

June 6, 1939.

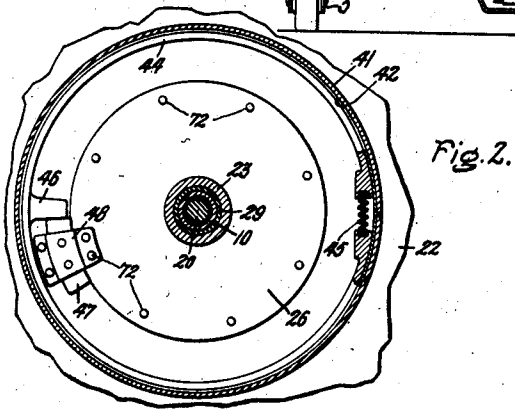
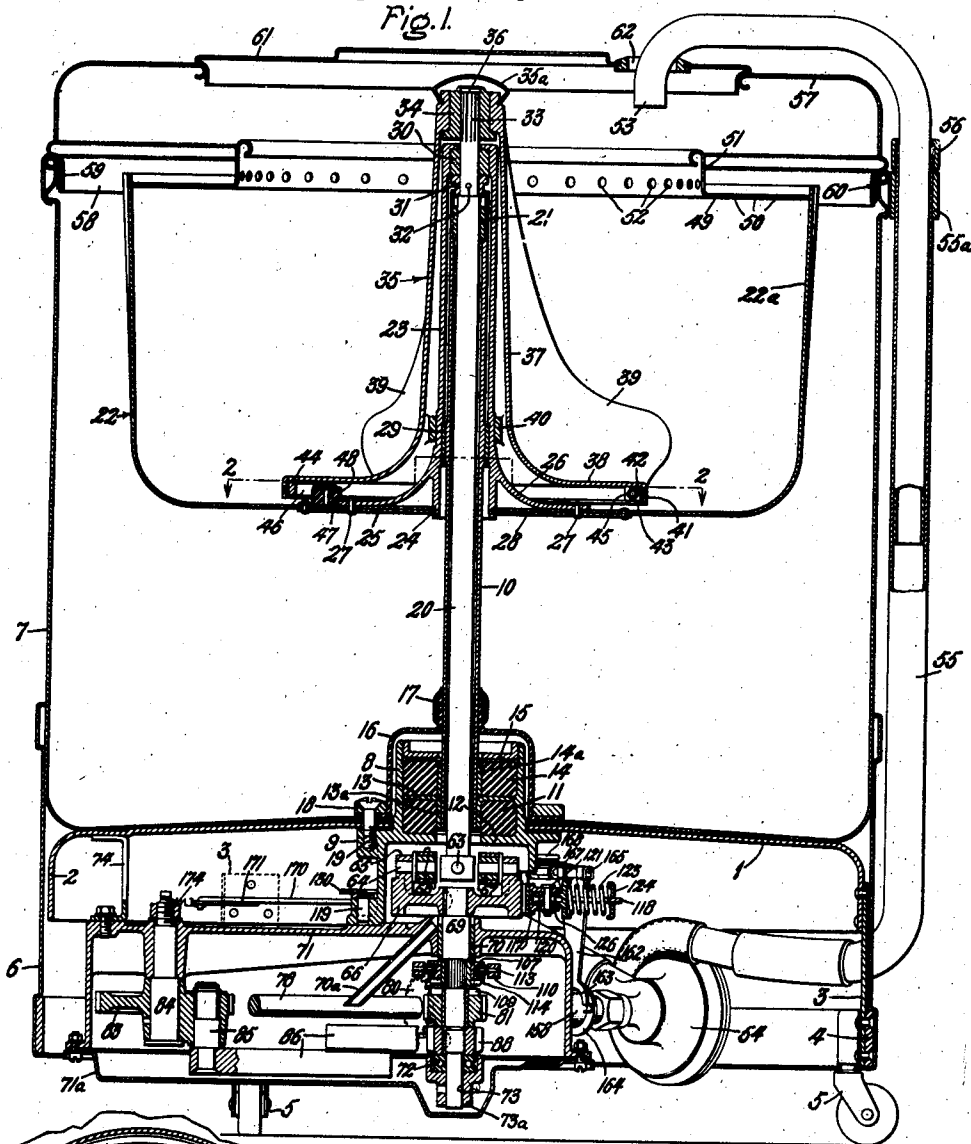
G. W. DUNHAM

