Aug. 5, 1952 T. R. SMITH 2,605,628

WASHING MACHINE PROVIDED WITH FLEXIBLE SEAL

Original Filed Dec. 20, 1948 2 SHEETS--SHEET 1

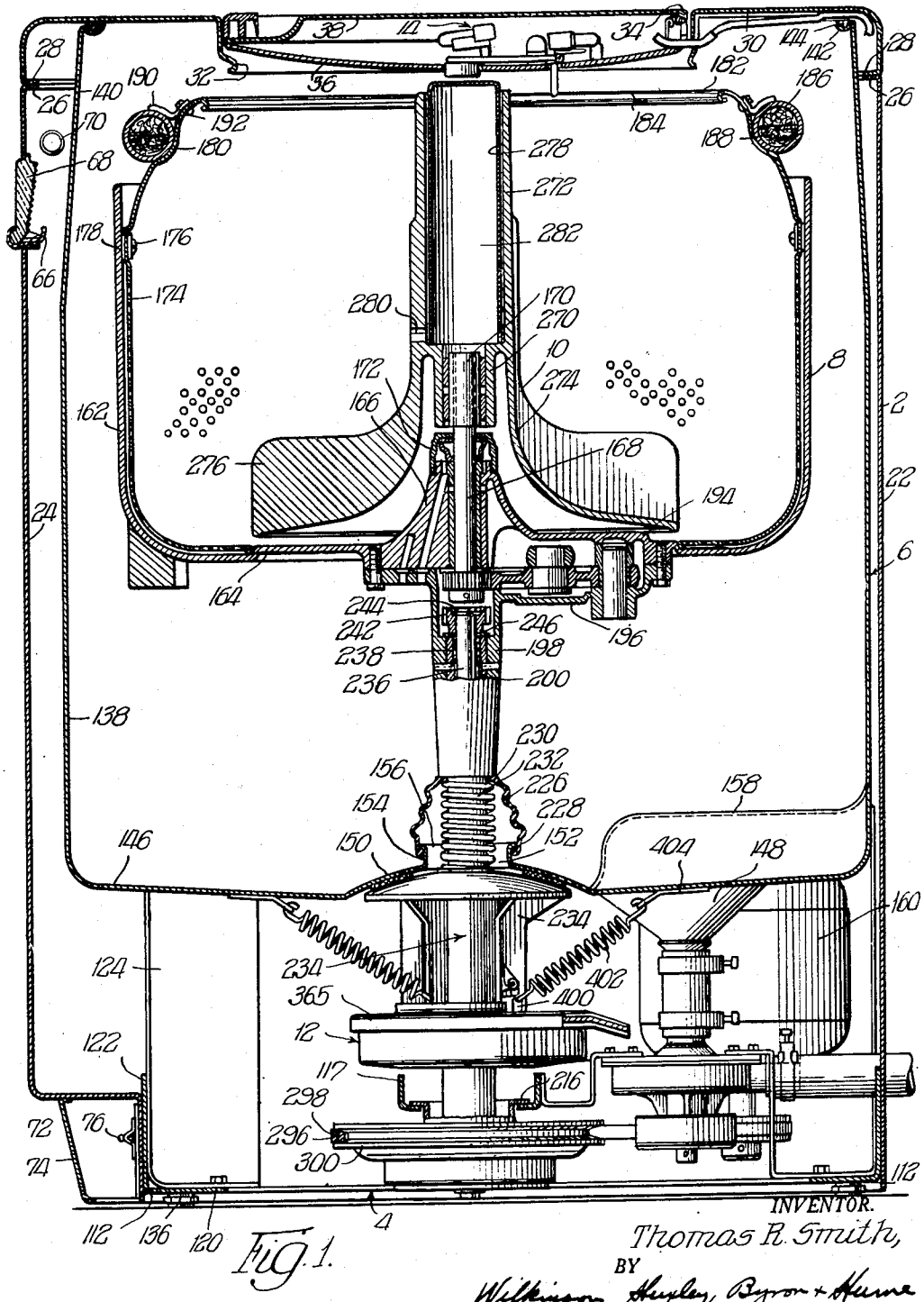


Fig. 1.

