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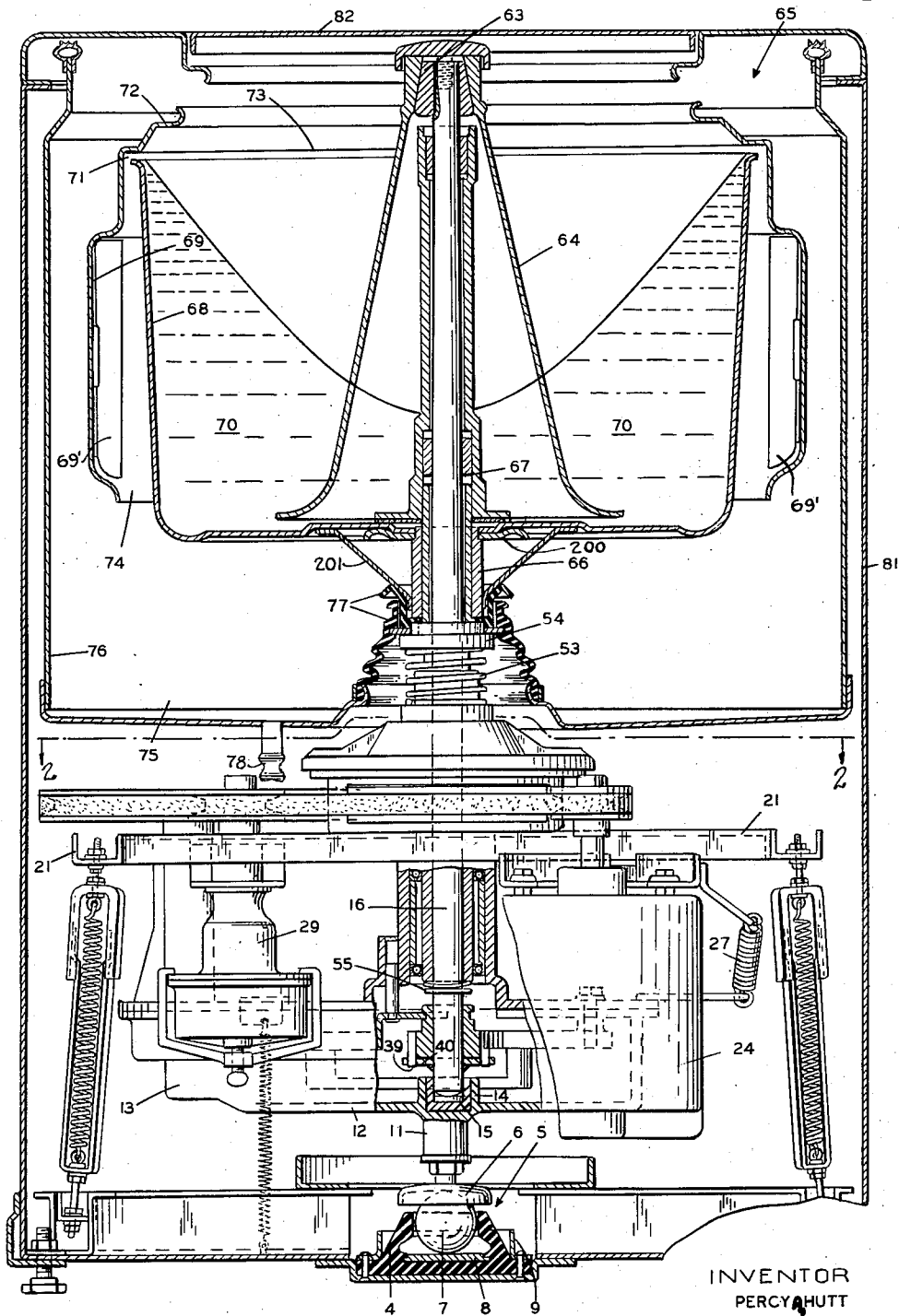
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2,969,172

