

Sept. 9, 1941.

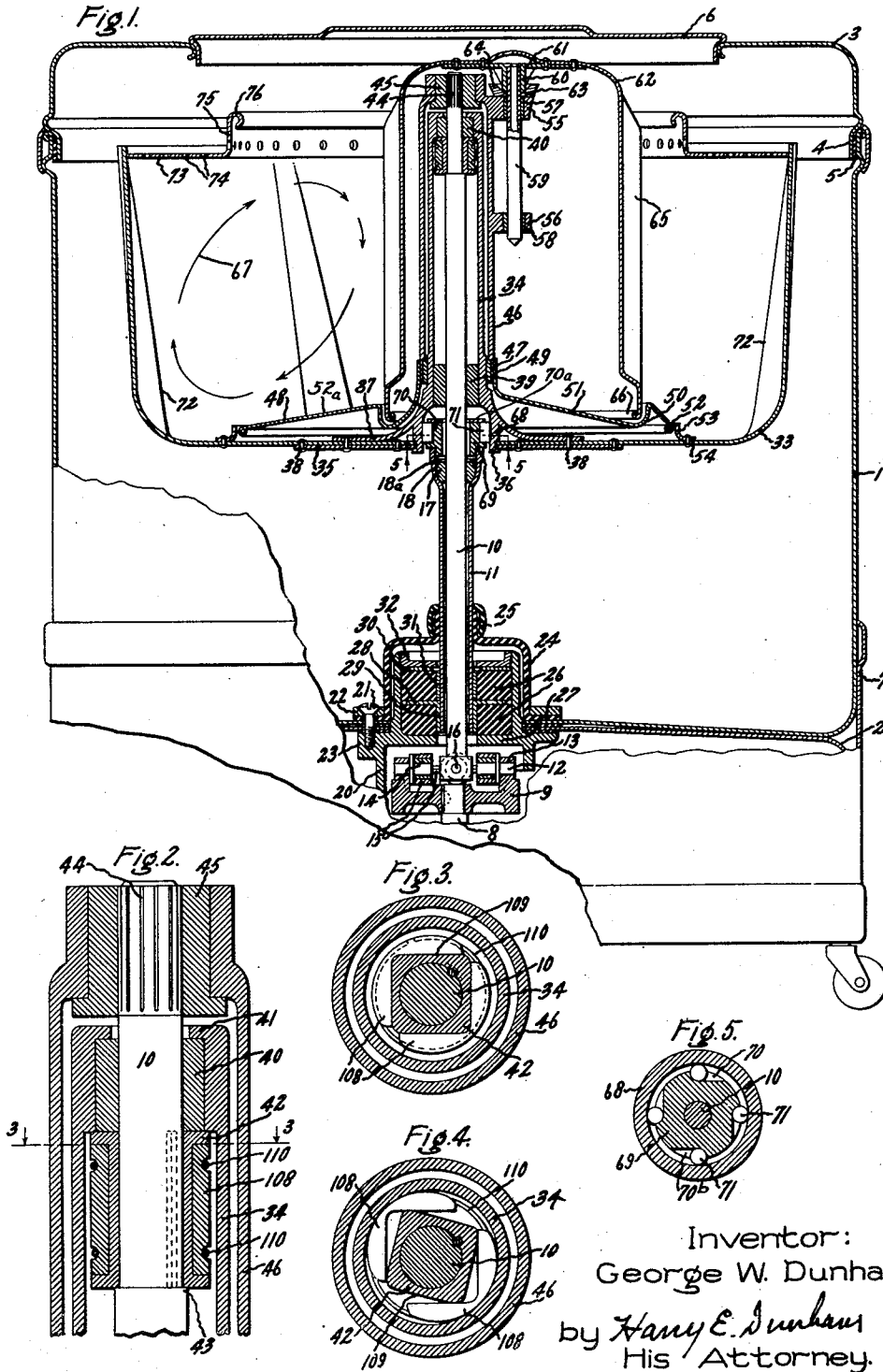
G. W. DUNHAM

2,255,505

WASHING MACHINE

Original Filed Nov. 11, 1937

2 Sheets-Sheet 1



Sept. 9, 1941.