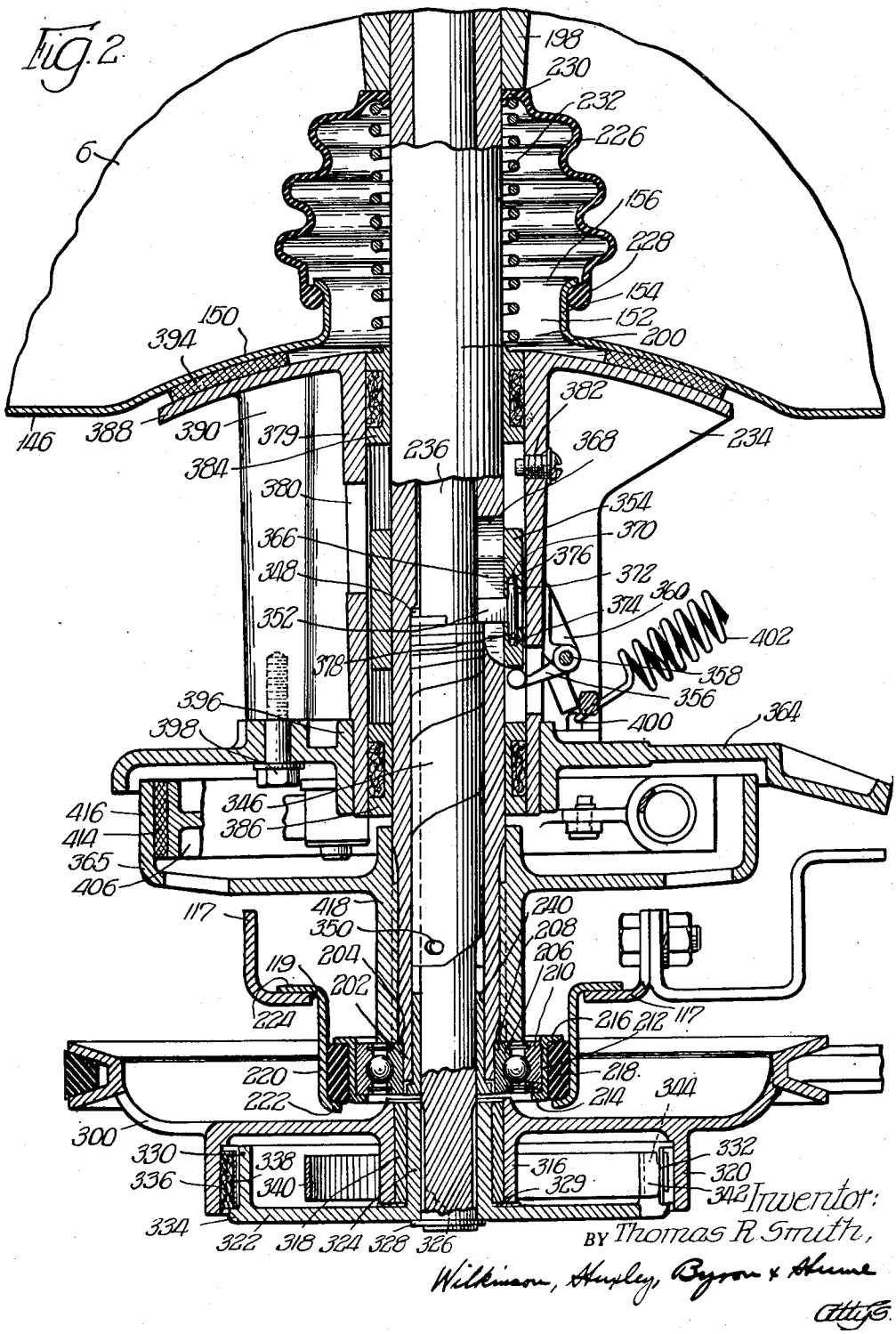
INVENTOR.
Thomas R. Smith,
BY
Wilkinson, Huxley, Byron & Hume
Attys.

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Fig. 2.



Inventor:
BY Thomas R Smith,
Wilkinson, Huxley, Byron & Hume
Attys.

Patented Aug. 5, 1952 2,605,628

UNITED STATES PATENT OFFICE

2,605,628

WASHING MACHINE PROVIDED WITH FLEXIBLE SEAL

Thomas R. Smith, Newton, Iowa, assignor to The Maytag Company, Newton, Iowa, a corporation of Delaware

Original application December 20, 1948, Serial No. 66,230. Divided and this application November 17, 1950, Serial No. 196,292

6 Claims. (Cl. 68—23)

1

This invention relates to washing machines and while it is not limited to any specific type, it finds particularly good application to the type in which a washing operation is accomplished by agitating the liquid and material contained therein and in which the tub thereafter is rotated to extract the liquid from the material to effect a partial drying thereof.

This application is a division of the parent application Serial No. 66,230, filed December 20, 1948.

One object of the invention is to provide a simple, durable and efficient liquid-tight seal between the tub assembly and an outer stationary tub which is effective under all operating conditions encountered in the washing machine to prevent passage of moisture into the driving, clutching, braking, stabilizing and other mechanisms located below.

