. The rotor of the pump consists of the extreme lower end of the motor shaft 33 which is slotted to receive vanes 42 which are held by centrifugal force against the bore 38. On the under side of the plate 39 is a chamber formed between a dished member 44 and the under side of the plate. Fixed in the member 44 is a tube 43 coaxial with a port 45 in the plate 39 normally closed by a spring biased plunger 46 of a solenoid valve 47 mounted on the under side of the plate 39. When the solenoid valve is energized, the plunger 46 is moved downward opening the port 45 to connect a drilled passage 48 in the motor shaft to the oil sump at the bottom of the shell 32 through an opening 43a in the lower end of the tube 43. The passage 48 feeds an eccentric vane pump having an intake passage 49 fed through passage 50 in the shaft and passages 51 and groove 52 in part 34. The rotor of the pump comprises a cylinder 53 keyed to the motor shaft having diametrically opposed slots receiving vanes 54 (Fig. 3) which are thrown out by centrifugal force against an eccentric bore 55 in the part 34. The pump discharge is through a passage 56 in a plate 56a to the interior of a rotary valve 57 connected through a passage 58 to a pressure relief valve 59. In Fig. 2 for purposes of illustration, intake passage 49 is shown as being located in the plane of the section on which Fig. 2 is taken and in line with discharge passage 56. Actually, passages 49 and 56 are not in alignment, the passage 49 being out of alignment with passage 56 as shown in Fig. 3, this being a well known arrangement of inlet and outlet ports in a vane type eccentric pump such as that illustrated. The valve 57 is rotated through reduction gearing comprising a pinion 60 on the motor shaft meshing with a gear 61 on a stub shaft 62 fixed in a plate 63 clamped between the cylinder parts 34 and 35. Integral with the gear 61 is a pinion 64 meshing with a gear 66 cut in a flange at the lower end of the valve 57. When the motor shaft 33 is running at its full speed the valve 57 is rotated at the speed at which the agitator should be oscillated. In this construction where the agitator is to be oscillated at 60 oscillations per minute the valve 57 is rotated at a speed of 60 R. P. M. During each revolution of the valve, oil is admitted first to one and then to the opposite side of a vane piston 67 fixed to the lower end of the agitator shaft 13. During the rotation of the valve 57, passages 68 and 69 on opposite sides of the vane piston 67 are alternately connected to the discharge passage 56 of the fluid pump and to a discharge passage 70, causing oscillation of the piston through the angular range permitted by the design of the cylinder (slightly over 180 degrees in the present construction). The oil discharged from the passage 70 is sprayed over the inner walls of the casing 22 for cooling purposes. If the agitator encounters an exceptionally heavy load, the vane

piston may not oscillate the agitator through the full stroke.

The operation of the valve is more easily explained with reference to Figs. 4, 5, and 6 which are sectional views of the upper, middle, and lower valve ports which are connected respectively to the passages 68, 70, and 69. The upper section of the valve (Fig. 4) has a semicircular groove 71 connected through a passage 72 and the interior of valve 57 to the discharge passage 56 of the fluid pump and a semicircular groove 73 connected through a port 74 to an annular groove 79 at the middle section of the valve which at all times communicates with discharge passage 70. In the position illustrated, pressure is supplied from discharge passage 56 to the passage 68 so as to cause clockwise movement of the vane piston 67 as viewed in Fig. 4. The lower section of the valve (Fig. 6) comprises a semicircular groove 75 connected through a port 76 to the middle section of the valve and a semicircular groove 77 connected through a passage 78 and the interior of valve 57 to the discharge passage 56 on the fluid pump. In the position illustrated, the passage 69 on the opposite side of the piston 67 is connected through the groove 75 and the port 76 to the annular groove 79 at the middle section of the valve (Fig. 5). When the valve turns 180 degrees in a counterclockwise direction from the position illustrated, the passage 68 is connected to the discharge passage 70 and the passage 69 is connected to the pump discharge passage 56. This results in a hydraulic oscillation of the agitator. Oscillation of the agitator may be stopped by cutting off the supply to the agitator pump intake by deenergizing the solenoid valve 47 at the lower end of the motor shaft. The spring pressed plunger 46 then closes the port 45. The agitator will oscillate only when the solenoid valve 47 is energized to open port 45. While the maximum stroke is fixed by the construction of the cylinder, the stroke may be less than maximum dependent upon the agitator load. If the valve plunger 46 partly closes the port 45 when the solenoid valve is deenergized, the agitator would have two strokes, a full stroke when the solenoid valve is energized and the port 45 is fully open and a shorter stroke when the solenoid valve is deenergized and the agitator pump intake port 45 is partially closed by the plunger 46. The shorter stroke would be useful in washing more delicate clothes.