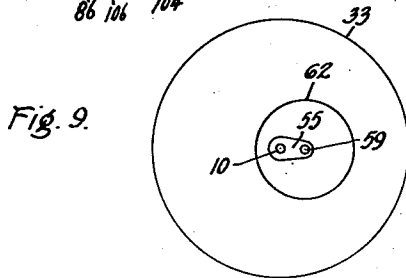
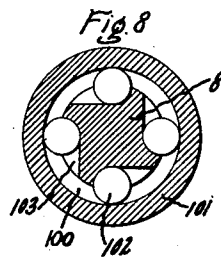
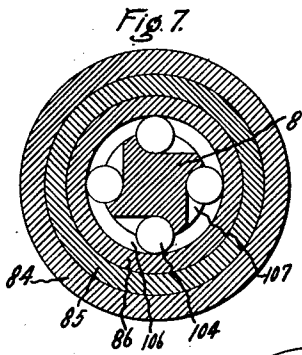
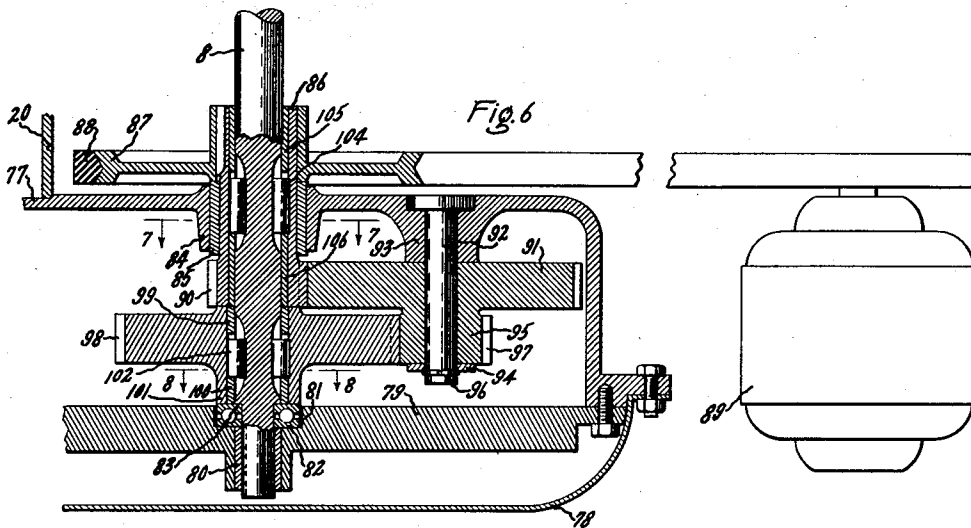
G. W. DUNHAM

2,255,505

WASHING MACHINE

Original Filed Nov. 11, 1937

2 Sheets-Sheet 2



Inventor:
George W. Dunham,
by *Harry C. Dunham*
His Attorney.

UNITED STATES PATENT OFFICE

2,255,505

WASHING MACHINE

George W. Dunham, Westport, Conn., assignor to
General Electric Company, a corporation of
New York

Original application November 11, 1937, Serial No.
173,987. Divided and this application August
23, 1939, Serial No. 291,599

5 Claims. (Cl. 68—98)

This application is a division of my application S. N. 173,987, filed November 11, 1937.

The present invention relates to washing machines of the type having an orbitally movable agitator.

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

In the accompanying drawings, Fig. 1 is an elevation, partly in section, of a washing machine embodying my invention; Fig. 2 is an enlarged sectional view of the driving connections for the agitator and the rotatable receptacle as shown in Fig. 1; Fig. 3 is a sectional view taken on line 3—3 of Fig. 2 showing the clutch between the shaft and the receptacle in the disengaged position; Fig. 4 is a similar view showing the clutch in the engaged position; Fig. 5 is a sectional view taken on line 5—5 of Fig. 1; Fig. 6 is a sectional elevation of the driving mechanism for the washing machine; Fig. 7 is a sectional view taken on line 7—7 of Fig. 6; Fig. 8 is a sectional view taken on line 8—8 of Fig. 6 and Fig. 9 is a diagrammatic view illustrating the operation of the agitator.

Referring to the drawings, the washing machine comprises a stationary tub 1 which is supported on a base 2. The upper end of the tub is partially closed by an annular cover 3 having a flange 4 which fits within the upper edge of the tub. Between the flange 4 and the tub is a suitable gasket 5. A cover 6 rests on the inner edge of the annular cover 3 and completes the closing of the top of the stationary tub. When clothes are to be inserted or removed from the washing machine, only the cover 6 need be removed. The cover 3 is removed when the inside of the stationary tub is to be cleaned. The base 2 is provided with a skirt 7 which extends above the bottom of the stationary tub and covers the abutting edges of the tub and the base.