Another object is to provide a novel liquid-tight seal between the tube assembly and operating parts located therebelow to prevent the passage of any moisture to said operating parts and to maintain a successful operative condition under all circumstances.

These and other objects are acomplished by means of the mechanisms and arrangements disclosed in the accompanying drawings, in which—

Figure 1 is a vertical sectional view of a washing machine showing one embodiment of my invention; and

Figure 2 is an enlarged fragmentary vertical sectional view of the driving mechanism of the washing machine and showing one embodiment of the liquid-tight seal for preventing the passage of moisture into said driving mechanism and other parts.

Referring now more in detail to the drawings, a combined washing and drying machine made in accordance with the present invention is shown as generally comprising an outer cabinet 2, a base structure 4 for supporting an outer tub 6 completely enclosed by the cabinet 2. Mounted within the outer tub 6 is a rotatable tub 8 provided with an agitator or washing device 10 therein, the tub 8 and its agitator or washing device 10 being operated by suitable mechanism 12 which, together with the inner tub and agitator assembly, are suitably supported on the base structure 4. As a further characteristic of the washing machine, a control mechanism, generally referred to as 14, is provided for automatically controlling certain operations in the washing cycle.

The cabinet 2 has its main body formed from

2

sheet metal to provide the opposite side panels and the back and front panels 22 and 24 which may be formed separately and welded at the corners to provide a substantially rectangular unitary structure, or one or more of these panels may be formed from a single piece suitably bent, and welded, or otherwise secured to the remaining panels to provide the said unitary structure. The panels are formed with inturned flanges 26 at the upper edges thereof which are adapted to mate with and be secured to similar flanges 28 of the cover or top panel 30 for the cabinet. This cover or top panel 30 is formed with an opening 32 whereby access may be had to the interior of the rotatable tub 8.

The opening 32 is normally closed by a pivotally mounted lid 34 formed with a base section 36 and a cover section 38 to provide a chamber or compartment for a plurality of switch assemblies for the control mechanism 14.

The front panel 24 of the cabinet is curved transversely to pleasing lines, the same being provided adjacent the upper marginal edge thereof with an opening 66 in which is mounted a panel 68 of translucent material such as "Lucite" in or on which a trade-name or the like may be impressed or otherwise embodied therein. The trade-name or the like is made more readily readable by means of a pilot light 70 mounted in the cabinet 2 to the rear of the panel and incorporated in a control circuit. The front panel 24 terminates short of the side panels of the cabinet to provide a toe space 72. The inner wall defining the toe space 72 is formed or defined by the finishing strip 74 which has its outer face transversely curved on the order of the curvature of the front panel 24, and is removably secured to the base structure 4 by means of the ball studs 76.

The base structure 4 is of rectangular formation and comprises the horizontally disposed L-shaped angle iron sections or portions 112, each of which has a horizontally and inwardly disposed leg or web 120 and a vertically and upwardly extending web or leg 122. These sections are secured together by any desired means, such as welding or the like. The base structure is further provided with corner posts or pedestals 124 formed from angle irons of the desired length which are rigidly secured in position, as by welding or the like, to the horizontally disposed L-shaped angle irons at the corners of the base structure, and each of which is adapted to provide a support for the outer tub 6. Extending between and secured to the horizontal legs 120 of

two of the angle irons is a channel shaped frame member 117 provided with an opening 119 in its central web for supporting the inner tub 8 and its associated mechanisms, as will be hereinafter more fully described.

Adjacent each corner of the base structure there is provided a short foot or adjustable leg portion 136 comprising a threaded nut secured to the base structure and an adjustable threaded shank having an enlarged head with a center point thereon facing toward and being adapted to penetrate the floor or foundation. These adjustable legs are provided to maintain all four supporting points of the machine in contact with the floor and at the same time to maintain the machine level. This tends to prevent any vibrations which may be set up in the machine from moving or displacing the machine from its operating position. Any suitable locking means may be provided to lock the same in any adjusted position after the washing machine has been leveled.

