April 18, 1944. G. W. DUNHAM 2,346,668

WASHING MACHINE

Filed Dec. 31, 1941

Fig. 1.

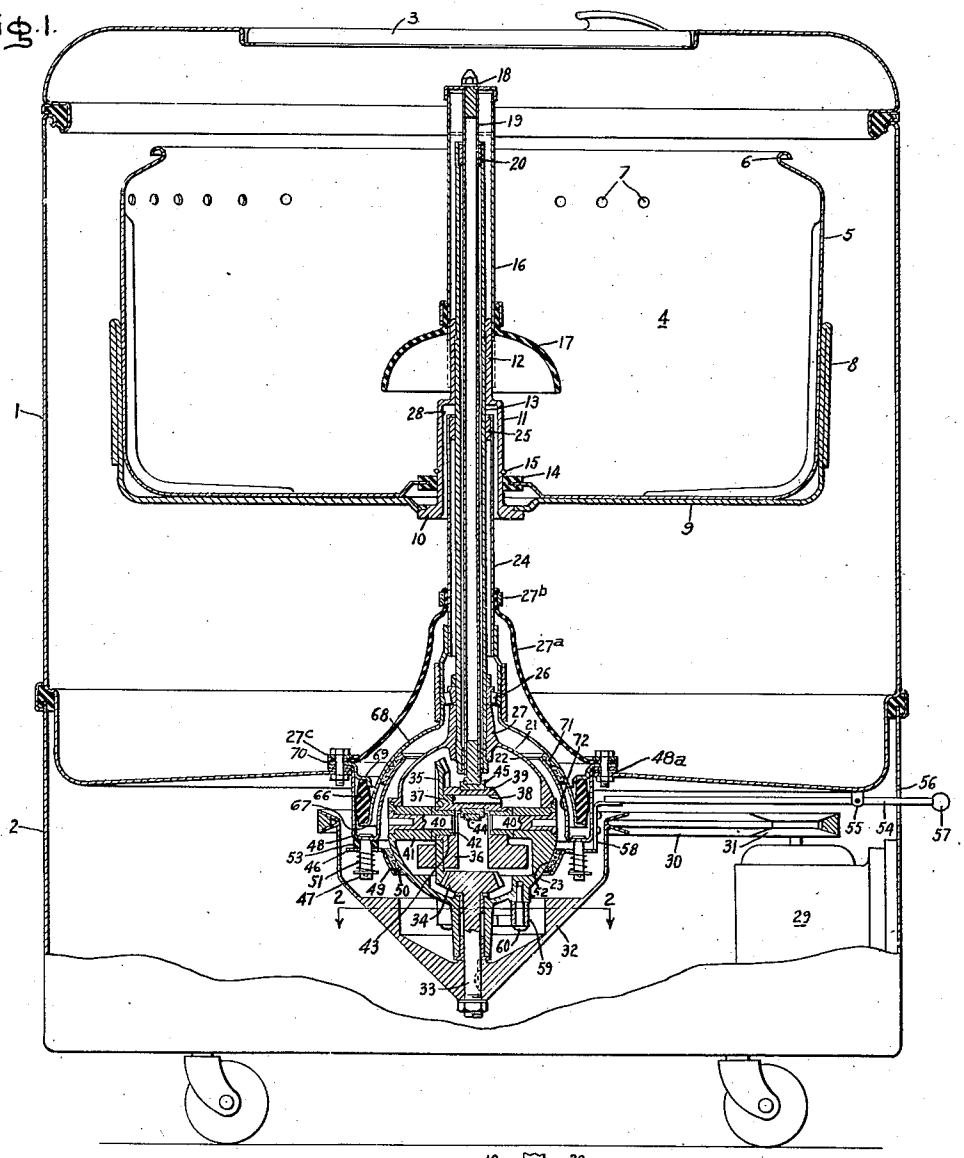


Fig. 2.

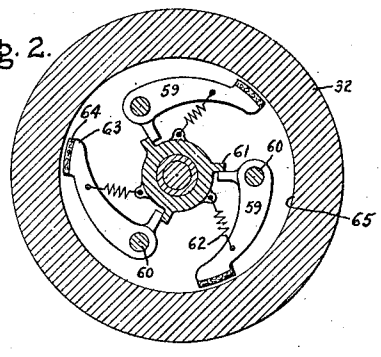
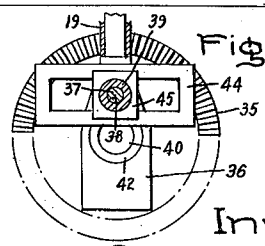


Fig. 3.