2,161,618

WASHING MACHINE

Original Filed April 2, 1935

4 Sheets-Sheet 1



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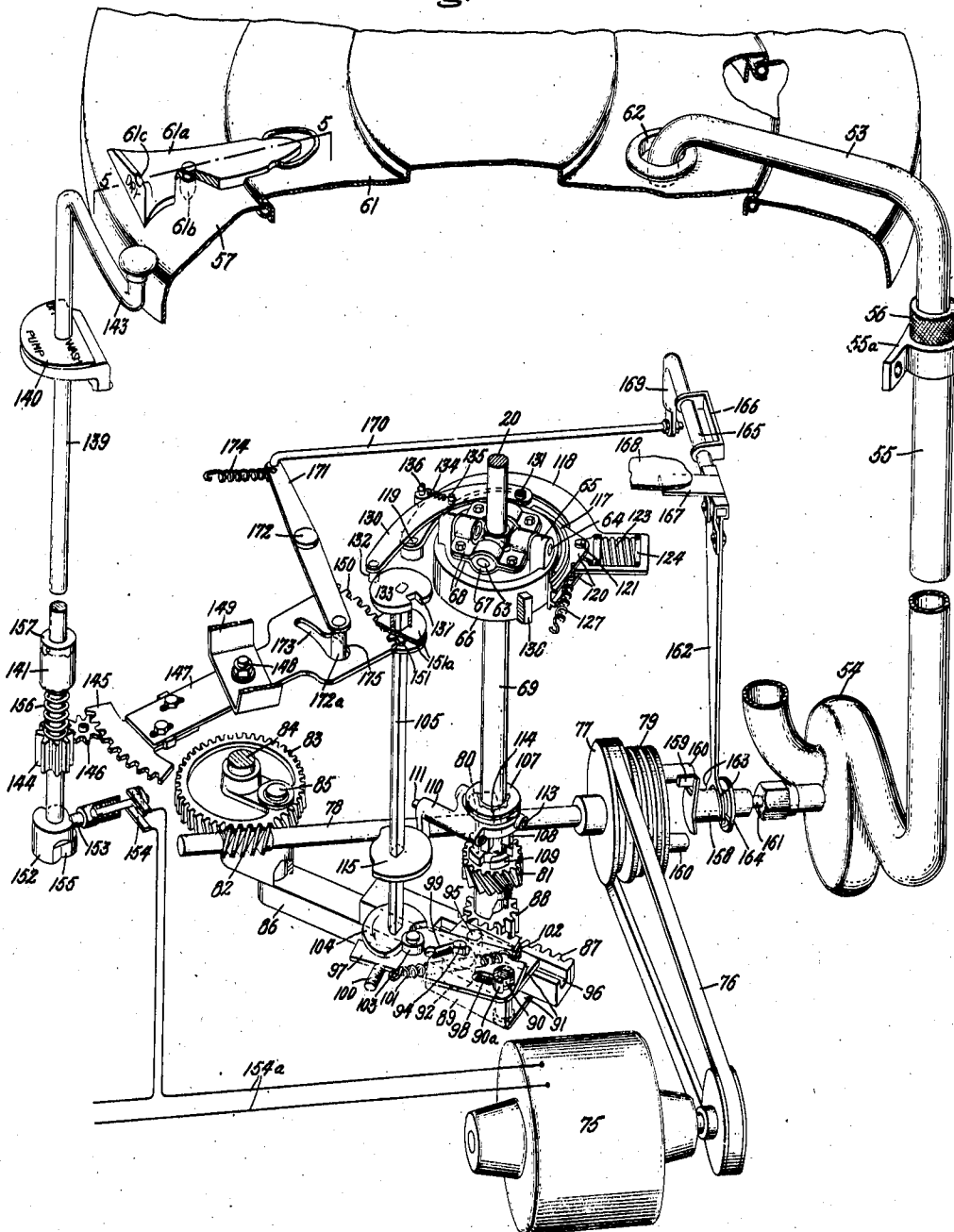
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Fig. 3.



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Fig. 4.

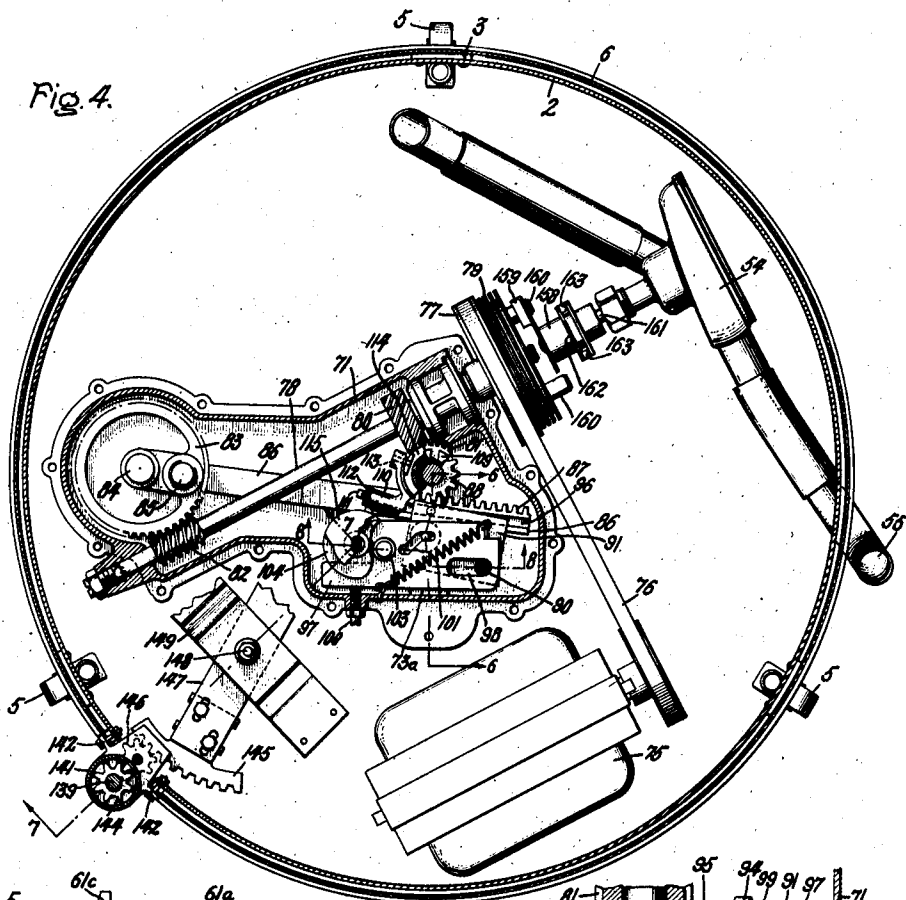


Fig. 5.

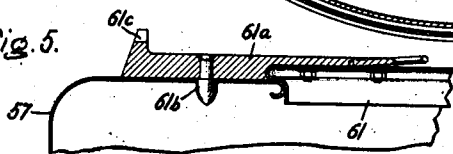


Fig. 6.

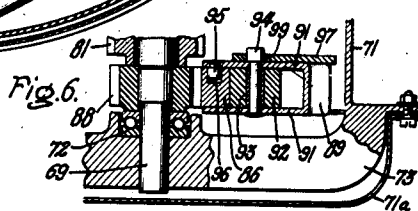


Fig. 8.

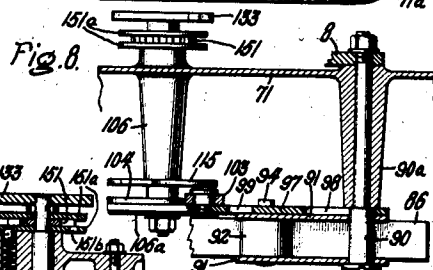


Fig. 7.