The outer tub 6 is formed with a side wall having its lower portion 138 cylindrical in horizontal cross-section and its upper portion 140 frusto-conical in shape which terminates in an inwardly extending flange 142 provided with an annular curved recess or groove adapted to receive a toroidal shaped sealing element 144 of resilient and compressible material, such as rubber or the like, which fits within the recess or groove and is compressed against the inner surface of the top wall or cover 30 in spaced relation to the opening 32 thereof to provide a fluid-tight joint therebetween and to prevent water within the tub 6 from leaking into the chamber or compartment formed between the outer tub 6 and the cabinet 2 and into the lower part of the cabinet disposed below the said outer tub 6. The outer tub 6 is further formed with a bottom wall 146 sloping inwardly and downwardly from the side wall portion 138 for the purpose of draining liquid falling into the bottom of the outer tub to the conical shaped drain outlet 148 depending from the bottom wall. This bottom wall is further formed with a centrally disposed crowned portion 150 having an opening 152 therein defined by an annular upstanding flange 154 which terminates in an outwardly extending peripheral portion 156 providing a shoulder for a purpose to be hereinafter more fully disclosed. The said tub 6 is also provided with an offset portion 158 which extends upwardly into the tub to provide clearance for the motor 160 which operates the washing machine.

The inner tub 8 disposed within the outer tub 6 is formed in two sections or parts, the outer part having an imperforate side wall 162 and an imperforate bottom wall 164 formed with a central hub 166 in which a shaft 168 is journaled. This shaft extends above the hub portion 166 and is splined, as at 170, to the agitator 10 which is mounted thereon. A sealing device, generally referred to as 172, embraces the upper end of the shaft 168 and the hub 166 and provides a fluid-tight joint between the shaft and the interior of the tub 8.

The inner part or section of the tub 8 is in the form of a perforate basket 174, the lower portion of which is disposed in substantially parallel relation to the side and bottom walls 162 and 164 of the outer imperforate part of the tub 8. The inner basket is rigidly secured to the side wall 162 by means of a plurality of screws 176 and is held in spaced relation to the outer imperforate tub by means of the spacing washers 178 to provide a channel which allows heavy dirt and the like to settle out below the basket so that when the tub 8 is rotated such heavy dirt and the like will be carried by the water passing through the perforations and flowing between the basket and the outer imperforate tub over the top of the wall 162 without passing through the clothes contained within the inner tub 8. The upper portion 180 of the basket 174 is imperforate and extends upwardly and inwardly and terminates in the rolled edge 182 defining an opening 184 disposed in association with the opening 32 whereby the operator is able to gain access to the interior of the rotatable tub 8 when the lid 34 is lifted. The upper portion 180 of the tub 8, by virtue of its inward inclination, serves to restrict the upward movement of clothes or other material contained within the tub 8 when the same is rotated during a drying operation. It should be observed in passing that the upper edge of the outer imperforate part of the tub 8 does not define the liquid level in the tub. Such level is controlled by mechanism which will be later more fully described.

The upper imperforate portion 180 of the basket has mounted thereon a hollow toroidal shaped tubular member 186 having a body of mobile material 188 of relatively high specific gravity, which assembly serves as a balancing ring for a purpose to be hereinafter more fully described. Steel wool or the like may be used to dampen the movement of a fluid when used in the balancing ring. This balancing ring 186 is secured to the upper wall portion 180 by means of a plurality of clips or brackets 190 secured to said wall portion 180 by means of bolts 192 or the like. As will be apparent, the outside diameter of the balancing ring 186 is less than the diameter of the inner tub 8 in order to position the balancing ring so as not to be engaged by wall 140 of the outer tub 6 in the event of excessive wobbling or gyratory movement of the inner tube which might otherwise cause damage thereto.

Formed as a part of the bottom wall 164 of the inner receptacle is a gear housing 194 having a cover or closure 196 provided with a downwardly extending hub or hollow supporting member 198 which embraces and is rigidly secured to the upper end of a hollow shaft 200 which extends downwardly through the opening 152 in the bottom wall 146 of the outer tub 6 and terminates in a restricted end portion 202 which provides a shoulder 204 mounted upon a radial and thrust bearing 206 which is supported by the arched supporting member 117 of the base structure 4. The radial and thrust bearing 206 comprises an inner race ring 208 which engages shoulder 204 of the hollow shaft 200 and an outer race ring 210 which is supported upon a dish-shaped member 212 substantially Z-shaped in cross-section, the lower inwardly extending annular flange 214 thereof engaging the outer race ring 210 and the upper outwardly extending annular flange 216 of which engages and is flexibly supported by the annular resilient bushing 218. The resilient bushing 218, which may be of rubber or the like, is supported by the annular dish-shaped retaining member 220 which extends downwardly through opening 119 of the channel shaped member 117. The member 220 is provided with a lower inwardly disposed annular flange 222 upon which the bushing 218 is mounted and an upper outwardly extending annular flange 224 which overlaps the

central web of the channel shaped member 117 and is rigidly secured thereto in any desired manner.