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WASHING MACHINE

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15 Claims. (Cl. 68—23)

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

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

In the accompanying drawing, Fig. 1 is a sectional elevation of a washing machine embodying my invention; Fig. 2 is a sectional view taken on line 2—2 of Fig. 1; and Fig. 3 is a sectional view of the agitator crankshaft and drive.

Referring to the drawing, there is shown a washing machine having an outer casing or tank 1 seated on the upper edge of a supporting skirt 2 and having its upper end closed by a cover 3. In the upper part of the casing is a rotatable clothes receptacle or spinner basket 4 having imperforate side walls 5 flaring outward toward the top and terminating in an inwardly extending clothes retaining rim 6. At the region of greatest diameter the side walls are provided with centrifugal discharge openings 7 which during washing also serve as overflow openings defining the liquid level. The receptacle 4 is supported in a combined balance ring and carrier having relatively heavy annular side walls 8 surrounding the receptacle side walls and connected by spaced radial arms 9 to a flange 10 at the lower end of a hub 11 non-rotatably seated on a reduced section 12 at the upper end of a tubular shaft 13. The receptacle side walls have a friction fit within the carrier side walls 8 so the receptacle and balance ring rotate as a unit upon rotation of the shaft 13. The carrier hub 11 extends through a rubber bushing 14 in the bottom of the receptacle which prevents leakage. Removal of the receptacle from the carrier is prevented by a snap ring 15. Within the receptacle is a vertically reciprocable agitator having a hub 16 slidably surrounding the carrier hub 11 and having a suction cup 17 fixed to its lower end. The upper end of the agitator hub 16 is fixed at 18 to the upper end of a tubular agitator shaft 19 guided in the receptacle shaft 13 by a bearing 20.

During the operation of the washing machine the agitator shaft 19 is reciprocated through a stroke of the order of 1½" and at a rate of the order of 250 reciprocations per minute for washing, and the receptacle drive shaft 13 is rotated at a speed of the order of 1200 revolutions per minute for centrifugal drying by driving mechanism located within a spherical casing 21 at the bottom of the outer casing. The spherical casing 21, which comprises upper and lower parts 22 and 23, the upper part 22 being fixed to the lower end of the receptacle drive shaft 13 which is journaled in a sleeve 24 extending up from the bottom of the outer casing by means of a sleeve bearing 25 between the upper end of the sleeve 24 and the receptacle drive shaft 13 and by means of a tapered roller thrust bearing 26 arranged between the lower end of the sleeve 24 and a sleeve 27 projecting from the upper housing part 22. With this construction the receptacle 4, the receptacle drive shaft 13, and the housing 21 for the driving mechanism are all supported and guided in the sleeve 24 by bearings 25 and 26. The upper end of the sleeve 24 extends above the maximum water level in the outer casing and into a recess 28 in the lower end of the carrier hub 11 so that leakage of water between the shaft 13 and the bearing 25 is effectively prevented. Leakage between the lower end of the sleeve 24 and the bottom of the outer casing 1 is prevented by a flexible rubber seal 27*a* sealed at its upper end to the sleeve 24 by a clamp 27*b* and sealed at its lower end to the bottom of the outer casing 1 by a clamping ring 27*c*.

The driving mechanism, which is mounted on the lower housing part 23, is driven by an electric motor 29, supported on the skirt 2, through a V-belt 30, a pulley 31 fixed to the motor shaft, and a pulley 32 fixed to a vertical shaft 33 journaled in the lower housing part 23. Fixed to the upper end of the shaft 33 within the housing 21 is a bevel gear 34 meshing with a bevel gear 35 fixed to a crankshaft 36 by means of a projection 37 on the gear fitting in a drilled hole 38 in the crank arm 39. The crankshaft is supported on the inner ends of pins 40 pressed into bosses 41 on the lower housing part 23 by means of bearings 42 seated in recesses 43 in the crankshaft. The crank arm 39 is connected to the agitator shaft 19 by means of a Scotch yoke comprising a cross head 44 fixed to the lower end of the agitator shaft and a slide 45 journaled on the crank arm. During washing, the housing 21 is held stationary by means of a brake comprising a ring 46 guided on diametrically opposed studs 47 at the lower end of a supporting member 48 depending through an opening in the bottom wall of the outer casing and having a supporting flange 48*a* at the top beneath the clamping ring 27*c*. At the inner edge of the ring 46 is a spherical surface 49 concentric with the spherical housing 21 and carrying friction material 50 co-