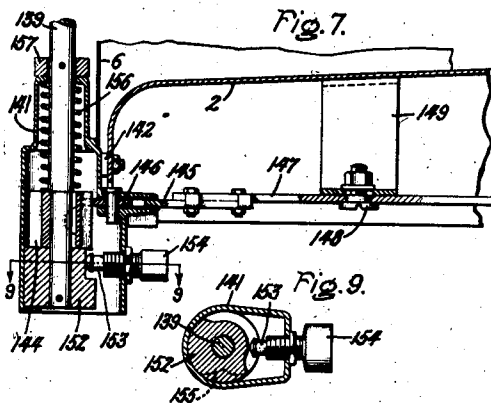
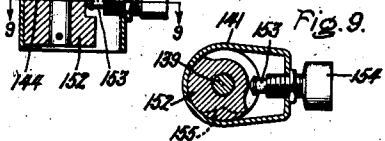


Fig. 9.



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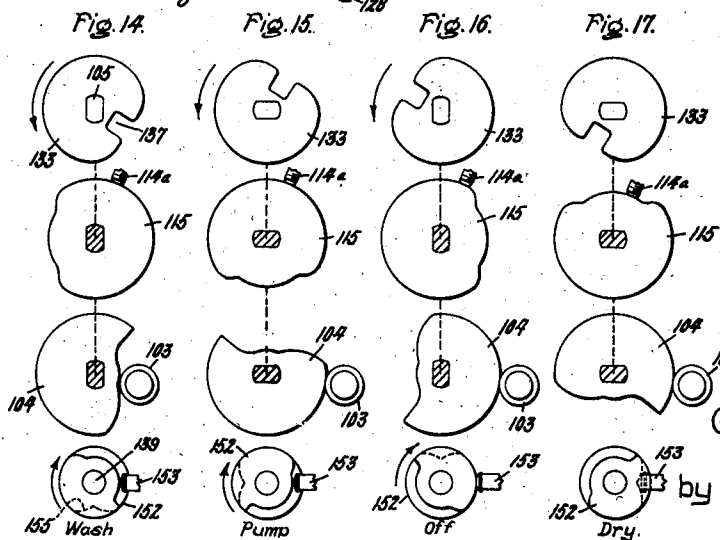
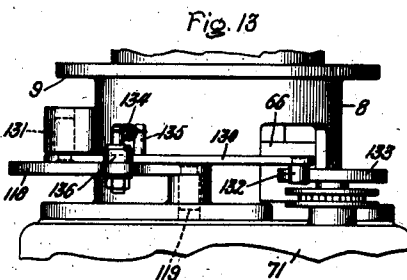
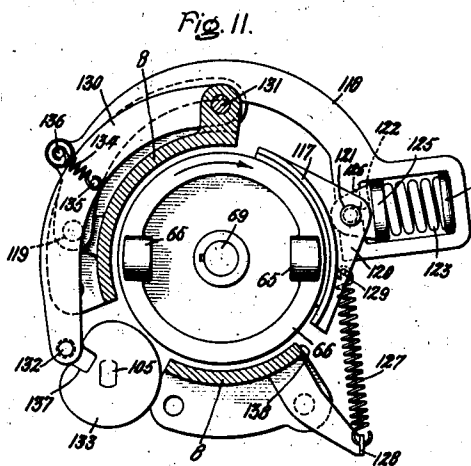
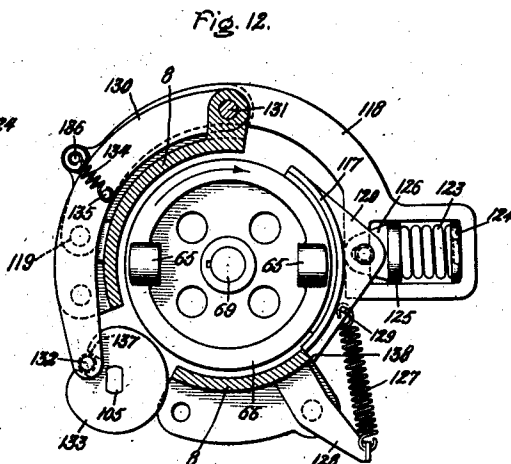
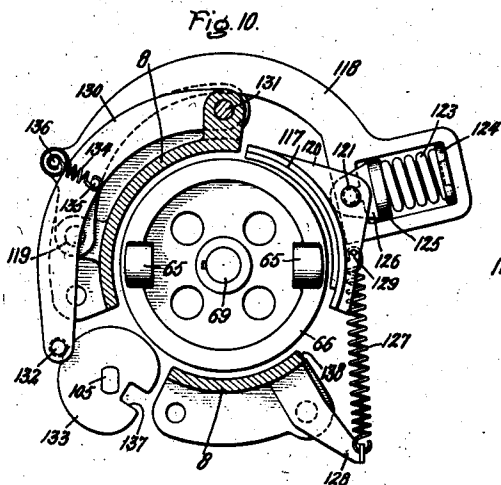
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UNITED STATES PATENT OFFICE

2,161,618

WASHING MACHINE

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New York

Application April 2, 1935, Serial No. 14,255
Renewed January 10, 1939

32 Claims. (Cl. 68—23)

My invention relates to washing machines of the type in which washing is effected by the oscillation of an agitating element in a tub, and in which the tub is subsequently rotated to centrifugally extract the liquid from the material washed, thereby washing and drying in a single tub.