Within the base 2 is supported a driving mechanism, hereinafter described, for the washing machine which drives a vertical shaft 8. Keyed to the shaft 8 is a brake drum 9 which is connected by means of a suitable universal joint to the lower end of a vertical shaft 10 which extends through a sleeve 11. The universal joint comprises diametrically opposed pins 12 which are fixed in ears 13 on the upper side of the brake drum. The inner ends of the pins 12 are journaled in bearings 14 clamped between plates 15

which form the intermediate member of the universal joint. The lower end of the shaft 10 is provided with diametrically opposed pins 16 which are spaced between the pins 12 and are likewise journaled in bearings carried between the plates 15 of the universal joint. With this construction, the vertical shaft 10 may have a gyratory movement with respect to the driving shaft 8. The sleeve 11 extends above the normal water level in the stationary tub 1. The upper end of the sleeve is provided with a spherical seat for a self-lubricating sleeve bearing 17 which guides the vertical shaft 10. This spherical seat comprises a flared portion 18 of the sleeve and a ring 18a fixed therein. This spherical seat permits alinement of the bearing 17 with the shaft 10 so that the bearing pressure is uniform regardless of the inclination of the shaft.

The housing for the driving mechanism which is supported within the base 2 has fixed thereto a hollow post 20 which extends through central openings in the top wall of the base and the bottom wall of the stationary tub. The post 20 is secured to the bottom wall of the tub and to the base by means of screws 21 which are threaded through a clamping ring 22 into a flange 23 which is integral with the post 20. Suitable gaskets are arranged between the flange 23 and the base and between the base and the bottom wall of the tub. Leakage from the bottom of the tub is prevented by means of a rubber sleeve 24 which has its lower edge clamped between the ring 22 and the bottom of the tub and which has its upper edge clamped to the sleeve 11 above the post 20 by means of a clamp 25. Within the post 20 is a resilient mounting for the lower end of the sleeve 11 which comprises two annuluses 26 of rubber or other resilient material. The lower annulus is arranged between an inwardly extending flange 27 at the lower end of the post and a flange 28 projecting from a sleeve 29 secured to the sleeve 11. The upper annulus is arranged between the upper side of the flange 28 and a washer 30. The inner edge of the upper annulus 26 rests against a sleeve 31 which is fixed to the sleeve 11. The sleeve 31 is of the same dimensions as the sleeve 29 and is used so that the annuluses 26 may be of the same size. The resilience of the mounting is adjusted by means of a nut 32 which is threaded into the upper end of the post 20. This nut varies the compression of the rubber and thereby varies the stiffness of the mounting. With this mounting, the sleeve 11 is resiliently held in a central position and is free to tilt in all directions in order that the shaft

10 which is guided in the sleeve may have a gyratory movement.

In the upper part of the stationary tub is a rotatable tub or receptacle 33 for receiving liquid and material to be washed. The space between the bottom of the receptacle 33 and the bottom of the stationary tub 1 is sufficient to provide a storage space for all the liquid which can be placed in the receptacle. At the center of the receptacle is a vertical sleeve 34 which serves as the hub for the receptacle. The upper end of the sleeve 34 projects above the water level in the receptacle. The lower end of the sleeve 34 fits into an opening in the bottom wall of the receptacle and an opening in a stiffening disk 35, both of which are held in position between a shoulder and a spun-over portion, as shown at 36. The lower end of the sleeve 34 is provided with a circular flange 37 which extends over the upper side of the bottom wall of the receptacle. The flange 37 and the stiffening disk 35 are secured to the bottom wall of the receptacle by means of rivets 38. The lower end of the sleeve 34 is guided by a self-lubricating bearing 39 which is fixed to the vertical shaft 10. The upper end of the sleeve 34 is guided on the shaft 10 by a self-lubricating sleeve bearing 40 which is pressed within the upper end of the sleeve against an inwardly extending flange 41 (see Fig. 2) formed thereon. The lower end of the sleeve bearing 40 bears on a hardened steel thrust collar 42 which is keyed to the shaft 10. The thrust collar is supported on the shaft by means of a shoulder 43 on the shaft. The weight of the receptacle and the material contained therein is transmitted to the thrust collar 42 by the bearing 40 and through the shoulder 43 to the shaft 10. From the shaft 10 the weight is transmitted through the universal joint to the shaft 8.

