Aug. 14, 1956 K. O. SISSON 2,758,685

AGITATING AND SPINNING MECHANISM

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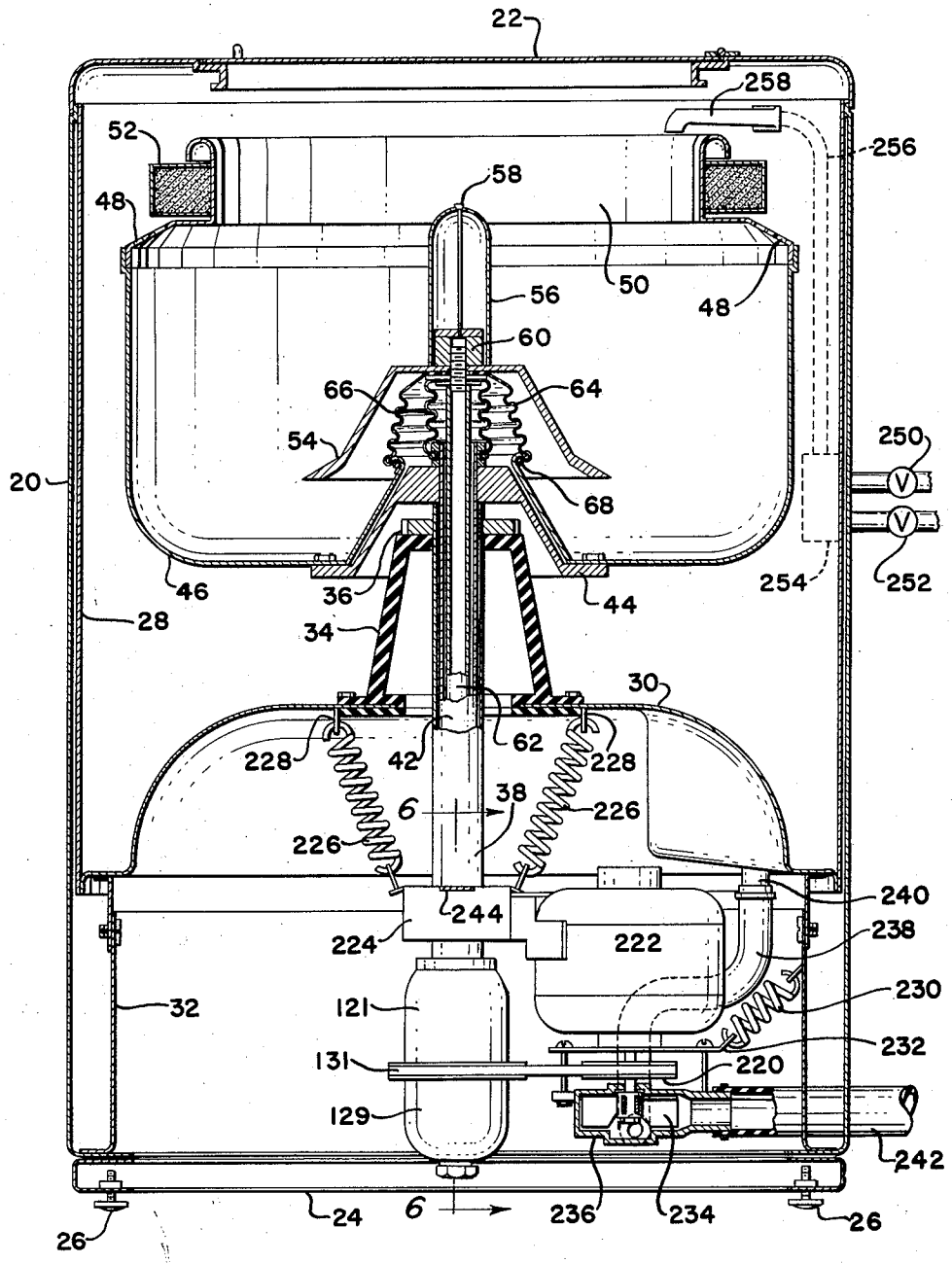


Fig. 1

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AGITATING AND SPINNING MECHANISM

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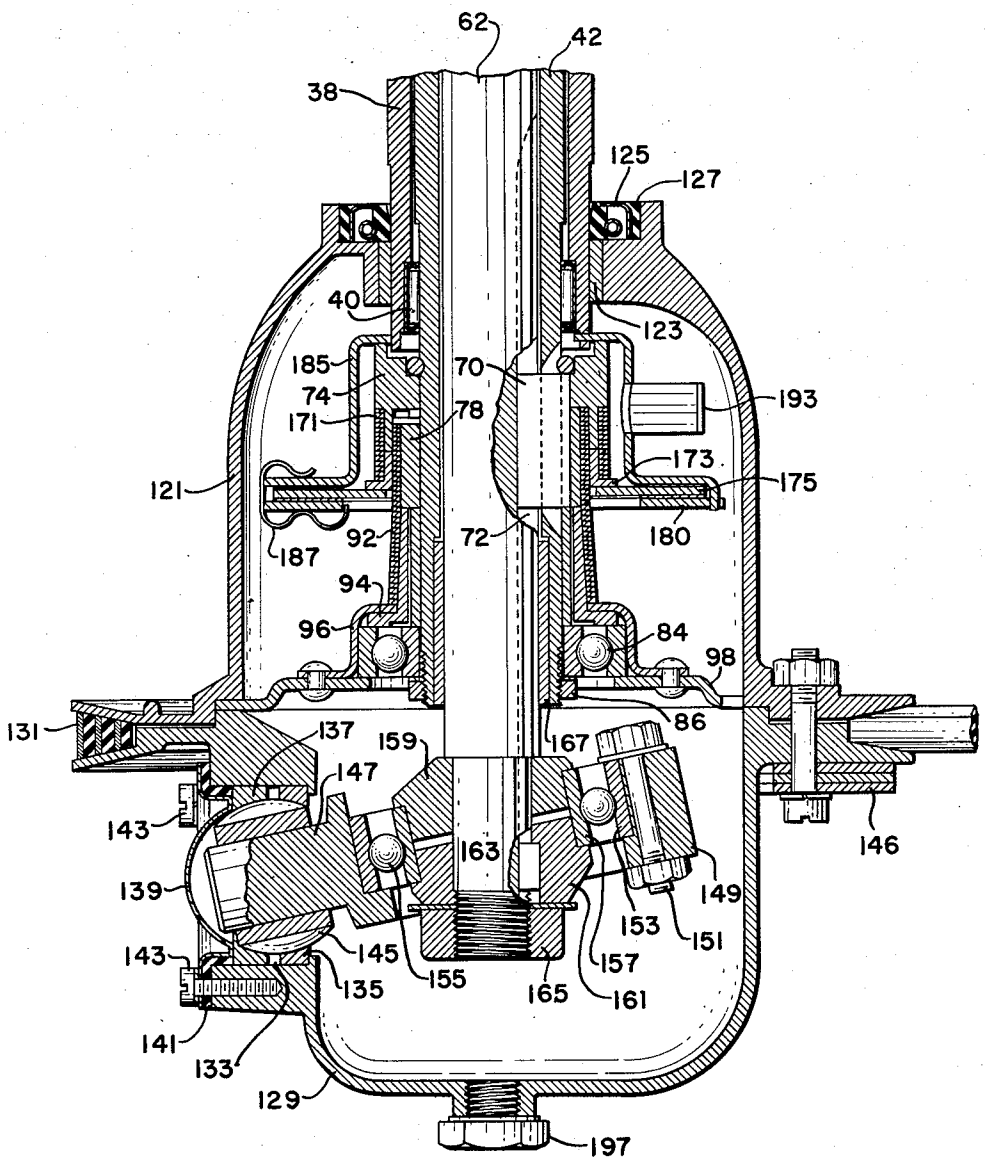