The object of my invention is to provide an improved construction and arrangement in a washing machine of this type.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the accompanying drawings, Fig. 1 is a sectional elevation of a washing machine embodying my invention; Fig. 2 is a sectional plan view taken on line 2—2 of Fig. 1; Fig. 3 is a perspective view of the control for the washing machine with the outer casing and base broken away; Fig. 4 is a sectional plan view of the driving mechanism for the washing machine; Fig. 5 is a sectional elevation taken on line 5—5 of Fig. 3; Fig. 6 is a sectional elevation taken on line 6—6 of Fig. 4; Fig. 7 is a sectional elevation taken on line 7—7 of Fig. 4; Fig. 8 is a sectional elevation taken on line 8—8 of Fig. 4; Fig. 9 is a sectional plan view taken on line 9—9 of Fig. 7; Fig. 10 is a plan view of the brake for retarding the rotation of the tub showing the brake in the released position; Fig. 11 is a plan view showing the brake in the initial braking position; Fig. 12 is a plan view showing the brake in the final braking position; Fig. 13 is an elevation of the brake; Fig. 14 is a diagrammatic view showing the control cams in the washing position; Fig. 15 is a diagrammatic view showing the control cams in the pumping position; Fig. 16 is a diagrammatic view showing the control cams in the off position; and Fig. 17 is a diagrammatic view showing the control cams in the drying or extracting position.

Referring to the drawings, the washing machine embodying my invention comprises a base 1 having a depending flange 2 to which are secured the upper ends of supporting legs 3. The lower ends of the supporting legs are secured to a ring 4 on which are carried casters 5. A cylindrical skirt 6 having its upper end extending above the base is secured to the outside of the ring 4. Supported on the upper side of the base is a stationary tub 7 which provides the outer casing for the machine. The lower end of the tub extends within the skirt 6. The tub and the base are provided with a central open-

ing through which extends a vertical sleeve 8 having a flange 9 on the under side of the base. On the inside of the sleeve 8 is a resilient mounting for the lower end of a vertical sleeve 10. This mounting comprises a rubber ring 11, which lies between an inwardly extending flange 12 on the sleeve 8 and the lower side of a flange 13 on a sleeve 13a secured to the sleeve 10, and a rubber ring 14 which surrounds a sleeve 14a secured to sleeve 10 and rests on the upper side of the flange 13. The rubber rings are held in place by a nut 15 which is threaded into the inside of the sleeve 8 and which bears against the upper edge of the ring 14. The rubber rings provide a resilient support for the lower end of the sleeve 10 which permits tilting movement of the sleeve. The stiffness of the mounting may be adjusted by threading the nut 15 into or out of the sleeve 8. Leakage of liquid around the sleeve 10 is prevented by a rubber sleeve 16 having its upper end secured to the sleeve 10 by a clamp 17 and having its lower end extending under a clamping ring 18. Screws 19 extending from the clamping ring 18 through the adjacent walls of the tub and the base and threaded into the flange 9 clamp the lower end of the sleeve 16 to the upper side of the tub and also clamp the tub to the base. Suitable gaskets are arranged between the tub and the base and between the base and the flange 9 to prevent leakage.

The sleeve 10 extends above the normal water level in the tub 7. Extending through the sleeve 10 and spaced therefrom is a vertical shaft 20. The upper end of the shaft is journaled in a self-lubricating sleeve bearing 21 which is fixed to the inside of the sleeve. There is no bearing for the lower end of the shaft.

In the upper part of stationary tub 7 is a rotatable tub or receptacle 22 for receiving liquid and material to be washed. The space between the bottom of the receptacle 22 and the bottom of the tub 7 is sufficient to provide a storage space for all the liquid which can be placed in the receptacle. At the center of the receptacle 22 is a vertical sleeve 23, the upper end of which projects above the water level in the receptacle. The lower end of the sleeve 23 fits into an opening in the bottom wall of the receptacle 22 and a stiffening disk 25, both of which are held in position between a shoulder and a spun-over portion as shown at 24. The sleeve 23 is provided with a disk-shaped flange 26 which extends over the upper side of the bottom wall of the receptacle. The sleeve 23 and the stiffening disk 25 are fixed to the bottom wall of the receptacle.

cle by rivets 27. Drain openings 28 are provided in the bottom wall of the tub and the stiffening disk 25 to drain liquid which may seep into the space between the tub and the disk 26.

5 The lower end of sleeve 23 is guided on the vertical sleeve 10 by a self-lubricating bearing 29 which is fixed to the inside of the sleeve 23. The upper end of the sleeve 23 is guided on shaft 20 by a self-lubricating sleeve bearing 30 fixed in the hub formed by the upper end of the sleeve. The lower end of the sleeve bearing 30 bears on a hardened steel thrust collar 31 which is supported on and positioned by a shoulder on shaft 20. The thrust collar is prevented from turning on the shaft by pin 32. The weight of the receptacle is transmitted to the thrust collar by the bearing 30 and through the shoulder to shaft 20. The lower end of the thrust collar projects within the upper end of the sleeve 10, but is spaced therefrom so that the weight of the tub is not carried by the sleeve 10. By this arrangement, the receptacle is supported by the shaft 20 and is free to rotate relative to the shaft and relative to the vertical sleeve 10. By using the sleeve bearing 30 to support the receptacle on the shaft, the weight of the receptacle can be transmitted through the shaft to an easily lubricated thrust bearing at the lower end of the shaft. This construction eliminates the necessity for the thrust bearing between the receptacle and the upper end of sleeve 10 which would be difficult to lubricate and would present corrosion problems in the humid atmosphere present at this point. During washing, when the shaft 20 is oscillated, the receptacle remains substantially stationary due to inertia, and the bearing loss in the bearing 30 is negligible. If the receptacle were supported on the sleeve 10 during washing, a complicated lifting device would be necessary to lift the receptacle from the sleeve during extracting. By continuously supporting the receptacle on the shaft, this lifting device is eliminated. The sleeve bearing 30 is located above the normal water level in the receptacle 22 and there is accordingly no leakage of liquid around the shaft 20. The receptacle may be lifted from the shaft 20 and sleeve 10 when the inside of the stationary tub 7 is to be cleaned.