CLOTHES WASHING MACHINE

Filed May 16, 1956

4 Sheets-Sheet 1



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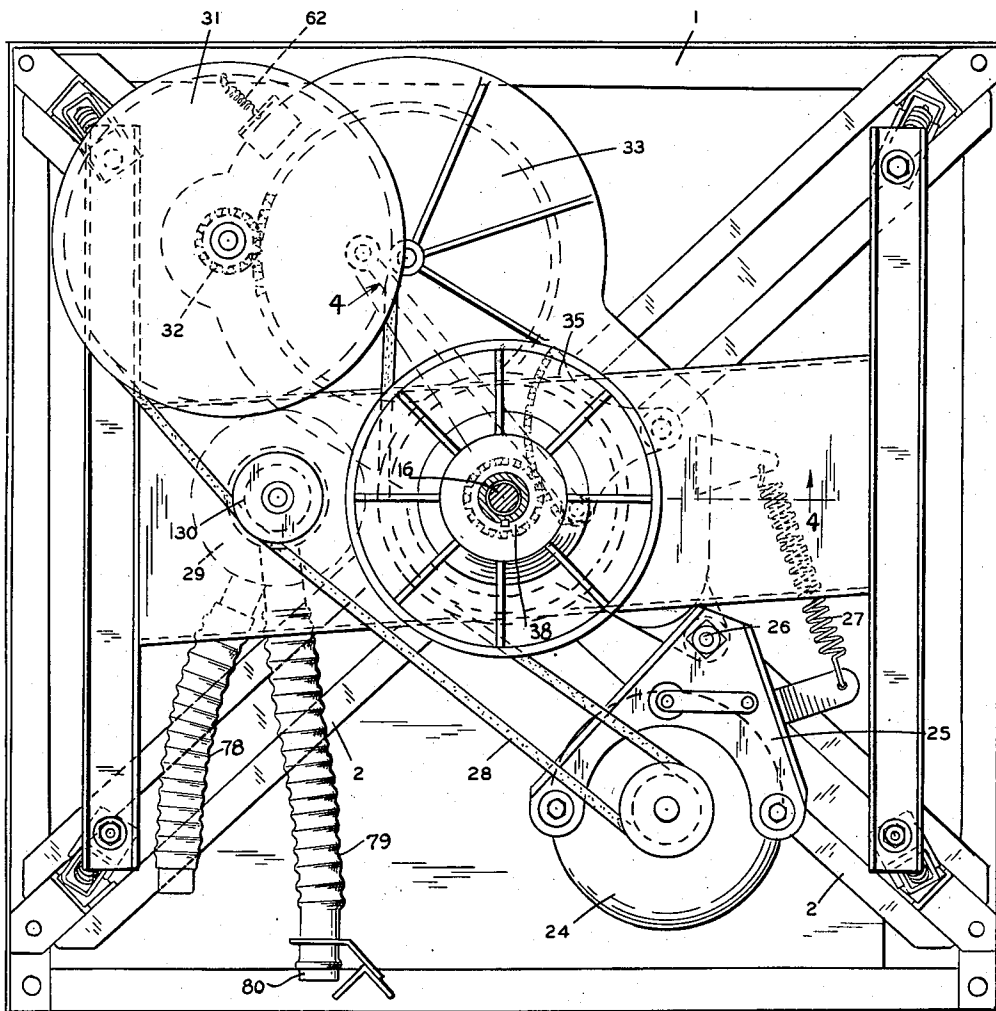


FIG. 2.