Fig. 2

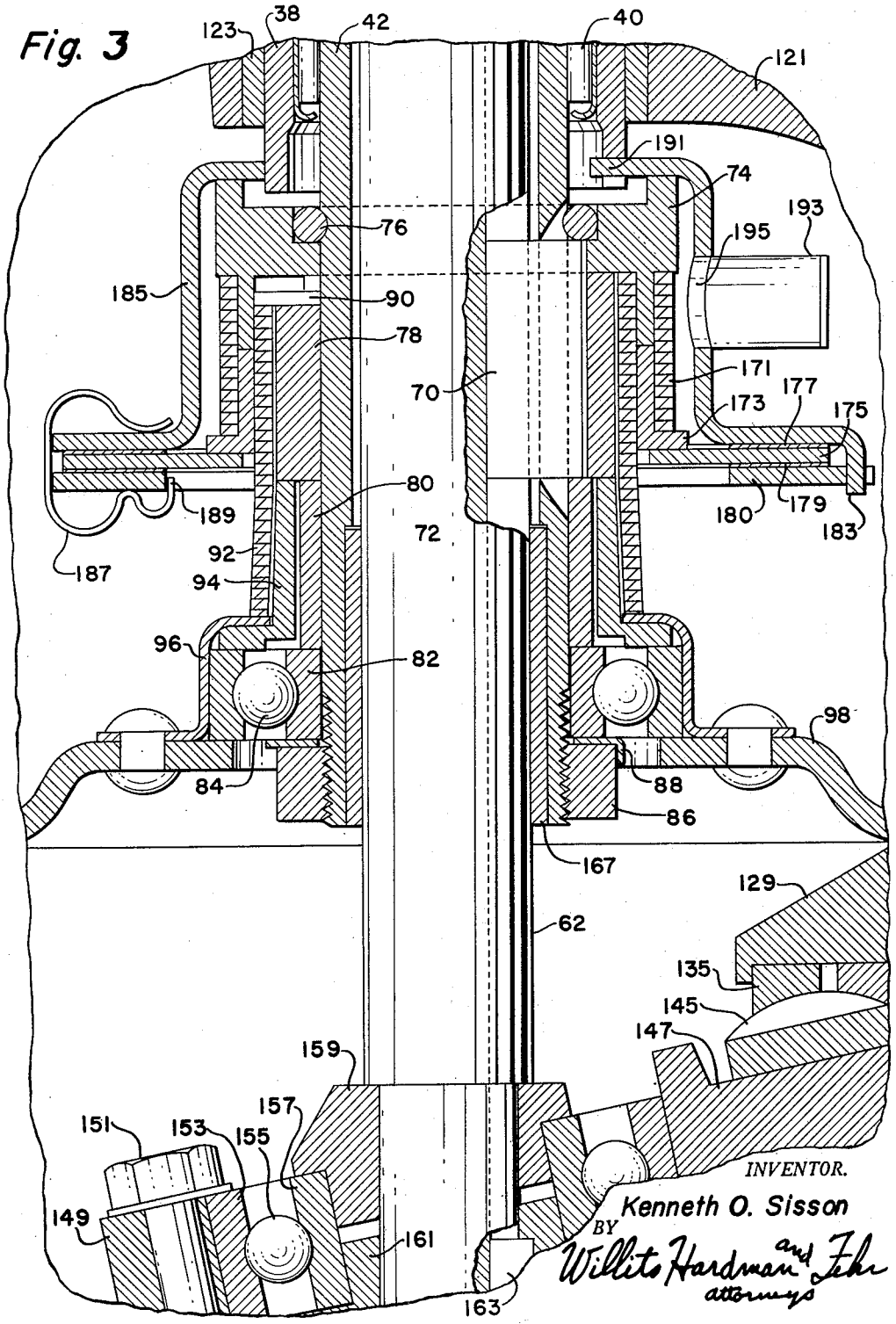
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AGITATING AND SPINNING MECHANISM

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Fig. 3



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AGITATING AND SPINNING MECHANISM

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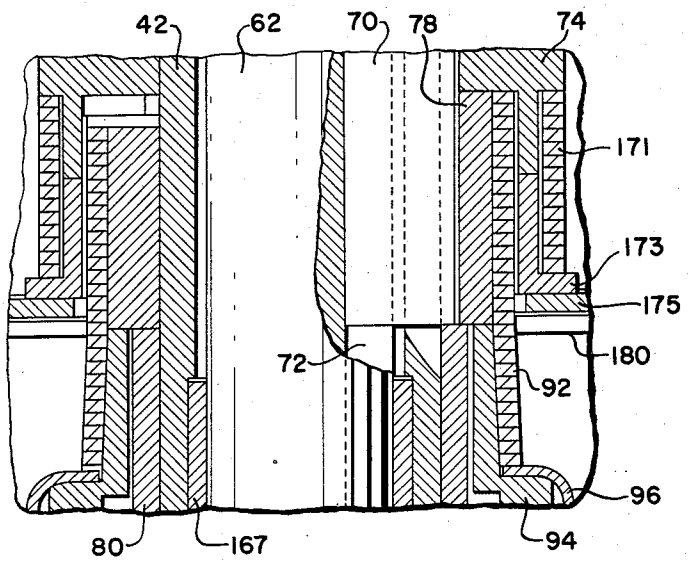


Fig. 4

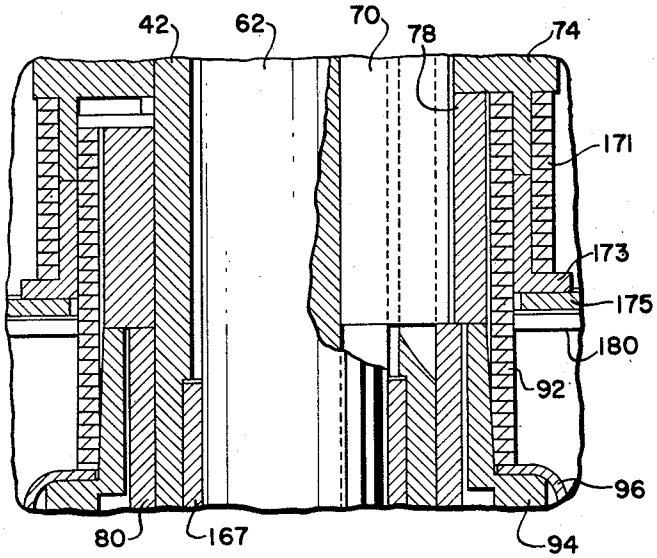


Fig. 5

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AGITATING AND SPINNING MECHANISM

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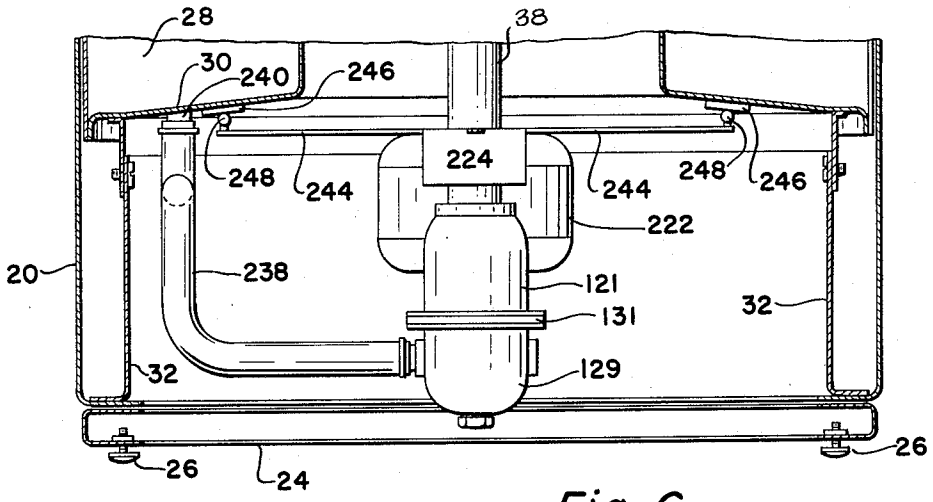