50 The shaft 20 projects beyond the upper end of sleeve 23 on the receptacle, and the projecting end is provided with splines 33 into which fit complementary splines in a bushing 34 fixed in the upper end of an agitator 35. A disk 36 is fixed in the upper end of bushing 34 and transmits the weight of the agitator to the upper end of the shaft 20. A cup 35a is snapped in place over the upper end of the agitator. The agitator has a tubular body portion 37 which extends downwardly around the sleeve 23 and terminates in a disk-shaped portion 38 adjacent the bottom of the tub. Three vanes 39 project outwardly from the tubular portion 37 and upwardly from the disk-shaped portion 38. These vanes agitate the liquid and material contained in the receptacle 22 in order to effect the washing operation. The agitator is guided on the sleeve 23 by a bearing 40 which is fixed to the inside of the tubular portion 37 of the agitator and which bears on the outside of the sleeve 23. The agitator is removable by lifting from the end of the shaft 20. Since the agitator is fixed to the shaft 20 by the splines 33, the agitator follows the movement of the shaft 20.

75 At the outer edge of the disk-shaped portion

38 of the agitator is a downturned flange 41 on the inside of which is secured a brake band 42 having an inturned flange 43 at the lower edge. A brake shoe 44 is supported by the flange 43 and is urged against the brake band by a compression spring 45 between the adjacent ends of the brake shoe. The brake shoe is provided with a projection 46 which is adapted to be engaged by a resilient block 47 fastened to the bottom of the tub 22 by a clamp 48. During the washing operation, the shaft 20 is oscillated through an angle of about 200 degrees. At the beginning of this oscillation, the projection 46 may engage the rubber block 47 and move the tub. The slip clutch which is provided by the brake shoe 44 relieves the impact. During the normal oscillation of the agitator, the projection 46 does not engage the block 47, and the receptacle therefore remains substantially stationary.

The receptacle is rotated to extract liquid from the material contained therein by rotating the shaft 20. This causes the projection 46, which is carried by the agitator to engage the block 47 and thereby to complete a coupling between the agitator and the receptacle which causes the receptacle to be rotated.

The receptacle is provided with outwardly flaring side walls 22a. Below the upper end of the side walls is secured an inwardly projecting annular guard ring 49 which is provided with holes 50. At the inner edge of the guard ring is a vertical flange 51 which is provided with holes 52. During the washing operation, the liquid is continuously introduced into the tub through a pipe 53, and the excess liquid flows over the upper edge of the tub. The guard ring 49 keeps the clothes within the tub during the washing and extracting operations. During extracting, the liquid flows up the flared side walls 22a and out over the upper edge of the receptacle. The liquid which overflows from the receptacle 22 during washing is returned to the tub by a pump 54, the inlet of which is connected to an opening in the bottom wall of the stationary tube 7 (not shown), and the outlet of which is connected to a vertical pipe 55 which extends up the outside of the outer casing and is secured thereto by a bracket 55a (see Fig. 3). One end of the pipe 53 is slidable within the pipe 55. Leakage around the pipe 53 is prevented by a seal 56 arranged between the upper end of the pipe 55 and the pipe 53.

The upper end of the stationary tub is partially closed by an annular cover 57 which extends inwardly over the upper edge of the receptacle 22. The cover is provided with a flange 58 which fits within the upper edge of the stationary tub. A rubber gasket 59 is arranged between the flange 58 and the tub. A pin 60 which is secured to the outer casing and projects through an opening in the flange 58 locates the cover with reference to the tub so that it always occupies the same relative position. A removable cover 61 rests on the inner edge of the annular cover 57 and completes the closing of the machine. Fixed to this cover and projecting beyond the edge thereof is a projection 61a carrying a pin 61b on the under side which fits in a hole in the cover 57 and locates the cover 61 on the cover 57. This is shown in Figs. 3 and 5. The cover 61 is provided with an opening 62 through which the pipe 53 projects when it is discharging liquid into the rotatable tub 22.

Power is transmitted to the lower end of vertical shaft 20 through a universal joint which com-

prises diametrically opposite pins 63 projecting from opposite sides of the shaft 20 and diametrically opposite pins 64 fixed to bosses 65 on a drum 66. The pins 64 are arranged midway between the pins 63. Bushings 67 are arranged around each of the pins. Plates 68 arranged on the upper and lower sides of the bushings 67 and each having four equally spaced depressions in which the bushings fit, are clamped together to complete the assembly of the universal joint. This universal joint permits tilting of the shaft 20 when rotating in an unbalanced condition. The drum 66 is keyed to a vertical shaft 69. The shaft 69 is journaled in a sleeve bearing 70 carried in the upper wall of a gear casing 71. The oil which is carried past bearing 70 is returned to the gear casing by a tube 70a. The lower end of the shaft 69 is carried in a bearing 73 mounted in a bridge 73a. The vertical load is carried by thrust bearing 72 also supported in bridge 73a. The bridge 73a is dowelled into position on gear case 71 and allows the entire mechanism to be assembled and operated with the gear case cover plate 71a removed. The entire weight of the receptacle 22 and the contents thereof, which is supported on the shaft 20, is carried on the thrust bearing 72. The gear casing is supported from the lower end of sleeve 8 and is also braced by a bracket 74 secured to the under side of the base 1. If for any reason the gearing needs repair or adjustment, the receptacle and the goose neck 53 are removed, the washing machine is inverted so that it rests on the upper rim of the outer casing, and the gear case cover 71a is removed. In this position all the gearing is accessible, and since the gearing is carried wholly by the gear case, it may be operated and tested with the cover removed. While in this position, none of the lubricant can leak from the gear casing since the end of the tube 70a is above the level of the lubricant. In fact the location of the tube 70a is such that lubricant cannot leak therefrom in any position of the gear case.

The power for driving the washing machine is obtained from an electric motor 75 which is suitably supported on the under side of the base in a manner not shown. The motor is provided with a belt drive 76 to a pulley 77 rotatable on a horizontal drive shaft 78. A suitable centrifugal clutch 79 completes the driving connection between the pulley 77 and the drive shaft 78 at a predetermined speed. The drive shaft 78 carries a helical gear 80 which meshes with a gear 81 rotatably carried on the vertical shaft 69. The drive shaft 78 also carries a worm 82 which meshes with a worm gear 83 rotatably carried on a pin 84 supported from the upper wall of the gear casing. Depending from the gear 83 is a crank pin 85 at the lower end of which is fixed one end of a rack 86. The crank pin 85 is rotatable in gear 83. The rack is provided with teeth 87 which are adapted to engage a pinion 88 fixed to the lower end of shaft 69. The body portion of the rack is offset, as shown in Figs. 1 and 3, so that the teeth of the rack are in line with the bearing of the crank pin in the gear 83.