Leakage between the outer hollow shaft 200 and the outer tub 6 is prevented by means of a seal or boot 226 of resilient and flexible material, such as rubber or the like, which has an enlarged lower marginal edge 228 adapted to snap over and engage the annular shoulder formed by the outwardly extending marginal portion 156 of flange 154 formed as a part of the bottom wall 146 of the tub 6. The upper end of the seal 226 is provided with an inwardly extending flange portion 230 having a friction face which bears against the lower end of the supporting hub 198, the said flange being provided with a facing of nylon fabric or the like which is impregnated with graphite or other similar matrial to reduce friction and wear therebetween. This construction is provided for the reason that the seal 226 remains stationary while the supporting hub 198 rotates together with the tub 8 during a spinning operation. Adequate pressure is applied to maintain this sealing relation between the seal 226 and the supporting hub 198 by means of a coil spring 232 having its upper end abutting the inwardly extending flange 230 and its lower end abutting a damper assembly 234.

Disposed within the hollow shaft 200 is an inner drive shaft 236 journaled in the outer shaft through an upper bearing 238 and a lower bearing 240 which align the inner shaft with respect to the hollow shaft and permit the inner shaft to rotate relative thereto. Splined to the upper end of the inner shaft 236 is a drive pinion 242 which is fixed thereon by means of the spring retaining ring 244, the said pinion 242 being supported upon the washer 246 which is mounted upon the bearing 238 and the outer shaft 200, whereby the drive shaft 236 is mounted in operative association with and is supported by the outer shaft 200. The pinion 242 is operatively connected to the agitator 10 for giving it an oscillatory movement for washing purposes as fully described in the parent application.

The agitator 10, as hereinbefore described, has its central hub 270 splined to the upper end of shaft 168. The agitator is further formed with a center post 272 and a base or body portion 274 extending downwardly and outwardly from the center post. One or more blades 276 which extend upwardly and outwardly from the base portion 274 may be provided which, when the agitator is oscillated, effect a washing operation within the inner tub 8. The central post or pedestal 272 extends upwardly from the base 274 and is formed with an inner chamber or compartment 278 which communicates with the interior of the tub 8 through one or more openings 280. As shown in the illustrated embodiment of the invention in Figure 1 of the drawings, a float 282 is slidably mounted within the chamber 278 and is adapted to be moved in accordance with the liquid level within the inner tub 8 for operating certain control mechanisms.

The drive shaft 236 is rotated for oscillating the agitator 10 and for rotating the inner tub 8, as will be presently described, by means of the motor 160. The motor drives the belt 296 which passes around and is received within the V-shaped groove 298 of the drive pulley 300. The motor 160 not only furnishes power for actuating the agitator 10, but also for spinning the inner tub 8 for extracting liquid from the washed clothes. Inasmuch as the delivered torque of this motor is less than the starting torque for rotating the inner tub 8, it is desirable to provide a clutch mechanism adapted to slip during the time when the motor is bringing the inner tub 8 up to operating speed, but in which no slipping is required after the operating speed of the inner tub 8 is reached. The clutch in question is covered in another application and is fully disclosed in the parent application. However it may be stated that the clutch comprises the pulley 300 which is driven by the belt 296 and which will transmit torque to the inner shaft 236 until the load on said shaft exceeds the maximum torque for which the clutch is designed. The pulley 300 is provided with a hub 316 having a bearing or bushing 318 mounted therein which is rotatably mounted on a hub 324 of the driven member 322. This pulley is formed with the downwardly extending and integral cylindrical wall 320 provided with an inner face forming a friction driving surface for the slip clutch. The driven member of the clutch includes a clutch drum 322 having the hub 324 thereof splined, as at 326, to the lower end of shaft 236, the drum being held in operative position on the shaft 236 by the spring retaining ring 328. As will be noted, the clutch drum 322 has a washer 329 embracing the central hub 324 thereof upon which the hub 316 and its bushing 318 is mounted for positioning the pulley 300 with respect to the driven member. The clutch drum 322 is provided with an integrally formed upstanding wall 330 disposed inwardly of and in spaced relation to the cylindrical wall 320 of the pulley 300, the said wall having an opening 332 provided therein. Disposed between the cylindrical walls 320 and 330 and supported upon the annular flange 334 of the drum is disposed a clutch band 336 to which is secured a clutch band lining 338 adapted to frictionally engage the inner surface of the cylindrical wall 320. Mounted upon the clutch drum 322 is a curved control spring 340 provided with radially extending ends 342 and 344 which extend through the opening 332 and are connected to the ends of the clutch band 336. As will be apparent, the spring 340 acts to expand the clutch band 336 whereby the clutch band lining 338 is moved into driving relation with the inner surface of the wall 320. All of the driving torque from the pulley 300 is transmitted by friction through the clutch band lining to the clutch band 336 and then to the clutch drum 322 through the spring 340 which has its ends 342 and 344 connected thereto.