operating with the spherical braking surface 52 on the lower housing part 23. Around both of the studs 47 are compression springs 51 which urge the brake upwardly into contact with the braking surface, and around one of the studs is a spacing washer 53. The brake is controlled by a lever 54 pivoted on a bracket 55 on the bottom wall of the outer casing and having its outer end projecting through a slot 56 in the skirt 2 and terminating in a handle 57. The inner end of the lever 54 engages the upper end of a slide 58 guided on the support 48 and having its lower end cooperating with the brake 46. By lifting the handle 57, the slide 58 is depressed to pivot the brake 46 downward about the washer 53 and move the brake clear of the braking surface 52. Upon releasing the handle 57, the springs 51 move the brake against the braking surface 52.

While the housing 21 is held stationary by the brake 46, the crankshaft 36 is rotated through the bevel gears 34 and 35, causing vertical reciprocation of the agitator shaft 19 at a rate of 250 strokes a minute and through a stroke of the order of 1½ inch. Upon release of the brake 46, the housing 21 is no longer held stationary and tends to rotate due to the torque reaction between the bevel gears 34 and 35. While the housing 21 is rotating under the torque reaction, the agitator continues its reciprocation, although at a somewhat lower rate, and the receptacle shaft 13 rotates with the housing 21. As soon as the speed of rotation of the housing 21 exceeds a few hundred R. P. M., the housing 21 is directly coupled to the pulley 32 by means of a centrifugal clutch diagrammatically shown in Fig. 2. The centrifugal clutch comprises weights 59 pivoted on studs 60 on the lower housing part 23 and retracted against stops 61 by tension springs 62. When the centrifugal force acting on the weights 59 overcomes the retracting force of the tension springs 62, the weights fly outward, bringing the outer ends 63, which are faced with frictional material 64, into engagement with a clutch surface 65 integral with the driving pulley 32. While there is some slippage between the friction material 64 and the surface 65, the housing 21 is rapidly accelerated to the speed of the pulley 32 which in the present machine is 1200 R. P. M. During the acceleration of the housing 21 the speed of reciprocation of the agitator decreases as the speed of rotation of the receptacle correspondingly increases until the reciprocation of the agitator ceases as the receptacle is rotated at its full extracting speed. At the end of the centrifugal extracting operation the receptacle 4 is brought to rest by releasing the handle 57 and thereby causing the application of the brake 46. During the deceleration of the receptacle, the driving motor 29 is stopped and, since the housing 21 and the pulley 32 are coupled together by the centrifugal clutch, the housing and pulley are decelerated together and there is accordingly no reciprocation of the agitator shaft until the centrifugal clutch is released, after which there may be some reciprocation of the agitator shaft due to the inertia of the pulley. The reciprocation of the agitator during the initial stages of the acceleration of the receptacle and during the final stages of the deceleration of the receptacle does not have any harmful effect on the operation of the machine.

While the receptacle is rotating at its extracting speed, vibration due to unbalanced distribution of the clothes is reduced by resiliently supporting the receptacle for gyratory movement so that it may rotate about its center of mass. The resilient support for the receptacle comprises a rubber ring 66 confined between a flange 67 at the lower end of a spherical member 68 fixed to the sleeve 24 and a flange 69 on a ring 70 clamped between the clamping ring 27c and the bottom wall of the outer casing. The spherical member 68 rests on friction members 71 on a spherical surface 72 rising from the inner edge of the support 48. The weight of the receptacle and contents is transmitted through the sleeve 24 to the spherical surface 72 through the spherical member 68 and the friction members 71. The friction between the spherical member 68 and the friction members 71 accordingly frictionally resists tilting of the axis of rotation of the receptacle, and this frictional resistance is effective to damp vibration and also to prevent gyroscopic vibration or precession. The rubber ring 66 being confined between the flanges 67 and 69 resiliently opposes tilting of the axis of rotation of the receptacle from the central position illustrated. The rubber ring 66 does, however, permit some tilting of the axis of rotation of the receptacle so that the receptacle during extracting will rotate very nearly about its center of mass and vibration due to unbalanced distribution of clothes in the receptacle will be decreased. The rubber ring 66 is preferably proportioned so that the critical speed of the receptacle is substantially below the normal extracting speed. In the present machine the critical speed is of the order of 100 R. P. M., while the extracting speed is 1200 R. P. M. The friction damping obtained from the friction members 71 is effective in reducing the amplitude of vibration at the critical speed, and accordingly assists in bringing the machine up through the critical speed to the normal extracting speed.