The rack is carried in a guiding bracket 89 which is pivoted on a pin 90 secured to a boss 90a depending from the upper wall of the gear casing. The guiding bracket has flanges 91 which extend over the upper and lower sides of the rack. A roll 92 is journaled between the flanges 91 on a sleeve 93 which is held in place by a pin 94. This roll engages the rear side of the rack and holds the teeth of the rack in engagement with the

pinion 88. The upper flange of the guiding bracket is provided with a depending pin 95 which fits within a longitudinal slot 96 in the upper surface of the rack. When the guiding bracket is pivoted in a counter-clockwise direction, as viewed in Fig. 3, this pin moves the rack out of engagement with the pinion 88.

The position of the guiding bracket is adjusted by adjusting plate 97 which is arranged above the upper flange 91 of the guiding bracket. The adjusting plate is provided with an elongated slot 98 which fits over the pin 90 on which the guiding bracket is pivoted. The adjusting plate is also provided with a cam slot 99 which fits over the upper end of pin 94. The adjusting plate is biased in a counter-clockwise direction, as viewed in Fig. 3, against the end of an adjusting screw 100 by a spring 101 arranged between the gear casing and an ear 102 on the adjusting plate. The cam slot 99 is formed so that when the adjusting plate 97 is moved to the right, as viewed in Fig. 3, the guiding bracket 89 is pivoted in a counter-clockwise direction about the pin 90, and the rack is moved out of engagement with the pinion 88.

The arrangement illustrated for moving the adjusting plate comprises a roller 103 which is rotatably carried on the upper surface of the adjusting plate and which is engaged by a cam 104. Cam 104 is keyed to a vertical cam shaft 105 which is rotatably carried in a boss 106 depending from the upper wall of the gear casing. A plate 106a (see Figs. 7 and 8) keyed to the lower end of cam shaft 105 supports the adjusting plate 97. In Fig. 3, the adjusting plate is shown in the position in which the rack engages the pinion 88. When the cam 104 is rotated in a counter-clockwise direction, the adjusting plate is moved to the right thereby causing the rack to be moved out of engagement with the pinion 88. During this movement, the spring 101 holds the adjusting plate against the end of screw 100. The rack is reciprocated continuously during the rotation of the driving shaft 78, but the shaft 69 and the shaft 20, which is driven thereby, are oscillated only when the rack engages the pinion 88.

The gear 81, which is continuously driven by the drive shaft 78 is coupled to the shaft 69 by a clutch which comprises a flanged collar 107 which is splined to the shaft 69. On the lower surface of the collar 107 are teeth 108 which are adapted to fit between teeth 109 on the upper surface of gear 81 and thereby couple the gear 81 to the shaft 69. The movement of clutch collar 107 is controlled by a bell crank lever 110 which is pivotally carried on a pin 111 supported by a bracket 112 (see Fig. 7) from the upper wall of the gear casing. The upper arm of the bell crank is provided with pins 113 which fit within an annular groove 114 in the side of the clutch collar 107. The other arm of the bell crank carries a stud 114a which is held against a clutch-operating cam 115 by a spring 116. The spring 116 biases the bell crank in the direction to move the clutch collar into engagement with the teeth on the upper surface of gear 81. In Fig. 3, the clutch-operating cam 115 is shown in the position in which the clutch collar 107 is held out of engagement with the teeth on the gear 81. When the clutch-operating cam is moved to the position shown in Fig. 17, the spring 116 moves the clutch collar into engagement with the teeth on gear 81 and thereby couples the gear 81 to the shaft 69. This completes a driving connection from the drive shaft through

the shaft 69 to the shaft 20 so that the shaft 20 can be rotated.

At the conclusion of the extracting operation, the receptacle and the shaft 20 are being rotated at high speed. In Figs. 10 to 13, inclusive, I have shown a braking arrangement for quickly bringing the receptacle to a stop at the conclusion of the extracting operation. This arrangement comprises a brake shoe 117 which is carried on a brake arm 118 pivoted on pin 119 on the lower end of sleeve 8. The brake shoe is provided with flanges 120 which extend on either side of the brake arm 118. A pin 121 is fastened between the flanges 120 and fits in an open ended slot 122 in the brake arm. The pin 121 is held against the bottom of the slot by a prestressed spring 123 arranged between a cup 124 and a cup 125. The cup 125 has spaced flanges 126 (see Fig. 1) which extend on either side of the brake arm 118 and between the flanges 120 on the brake shoe and are pivoted on the pin 121. The brake shoe is maintained centered with respect to the slot 122 by a spring 127 arranged between a bracket 128 on the sleeve 8 and a pin 129 on the brake shoe. This spring maintains the outer surface of the brake shoe against the brake arm when the brake is in the position shown in Fig. 10. The spring 127 also biases the brake arm 118 in a clockwise direction, as viewed in Fig. 10. The position of the brake arm 118 is controlled by a lever 130 which is pivoted on pin 131 on the sleeve 8 and which carries a pin 132 at the other end which bears on a brake control cam 133. A spring 134 arranged between a pin 135 on lever 130 and a boss 136 on brake arm 118 normally holds the lever 130 against boss 136.