Fig. 6

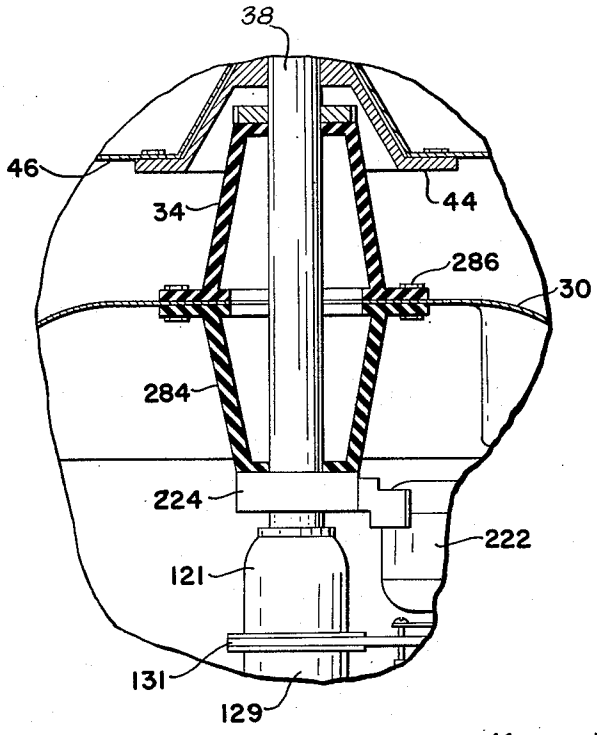


Fig. 7

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AGITATING AND SPINNING MECHANISM

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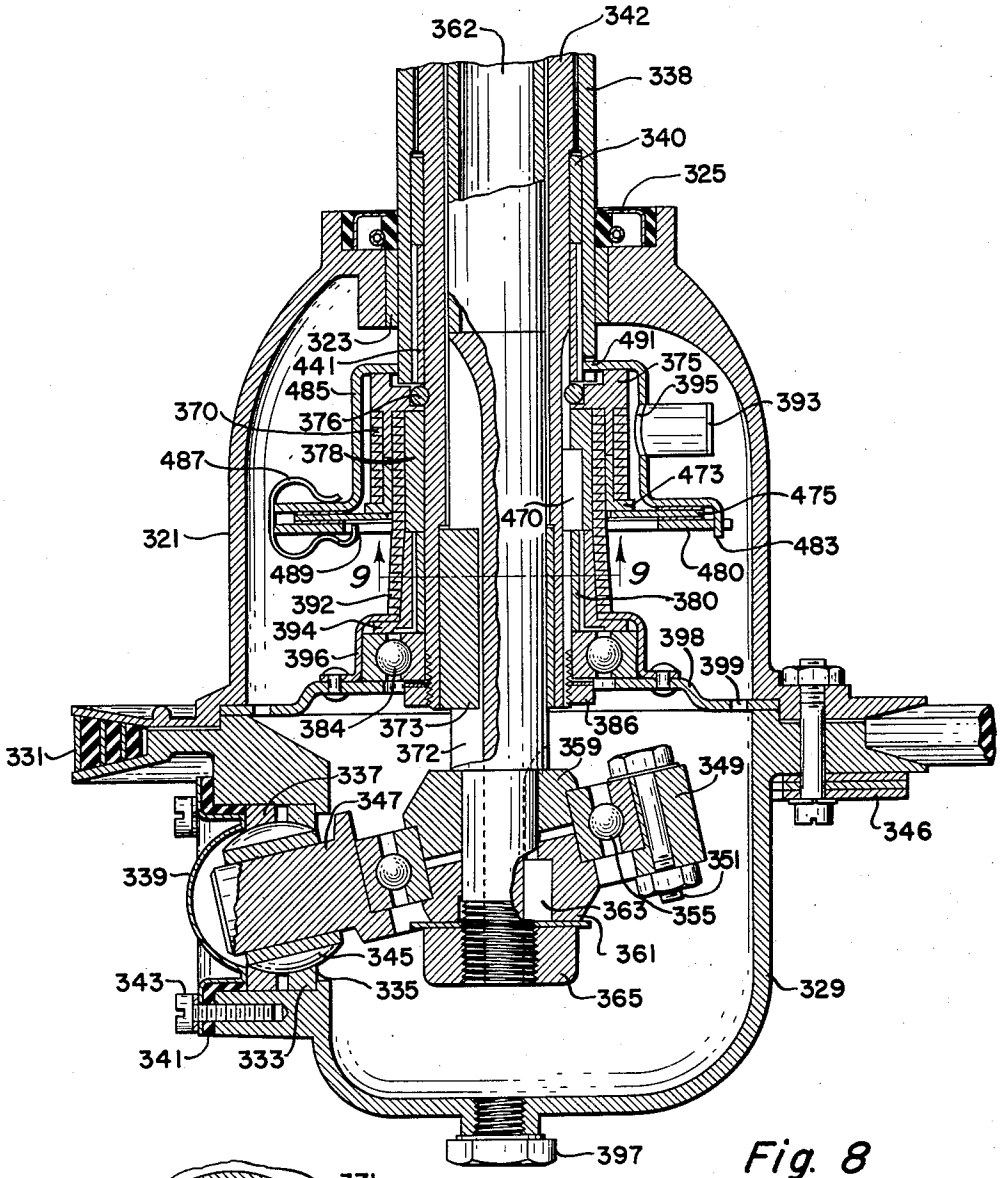


Fig. 8

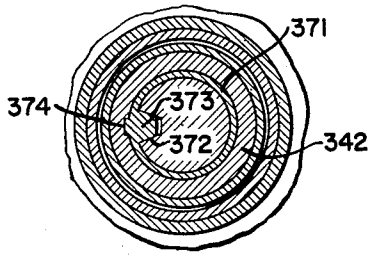


Fig. 9

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AGITATING AND SPINNING MECHANISM

Kenneth O. Sisson, Dayton, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

Application April 8, 1952, Serial No. 281,062

13 Claims. (Cl. 192—3.5)

This invention relates to an agitating and spinning mechanism and more particularly to automatic wasing machines of the type having an oscillatable agitator within the tub and a rotating tub to dry the clothes.

At the present time, automatic washing machines especially those which have an oscillatable agitator in the tub and dry by spinning the tub, cost much more to manufacture and sell than the best wringer washers. In such automatic washers the agitating mechanism involves a number of large, expensive and complicated parts. Some of these complications ensue from the system of agitating with a long stroke at a much lower speed than the spinning operation.

It is an object of my invention to provide a more simple, inexpensive, efficient agitating and spinning mechanism for an automatic washing machine having a reciprocable agitator in the tub which is spun to dry the clothes.

It is another object of my invention to provide an automatic machine in which the number of strokes per minute the agitator is reciprocated in the tub during the operating period equals the revolutions per minute that the tub is spun for drying.

It is another object of my invention to provide an automatic washing machine in which the agitation mechanism housing is rotated to provide both agitating and spinning operations.