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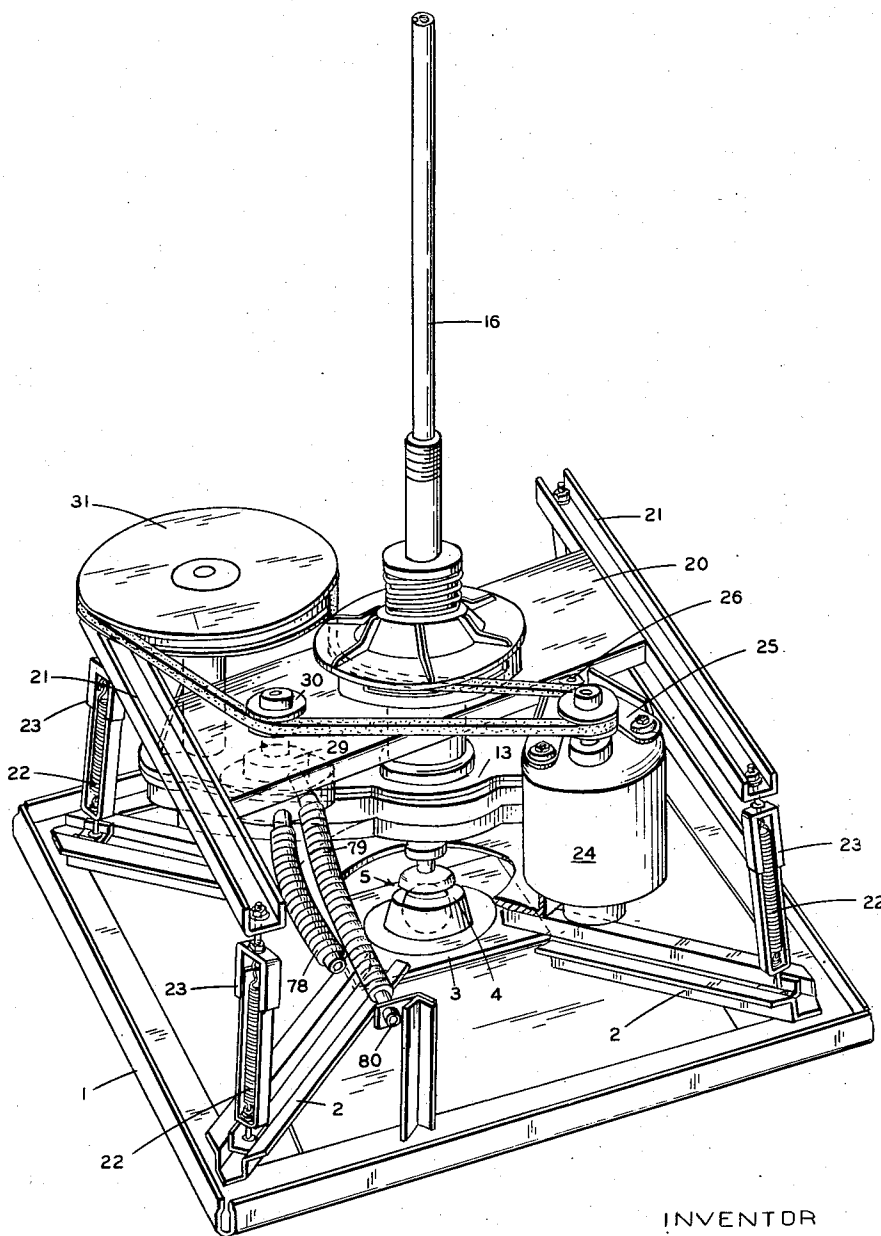


FIG. 3.

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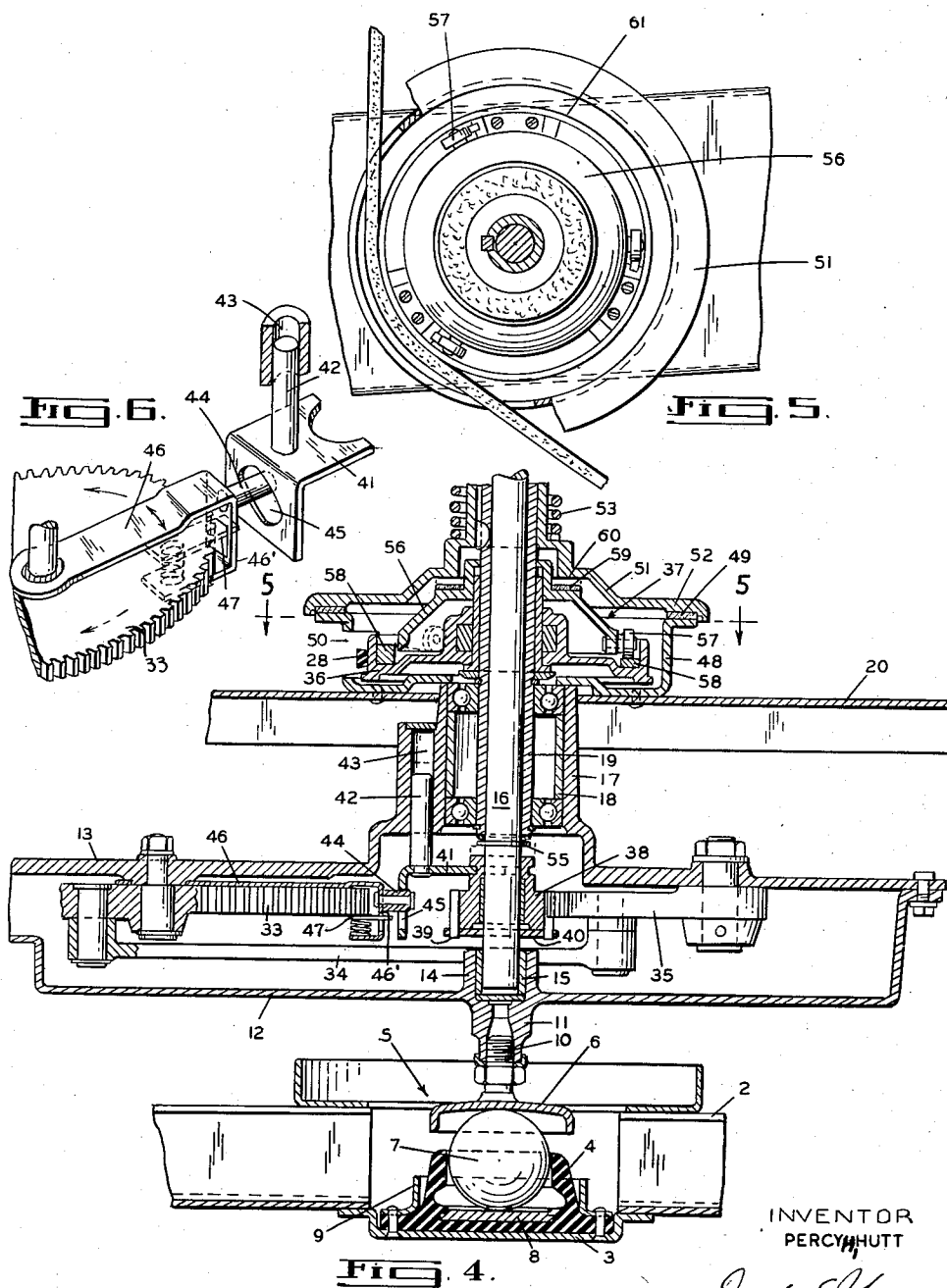
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2,969,172