As the pulley 300 is rotated, the friction between the inner face of the wall 320 and the clutch band lining 338 causes the clutch band 336 which carries the control spring 340 to rotate a short distance until one end of the control spring contacts one edge of the wall 330 defining the opening 332, the edge of the wall 330 engaged by the control spring depending, of course, upon the direction of rotation of the pulley 300. The clutch drum 322 is then caused to rotate and drives the shaft 236. When the torque required to rotate the shaft 236 exceeds the loading of the spring 340 slippage occurs between the pulley 300 and the clutch drum 322. This slippage occurs until such time as the torque required to rotate the shaft 236 is equal to or less than the torque being transmitted between the pulley 300 and the clutch drum 322 through the lining 338. This clutch construction provides for the delivery of constant torque to the shaft 236 which cannot be exceeded, whereby the shaft 236 can be brought gradually up to speed for the spin-

ning operation without causing damage to the motor 160 because of excessive loads during the starting period. After the inner tub 8 has been brought up to speed, the torque required to maintain this speed is less than the rated capacity of the motor and, accordingly, no slippage takes place between the pulley 300 and the clutch drum 322.

As will be apparent from the above description, the combined radial and thrust bearing 206 mounted on the reduced portion 202 of the outer shaft 200 and engaging the annular shoulder 204 thereof not only supports the receptacle 8 and associated mechanisms but also provides a support for the inner shaft 236 through the thrust bearing 246 and, accordingly, such radial and thrust bearing positions and supports the pulley 300 and the constant torque slip clutch immediately above described which effects a driving connection between said pulley 300 and the shaft 236. It is to be noted that as the receptacle 8 is moved laterally, as it will under certain conditions of operation presently to be described, the same will tilt about the bearing 206 and that the said bearing constitutes the sole support for the receptacle and the agitating mechanism as well as other mechanisms to be hereinafter more fully described. Furthermore, the pulley 300 is dish-shaped so that the center line of the groove 298 passes through the pivot point of the bearing 206 in order to minimize deflection of the driving belt 296 at all times.

As previously referred to in a general way, the present invention contemplates a structure in which material within the receptacle 8 is subjected to a washing operation through the action of the agitator 10 and also subjected to a centrifuging action whereby the said material is spin dried upon rotation of the tub 8. In order to rapidly rotate the inner tub 8 suitable clutch mechanism is provided for effecting a driving relation between the inner shaft 236 and the outer shaft 200. In the illustrative embodiment of the invention such clutch mechanism takes the form of a spring clutch including an expanding type tapered spring clutch element 346 embracing the shaft 236 and being disposed within the enlarged hollow portion 348 of the outer hollow shaft 200. The lower end of the spring clutch element 346 is operatively connected to the shaft 236 and a pin 350 is provided to prevent axial movement of the spring. The upper actuating end of the spring clutch element is arranged to be engaged by a key 352 mounted within the clutch collar 354. During the period when the agitator 10 is being operated, the clutch collar 354 is held in an elevated position by means of bell crank lever 356 whereby the key 352 is disengaged from the upper operating end of the spring clutch element 346. When the bell crank lever 356 is tripped, the clutch collar 354 moves downwardly under the action of gravity to position the key 352 in the path of movement of the upper operating end of spring clutch element 346 whereby the said spring clutch element is expanded to frictionally engage the wall of enlarged recess 348 of the outer hollow shaft 200 at which time a driving connection is effected between the shafts 200 and 236 to rapidly rotate the inner tub 8.

The bell crank lever 356 is pivoted, as at 358, to a bracket 360 connected by any suitable means, to a hollow sleeve 379 constituting a part of the damper mechanism 234 to which is secured a brake shoe support 364 forming an element of brake mechanism 365, to be hereinafter more fully described.