It is another object of my invention to provide an improved suspension system for the tub and agitating mechanism which is more simple, inexpensive and which reduces the transmission of vibrations to the floor.

These objects are obtained by providing a washing machine in which the catch basin surrounds the tub. The housing which supports the tub and agitator is resiliently mounted upon a conical rubber member supported by the catch basin and assisted by coil springs extending diagonally downward from the catch basin to points of connection on the housing. The tub is rotatably mounted upon the housing. At the bottom of the housing the tub is connected by alternate overrunning clutch mechanism either with a normally stationary friction device connected to the housing or to a second housing which is rotatably mounted on the first housing and which is provided with a surrounding pulley groove receiving a belt from the drive pulley of an electric motor mounted upon one side of the first housing. The bottom of the agitator shaft is connected by an angularly mounted bearing to a pivoted member connected to the rotatable second housing.

The drive motor operates in one direction to rotate the second housing in one direction while the tub is kept stationary through the winding up and gripping of a wound spring clutch extending between a member connected to the tub and the friction device connected to the first housing. When the drive motor is reversed, this wound spring clutch is released and a second wound spring clutch is wound to provide a connection between the rotatable second housing and the shafts connecting with the tub.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Figure 1 is a vertical sectional view through an automatic washing machine embodying one form of my invention;

Figure 2 is an enlarged sectional view through the rotatable housing shown in Figure 1;

Figure 3 is a further enlarged view of the mechanism within the rotatable housing shown in Figure 2 with the wound spring clutch members shown in position for the agitating operation;

Figure 4 is a view of the wound spring clutch mechanism shown in Figure 3, but with the wound spring clutch members shown in the positions they assume during the spinning operation;

Figure 5 is a view of the wound spring clutch mechanism with the wound spring clutch members shown in the positions they assume during the braking period in which the drive motor is stopped following the spinning operation;

Figure 6 is a sectional view taken substantially along the line 6—6 of Figure 1;

Figure 7 is a sectional view analogous to Figure 6 showing a modified form of resilient suspension;

Figure 8 is a sectional view analogous to Figure 2 showing a modified form of rotatable housing; and

Figure 9 is a sectional view taken on the line 9—9 of Figure 8.

Referring now to the drawings and more particularly to Figure 1, there is shown an outer cabinet shell 20 provided with a lid 22. This outer cabinet shell 20 is supported upon a base 24 provided with adjustable feet 26. Within the cabinet shell 20 there is provided a catch basin having a vertical tubular portion 28. The vertical tubular portion 28 connects to a bottom portion 30 having a raised center provided with an opening. This bottom portion 30 is supported by a support means 32 extending downward and supported by the portion of the outer shell 20 which rests upon the base 24. In this way the catch basin is entirely supported by the base and the outer shell may be coated with porcelain, if desired, before the catch basin is assembled therein.

Extending over the opening in the raised center of the bottom 30 of the catch basin is a conical rubber member 34 the upper end of which supports a supporting flange 36 provided upon the supporting tubular housing 38. Rotatably mounted within this supporting tubular housing 38 upon the lower bearing 40 and by a suitable prelubricated upper bearing, is a tubular shaft 42, the upper end of which connects to a hub member 44 to which the tub 46 is connected and sealed. The tub 46 is provided with a series of apertures 48 adjacent its upper periphery and an upper rim 50, of reduced diameter, which prevents the loss of the clothes during the spinning operation. To reduce the vibrations of the mechanism during the spinning of the tub, there is provided a hollow flywheel member 52 mounted upon the top of the tub surrounding its opening which is filled with particles of heavy material such as iron or lead.

Within the tub there is provided a flared agitator 54 on top of which is provided a pilot 56 extending above the water level to prevent the clothes from being caught when the agitator 54 operates up and down through a stroke of about ¾ inch with a minimum clearance of about 1⅝ inches between the bottom of its flared skirt and the bottom of the tub. A long screw 58 extends from the top of the pilot 56 to a cap nut 60 threaded to the top of the hollow agitator shaft 62. This cap nut

60 clamps the central portion of the flared agitator member and the outer flexible rubber bellows seal 64 and the inner flexible rubber bellows seal 66 to a washer provided at the top of the agitator shaft 62. The lower end of the outer bellows seal is connected to an inner neck portion 68 of the tub 46 while the lower end of the inner bellows seal is secured to the upper portion of the tubular tub shaft 42. These inner and outer seals 64 and 66 prevent leakage of any fluid in the tub into the mechanism or into the catch basin.

The lower portion of the tubular shaft 42 is provided with a key 70 fitting into a slot 72 in the inner shaft 62 connecting with the agitator to provide a slidable connection between these shafts. The key 70 also provides a connection with the clutch member 74 mounted upon the outside of the shaft 42. This clutch member 74 is locked on its upper side by a ring 76 fitting in a notch provided in the outer surface of the shaft 42 and lodged within a recess in the member 74. The bottom of the clutch member 74 rests against a second clutch member 78 surrounding the shaft 42 in engagement with a spacing sleeve 80 which rests upon the inner race 82 of a ball bearing 84. This assembly of the members 74, 78, 80 and 82 is locked in place against the ring 76 by the nut 86 which is threaded upon the bottom of the shaft 42 and locked in place by a suitable lock washer 88. The key 70 also engages a notch in the member 78. The member 78 holds the turned-in end portion 90 at the upper end of a wound spring clutch member 92 which is wound in such a direction that when the hub 94 is turned in the direction for the agitating operation, the spring 92 will be unwound as shown in Figure 3. The hub 94 rests upon the outer race of the ball bearing 84 which is held in place by a cup member 96 riveted to the plate 98.

The outer periphery of the plate 98 is notched and is held against a bottom peripheral flange of an upper rotatable housing member 121 which surrounds the clutch mechanism and has a plain bearing 123 at its upper end which bears against the lower portion of the tubular housing support 38 as shown in Figures 2 and 3. Above the plain bearing 123 there is provided a shaft seal 125 formed of an inner ring of a rubber-like bearing material around which there is provided a light tension coil spring to hold it in contact with the outer surface of the tubular housing support 38. A flanged ring rests upon the inner member and is held in place by an outer ring 127 of rubber-like material which holds the flanged metal ring in place within the recess provided for the surface seal 125 in the top of the upper housing member 121.

The notched edge of the plate 98 is held in place against the bottom flange of the upper housing member 121 by the upper flange of the lower housing member 129. The flange around the bottom of the upper housing member is shaped to form one side of a V-grooved pulley while the flange around the top of the lower housing 129 is shaped to provide the second side of the V-grooved pulley. This V-grooved pulley receives the V-belt 131 by which the upper and lower portions 121 and 129 of the lower housing are rotated.

The lower housing 129 at one side is provided with a recess 133 which receives an inner spherical socket member 135 and an outer spherical socket member 137 which are clamped together against the inner flange of the recess 133 by a sheet metal cap member 139. This sheet metal cap member 139 is sealed to the lower housing 129 by a suitable gasket 141 and is held in place by three cap screws 143. The spherical socket members 135 and 137 hold a spherical bearing member 145 which provides a pivotal connection between the lower housing member 129 and an extending pin 147 which slides within a cylindrical bearing provided in the spherical bearing member 145. The unbalance of these parts is balanced by a counterbalance weight 146 on the pulley flange of the lower housing member 129. The extending pin 147 is in the

form of a projection from a ring shaped member 149 to which is clamped, by three bolts 151, the outer race 153 of a ball bearing 155. The inner race 157 of the ball bearing 155 is mounted upon an upper angular support member 159 against the shoulder provided by the reduced end portion of the inner shaft 62. The inner race 157 is held in place by a complementary lower angular support member 161 set at the same angle to the axis of the shaft 62 as the upper member 159. It is keyed to the shaft 62 by the key 163 and the members 159, 161 and 157 are locked in place by the nut 165 which is threaded onto the bottom of the stub end of the inner shaft 62 and locked by a lock washer as shown in Figure 2. The shaft 62 is centrally located in the tubular shaft 42 by a plain bearing 167 located in the vicinity of the nut 86.