CLOTHES WASHING MACHINE

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5 Claims. (Cl. 233—24)

This invention relates to improvements in washing machines of the type such as disclosed in United States Patent No. 2,700,473, dated January 25, 1955, in which the tub is rotated at a relatively high speed to extract the water from the clothes being washed.

Due to the fact that either in the initial placing of the clothes in the washing tub or as a result of displacement of the clothes in washing, there is normally a condition of tube unbalance created, steps must be taken to counteract such unbalance, or the tub will vibrate severely under rotation and may render the machine unusable.

It has previously been proposed to use the water being extracted from the clothes to counterbalance unbalance of the tub during spinning, and the object of this invention is to provide an improved tub supporting and vibration damping arrangement to enable maximum advantage to be taken of such water balancing system.

Another important object is to provide a washer which in itself will be dynamically balanced and in which the mass of the tub spinning and driving mechanism and water pumping mechanism will be utilized to assist in minimizing unbalance set up by the clothes in the tub.

According to the invention, the tub of the machine is axially supported at the upper end of a drive shaft assembly the lower end of which is supported from an axially disposed thrust bearing of special construction which will allow the lower end of the drive shaft assembly to hunt freely over a limited area to assist in the dynamic balancing of the tub as it is spun, the shaft assembly being resiliently held in the upright position by an arrangement of springs disposed symmetrically about and acting on the shaft assembly whereby the downward pull of the springs is transferred axially of the shaft assembly against the thrust bearing.

Further in accordance with the invention the actuating devices of the washer comprising the driving motor, clutch mechanism, water pump and gear assembly are all carried on a frame which is mounted on and surrounds the driving shaft below the tub and through which the springs which support the shaft in upright position act, the arrangement of the frame, springs and such devices being such that their masses are disposed to provide dynamic balance of the spinning system under tub rotation and to introduce a restoring couple to counteract dynamic unbalance as a result of uneven loading of the tub.

The invention further resides in the arrangement and construction of the various parts as hereinafter more fully described with reference to the accompanying drawings, in which:

Figure 1 is a mid-vertical sectional view of a machine constructed in accordance with the invention.

Figure 2 is a horizontal sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a perspective view illustrating the suspension of the drive mechanism of the machine according to the invention, the tub assembly and casing being removed.

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Figure 4 is an enlarged vertical section on the line 4—4 of Figure 2.

Figure 5 is an enlarged horizontal section on the line 5—5 of Figure 4, and

Figure 6 is a broken away perspective view of the clutch mechanism for controlling tub oscillation.

With reference particularly to Figures 2 and 3, at the base of the machine is an outer frame 1 provided with diagonal cross braces 2 which support at the centre thereof of a well 3 in which is seated a cup member 4 constituting one component of a thrust bearing generally designated at 5, through which the entire weight of the operating parts of the machine are transferred as hereinafter more fully described. The bearing 5 comprises in addition to the cup member 4 an inverted cup 6 and a hardened, preferably steel, ball 7. The cup member 4 is formed of a suitable resilient material such as rubber, and has seated therein and forming the bottom wall thereof a hardened plate 8 formed of a suitable material such as skate steel.