When the parts are in the position shown in Fig. 10, the brake control cam 133 maintains the brake arm in the position shown in Fig. 10 in which the brake does not touch the brake drum 66. To apply the brake, the cam shaft 105 is moved to the position shown in Figs. 11 and 16 in which the pin 132 is opposite a slot 137 in the brake control cam. When the parts are in this position, the spring 127 moves the brake arm 118 in a clockwise direction so that the surface of the brake shoe is brought into contact with the surface of the brake drum. The frictional torque exerted by the brake drum on the brake shoe acts through the brake shoe to the brake arm and moves the brake arm to the position shown in Fig. 12. In this position the brake shoe is wedged against the surface of the brake drum and is moved to the right in slot 122 against the force of prestressed spring 123. The spring 123 therefore controls the braking pressure which is exerted between the brake shoe and the brake drum. A stop 138 on the sleeve 8 limits the rotational movement of the brake arm. When the brake drum stops rotating, the frictional torque exerted on the brake shoe by the brake drum decreases to zero, and the spring 123 returns the brake shoe to the position shown in Fig. 11. This return movement is made possible by the fact that when the parts are in the position shown in Fig. 12, the direction of the force exerted by spring 123 is on the same side of shaft 69 as the pin 119 on which the brake arm is pivoted. When the parts are in the position shown in Fig. 12, the pin 132 is held within the slot 137 in the brake control cam and prevents further rotation of the cam shaft 105 while the parts are in this position. In other words, the entire control mechanism is locked in position until the brake drum comes to rest.

The rotation of the cam shaft is controlled by a rod 139 which is journaled at its upper end in a dial plate 140 fixed to the upper end of stationary tub and at the lower end in a casing 141 supported by a bracket 142 from the side wall 2 of the base. The upper end of the control rod 139 has an offset portion 143 which provides a handle for rotating the rod. Fixed to the lower end of the control rod 139 within housing 141 is a gear 144 which drives a segmental gear 145 through an intermediate gear 146. The segmental gear 145 is connected to one end of a lever 147 which is pivotally carried on a pin 148 in a bracket 149 supported from the upper wall of the base, as shown in Fig. 7. The other end of lever 147 is provided with a segmental gear 150 which meshes with a pinion 151 which is keyed to the cam shaft 105 between guide plates 151a. The lower guide plate 151a is provided with spaced holes 151b which are engaged by a spring pressed ball 151c. This provides a detent for holding the cam shaft in the position to which it is moved. When the control rod 139 is rotated in a clockwise direction, the cam shaft 105 is rotated in a counter-clockwise direction. At the lower end of the operating rod is a cam 152 which engages the operating plunger 153 of a motor control switch 154. The switch is normally biased to the closed position and is opened by pushing the rod toward the switch. The switch is placed in one of the conductors 154a which supply power to the driving motor. The cam surface on the cam 152 is arranged so that the motor is energized when the rod is in the washing and pumping positions shown in Fig. 3, and is deenergized when the rod is in the off position. When the operating rod is moved to the drying position shown in Fig. 3, the rod is lifted so that the handle 143 can fit in the notch 61c in projection 61a. This movement lifts the cam 152 so that the depression 155 in the cam is opposite the plunger 153, thereby permitting the motor switch to be closed. If the operating rod is not lifted, the motor switch is held open by the cam 152. When the operating rod is moved from the drying position, it is returned to the lowered position shown in Fig. 3 by a spring 156 arranged between the upper side of gear 144 and the upper end of casing 141. Downward movement of the operating rod 139 is limited by a collar 157 which is pinned to the operating rod and which engages the top of the housing 141.

The pump 54 is driven from the drive shaft 78 through a collar 158 having an ear 159 which engages one of the pins 160 on the rotatable part of centrifugal clutch 79. The collar 158 is splined on the pump shaft 161 and is spring biased toward the connecting position. The collar 158 is moved from this position by a lever 162 having forked arms 163 which fit over the collar 158 and engage a flange 164 on the collar. The upper end of lever 162 is fixed to a rock shaft 165 which is carried on the under side of the base in a bracket 166. A strip 167, which is fixed to the rock shaft, bears on the under side of a plate 168 carried by the base and provides a stop for lever 162, so positioning it that it is out of contact with flange 164 when the pump is running. The rear end of the rock shaft terminates in a crank arm 169, which is connected by rod 170 to one end of a lever 171. The lever 171 is pivoted intermediate its ends on a pin 172 carried on the under side of the base.

The front end of lever 171 carries a pin 172a which fits in a slot 173 in lever 147. The pin 172a is biased against the right hand edge of slot 173 by a tension spring 174 connected to the rear end of lever 171. When the parts are in the position shown in Fig. 3, the pin 172a is in the enlarged portion 175 of slot 173 and, in this position, the pump is driven by the drive shaft 78. When the control rod is moved to the "off" or to the "dry" positions on dial 140, the pin 172a enters the narrow portion of slot 173 and in this position the lever 162 is rotated in a counter-clockwise direction by the rod 170 and moves the collar 158 away from the connecting position. In this position, the pump remains stationary.

In the use of the washing machine, the handle 143 on the control rod 139 is moved to the position marked "pump" on the dial 140. In this position, the switch 154 is closed energizing the driving motor and the pin 172a on lever 171 is in the enlarged portion 175 of slot 173, as shown in Fig. 3 so the pump is rotated by the drive shaft 78. Water is next introduced into the rotatable receptacle 22 until water is pumped from the lower part of stationary tub 7 through the pipes 55 and 53 to the tub 22. Under these conditions, the receptacle is completely full of water and there is a small quantity of water in the bottom of tub 7.

The clothes to be washed and the desired quantity of soap are next placed in the receptacle. The handle 143 is then moved to the position marked "wash" on the dial 140. This is the position illustrated in Fig. 3. In this position, the rack operating cam 104 permits the adjusting plate 97 to be moved to the left, as viewed in Fig. 3, by spring 101 and the cam slot 99 in the adjusting plate co-operates with the pin 84 on the guiding bracket 89 to move the rack into engagement with pinion 88. This causes the shaft 20 and the agitator connected thereto to be oscillated to effect working of the clothes. At the start of this oscillation, the projection 46 on the under side of the agitator may engage the block 47 on the bottom wall of the receptacle. Since the projection 46 is carried by the brake shoe 44, the impact will cause the brake shoe to slip relative to the agitator and the receptacle will not receive the full force of the impact. This impact will cause the receptacle to move to a position in which the projection 46 no longer engages the block 47, and the receptacle will remain in this position and substantially stationary throughout the oscillation of the agitator. Since the pump is running continuously during the washing operation, an excess of liquid is being introduced into the receptacle from stationary tub 7.