The clutch mechanism includes a second wound spring clutch member 171 which is wound so as to grip internally. The upper end of this wound spring clutch member 171 is supported upon an outer spring engaging surface of the clutch member 74 while the lower end of the wound spring clutch member 171 is supported upon the outer spring engaging surface of an element 173 of a friction device. This element 173 is bonded directly to a friction disc 175 having friction facings 177 and 179 upon its upper and lower surfaces. Below the friction surface 179 there is provided a friction disc 180 which is provided with notches on its periphery which are engaged by tongues 183 extending downwardly from the inverted flanged cup-shaped member 185. A plurality of peculiar C-shaped spring members 187 having a projection 189 extending into the inner periphery of the friction ring disc 180 are provided for applying a limited pressure to the ring disc 180 to hold the friction surface 177 against the lower surface of the inverted cup-shaped friction member 185 and to hold the friction ring disc 180 against the surface 179. The upper portion of the inverted cup-shaped member 185 is provided with a plurality of inwardly extending tongues 191 engaging notches provided at the lower end of the tubular housing member 38. This arrangement therefore provides a friction device in which the elements 185, 187 and 180 are locked to the normally stationary housing member 38 so that they do not turn.

The inverted cup shaped friction element 185 through the friction surfaces 177 and 179 is connected to the member 173. The member 173 will be connected to the element 74 when the element 74 moves in such a direction as to wind the wound spring clutch member 171 tightly upon the spring engaging surfaces of the members 74 and 173. The member 173 is also connected to the member 74 when the wound spring clutch member 92 is unwound by the spring engaging surface of the member 94 so that the outer surface of the wound spring clutch member 92 then engages the inner spring engaging surface of the member 173 as shown in Figure 3. The wound spring clutch members 171 and 92 are both wound so that their natural tendency is to engage the inner spring engaging surfaces. They are arranged so that when the element 94 is turned in such a direction as to unwind the spring 92, the wound spring clutch member 171 will be wound tightly on its clutch engaging surfaces. At the same time, the unwinding of the wound spring clutch 92 will cause it to engage the inner spring engaging surface of the element 173. This will connect the tub shaft 42 and the agitator shaft 62 through the key 70, the element 74, the wound spring clutch members 171 and 92, the member 173, the friction elements 175, 180 and 185 with the tubular housing member 38.

The tub shaft 42 and the agitator shaft 62 are thereby prevented from rotating while the housing 121 is being rotated in this direction. This rotates in a circle the pivot point for the pivoted member 149 thereby forcing the free end of this pivoted member 149 downwardly to the position shown in Figure 3 and back to the position shown in Figure 2 every revolution. This is caused by the fixed angular mounting of the inner race 157 of the

ball bearing 155 upon the agitator shaft 62. The upward and downward movement of the pivoted member 149 reciprocates the agitator shaft 62 and the agitator 54 through a stroke of about ¾ inch for agitating the washing liquid in the tub 46.

When the member 94 is turned in the direction to unwind the wound spring 92 and to wind the wound spring clutch member 171, the tubular tub shaft 42 will be connected through the key 70, the element 74, the wound spring clutch members 171 and 92, to the friction disc 175 frictionally connected with the elements 180 and 185 which are locked to the normally stationary tubular housing member 38. This acts as a friction braking device to hold the tub stationary.

When the member 94 is turned in the opposite direction to wind inwardly the wound spring clutch member 92 upon the outer spring engaging surfaces of the members 94 and 78, there is provided a connection with the member 78 which is keyed by the key 70 to the tubular tub shaft 42 as well as to the agitator shaft 62. At the same time, the wound spring clutch member 171 is unwound to disengage the members 74 and 173 as shown in Figure 4. This is the position the clutch assumes during the spinning operation.

When the driving motor is stopped for terminating the spinning operation, the wound spring clutch 92 will be unwound as shown in Figure 5 to provide a connection from the tub shaft 42 through the key 70, the clutch member 74 and both the wound spring clutch members 171 and 92 to the friction elements 173 and 175 which will permit the tub 46 to continue its rotation until its inertia is overcome by the friction upon the friction surfaces 177 and 179.

The rotatable housing composed of the upper and lower housing portions 121 and 129 is filled with lubricant in the amount of between about 14 and 20 ounces. This amount fills the lower portion 129 when the housing is not rotating. When the housing is rotating, the centrifugal force throws the lubricant against the inner surfaces of the outer wall of the upper and lower portions 121 and 129. To supply lubricant to the bearings 40, 123 and the bearing surfaces below them, the inverted cup-shaped friction member 185 is provided with an oil scoop 193 extending out into the lubricant rotating with the housing so that the lubricant is scooped and splashed inwardly so as to supply lubricant to all of the bearings in the housing. An aperture 195 is provided at the base of the scoop 193 to allow the lubricant to flow into the portion where the wound spring clutch elements 171 and 92 are located. The bottom of the lower housing portion 129 is provided with a suitable drain plug 197.

The belt 131 connects to a V-groove drive pulley 220, provided upon the bottom of a reversible electric motor 222 as shown in Figure 1. This motor 222 is supported by a bracket 224 mounted upon the lower portion of the tubular housing member 38 which is suspended upon the conical rubber mounting 34. To hold mechanism in the central position, there are provided a plurality of tension coil springs 226, the lower ends of which are connected to the bracket 224 and which extend diagonally outwardly and have their upper ends connected to spring eyelets 228 connected to the bottom 30 of the catch basin assembly. To balance the off center weight of the motor 222 there is provided an additional coil spring 230 having its lower end connected to the plate 232 fastened to the bottom of the motor 222 and having its upper end connected to a spring eyelet provided upon the catch basin support 32 as shown in Figure 1. Below the pulley 220, the motor shaft is provided with the impeller 234 of a centrifugal pump 236 which is supported by bolts from the plate 232 as shown in Figure 1. The inlet of this pump 236 is connected by a rubber hose 238 to an outlet 240 provided in the bottom portion 30 of the catch basin assembly. The outlet of the pump 236 is connected by a rubber hose 242 to the drain.

The bracket 224 is provided with spring arms 244 having spring pads 246 connected at their outer end by a universal-type connection 248. These spring pads bear against surfaces on the bottom portion 30 of the catch basin assembly with a pressure of about 10 to 12 pounds to provide a light resilient damping force to dampen any vibrations of the tub and driving assembly.

The tub 42 is supplied with hot and cold water under the control of the valves 250 and 252 connecting with a thermostatically controlled mixing valve 254, the outlet of which is connected by the pipe 256 with the spout 258 extending over the upper rim of the tub 46 so as to discharge the proper mixture of water into the tub 46 at the proper time.

The washer is first filled with about eight pounds of clothes, preferably in four evenly spaced groups in the tub. A suitable amount of detergent is added to the tub. The automatic washer is preferably controlled by a suitable timed electrical control system such as is illustrated in Figure 5 of the Dyer Patent 2,331,897, issued October 19, 1943, or by the timed electrical control system provided in the Frigidaire automatic washer model WO-65. According to either of such systems, when the washer is started, the valve 250 is opened to send hot water through the pipe 256 and the nozzle 258 from which it is discharged into the tub for a definite timed period. After this timed fill period the motor 222 is energized for a definite timed period to operate in the direction to drive the belt 131 in the direction required to unwind the wound spring clutch 92 and to wind the wound spring clutch member 171 by which the tub 46 is connected through the shaft 42 and the wound spring clutch members 92 and 171 to the friction disc 175 to hold the tub stationary. While the tub 46 is thus being held stationary, the housing 121 and 129 is rotated. In its rotation, the housing 121 and 129 is supported by the bearings 84 and 123.