It is essential to the correct operation of the machine that the plate 8 retain its smooth uniform bearing surface throughout the life of the machine, and will resist grooving under ball rotation to provide at all times free rolling movement of the ball over the limited area within the peripheral wall of the cup 4.

The inverted cup member 6 should also be of material similar in hardness to the plate 8 to prevent grooving under ball movement. Because the cup member 4 is formed of a resilient material, it will resiliently act to urge the ball 7 to a central position, but will tolerate substantial orbital movement of the ball under bearing rotation, being capable of deforming to a limit position as determined by a surrounding stop ring 9.

The cup member 6 carries a stud bolt 10 which is threaded into a boss 11 formed on the bottom pan 12 of a gear case 13, as seen particularly in Figure 4. Disposed above the boss 11 on the pan 12 is a boss 14 having disposed therein a cup bearing 15 receiving the lower end of a shaft 16. The gear case 13 has an upward sleeve extension 17 within which is disposed a journal 18 through which extends the shaft 16 and a hollow spindle 19 sleeved on the shaft 16, the shaft being capable of being oscillated within the hollow spindle 19 as will hereinafter appear, the shaft and spindle constituting a shaft assembly.

Secured to the sleeve extension 17 of the gear case is a frame generally designated at 20 which carries the drive components for the machine. The frame 20 includes a pair of parallel end channel rails 21 and secured between the end of these rails 21 and the ends of the cross braces 2 are springs 22 enclosed by suitable sliding guides 23 which constrain spring movement. The spring 22 bias the support frame 20, components carried thereby, and gear case 13 and the components mounted therein downwardly from opposing points on opposite sides of the shaft 16 and act through the journal 18 which is located centrally of the frame 20 to maintain the shaft 16 in an upright position, the downward thrust of the springs and assemblies biased thereby being transferred to the thrust bearing 5.

Mounted on the frame 20 is a reversible motor 24 and adjustable mounting bracket 25 pivoted at 26 and biased in a counter-clockwise direction as seen in Figure 2 by spring 27. The motor 24 drives through a belt 28, a pump 29 mounted on the frame 20 through pump pulley 30, and also drives through a reduction pulley 31 and pinion 32, a gear 33 connected through an eccentric or pitman 34 to a sector gear 35, the pulley 31 being journaled on the frame 20 and the members 32 to 35 being located within the gear casing 13. The motor 24 also drives through the belt 28, one member 36 of a clutch mechanism 37 hereinafter more fully described.

The sector gear 35 meshes with a pinion 38 journaled on the shaft 16 and slidable thereon, the pinion having

teeth 39 adapted to coact with a slotted plate 40 secured to the shaft 16 to couple the shaft for oscillatory movement with the teeth 39 engaged in the slotted plate 40, and to release the shaft for rotation when the pinion, as best seen in Figure 4, is raised to clear the plate 40 to the dotted line position.

The means for actuating the pinion 38 comprises, as best seen in Figures 4 and 6, a yoke 41 guided for vertical movement by a pin 42 sliding in a bore 43 in the sleeve extension 17. Carried loosely on the support shaft of gear 33 is a pivotal arm 46 which has a U-shaped end 46' within which the edge of the gear 33 is received. Guided in a slot in the end 46' of the arm is a brake plate 47 which is spring urged against the under side of the gear 33. Carried on the end 46' of the arm is a pin 44 which engages in a diagonal slot 45 in the yoke 41. The arrangement is such that when the gear 33 turns, for instance in a clock-wise direction, the friction between the brake plate 47 and the gear 33 will cause the arm 46 to turn clock-wise with the gear which will cause a relative movement of the pin 44 and yoke 41 with the pin which is forced to travel on a fixed horizontal path camming up the yoke by virtue of the diagonal form of the yoke slot 45. When the limit position is reached, that is when the pin 44 reaches the lower end of the slot 45 the brake friction will be overcome and the arm 46 will remain stationary as the gear continues to turn. When the direction of the gear 33 is reversed, the arm 46 will, of course, also reverse its direction of travel and will cam the yoke 41 downwardly through the interengagement of the pin 44 and diagonal slot 45.

The clutch mechanism 37 is disposed within a cup member 48 fixed to the frame 20, the cup member having a flanged upper edge carrying a suitable friction material 49, and being provided with a slot 50 in its annular wall through which the belt 28 operates to drive the clutch member 36. Slidable on and keyed to the hollow spindle 19 is a cap 51 for the cup 48, having a brake surface 52 for coaction with the brake surface 49 of the cup. Cap 51 is urged by spring 53 secured beneath collar 54 to move the cap 51 into braking engagement with the cup 48, to thereby anchor spindle 19 from rotation, the spindle being held from downward movement by a suitable spring washer 55.