The shaft 10 projects above the sleeve 46 and the projecting end is provided with splines 44 into which fit complementary teeth formed in a bushing 45 which is fixed in the upper end of a sleeve 46. The sleeve depends around the hub 34 of the receptacle and has a bearing 47 in its lower end which bears on the hub. At the lower end of the sleeve 46 is a disk 48 having a hub 49 fixed to the sleeve 46. Eccentrically located in the upper surface of the disk is a circular depression having vertical walls 50 and bottom walls 51 inclined upward and merging into the hub 49. From the upper end of the vertical walls 50 the upper surface 52a of the disk flares downward and outward toward the bottom of the receptacle terminating in an inwardly rolled edge 52 adjacent the inner surface of a vertical flange 53 of a ring 54 secured to the bottom walls of the receptacle. Projecting from the sleeve 46 are upper and lower arms 55 and 56 in which are fixed bearings 57 and 58 in which a pin 59 is rotatably carried. The upper end of the pin 59 is fixed in a boss 60 on a plate 61 secured to the top wall of a cylindrical agitator 62. The arms 55 and 56 and the pin 59 journaled therein constitute an eccentric means supporting the agitator. The lower edge of the boss 60 bears on a chamfered seat 63 formed in a thrust bearing 64 fixed to the upper side of the arm 55. The chamfered seat 63 serves as a guide opening which facilitates the insertion of the pin 59 into the bearing 57. The side walls of the agitator are corrugated to form vertical ribs 65. The lower end of the agitator is cylindrical and projects within the circular depression formed in the

top of the disk 48. The lower end of the agitator terminates in an inwardly rolled edge 66. Upon rotation of the shaft 10 the disk 48 and the arms 55 and 56 are rotated. This causes the agitator 62 to have an orbital movement in the receptacle, squeezing the clothes between the agitator and the side walls of the receptacle. Since the agitator is freely rotatable in the bearings 57 and 58 it is held relatively stationary by the resistance offered by the clothes. The agitator may have some slight rotating movement due to variations in the resistance offered by the clothes. Since the disk is rotating relative to the agitator there is no tendency for clothes to move beneath the lower end of the agitator. Clothes which are accidentally moved into the space between the agitator and the vertical walls 50 on the disk move outward as the disk revolves. The downwardly flaring upper surface 52a of the disk also tends to move the clothes outward along the bottom wall of the receptacle. This outward movement tends to force the clothes upward along the side walls of the receptacle inducing a circulation of clothes diagrammatically shown by the arrows 67. From one aspect the disk 48 with the recess formed by the walls 50 constitutes a guard ring surrounding the lower end of the agitator. The flange 53 cooperates with the edge 52 of the disk to prevent the movement of the clothes underneath the disk.

While the agitator is being operated for washing, there is some tendency for the receptacle 33 to be rotated in the same direction as the shaft 10. In the construction illustrated, this direction of rotation is counterclockwise viewed from the top of Fig. 1. If this rotation of the receptacle were permitted there would be less relative movement of the agitator in the receptacle and the washing action would therefore be less. This counterclockwise rotation of the receptacle 33 is prevented by an over-running clutch arranged between a cylindrical flange 68 depending from the sleeve 34 and a collar 69 threaded into the upper end of the sleeve 11 and loosely surrounding the shaft 10. There is sufficient clearance between the collar and the shaft so that the shaft and collar do not come in contact in any position of the shaft. In the side walls of the collar 69 are notches 70 (Fig. 5) in which are carried rolls 71. Vertical movement of the rolls in the notches is prevented by a washer 70a at the top and by bottom walls 70b of the notches. The sides of the notches 70 are inclined so that when the receptacle 33 is rotated in a counterclockwise direction as viewed from the top in Fig. 1 (a clockwise direction as viewed in Fig. 5) the rolls 71 are jammed between the inclined surfaces of the notches 70 and the inner walls of the flange 68, holding the receptacle against rotation. When the receptacle is rotated in the reverse direction, the rolls occupy the position shown in Fig. 5, and offer no resistance to the rotation of the receptacle.

The side walls of the receptacle are provided with ribs 72 which tend to prevent rotational movement of the clothes around the receptacle during washing. The ribs also "key" the clothes and liquid to the side walls of the receptacle at the start of extracting. The clothes are prevented from falling over the upper edge of the receptacle by means of an annular guard ring 73 which is located slightly below the lower edge of the receptacle. During washing, water may be continuously discharged into the top of the receptacle. The excess water will flow through

openings 74 in the guard ring and over the upper edge of the receptacle. The inner edge of the guard ring is provided with a cylindrical flange 75 terminating in a rolled edge 76 which serves as a handle by means of which the receptacle may be lifted from the shaft 10.