The rotation of this lower housing 121, 129 rotates the pivot point for the member 147 in a circle. This causes the member 147 and the shaft 62 to move downwardly from the position shown in Figure 2 to the position shown in Figure 3 and back again every revolution of the housing 121, 129. This provides one downward and one upward stroke of about ¾ inch for the agitator 54. The agitator 54 moves from the position shown in Figure 1 a distance of ¾ inch downwardly within about 1⅝ inches of the bottom of the tub 46. The motor 222 has a rated speed of about 1750 R. P. M. and the pulley 220 and the pulley groove on the housing 121, 129 provide sufficient reduction to reduce the speed of the housing to about 750 R. P. M. Thus this agitator 54 is agitated through a stroke of ¾ inch with a minimum clearance of 1⅝ inches and at the rate 750 strokes per minute, which corresponds to the rate at which the tub is spun, namely, at 750 R. P. M. This short stroke, with the high speed, provides fast satisfactory washing action by agitating the clothes to turn them over and over again in the manner described in the Clark Patent 2,366,236, issued January 2, 1945. In that patent, however, the agitator is reciprocated much more slowly at a speed of about 300 to 350 strokes of 1½ inches per minute and the minimum clearance at the bottom of the tub is only about ½ inch. I find that the shortened stroke makes it possible to use a much lighter and less costly mechanism even though it is operated at about twice the speed. This speed and stroke have been found to provide excellent results but other speeds and strokes may be used if desired.

As soon as the timer terminates the agitating period, the motor 222 is stopped and then reversed. This causes the wound spring clutch 92 to engage on its inner surfaces connecting the housing 121 through the disc 98 the members 96, 94 and the wound spring member 92 and its projection 90 to the member 78 and the key 70, to the vertical shafts 42 and 62 to rotate simultaneously the tub 46 and the agitator 54 to spin the tub 46 at the same housing

speed at which the agitation took place. This speed is about the minimum speed for satisfactory drying in a tub of convenient size. In the spinning operation, the centrifugal force forces the washing solution in the tub out through the holes 48 adjacent the top of the tub and into the catch basin assembly 28 and 30, from which the washing solution is pumped through the outlet 240 and the tube 238 by the pump 236 which discharges the solution through the hose 242 to a drain. This spinning operation is continued until substantially all of the water is taken out of the clothes which are in the tub.

After this, the valves 250 and 252 are open for a timed period to provide rinse water after which the motor 222 is restarted in the direction to provide agitation for a timed period. The motor 222 is then stopped and reversed to spin the rinse water out of the clothes. Preferably, several complete rinsing cycles are provided and during the final rinse cycle, the spinning operation is continued until substantially all of the water is centrifuged out of the clothes, after which the motor is stopped and the clothes may be removed. By this arrangement, the mechanism is made simpler, lighter, more durable and less expensive. However, satisfactory automatic washing and drying operations will be provided. In this way, a satisfactory low cost automatic washer can be provided.

Referring now more particularly to Figure 7 there is shown a modified form of the invention in which the springs 226 and their connections as well as the spring arms 244 and the friction pads 246 are replaced by an inverted cone shaped member 284 which is similar to the cone shaped member 34 but is inverted. The two cones, 34 and 284, have their large ends fastened into contact with the upper and lower surfaces on the central portion of the catch basin member 30 by the bolts 286. This provides a simplified form of resilient suspension which dampens the gyration of the tub and its driving means to minimize the transmission of vibrations to the cabinet. The members 34 and 284 are preferably made principally of a suitable synthetic rubber-like material such as neoprene properly compounded and properly reinforced to give suitable resilient damping characteristics.

Referring now more particularly to Figures 8 and 9 there is shown a modified form of agitating mechanism supported on the lower end of the tubular shaft 338 corresponding to the shaft 38 in Figure 2. A tubular shaft 342 connecting with the tub 46 is provided which corresponds to the tubular shaft 42 in Figure 2 and a hollow agitator shaft 362 is provided which corresponds to the agitator shaft 62 in Figure 2 and similarly connects to the agitator 54. A porous bronze bearing 340 is provided between the shafts 338 and 342 which is lubricated by a felt sleeve wick 441.

An improved key arrangement is provided in Figures 8 and 9. For this purpose the lower end of the hollow agitator shaft is made solid and provided with a keyway 372 having tapered walls as shown in Figure 9. Instead of using a conventional key there is provided a keying sleeve 371 preferably of prelubricated porous bronze having an inwardly extending key tongue 373 extending into the keyway 372 and an outwardly extending key tongue 374 extending into a shallow keyway provided in the lower end of the inner surface of the tubular shaft 342. This key sleeve 371 is located directly within the ball bearing 384 having its inner race mounted upon the outer surface of the tube shaft 342 an shown in Figure 8. This keying sleeve 371 serves the dual purpose of providing a lower reciprocating bearing as well as a key connection to prevent relative rotation between the shafts 342 and 362. The particular advantage of this arrangement is that any relative twisting effort between the agitator shaft 362 and the tub shaft 342 will not act upon the key so as to cause binding upon any of the bearings and there is less friction upon the surfaces of the key projections. Better fits and more quiet operation are obtained by this construction.

Above the bearing 384 there is provided a clutch member 375. This clutch member 375 is locked from upward movement by a ring 376 fitting within an annular groove provided in the outer surface of the shaft 342 and lodged within a recess in the clutch member 375. The bottom of the clutch member 375 rests against a second clutch member 378 surrounding the tub shaft 342 in engagement with a spacing sleeve 380 which rests upon the inner race of the ball bearing 384. This assembly of the members 375, 378, 380 and the inner race of the ball bearing 384 is locked in place against the ring 376 by a lock washer and the nut 386 which is threaded upon the bottom of the tub shaft 342. The second clutch member 378 is keyed to the tub shaft 342 by the key 470.

The outer surface of the second clutch member 378 has mounted thereon the upper portion of a wound spring clutch member 392. The lower end of this wound spring clutch member 392 is supported by a hub 394. This hub 394 rests upon the outer race of the ball bearing 384 which is held in place by a cup member 396 riveted to the plate 398. The plate 398 is provided with a series of apertures 399 adjacent the wall of the upper housing member 321 which surrounds the clutch mechanism. This upper housing member 321 has a plain bearing 323 at its upper end which rotates upon the lower portion of the tubular housing support 338. Above the plain bearing 323 there is provided a shaft seal 325.

The rim of the plate 398 is held in place upon a shoulder in the bottom of the flange of the upper housing member 321 by a projection on the flange of the lower housing member 329. The flange at the bottom of the upper housing member 321 is shaped to form one side of a V-grooved pulley, while the flange around the top of the lower housing member 329 is shaped to provide the second side of the V-grooved pulley. This V-grooved pulley receives the V-belt 331 corresponding to the V-belt 131 in Figure 1.

As in Figure 2, the lower housing member at one side is provided with a recess 333 which receives inner and outer spherical socket members 335 and 337 clamped together against the flange at the inner end of the recess 333 by a sheet metal cap member 339. This sheet metal cap member 339 is sealed to the lower housing by a suitable gasket 341 and is held in place by three cap screws 343. The spherical socket members 335 and 337 hold a spherical bearing member 345 which provide a universal pivot bearing providing a connection between the lower housing member 329 and an extending pin 347 which slides within a cylindrical bearing provided in the spherical bearing member 345. The unbalance of these parts is balanced by a counterbalance weight 346 on the pulley flange of the lower housing member 329. The extending pin 347 is in the form of a projection from a ring shaped member 349 to which is clamped by three bolts 351 the outer race of a ball bearing 355.