The above described construction produces a compact arrangement of the driving mechanism, the resilient support, and the friction damper. The driving mechanism is contained within a spherical housing 21 arranged within and concentric with the spherical member 68, the spherical surface 72, and the brake 46. Since the driving mechanism occupies a minimum of space, it can be made relatively light and accordingly will have a minimum of reaction on the bearings 25 and 26 during the extracting operation when it gyrates with the receptacle. The friction damper 68, 71, the resilient support 66—69, and the brake 46 are compactly arranged about the casing 21.

In the use of the machine the receptacle 4 is filled with liquid and clothes and the motor 29 is started while the parts are in the position illustrated. In this position the brake 46 holds the rotatable housing 21 stationary so that the agitator 17 is vertically reciprocated to wash the clothes by the crankshaft 36 through the bevel gears 34 and 35. When the clothes are washed the handle 57 is lifted, depressing the slide 58 to release the brake 46, and the casing 21 and receptacle 4 start to rotate due to the torque reaction between the gears 34 and 35 while the agitator continues its reciprocation at a correspondingly reduced rate. When the speed of rotation of the casing 21 reaches a few hundred R. P. M., the casing is directly coupled to the driving pulley 32 by the centrifugal clutch weight 59, after which the receptacle is rapidly accelerated to its normal extracting speed while the rate of reciprocation of the agitator decreases until it finally stops entirely when the receptacle is up to speed. During extracting, liquid in the receptacle is discharged

through centrifugal discharge openings 7 and is stored in the bottom of the outer casing below the receptacle. At the conclusion of the centrifugal extracting operation, the motor 29 is stopped and the handle 57 is released, permitting application of the brake 46 by the springs 51 to stop the receptacle.

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

1. In a washing machine, a receptacle rotatable on a vertical axis, a vertical tubular drive shaft therefor, a vertically reciprocable agitator in the receptacle, an agitator drive shaft within the tubular shaft, a rotatable frame fixed to said tubular shaft, a power driving member journaled in the frame, a crank for reciprocating the agitator shaft journaled in the frame, a driving gear for said crank journaled in the frame and driven by rotation of the driving member relative to the frame, and means selectively holding said frame stationary whereby said driving gear is driven or coupling the frame to said driving member whereby the receptacle is rotated.

2. In a washing machine, a receptacle rotatable on a vertical axis, a vertical tubular drive shaft therefor, a reciprocable agitator in the receptacle, an agitator drive shaft within the tubular shaft, a rotatable frame fixed to said tubular shaft, a power driving member journaled in the frame, a crank for reciprocating the agitator shaft journaled in the frame, a driving gear for said crank journaled in the frame and driven by rotation of the driving member relative to the frame, a brake for holding said frame stationary whereby said driving gear is driven, and a centrifugal clutch carried by said frame for coupling the frame to said member whereby the receptacle is rotated.

3. In a washing machine, a support, a rotatable clothes receptacle, means including a sleeve in which the receptacle is journaled for resiliently supporting the receptacle for gyratory movement relative to the support, said sleeve being supported for tilting in all directions about a point, driving mechanism for the receptacle including planetary gearing carried on a rotatable frame, means including a thrust bearing rotatably supporting said frame on and journaling said frame in said sleeve, whereby the frame tilts with the sleeve, and cooperating spherical braking surfaces for controlling said gearing concentric with said point.

4. In a washing machine, a support, a sleeve supported thereon for tilting in all directions about a point, a shaft journaled in and supported by the sleeve, a rotatable receptacle on the shaft, planetary driving mechanism including a rotatable frame fixed to the shaft and having a spherical braking surface concentric with said point, and a brake for controlling said mechanism mounted on said support.

5. In a washing machine, a support having an upwardly presented spherical friction surface, a vertical sleeve having its lower end seated on said surface whereby tilting of the sleeve is frictionally resisted, means resiliently centering the sleeve on said support, a rotatable clothes receptacle journaled in and supported by said sleeve, driving mechanism for said receptacle, and a housing for said mechanism supported by said sleeve.

6. In a washing machine, a support having an upwardly presented spherical friction surface, a vertical sleeve having its lower end seated on said surface whereby tilting of the sleeve is frictionally resisted, means resiliently centering the sleeve on said support, a rotatable clothes receptacle journaled in and supported by said sleeve, agitating means in said receptacle, driving mechanism for said receptacle and said agitating means including planetary gearing carried on a rotatable housing, and means including a thrust bearing journaling and supporting said housing in said sleeve.