The clutch mechanism 47 includes, in addition to the clutch member 36 which is journaled to rotate freely about spindle 19, an upper clutch ring 56 carrying rollers 57 for coaction with inclined surfaces 58 provided on the lower clutch member 36, as best seen in Figures 4 and 5. For one direction of motor rotation, rollers 57 will run up inclined surfaces 58 to lift clutch ring 56 bringing its braking surface 59 into engagement with a corresponding surface 60 on cap 51, to lift the cap from braking engagement with the cup 48. The clutch ring 56 having moved relatively to the clutch member 36 to the extent permitted by the incline of the surfaces 58, clutch member 36 is then locked to clutch member 36, and a positive drive to the spindle 19 is imparted through the cap 51 keyed thereto.

On reversal of motor rotation, clutch member 36 will be rotated in a direction to cause the rollers 57 to roll down the inclined surfaces 58, uncoupling clutch member 56 from cap 51 and allowing spring 53 to move the cap back into braking engagement with the fixed cup 48. Suitable stops 61 are provided to limit relative movement of the clutch members 36 and 56.

It will be understood that the arrangement is such that clutch member 56 will be moved into driving engagement with cap 51 when pinion 38 is released from driving engagement with shaft 16 so that the shaft is free to rotate with the spindle 19.

The assembly so far described has the various components comprising all of the operating mechanisms of the machine, including the pump, so disposed and arranged that their centre of gravity acting through the frame 20 is substantially coincident with the axis of the shaft assembly

comprising the shaft 16 and spindle 19 so that an even tension on the springs 22 will be obtained with the shaft assembly upright. As it has been found that the motor 24 has the largest mass concentration, an adjustable spring 62 is provided to counterbalance the motor and to also accommodate slight motor shifting for belt tightening under the action of the spring 27. By so disposing and arranging the parts, the entire load of the assembly so far described, including the entire machine operating mechanisms, is transferred substantially axially of the shaft assembly to the thrust bearing 5, and on rotation of the shaft assembly there will be substantially no unbalance set up, and the ball 7 will remain substantially at the centre of its rolling surface 8.

In addition to using the mass of the entire assembly for damping of vibration as hereinafter more fully explained, the arrangement allows the use of a single main driving motor. The fact that the pump 29 is driven by the main motor in turn allows the economical use of a high capacity pump for improved machine operation.

Secured to the upper end of the shaft 16 through a suitable fitting 63 is an agitator 64 arranged within a clothes receiving tub assembly 65. The tub assembly 65 is clamped to the spindle 19 between a sleeve 66 and associated ring 200 and a stand pipe 67, both the sleeve and stand pipe being threaded onto the upper end of the spindle. The stand pipe 67 serves as a bearing support for and prevents liquid in the tub from contacting the shaft 16. A brace arrangement 201 extends between the sleeve assembly 66 and the tub to increase the tub support. The tub assembly 65 includes an inner tub 68 having an upwardly and outwardly flared wall and a surrounding ring 69 supported in any suitable manner (not shown) from an in spaced relation to the upper edge of the tub 68. The ring 69 forms a chamber to receive liquid 70 centrifuged outwardly as illustrated in Figure 1 through the annular passage 71, defined between the upper edge of the tub 68 and the ring, under tub rotation.

The ring 69 has an inwardly directed upper wall 72 forming an annular lip to prevent upward discharge of the centrifuged liquid and defining an opening 73 through which clothes are disposed in the tub 68. The ring 69 is provided with suitable baffles 69' to restrict free circulation of water in the chamber defined by the ring 69. The lower end of the ring 69 provides an annular discharge passage 74 which is disposed radially inwardly of the main wall of the ring and provides a discharge path for the water received in the ring 69 to a waste chamber 75, defined by an enclosing housing 76.

A flexible membrane seal 77 is provided to prevent water accumulating in chamber 75 from escaping down the spindle and shaft assembly. Water discharged into chamber 75 is led through a suitable flexible hose connection 78 to the inlet of pump 29 and from the outlet of pump 29 through a flexible hose connection 79 to a fixed discharge pipe 80, Figure 2.

As shown in Figure 1, a suitable housing 81 with lid closure 82 is provided and it will be understood that the control of the machine may be effected through manual or automatic controls, not shown, as desired.