Splined on the lower end of the lower half 34 of the hydraulic agitator driving motor as is indicated at 98 is a conical brake member 80 urged by a coil spring 81 into engagement with a complementary brake surface 82 on the motor frame 31. The spring 81 is arranged between a flange 83 on the brake member 80 and the upper half 84 of a kinetic type fluid coupling 85. When the brake surfaces are engaged, the cylinder of hydraulic motor 34a and the spinner basket are held against rotation and the agitator may be oscillated for washing.

The brake is released to permit rotation of the spinner basket by oil supplied from the pump at the lower end of shaft 33 through passages 86, 87, 88, and 89 to the interior of a bellows 90 having its upper end 91 fixed to the lower part 34 of the cylinder 34a and having its lower end fixed to the brake member 80. The oil pressure supplied to the bellows is controlled by a normally open solenoid valve 92 having a plunger 93 which controls the oil flow through a passage

93a leading from the passage 86. When the solenoid valve 92 is deenergized, the passage 93a is open, bleeding oil from the passage 86 so the oil pressure is insufficient to expand the bellows. When the valve is energized, the passage 93a is closed and the pressure in the passage 86 builds up to a value sufficient to expand the bellows, forcing the brake member 80 downward clear of the brake surface 82. The lower end of the oil passage 89 communicates through a passage 94 with the interior of the fluid coupling 85. Upon supplying oil to the fluid coupling, a hydraulic drive is established through the lower half 95 of the coupling which is keyed to the motor shaft 33 to the upper half 84 of the coupling which is connected to the spinner basket through its connection with the cylinder of hydraulic motor 34a. The hydraulic coupling results in a smooth and quiet acceleration of the spinner basket.

Since both the agitator and spinner basket drive depend upon oil pressure, neither can be established until the motor is running. This decreases the motor starting load and further prevents damage due to failure of the power supply while the control is in either the washing or spinning position. All of the parts are enclosed in a sealed casing which contains a lifetime supply of oil which is used for full pressure lubrication of bearings, for the control of the washing and drying operations, and for cooling the motor and mechanism.

The power leads for the motor and the solenoid valves are led into the sealed casing through glass-to-metal seals 96, and the control is effected through remote switches (not shown) in the leads. The motor switch may be closed at all times. For washing, the solenoid valve 47 is energized and valve 92 is deenergized. For centrifugal drying, the solenoid valve 47 is deenergized (or not if desired) and the solenoid valve 92 is energized. If the valve 47 is energized during drying, the agitator oscillates at a gradually decreasing speed as the spinner basket accelerates and will cease oscillation when the spinner basket reaches full centrifugal drying speed. The machine is stopped by deenergizing the motor.

The agitator shaft bearings 13a, 13b, are pressure-lubricated through a tube 97 which will be supplied with oil under pressure during washing. During spinning if the valve 47 is deenergized, the oil pressure to the tube 97 will drop so the bearings will have to be designed to run during spinning without additional oil.

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

1. In combination, two members to be driven, a hydraulic motor having a rotatably mounted cylinder connected to one of said members, a piston connected to the other of said members and power driven valve means for admitting hydraulic pressure alternately on one side and the other of said piston for oscillating said other member; a motor driven shaft; hydraulic pump means driven by said shaft; a hydraulic coupling between the shaft and the cylinder for coupling the cylinder to the shaft for rotation thereby; and valve means for directing fluid from said pump means to the coupling and to the hydraulic motor.

2. In combination, two members to be driven, a hydraulic motor having a rotatable cylinder connected to one of said members, a piston within said cylinder connected to the other of said members and a power driven valve for directing hydraulic pressure alternately on one side and the

other of said piston to drive the same for oscillation of its associated member, a source of hydraulic pressure, a drive shaft, a kinetic type fluid coupling between said shaft and said cylinder, a brake for restricting rotation of said cylinder, a hydraulic operator for releasing said brake upon supply of hydraulic pressure thereto, valve means for supplying fluid to said operator and coupling to release the brake and effect driving connection between the drive shaft and the cylinder, and means for supplying fluid to the motor via the valve thereof for operation of said piston.