The inner race of the ball bearing 355 is mounted upon an upper angular support member 359 lodged against the shoulder provided by the reduced end portion of the inner shaft 362. The inner race 357 is held in place by a complementary lower angular support member 361 set at the same angle to the axis of the shaft 362 as the upper member 359. It is keyed to the shaft 362 by the key 363, and the members 359, 361 and 357 and are locked in place by the nut 365 which is threaded onto the bottom of the stub end of the inner shaft 362 and locked by a lock washer as shown in Figure 8.

The clutch mechanism includes a second wound spring clutch member 370 which is wound so as to grip internally. The upper end of this wound spring clutch member 370 is supported upon an outer spring engaging surface of the clutch member 375, while the lower end of this wound spring clutch member 370 is supported upon the outer spring engaging surface of an element 473 of a friction device. This element 473 is bonded directly to a flat disc 475 having friction facings upon its upper

and lower surfaces. Below the disc 475 there is provided a friction disc 480 provided with notches on its periphery which are engaged by tongues 483 extended down from the inverted flanged cup shaped member 485. A plurality of a peculiar C-shaped spring members 487 having a projection 489 extending into the inner periphery of the friction ring 480 are provided for applying limited pressure to the ring disc 480 to hold the friction facings upon the friction disc 475 in contact with the lower surface of the inverted cup shaped member 485 and the flat ring disc 480. The upper portion of the inverted cup shaped member 485 is provided with a plurality of inwardly extending tongues 491 engaging notches provided at the lower end of the tubular housing member 338. This arrangement therefore provides a friction device in which the elements 485, 487 and 480 are locked to the normally stationary housing member 338 so that they do not turn.

The inverted cup shaped friction element 485 through the friction surfaces upon the disc 475 is connected to the member 473. The member 473 will be connected to the element 375 when the element 375 moves in such a direction as to wind the wound spring clutch member 370 tightly upon the spring engaging surfaces of the members 375 and 473. The member 473 is also connected to the member 375 when the wound spring clutch member 392 is unwound by the spring engaging surface of the member 394 so that the outer surface of the wound spring clutch member 392 then engages the inner spring engaging surface of the member 473. The wound spring clutch members 370 and 392 are both wound so that their natural tendency is to engage the inner spring engaging surface. They are arranged so that when the element 394 is turned in such a direction as to unwind the spring 392, the wound spring clutch member 370 will be wound tightly on its clutch engaging surfaces. At the same time the unwinding of the wound spring clutch 392 will cause it to engage the inner spring engaging surface of the element 473. This will connect the agitator shaft 362 through the key sleeve 371 to the tub shaft 342 and the tub shaft 342 will connect through the key 470, the element 375 and the wound spring clutch members 370 and 392, the member 473 and the friction elements 475, 480 and 485 with the tubular housing member 338.

The tub shaft 342, the agitator shaft 362 are thereby prevented from rotating while the housing 321 is being rotated in this direction. The pivoted member 349 is caused to oscillate as described in connection with Figure 2. When the member 321 and consequently the member 394 are turned in the opposite direction to wind inwardly the wound spring clutch member 392 upon the outer spring engaging surfaces of the members 394 and 378, there is provided a connection through the key 370 with the tubular tub shaft 342. At the same time the wound spring clutch member 370 is unwound to disengage the members 375 and 473. This is the position the clutch assumes during the spinning operation.

When the drive motor is stopped for terminating the spinning operation, the wound spring clutch 392 will be unwound to provide a connection from the tub shaft 342 through the key 470, the clutch member 375 and both wound spring clutch members 370 and 392 to the friction elements 473 and 475 which will permit the tub to continue its rotation until its inertia is overcome by the friction device.

This rotatable housing composed of the upper and lower housing portions 321 and 329 is likewise filled with lubricant in the amount of between about 14 and 20 ounces. There is also provided an oil scoop 393 extending out into the lubricant rotating with the housing so that the lubricant is scooped and splashed inwardly so as to provide lubricant to all of the bearings in the housing. The wick 441 supplies lubricant to the porous bronze bearing 340. An aperture 395 is provided at the base of the scoop 393, to direct the lubricant into the portion where the wound spring clutch elements 370 and 392 are located. The bottom of the lower housing portion 329 is provided with a suitable drain plug 397. In general operation, this form shown in Figures 8 and 9 operates in the same manner as described in connection with the form shown in Figure 2.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In combination, a first housing, a tubular shaft rotatably mounted in said first housing, a shaft slidably mounted for reciprocation within said tubular shaft, a friction device having a first element connected to said first housing, a clutch means acting alternately as a brake and clutch and including a driven member connected to said tubular shaft and having a spring engaging surface, a reciprocating means connected to said slidable shaft means, a second housing enclosing said friction device and said clutch means and said reciprocating means, a drive means for said tubular shaft, said drive means having a spring engaging surface, a second member connected to said tubular shaft and having oppositely-facing spring-engaging surfaces on a portion spaced from said tubular shaft, said friction device having a second element having a portion spaced from said tubular shaft and provided with oppositely-facing spring engaging surfaces, a wound spring adapted to simultaneously engage two corresponding spring engaging surfaces of said oppositely-facing surfaces of said second member and said second element, said clutch means also including a second wound spring extending over and contractible against the spring-engaging surfaces of said driven member and said drive means in response to relative rotation between said drive means and said driven member in one direction and expansible against the other corresponding spring engaging surfaces of said second member and said second element, in response to relative rotation between said drive means and said driven member in the opposite direction.

2. In combination, two shaft means concentrically arranged, an enclosing housing completely enclosing the one adjacent end of each of the shaft means, the opposite adjacent ends of each of said shaft means protruding out of said housing, means preventing relative rotation of said two shaft means, said housing including a relatively stationary portion enclosing said shaft means and a rotatable portion rotatable with respect to the normally stationary portion, said housing being provided with a substantially sealed joint between the two portions, both of said shaft means being rotatably mounted with respect to both of said portions of said housing, means connecting and disconnecting the first of said two shaft means alternately to said relatively stationary portion and to said rotatable portion, reciprocating means located entirely within said rotatable portion without any connection through the walls thereof connecting said rotatable portion and the second of said two shaft means, and means for rotating said rotatable portion in opposite directions relative to the stationary portion, said housing constituting a complete lubricant container completely enclosing the reciprocating means.

3. In combination, two shaft means concentrically arranged, an enclosing housing completely enclosing the one adjacent end of each of the shaft means, the opposite adjacent ends of each of said shaft means protruding out of said housing, means preventing relative rotation of said two shaft means, said housing including a relatively stationary portion enclosing said shaft means and a rotatable portion rotatable with respect to the normally stationary portion, said housing being provided with a substantially sealed joint between the two portions, a double acting overrunning clutch means having means effective in one direction of rotation of the rotatable portion for connecting the first of said two shaft means to said rela-

tively stationary portion and having means effective in the opposite direction of rotation of the rotatable portion for connecting said first shaft means to said rotatable portion, reciprocating means connecting said rotatable portion and the second of said two shaft means for reciprocating said second shaft means in response to relative rotation between said second shaft means and said rotatable portion, said housing providing a complete envelope for said reciprocating means, and reversible driving means for said rotatale housing portion.