7. In a washing machine, a support having an upwardly presented hollow spherical friction surface, a vertical sleeve having its lower end seated on said surface whereby tilting of the sleeve is frictionally resisted, means resiliently centering the sleeve on said support, a rotatable clothes receptacle journaled in and supported by said sleeve, agitating means in the receptacle, driving mechanism for said receptacle and said agitating means comprising a rotatable housing, planetary gearing on said housing, means including a thrust bearing journaling and supporting said housing in said sleeve within said hollow spherical surface, and a brake on said support cooperating with said housing.

8. In a washing machine, a support, a rotatable clothes receptacle, a sleeve in which the receptacle is journaled for resiliently supporting the receptacle for gyratory movement relative to the support, a tubular receptacle drive shaft in said sleeve, washing means in the receptacle, planetary gearing for selectively operating said washing means and rotating the receptacle, said planetary gearing being enclosed in a rotatable housing fixed to said tubular shaft, and means including a thrust bearing rotatably supporting said housing on and journaling said housing in said sleeve.

9. In a washing machine, a support having an upwardly presented spherical friction surface, a vertical sleeve having its lower end seated on said surface, means resiliently centering the sleeve on said support, a rotatable clothes receptacle journaled in and supported by said sleeve, washing means in the receptacle, planetary gearing for selectively operating said washing means and rotating the receptacle, said planetary gearing being enclosed in a rotatable housing connected to the receptacle, and means including a thrust bearing rotatably supporting said housing on and journaling said housing in said sleeve.

10. In a washing machine, a vertical sleeve, means resiliently supporting the sleeve for gyratory movement, a rotatable clothes receptacle journaled in and supported by said sleeve, washing means in the receptacle, planetary gearing for selectively operating said washing means and rotating the receptacle, said planetary gearing being enclosed in a rotatable housing connected to the receptacle, and means including a thrust bearing rotatably supporting said housing on and journaling said housing in said sleeve.

11. In a washing machine, a rotatable clothes receptacle, a tubular drive shaft therefor, an agitator in the receptacle, an agitator drive shaft within said tubular shaft, planetary gearing for selectively oscillating the agitator and rotating the receptacle, said planetary gearing being carried in a rotatable housing split into upper and lower parts, the upper part being fixed to said tubular shaft, and the lower part carrying gearing fixed to the agitator shaft.

12. In a washing machine, a spinner basket having associated washing devices for washing clothes therein, driving mechanism for operating said washing devices enclosed within a rotatable gear casing, means for connecting said gear casing to the spinner basket to rotate the spinner basket for centrifugal drying whereby the gear casing and spinner basket rotate in unison, and

means resiliently supporting the spinner basket and gear casing for gyratory movement as a unit during centrifugal drying, the stiffness of said supporting means being such that the critical speed due to such supporting means is substantially below the centrifugal drying speed.

13. In a single tub washer and drier, a tub, a spinner basket therein for receiving clothes to be washed and centrifugally dried, provisions for washing clothes in the spinner basket and for rotating the spinner basket to centrifugally dry the clothes including driving mechanism having a spherical gear casing rotatable during centrifugal drying and stationary during washing, a shaft connecting the housing and spinner basket for rotating the spinner basket during centrifugal drying, and means resiliently supporting the gear casing, shaft and spinner basket for gyratory movement as a unit during centrifugal drying.

14. In a washing machine, a spinner basket, washing means associated therewith, gearing for operating said washing means and for rotating the spinner basket for centrifugal drying, said gearing being carried in a gear casing rotatable with the spinner basket during centrifugal drying, and means resiliently supporting the spinner basket and gear casing for gyratory movement as a unit during centrifugal drying, the stiffness of said supporting means being such that the critical speed due to such supporting means is substantially below the centrifugal drying speed.

15. In a washing machine, a support, a rotatable clothes receptacle, means including a sleeve in which the receptacle is journaled for resiliently supporting the receptacle for gyratory movement relative to the support, said sleeve being supported for tilting in all directions about a point, means frictionally resisting tilting of the sleeve, driving mechanism for the receptacle including planetary gearing carried in a rotatable housing, means supporting the housing for tilting with the sleeve, and cooperating brake surfaces for controlling said gearing, said brake surfaces being concentric with said point and arranged between said housing and said support.

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