3. In combination, two members to be driven, a hydraulic motor having a rotatable cylinder connected to one of said members and a reciprocating piston, connected to the other of said members, a brake for said cylinder, a drive shaft, a source of hydraulic pressure, valve means driven by said shaft for directing hydraulic pressure into said cylinder to effect reciprocation of said piston, a kinetic type fluid coupling between said shaft and said cylinder, a hydraulic operator for releasing the brake upon the supplying of fluid thereto, a fluid passage from the hydraulic operator to the coupling, means for supplying fluid pressure to the hydraulic operator and to said passage to effect release of said brake and connection of the drive shaft to said cylinder, and means for supplying fluid pressure to the hydraulic motor to effect reciprocation of the piston.

4. In a machine having a rotatable member and an associated reciprocatory member, a sealed casing containing an oil pump, a hydraulic motor for operating the reciprocatory member, a power shaft, a hydraulic coupling between said power shaft and said rotatable member, valve means controlling the supply of oil from the pump to the motor and to the coupling for effecting reciprocation of said reciprocatory member and rotation of said rotatable member and a brake for restraining rotation of said rotatable member during periods of operation of said reciprocating member.

5. The combination with two members to be driven, of a hydraulic motor comprising a rotatable cylinder and a movable piston in the cylinder, means connecting the rotatable cylinder to one of said members, means connecting the piston to the other of said members, a brake for holding the rotatable cylinder stationary when the piston is actuated, a driving motor, a fluid pump driven by the driving motor, power driven valve means connecting the discharge side of the fluid pump to the hydraulic motor to effect operation of said movable piston to operate the one member connected thereto, a second fluid pump driven by said driving motor, valve means at the discharge side of said second pump to control fluid to said first named pump, fluid actuated means operable to release said brake, a fluid coupling through which said driving motor is connected to said rotatable cylinder, and means for supplying fluid pressure to said fluid actuated means and to said fluid coupling to release said brake and effect a driving connection between said driving motor and said rotatable cylinder and valve means for controlling said fluid pressure supply to said fluid actuated means and fluid coupling.

6. The combination with a first member to be rotated and a second member to be oscillated, of a hydraulic motor comprising a rotatable cylinder connected to the first member and an oscillatable piston in the cylinder connected to the second member, a brake for holding the rotatable

cylinder stationary when the piston is oscillated, a driving motor, fluid pump means driven by the driving motor, valve means driven by said driving motor and through which fluid discharging from said pump means is connected to said cylinder to effect oscillation of said piston, fluid pressure actuated means for releasing said brake and connecting the driving motor to said cylinder to effect rotation of said first member, and means for supplying fluid pressure from said pump means to said fluid pressure actuated means.

7. For use in a washing machine or the like, the combination of a pair of shafts and mechanism for effecting oscillation of one shaft and rotation of the other comprising a stationary support having a bearing, a casing supported in said bearing for rotation therein, a fluid pump in said casing, a motor for driving said pump, fluid motor means in said casing connected to said shaft means, a valve within said casing and driven by said pump drive motor to direct fluid supplied by said pump means to said fluid motor means for effecting oscillation of said one shaft, a brake for said casing for holding it from rotation in said bearing, hydraulic pressure means for effecting release of said brake, means for supplying pressure to said brake release means and means operated by fluid from said brake release means for effecting the rotation of said casing and said other shaft when the brake is released.

8. In a washing machine or the like, the combination of a first member to be oscillated, a second member to be rotated, a stationary support having a bearing, a casing supported in said bearing for rotation therein, means connecting said second member to said casing, fluid pump means in said casing, a motor for said pump means, fluid motor means in said casing connected to said first member and actuated by fluid supplied by said pump means for effecting oscillation of said first member, a brake for said casing for holding it from rotation in said bearing, hydraulically operated means for effecting release of said brake, fluid coupling means for effecting the rotation of said casing and said second member by said pump drive motor when the brake is released and means for supplying fluid to said coupling and to said brake release means.