In operation, in the washing cycle, the tub assembly 65 is held against rotation by the brake between the cap 51 and cup 48, and the shaft 16 is oscillated to oscillate the agitator 64. During the liquid extraction cycle, as above explained, the oscillating drive to the shaft 16 is released and the brake between cap 51 and cup member 48 interrupted, and the cap 51, and through the cap spindle 19, are rotated by means of the frictional drive set up between the clutch ring 56 and the cap, such release of shaft drive and commencement of spindle drive being effected by simply reversing the direction of motor rotation. As the tub assembly commences to rotate, the agitator 64 and shaft 16 will also rotate and the liquid in the tub will assume the parabolic configuration illustrated in Figure 1. If the clothes in the tub 68 are symmetrically

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disposed or equally balanced, the centre of gravity will coincide with the axis of the shaft 16, and the tub will spin about this axis without any vibration or wobble. As in practice, perfectly balanced conditions are never achieved, there will be an unbalance in the tub and the centre of gravity of the load will shift to a point displaced from the axis of the shaft 16. There is thus created a vibration or wobble in the assembly, and it is recognized that under such conditions any water centrifuged outwardly from the inner tub 68 through the passage 71 to the chamber 69 will collect at the side of the tub after the tub has passed a certain critical speed to counteract the unbalance of the mass in the tub, and to minimize vibration set up by such unbalance and reflected through the machine by the wobble of the shaft or spin axis.

By the provision of the baffles in the ring 69, free circulation of the balancing liquid centrifuged outwardly from the inner tub 68, is prevented to eliminate surge unbalance. Also, by having the discharge passage 74 disposed inwardly from the outermost peripheral wall of the ring 69, sufficient liquid is retained in the ring 69 to effect counterbalancing of the mass unbalance in the tub until the tub assembly is decelerated and brought substantially to a stop.

While the balancing effect of liquid in a balancing ring surrounding the clothes chamber or tub is an important factor in minimizing vibration, one of the important features of the present invention is the freeing of the lower end of the axis of spin, that is, the drive shaft assembly comprising shaft 16 and spindle 19 for substantially free orbital movement. Such movement as above described corresponds to the movement of the ball 7 over the surface of the plate 8 within the wall of the resilient cup 4 and substantially to the extent of the permitted deformation of this cup.

With the arrangement as above described, the lower end of the spin axis or drive shaft assembly moves in an orbital path as it hunts under the gyroscopic effects of the spinning assembly to minimize the unbalancing forces. This hunting is dampened, not only by the resilient wall of the cup member 4, but also by the balanced mass supported from the bearing 5 through the frame 20 and comprising the drive components for the machine.

Preferably the frame 20 has the component parts thereof, including the channel rails 21 formed as stampings having a degree of flexibility, and the flexibility of this frame, coupled with the action of the springs 22, further augments the damping of the vibratory orbital movement of the spinning assembly, yet enables the free rolling of the ball 7 on the plate 8, and as well on the surface of the inverted cup 6 to iron out or counteract the unbalanced vibrations of the machine.

It has been found that, by combining with the water balance occurring in the chamber 69, the damping effect resulting from the freeing of the lower end of the spin axis for orbital movement as controlled by the damping springs and flexible frame which in itself with its components is directly balanced, a machine having remarkably little vibration tendency can be produced.

It will be understood that various modifications in the specific details of construction and arrangement of the parts may be made without departing from the spirit of the invention, and within the scope of the appended claims.

What I claim as my invention is:

1. A washing machine comprising a fixed frame, an upright rotatable tub, rigid support means supporting said tub at a substantially fixed height above a bearing point on said frame, said support means comprising an upright shaft assembly forming an axial extension depending from said tub to said bearing point and supporting said tub for both tilting and lateral movement in unison, a sub-assembly supporting frame having a centrally disposed journal through which said shaft assembly extends at a point intermediately of its height, said sub-assembly supporting frame being supported at a substantially fixed height

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above said bearing point by said shaft assembly, a drive mechanism and a clutch mechanism for driving said tub in rotation through said shaft assembly, a pump, and a motor provided with a drive pulley for driving said drive mechanism and pump, said motor being mounted on said sub-assembly supporting frame on one side of said shaft, said drive mechanism comprising a pulley and gear means in driven connection therewith mounted on said sub-assembly supporting frame on the side of said shaft substantially opposite to said motor and said pump being mounted on said sub-assembly supporting frame on the side of said shaft towards said pulley, said pump having a pulley drive, and said clutch mechanism comprising a pulley member concentric with said shaft, the arrangement being such that the center of gravity of said sub-assembly supporting frame substantially coincides with the axis of said shaft assembly, means acting to bias said sub-assembly carrying frame downwardly on opposite sides of said shaft assembly, and urging said shaft assembly to an upright position, and common drive means driving said drive and clutch mechanism and said pump from said motor, said common drive means comprising an endless belt extending between and passing around said motor pulley and said drive mechanism pulley, and engaging said pump pulley and said clutch pulley with said pump pulley being confined within the reaches of said belt to be engaged by the inner face thereof, and said clutch pulley being disposed without the reaches of said belt to be engaged by the outer face thereof.