The mechanism for rotating the shafts 8 and 10 is shown in Fig. 6. It is contained in a gear casing 77 suitably carried, in a manner not shown, by the lower end of the tubular post 20. The top and side walls of the gear casing are formed from a casting, the lower end of which is closed by a plate 78. Extending across the side walls of the casting is a strut 79 in which is fixed a sleeve bearing 80 guiding the lower end of the shaft 8. In the upper side of the strut 79 is a seat 81 in which is arranged a ball thrust bearing 82. A shoulder 83 on the shaft 8 transmits the thrust from the shaft through the ball bearing 82 to the strut 79. The ball bearing therefor carries the weight of the receptacle 33 and contents, the weight being transmitted through the universal joint between the shafts 8 and 10. The bearings 80 and 82 are located within the gear casing and are therefore easily lubricated.

In the top wall of the gear casing is a boss 84 in which is fixed a sleeve bearing 85. Journalled in the bearing 85 is a sleeve 86 the upper end of which projects outside the gear casing and has keyed thereto a pulley 87 which is driven through a V-belt 88 by a reversible electric motor 89. The motor is suitably supported, in a manner not shown, from the base 2. Integral with the lower end of the sleeve 86 is a pinion 90 which meshes with a gear 91 rotatably carried on a shaft 92 fixed in a boss 93 integral with the top wall of the gear casing. The gear 91 is supported on the shaft 92 by a thrust washer 94 bearing against the lower end of the hub 95 of the gear. The thrust washer is held in place by a snap ring 96. On the hub 95 is cut a pinion 97 which meshes with a gear 98 rotatably surrounding sleeves 99 and 100 fixed to the shaft 8. Projecting from the lower side of the gear 98 is a hub 101 which bears on the ball thrust bearing 82.

Between the gear 98 and the shaft 8 is an over-running clutch (Fig. 8) which comprises rolls 102 confined between the adjacent ends of sleeves 99 and 100 and fitting in notches 103 formed in the shaft 8. When the gear 98 is rotated in a clockwise direction, as viewed in Fig. 8, the rolls are in the position shown and there is no connection between the gear and the shaft. This may be termed the "free" position of the clutch, i. e. the position in which no driving connection is established. When the gear 98 is rotated in a counterclockwise direction, as viewed in Fig. 8, the rolls are wedged between the inner surface of the hub 101 and the inclined surfaces of the notches 103, establishing a driving connection between the gear and a driving connection between the gear and the shaft. In this condition, the clutch is in its engaged or driving position.

Between the sleeve 86 and the shaft 8 is an over-running clutch which comprises rolls 104 confined between sleeves 105 and 106 fixed to the shaft 8 and arranged in notches 107 in the shaft. When the sleeve 86 is rotated in a counterclockwise direction, as viewed in Fig. 7, the rolls are in the position shown, this being the "free" position in which no driving connection is established between the sleeve and the shaft. When the sleeve 86 is rotated in a clockwise direction the rolls 104 are wedged between the inner surfaces of the sleeve 86 and the inclined surfaces of the

notches 107 establishing a driving connection to the shaft.

When the motor 89 rotates in the direction to rotate the pulley 87 in a counterclockwise direction, as viewed from the top of Fig. 6, the over-running clutch between the sleeve 86 and the shaft 8 is in the "free" position, i. e., the position in which no driving connection is established between the sleeve and the shaft, while the over-running clutch between the gear 98 and the shaft 8 is in the engaged or driving position establishing a driving connection to the shaft. Under these circumstances the shaft 8 is rotated at a relatively slow speed in a counterclockwise direction through the reduction gearing which comprises the pinion 90, the gear 91, the pinion 97, and the gear 98. This causes the sleeve 46 to be rotated giving the agitator 62 an orbital movement in the receptacle which effects the washing action. The over-running clutch between the flange 68 of the receptacle and the collar 69 fixed to the sleeve 11 (Fig. 5) holds the receptacle stationary, as explained above.

When the motor is rotated in the direction to cause rotation of the pulley 87 in a clockwise direction, as viewed from the top of Fig. 6, the over-running clutch between the sleeve 86 and the shaft 8 is in the position to establish a driving connection to the shaft 8 and the shaft is accordingly rotated at the same speed as the pulley. Under this condition the over-running clutch between the gear 98 and the shaft 8 is in the free position so that no driving connection is established between the gear 98 and the shaft 8. Since no reduction gearing is interposed between the pulley and the shaft 8, the shaft is rotated at a relatively high speed and in a clockwise direction. During this rotation of the shaft, the clutch between the flange 68 and the collar 69 is in its "free" position.