The clutch mechanism requires a minimum of space in the device and the assembly for the clutch operating means is such as to permit the same to be rapidly and easily assembled and disassembled. The key 352 is of T-formation and has its operating shank or extension movably mounted within the key-hole slot 366, the said key being restrained from turning movement within the lower part of the slot 366, but the opening 368 is of such size as to permit the key 352 to be turned at 90° to its normal operating position. The clutch collar 354 is provided with an opening having a lateral dimension adapted to permit radial movement of the extensions 376 and 378 of the key 352 with respect to the collar 354 when the shank or extension thereof is disposed within the opening 368 at 90° to its normal operative position. The opening 370 is defined at its upper and lower edges by the under-cut grooves 372 and 374 which are adapted to receive the extensions 376 and 378, respectively, of the key to prevent lateral radial movement of the key 352 with respect to the shaft 200. It is therefore apparent that when the opening 370 is aligned with the opening 368 the key 352 may be disposed at 90° from its normal operative position and either removed from or inserted into its engaging relation with the clutch collar 354. As will be noted, the damper mechanism 234 is provided with a hollow sleeve 379 which surrounds and embraces the outer shaft 200 and has the upper and lower journal bearings 384 and 386 mounted co-axially with and journaled on the hollow shaft 200 and providing an annular space therebetween within which the collar 354 is axially movable. This hollow sleeve 379 is provided with an opening 380 which may be aligned with the openings 368 and 370 whereby the key 352 may be readily inserted into or removed from its assembled position with respect to the collar 354. Threadedly mounted in the hollow sleeve 379 is a screw 382 projecting inwardly into the path of movement of the clutch collar 354 to prevent upward movement thereof to such an extent that the shank of the key 352 enters the opening 368, but which is withdrawn sufficiently to permit the collar 354 to be moved upwardly a sufficient amount to bring the openings 368, 370 and 380 into alignment when it is desired to insert or remove the key 352. As shown in Figure 2 of the drawings, the upper journal bearing 384 provides a shoulder against which the lower end of the coil spring 232 for the seal 226 abuts.

The hollow sleeve 379 is formed with an outwardly extending spherical shaped wall 388, reinforced by the oppositely disposed webs 390, and to the upper surface of which friction material 394 is connected in any suitable manner which frictionally engages or mates with a complementary spherical surface formed on the under side of the central crowned portion 150 of the outer tub 6.

The brake shoe support 364, heretofore referred to generally, is formed with a hub 396 mounted on the lower end of the hollow sleeve 379 the said support being connected by a plurality of bolts 398 in fixed relation to said hollow sleeve. The webs 390, of which four are shown in the present embodiment, are each provided at their lower end with an aperture 400 engaged by the end of a coil spring 402. Each of these springs extends at an angle to the vertical axis of the

sleeve 379 and has its opposite end mounted in a bracket 404 rigidly secured to the bottom wall 146 of the outer tub 6. Due to the angular disposition of the springs 402 with respect to the vertical axis of the sleeve 379 and their connection to the brake shoe support 364 and the tub 6, a component of the spring force is applied in a vertical direction to the friction material 394. It is also apparent that inasmuch as the springs 402 are equally loaded and the springs of each pair are disposed in opposite relation to one another, the spring forces acting through the hollow sleeve 379 will tend to return the tub 8 to its neutral or vertical position where the spring forces are all equal or opposite should said tub 8 tend to move away from its normal vertical position. It is further apparent that the friction material 394 is forced by the springs into effective frictional engagement with the spherical under-surface of the bottom wall 146 of the outer tub and that as the receptacle tends to move in a horizontal plane a certain portion of the energy tending to move the receptacle is absorbed by the friction material. The friction material, therefore, tends to reduce the amplitude or extent of horizontal movement of the inner tub and absorbs some of the energy applied thereto when the said tub wobbles or moves laterally under eccentric loadings within the tub during a spinning operation.

When the shaft 236 is rotated freely to oscillate the agitator 10, at which time the key 352 is disengaged from the spring clutch element 346, the outer shaft 200 and the tub assembly connected thereto is held against rotation by the friction brake 365. As previously indicated, this friction brake mechanism incorporates the brake shoe support 364 having the brake shoes 406 pivoted thereto, the said brake shoes being provided with a brake lining, such as 414, engageable with the inner cylindrical surface of the brake drum 416 having a hub 418 splined to the outer hollow shaft 200 and which has its lower end in abutting relation with the inner race ring 208 whereby the same is supported and held in operative position. For further details of construction and operation of the brake mechanism, not specifically claimed herein, attention is called to the parent application.

Sufficient description has been given in this present application to show that it is important to prevent water from leaking into the many parts of the transmission mechanism including the clutch, brake and stabilizer parts located below the water-tight seal 226 which is located in the lower part of stationary tub 6 through which tub considerable water passes as a result of the operation of the agitator 10 in washing and the spinning of the tub 10 for extracting water from the washed clothes. The water-tight seal 172 mounted over the upper end of the central hub 166 in which the upper end of the vertical shaft 168 is journaled also cooperates to prevent water from entering into the power transmission mechanism therebelow.

By means of the parts and arrangements herein described, the objects of the invention are accomplished.