2. A machine as claimed in claim 1 in which said motor is swingably supported for movement in a direction to tension said belt and to simultaneously increase wrap-around contact of said belt with said pump and clutch pulleys, and means urging said motor to swing in a direction to increase such belt wrap-around.

3. A washing machine comprising a first fixed frame, an upright rotatable tub, rigid support means supporting said tub at a substantially fixed height above a bearing point on said frame, said support means comprising an upright shaft assembly forming an axial extension depending from said tub to said bearing point and supporting said tub for both tilting and lateral movement in unison, a second frame having a centrally disposed journal through which said shaft assembly extends at a point intermediate of its height, said second frame being supported at a substantially fixed height above said bearing point by said shaft assembly, a motor having a drive pulley mounted in an upright position on said second frame on one side of said shaft to swing on an axis parallel to said shaft, a shaft drive mechanism comprising a pulley and gear means in driven connection therewith mounted on said second frame on the side thereof substantially opposite to said motor with the axis of rotation of said pulley parallel to said shaft, a clutch mechanism for connecting said drive mechanism to and disconnecting said drive mechanism from said shaft and including a pulley member concentric with said shaft, and a pump mounted on said second frame on the side of shaft adjacent to said drive mechanism, said pump having a pulley arranged with its axis of rotation parallel to said shaft, the arrangement being such that the center of gravity of said second frame, motor, drive mechanism, clutch mechanism and pump carried thereby substantially coincides with the axis of said shaft assembly, a belt in driving connection between said motor pulley and said drive mechanism, clutch, and pump pulleys, with said pump pulley being disposed within the belt reaches extending between said motor and drive mechanism pulleys, and being engaged over an arc of its surface by the inner face of one of said belt reaches, and said clutch pulley being disposed without said belt reaches and being engaged over an arc of its surface by the outer face of the other of said belt reaches, and means urging said motor to swing in a direction to tension said belt and to increase

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the arc of contact between said belt and said pump and clutch pulleys simultaneously.

4. A machine as claimed in claim 3 in which said tub is surrounded by a fixed receptacle having an opening beneath said tub through which said shaft assembly extends, flexible diaphragm means sealing said opening around said shaft assembly, said pump having an inlet and an outlet, said fixed receptacle having a waste liquid discharge, and flexible hose means connecting said receptacle discharge to said pump inlet and said pump outlet to a fixed point of discharge provided on said main frame.

5. In a clothes washing machine, a tub assembly axially mounted on an upright drive shaft assembly, a motor and drive mechanism for driving said shaft assembly and a pump for evacuating liquid introduced into said tub assembly, said drive shaft assembly being supported from its lower end by an axially non-yieldable thrust bearing providing for free hunting movement of said lower shaft end over a limited area on tub rotation, means for resiliently holding said shaft assembly in the upright position comprising a support frame having a centrally disposed journal through which said shaft assembly extends intermediately of its height, said support frame having said motor, drive mechanism and pump mounted thereon in fixed relative relation so disposed and arranged on op-

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posite sides of said drive shaft assembly to locate the center of gravity of said support frame and the members carried thereby substantially coincident with the axis of said shaft assembly, and spring means acting on said support frame on opposite sides of and at points remote from said shaft assembly to provide a balanced downward pull on said frame around said shaft assembly, a clutch mechanism for driving said tub assembly in rotation from said drive mechanism, a common belt drive for driving said drive mechanism pump and clutch from said motor and means for simultaneously tensioning said belt drive element and increasing pump driving and clutch driving belt contact.

References Cited in the file of this patent

UNITED STATES PATENTS

2,091,536	Van Impe	Aug. 31, 1937
2,106,609	Krauss	Jan. 25, 1938
2,161,618	Dunham	June 6, 1939
2,168,068	Loweke	Aug. 1, 1939
2,652,710	De Remer	Sept. 22, 1953
2,667,269	Reitz	Jan. 26, 1954
2,748,945	Lodge	June 5, 1956