9. For use in a washing machine or the like, a stationary support having a bearing, a combined fluid pump and fluid actuated motor means having a casing rotatably mounted in said bearing, said pump supplying fluid to said motor means for actuating it, a motor for driving said pump, a brake biased to engaged position for holding said casing stationary, a fluid coupling connection between said casing and said pump drive motor, a first member to be oscillated, a second member to be rotated, means connecting the fluid motor means to said first member for effecting oscillation of such member, means connecting said casing to said second member for rotation thereof, and means for effecting release of said brake and connection of said casing to said pump drive motor to effect rotation of said casing, said means including a hydraulic cylinder acting directly on said brake to disengage the same and means for supplying fluid under pressure to said cylinder and to said coupling.

10. For use in a washing machine or the like, a stationary support having a bearing, a combined fluid pump and fluid actuated motor means

having a casing rotatably mounted in said bearing, said pump supplying fluid to said fluid actuated motor means for actuating it, an electric motor for operating said pump, a brake for holding said casing stationary, a first member to be oscillated, a second member to be rotated, means connecting the fluid motor means to said first member for effecting oscillation of such member, means including a kinetic type fluid coupling connecting said casing to said second member, and means for effecting release of said brake and rotation of said casing by said electric motor for rotating said second member.

11. For use in a washing machine or the like, a stationary support having a bearing, a combined fluid pump and fluid actuated motor means having a casing rotatably mounted in said bearing, said pump supplying fluid to said motor means for actuating it, a brake for holding said casing stationary, a hydraulic actuator for releasing said brake, a shaft to be oscillated, a shaft to be rotated, means connecting the motor means to the first-named shaft for effecting oscillation of such shaft, means connecting said casing to said second-named shaft, an electric motor for operating said pump to generate pressure fluid to drive said fluid motor for oscillation of said first-named shaft and for rotating said casing to effect rotation of said second-named shaft, a second motor driven pump, and valve means for directing pressure fluid from said second pump to said brake actuating means for releasing said brake when the casing is to be rotated.

12. For use in a washing machine or the like, a stationary support having a bearing, a combined fluid pump and fluid actuated motor means having a casing rotatably mounted in said bearing, said pump supplying fluid to said motor means for actuating it, a first member to be oscillated, a second member to be rotated, means connecting the motor means to the first member for effecting oscillation of such member, means connecting said casing to said second member, a brake for holding said casing stationary when said first member is to be oscillated, an electric motor for operating said pump to effect oscillation of said first member and for rotating said casing to effect rotation of said second member and means for releasing said brake.

13. For use in a washing machine or the like, a stationary support having a bearing, a combined fluid pump and fluid actuated motor means having a casing rotatably mounted in said bearing, said pump supplying fluid to said motor means for actuating it, a shaft to be oscillated, a shaft to be rotated, means connecting the motor means to the first-named shaft for effecting oscillation of such shaft, fluid coupling means connecting said casing to said second-named shaft, a brake to hold said casing against rotation during oscillation of said shaft, an electric motor for operating said pump to effect oscillation of said first-named shaft and for supplying fluid to said coupling for rotating said casing to effect rotation of said second-named shaft and means for releasing said brake.

14. For use in a clothes washing machine, concentric shafts, mechanism including electric motor driving means and coupling means including an oscillatable mechanism for connecting said driving means to one of said shafts for effecting oscillation of such shaft and a kinetic type fluid coupling for connecting said driving means to the other of said shafts for effecting rotation

thereof, hydraulically controlled means for braking said other shaft during oscillation of said first named shaft, and means including a source of hydraulic pressure and an externally controllable valve means for directing fluid under pressure to said brake means and supplying said kinetic coupling.

15. A mechanism for selectively driving a pair of shafts comprising electric motor driving means, coupling means including an oscillatable mechanism for connecting said motor driving means to one of said shafts for effecting oscillation of said shaft, kinetic type fluid coupling means for connecting said motor driving means to the second of said shafts for effecting rotation thereof, brake means for said second shaft, means biasing said brake into engaged position during oscillation of said first named shaft to restrain rotation of said second shaft, and control means operative to render ineffective said first shaft coupling means and to disengage said brake means for rotating said second shaft.

16. For use in a clothes washing machine, a mechanism for selectively driving a pair of shafts comprising an electric motor, a power shaft

driven by said motor, an oscillatory mechanism driven by said power shaft, means connecting said oscillatory mechanism to one of said driven shafts to effect oscillation thereof, a kinetic energy type fluid coupling connecting said power shaft to the second of said driven shafts, a brake for restraining rotation of said second driven shaft, and a control system effective to release said brake to permit rotation of said second driven shaft and to engage said brake during oscillation of said first named driven shaft.

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