4. In combination, two shaft means concentrically arranged, an enclosing housing completely enclosing the one adjacent end of each of the shaft means, the opposite adjacent ends of each of said shaft means protruding out of said housing, means preventing relative rotation of said two shaft means, said housing including a relatively stationary portion enclosing said shaft means and a rotatable portion rotatable with respect to the normally stationary portion, said housing being provided with a substantially sealed joint between the two portions, said normally stationary portion being provided with a friction device, means alternately connecting the first of said shaft means through said friction device to said normally stationary portion and to said rotatable portion, reciprocating means connecting said rotatable portion and the second of said two shaft means, and means for rotating said rotatable portion, said housing constituting a complete lubricant container completely enclosing the reciprocating means.

5. In combination, two shaft means concentrically arranged, an enclosing housing completely enclosing the one adjacent end of each of the shaft means, the opposite adjacent ends of each of said shaft means protruding out of said housing, means preventing relative rotation of said two shaft means, said housing including a relatively stationary portion enclosing said shaft means and a rotatable portion rotatable with respect to the normally stationary portion, said housing being provided with a substantially sealed joint between the two portions, said normally stationary portion being provided with a friction device, a double acting overrunning clutch means having means effective in one direction of rotation of the rotatable portion for connecting the first of said two shaft means through said friction device to said stationary portion, and having means effective in the opposite direction of rotation of the rotatable portion for connecting said first shaft means to said rotatable portion, reciprocating means connecting said rotatable portion and the second of said two shaft means for reciprocating said second shaft means in response to relative rotation between said second shaft means and said rotatable portion, said housing providing a complete envelope for said reciprocating means, and reversible driving means for said rotatable housing portion.

6. In combination, two shaft means concentrically arranged, means preventing relative rotation of said two shaft means, a friction device having a normally stationary element and a movable element, a first overrunning clutch effective in one direction of relative rotation for coupling one of said shaft means and said movable element and effective in the opposite direction of relative rotation for uncoupling said shaft means from said movable element, a rotatable means rotatably mounted relative to said one shaft means, a second overrunning clutch effective in said opposite direction of relative rotation for coupling said rotatable means and said one shaft means and effective in said one direction of relative rotation for uncoupling said rotatable means from said one shaft means, a reciprocating means connecting said rotatable means and the other shaft means, and a reversible driving means for reversibly rotating said rotatable means to couple said first clutch means in said one direction of rotation to operate said reciprocating means and reciprocating said other shaft means and to couple said second clutch means in the opposite direction of rotation to rotate said shaft means.

7. In combination, two shaft means concentrically arranged, means preventing relative rotation of said two shaft means, a friction device having a normally stationary element and a movable element, a rotatable means rotatably mounted relative to said one shaft means, one of said shaft means and said movable element having means provided with a first set of coaxial annular spring engaging surfaces, said one shaft means and said rotatable means having means provided with a second set of separate coaxial annular spring engaging surfaces, said first set having in wrapping engagement therewith a wound spring which is wound in a first direction, said second set having in wrapping engagement therewith a second wound spring which is wound in the direction opposite the winding of the first mentioned wound spring, and a reversible driving means for said rotatable means.

8. In combination, two shaft means concentrically arranged, an enclosing housing completely enclosing the one adjacent end of each of the shaft means, the opposite adjacent ends of each of said shaft means protruding out of said housing, means preventing relative rotation of said two shaft means, said housing including a relatively stationary portion enclosing said shaft means and a rotatable portion rotatable with respect to the normally stationary portion, said housing being provided with a substantially sealed joint between the two portions, the enclosed end portion of one of the shaft means being provided with an angular bearing means, an operating member rotatably mounted upon the angular bearing means, a pivotal connection between said rotatable portion of said housing and said operating member, said rotatable portion constituting also an enclosed sealed lubricant container for confining lubricant therein for lubricating all the working parts within the housing, means connecting the second of the shaft means alternately to said relatively stationary portion and to said rotatable portion, and means for rotating said rotatable portion.

9. In combination, two shaft means concentrically arranged, an enclosing housing completely enclosing the one adjacent end of each of the shaft means, the opposite adjacent ends of each of said shaft means protruding out of said housing, means preventing relative rotation of said two shaft means, said housing including a relatively stationary portion enclosing said shaft means and a rotatable portion rotatable with respect to the normally stationary portion, said housing being provided with a substantially sealed joint between the two portions, means connecting the second of the shaft means alternately to said relatively stationary portion and to said rotatable portion, reciprocating means connecting said rotatable portion and the second of said two shaft means, said rotatable portion constituting a lubricant container for lubricating the working parts within the housing, means for rotating said rotatable portion, and a lubricant scoop within said housing supported and held from rotation by said normally stationary portion and extending near wall portions of said rotatable portion for scooping and splashing lubricant within the housing to lubricate the working parts therein.

10. In combination, two shaft means concentrically arranged, an enclosing housing completely enclosing the one adjacent end of each of the shaft means, the opposite adjacent ends of each of said shaft means protruding out of said housing, means preventing relative rotation of said two shaft means, said housing including a relatively stationary portion enclosing said shaft means and a rotatable portion rotatable with respect to the normally stationary portion, said housing being provided with a substantially sealed joint between the two portions, both of said shaft means being rotatably mounted with respect to both of said portions of said housing, means connecting and disconnecting the first of said two shaft means

alternately to said relatively stationary portion and to said rotatable portion, reciprocating means located entirely within said rotatable portion connected between said rotatable portion and the second of said two shaft means and being operable solely by the relative rotation between said rotatable portion and said second shaft means without penetrating the rotatable housing portion, said rotatable housing portion being provided with a reversible solely external drive means without any penetration to said reciprocating means.

11. In combination, two shaft means concentrically arranged, an enclosing housing completely enclosing the one adjacent end of each of the shaft means, the opposite adjacent ends of each of said shaft means protruding out of said housing, means preventing relative rotation of said two shaft means, said housing including a relatively stationary portion enclosing said shaft means and a rotatable portion rotatable with respect to the normally stationary portion, said housing being provided with a substantially sealed joint between the two portions, both of said shaft means being rotatably mounted with respect to both of said portions of said housing, means connecting and disconnecting the first of said two shaft means alternately to said relatively stationary portion and to said rotatable portion, reciprocating means located entirely within said rotatable portion connected between said rotatable portion and the second of said two shaft means and being operable solely by the relative rotation between said rotatable portion and said second shaft means without penetrating the rotatable housing portion, said rotatable housing portion having fixed thereon an external pulley, and a reversible drive means provided with a pulley and a belt drive with said external pulley.

12. In combination, two shaft means concentrically arranged, an enclosing housing completely enclosing the one adjacent end of each of the shaft means, the opposite adjacent ends of each of said shaft means protruding out of said housing, means preventing relative rotation of said two shaft means, said housing including a relatively stationary portion enclosing said shaft means and a rotatable portion rotatable with respect to the normally stationary portion and said shaft means, said housing being provided with a substantially sealed joint between the two portions, reciprocating means connecting said rotatable housing portion and the innermost shaft means, means connecting and disconnecting the outermost shaft means alternately to said relatively stationary portion and to said rotatable portion, and means for rotating said rotatable portion.

13. In combination, two shaft means concentrically arranged, an enclosing housing completely enclosing the one adjacent end of each of the shaft means, the opposite adjacent ends of each of said shaft means protruding out of said housing, means preventing relative rotation of said two shaft means, said housing including a relatively stationary portion enclosing said shaft means and a rotatable portion having a first rotatable bearing mounting upon said relatively stationary portion and a second rotatable bearing mounting upon said outermost shaft means, reciprocating means connecting said rotatable housing portion and the innermost shaft means, means connecting and disconnecting the outermost shaft means alternately to said relatively stationary portion and to said rotatable portion, and means for rotating said rotatable portion.

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