There may be various modifications of the invention herein particularly described and it is my intention to cover all such modifications coming within the spirit and scope of the following claims.

I claim:

1. In a washing machine, the combination of an inner rotatable tub adapted to receive liquid and material to be washed therein, a vertically disposed shouldered operating shaft means for rotating said tub, an outer stationary tub having a shouldered flange defining a centrally disposed opening in the bottom wall thereof through which said shaft means extends, a flexible seal engaging the stationary shoulder of said flange at one end and having frictional bearing relation with the shoulder of said rotating shaft means at its other end to provide a liquid-tight joint between said shaft means and said bottom wall, and spring means for holding said other end in frictional bearing relation with the shoulder of said rotating shaft means.

2. In a washing machine, the combination of an inner rotatable tub adapted to receive liquid and material to be washed therein, a washing device disposed within said tub, means including an inner shaft for operating said washing device to effect a washing operation within said tub, means including an outer shaft for rotating said tub to extract liquid from material contained therein, an outer stationary tub having a shouldered flange defining a centrally disposed opening in the bottom wall thereof through which said shafts extend, said means for operating said washing device including mechanism associated with the bottom wall of said inner tub, a casing for said mechanism including a supporting hub secured to said outer shaft, a flexible seal engaging the stationary shoulder of said flange at one end and having frictional bearing relation with said supporting hub at its other end to provide a liquid-tight joint between said outer shaft and the bottom wall of said outer stationary tub, and spring means for holding said other end in frictional bearing relation with said supporting hub.

3. In a washing machine, the combination of an inner rotatable tub adapted to receive liquid and material to be washed therein, a washing device disposed within said tub, means including an inner shaft for operating said washing device to effect a washing operation within said tub, means including an outer shaft for rotating said tub to extract liquid from material contained therein, an outer stationary tub having a shouldered flange defining a centrally disposed opening in the bottom wall thereof through which said shafts extend, said means for operating said washing device including mechanism associated with the bottom wall of said inner tub, a casing for said mechanism including a supporting hub secured to said outer shaft, damper means comprising a damper member embracing said outer shaft and having frictional engagement with the bottom wall of said outer stationary tub for resisting tilting movement of said inner tub, a flexible seal engaging the stationary shoulder of said flange at one end and having frictional bearing relation with said supporting hub at its other end to provide a liquid-tight joint between said outer shaft and the bottom wall of said outer stationary tub, and a coil spring disposed between said other end of said seal and said damper member for holding said other end in frictional bearing relation with said supporting hub.

4. In a washing machine, the combination of an inner rotatable tub adapted to receive liquid and material to be washed therein, a washing device disposed within said tub, means including an inner shaft for operating said washing device to effect a washing operation within said tub, means including an outer shaft for rotating said tub to extract liquid from material contained

therein, an outer stationary tub having a centrally disposed opening in the bottom wall thereof through which said shafts extend, said means for operating said washing device including mechanism associated with the bottom wall of the inner tub, a casing for said mechanism including a supporting hub secured to said outer shaft, a flexible seal for covering said centrally disposed opening and having friction bearing relation with said supporting hub to provide a liquid-tight seal between said outer shaft and said bottom wall, and means for maintaining said flexible seal in operative position.

5. In a washing machine, the combination of an inner rotatable tub adapted to receive liquid and material to be washed therein, a washing device disposed within said tub, means including an inner shaft for operating said washing device to effect a washing operation within said tub, means including an outer shaft for rotating said tub to extract liquid from the material contained therein, an outer stationary tub having a centrally disposed opening in the bottom wall thereof through which said shafts extend, said means for operating said washing device including mechanism associated with the bottom wall of the inner tub, a casing for said mechanism including a supporting hub secured to the outer shaft, damper means comprising a damper member embracing said outer shaft and having frictional engagement with the bottom wall of said outer stationary tub for resisting tilting movement of said inner tub, a flexible seal covering said centrally disposed opening and having frictional bearing relation with said supporting hub to provide a liquid-tight seal between said outer shaft and the bottom wall of said outer tub, and means located between one end of said seal and said damper member for maintaining the frictional bearing relation with said supporting hub.

6. In a washing machine, the combination of a rotatable tub adapted to receive liquid and material to be washed therein, vertically disposed shaft means for rotating said tub, means for supporting said vertically disposed shaft means only at its lower end whereby it is subject to a gyratory motion, an outer stationary tub having a centrally disposed opening in its bottom wall through which said shaft means extends, and a flexible seal covering said opening and operatively associated with said shaft means to provide a liquid-tight seal between said shaft means and said bottom wall whether or not said shaft means is gyrating.

THOMAS R. SMITH.

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