During the high speed rotation of the shaft 8, a driving connection between the shaft 10 and the receptacle 33 is effected by means of a centrifugal clutch which is carried in the thrust collar 42. This clutch comprises two shoes 108 which are held against a squared cam surface 109 on the thrust collar by means of two split rings 110. During washing, when the shaft 10 is rotated at a relatively slow speed, of the order of a magnitude of 60 revolutions per minute, the split rings 110 are strong enough to hold the shoes 108 against the squared portion 109. During extracting, the shaft 10 is rotated at a speed of the order of 1200 R. P. M. As soon as the speed of rotation of the shaft 10 exceeds a few hundred R. P. M. the clutch shoes 108 move outward under the action of centrifugal force and touch the inner surface of the sleeve 34 which forms the hub of the receptacle 33. As soon as the shoes 108 contact the inner surface of the sleeve 34, rotation of the shoes is retarded and the squared surface 109 of the clutch 42 cooperates with the inner surface of the shoes 108 and wedges the shoes tightly against the inner surface of the sleeve 34 to the position shown in Fig. 4. The pressure between the sleeve and the shoes is proportional to the torque exerted on shaft 10. This effects a positive driving connection between the shaft 10 and the receptacle which causes the receptacle to be rotated. Similarly, when the speed of the shaft is retarded by the brake in stopping, the shoes release and immediately wedge in the opposite direction. During the high speed (clockwise) rotation of the shaft 10, the over-running clutch between the receptacle and the

sleeve 11 (Fig. 5) is in the free position, permitting the rotation of the receptacle.

In the use of the washing machine, the receptacle is filled with liquid and clothes and the motor is rotated in the direction to cause rotation of the pulley 87 in a counterclockwise direction, as viewed from the top of Fig. 6. This causes the shaft 8 to be rotated at a relatively slow speed through the reduction gearing which comprises the pinion 90, the gear 91, the pinion 97, and the gear 98, causing the agitator 62 to be given an orbital movement in the receptacle squeezing the clothes between the sides of the receptacle. During washing, the over-running clutch between the flange 68 and the collar 69 holds the receptacle stationary. At the conclusion of the washing operation the direction of the rotation of the motor is reversed causing the shaft 8 to be rotated at a relatively high speed through the clutch between the sleeve 86 and the shaft 8. During the high speed rotation the liquid is centrifugally extracted from the clothes in the receptacle. The over-running clutch between the flange 68 and the collar 69 is in its "free" position during the high speed rotation of the receptacle, and accordingly, offers no resistance. With this construction, the shift from washing to extracting is obtained by reversing the direction of rotation of the motor. Since the motor must come to a standstill before reversing its rotation, it is not possible to simultaneously operate both the washing and extracting mechanism and there is no need for interlocks or other safety devices to prevent the simultaneous operation of the washing and extracting mechanism.

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

1. In a washing machine, a tub, a rotatable agitator therein, the lower end being adjacent the bottom of the tub, a guard ring surrounding the

lower end of the agitator, and means for rotating the guard ring relative to the tub and to the agitator.

2. In a washing machine, a tub, eccentric means, an agitator rotatably carried thereby, the lower end being adjacent the bottom of the tub, means for rotating the eccentric means whereby the agitator is moved orbitally in the tub, and a guard ring carried by the eccentric means surrounding the lower end of the agitator.

3. In a washing machine, a tub, a disk adjacent the bottom of the tub, eccentric means, an agitator rotatably carried thereby, the lower end thereof being adjacent the bottom of the tub, means for rotating the disk and the eccentric means whereby the agitator is moved orbitally in the tub, and walls on the disk surrounding the lower end of the agitator for preventing ingress of clothes beneath the lower end of the agitator.

4. In a washing machine, a tub, eccentric means having a disk connected thereto and located adjacent the bottom of the tub, an agitator rotatably mounted on the eccentric means, means for rotating the eccentric means whereby the agitator is moved orbitally in the tub, and walls on the disk surrounding the lower end of the agitator.

5. In a washing machine, a tub, a disk adjacent the bottom of the tub, eccentric means connected to the disk, an agitator rotatably carried by the eccentric means, the lower end thereof being adjacent the upper surface of the disk, the upper surface of the disk flaring downwardly and outwardly toward the bottom of the tub from the agitator, walls on the disk surrounding the lower end of the agitator, and means for rotating the eccentric means whereby the agitator is moved orbitally in the tub.

GEORGE W. DUNHAM.