When the clothes are clean, the handle 143 is moved in a clockwise direction from the position shown in Fig. 3 through the "pump" and "off" positions to the position marked "dry" on the projection 61a. When the handle reaches the position marked "pump" on the dial 140, the rack control cam 104 is moved to the position shown in Fig. 15. In this position, the cam engages the roller 103 on the adjusting plate 97 and moves the adjusting plate to the right, as viewed in Fig. 3. This causes the guiding bracket 89 to be pivoted in a counter-clockwise direction, thereby moving the rack out of engagement with the pinion 88. At this time, the oscillation of the agitator ceases although the rack continues its reciprocation. When the

handle reaches the "off" position, the cam 152 at the lower end of the operating rod opens the switch 154 and deenergizes the motor and the pump is disconnected from shaft 78. Just after the handle passes the "off" position, the clutch control cam 116 is moved to a position in which the bell crank 110 moves the clutch collar 107 into engagement with the gear 81 under the action of spring 116. Since the motor is deenergized, the drive shaft 78 is stationary at this time and there is no danger of injuring the clutch by this operation. During the latter part of the movement of the handle from the "off" position to the "dry" position, the handle is lifted into notch 61c, and when the handle reaches the "dry" position, the operating plunger 153 of motor switch 154 rests in depression 155 of cam 152, closing switch 154 and energizing the motor. As soon as the motor reaches a predetermined speed, the centrifugal clutch 79 completes the driving connection between the motor and drive shaft 78, and the vertical shaft 20 is rotated. During this movement, the projection 46 on the under side of the agitator engages the block 47 carried by the receptacle and causes the receptacle to be rotated. When the shaft 20 reaches a speed of about 100 R. P. M., there is a critical vibration of the shaft about the resilient mounting provided by rubber rings 11 and 14. There is no other critical vibration of the shaft between this speed and 1150 R. P. M. which is the normal running speed. During the rotation of receptacle, the liquid in the clothes is thrown by centrifugal force to the side walls of the receptacle and flows over the upper edge of the receptacle. The annular guard ring 49 keeps the clothes within the receptacle during this extracting operation. The liquid which is discharged from the receptacle is collected in the bottom part of stationary tub 7 and remains there since the pump is not running.

When the clothes have been sufficiently dried, the handle 143 is moved in a counter-clockwise direction to the "off" position, thereby deenergizing the motor and disconnecting the clutch collar 107 from the gear 81. When the handle reaches this position, the brake cam 133 is in the position shown in Figs. 11 and 16 in which pin 132 is opposite slot 137 in the cam. When the cam reaches this position, the brake shoe 117 is moved to the position shown in Fig. 11 by the spring 127. The brake drum 66 which is connected to the shaft 20 is now rotating at about 1150 R. P. M. in the direction indicated by the arrow in Fig. 11. The frictional torque exerted by the brake drum on the brake shoe moves the brake shoe in a clockwise direction to the position shown in Fig. 12. In this position, the brake shoe is held against the surface of the brake drum by the prestressed spring 123. This spring exerts a large force on the brake shoe so that the braking force exerted on the brake drum quickly brings the tub to rest. While the brake shoe is in the position shown in Fig. 12, the pin 132 on lever 130 is held within the slot 137. This holds the cam shaft in this position and prevents movement of the operating rod 139. It is, therefore, not possible to move the control rod to either the washing or drying positions while the brake is applied. This is important because the clutch between the gear 81 and the shaft 69 would be injured if it were engaged while the shaft were rotating. Also, the clothes might be damaged if the agitator were oscillated while the tub was ro-

tating. The brake remains in the position shown in Fig. 12 until the rotation of the tub stops. At this time, the frictional torque exerted on the brake shoe decreases to zero, and the spring 123 returns the brake shoe to the position shown in Fig. 11. During the return movement, the spring 134 moves the arm 130 so that the pin 132 is moved clear of slot 137.

The clothes are now dried and may be removed.

10 If the washing solution in the bottom of tub 7 is to be re-used, the handle 143 is moved to the pumping position, and the solution is pumped through pipes 55 and 53 to the tub 22. Another batch of clothing may now be put in the tub 22, and the washing and extracting operations described above may be repeated. If the washing solution in the tub is not to be used again, the pipe 53 is pivoted in the pipe 55 so that it discharges to a drain and the solution is pumped to the drain.

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

1. In a washing machine, a rotatable receptacle, driving means for rotating said receptacle to extract liquid from the material contained therein, means including a brake for retarding the rotation of said receptacle, and means controlled by said brake means for preventing rotation of said receptacle by said driving means until rotation of said receptacle has substantially stopped.

2. In a washing machine, a rotatable receptacle, driving means for rotating said receptacle to extract liquid from the material contained therein, means including a brake for retarding the rotation of said receptacle, a control lever for controlling said driving means and said brake means, and means controlled by said brake means for holding said control lever in the braking position until rotation of said receptacle has substantially stopped.

3. In a washing machine, a rotatable receptacle, an agitator in said receptacle, driving means for rotating said receptacle to extract liquid from the material contained therein and for oscillating said agitator in said receptacle for washing, means including a brake for retarding the rotation of said receptacle, and means controlled by said brake means for preventing rotation of said receptacle or oscillation of said agitator by said driving means until rotation of said receptacle has substantially stopped.

4. In a washing machine, a rotatable receptacle, driving means for rotating said receptacle to extract liquid from the material contained therein, means including a brake for retarding the rotation of said receptacle, and means controlled by the frictional torque on said brake means for preventing rotation of said receptacle by said driving means until rotation of said receptacle has substantially stopped.

5. In a washing machine, a rotatable receptacle, driving means for rotating said receptacle to extract liquid from the material contained therein, an agitator in said receptacle, means for oscillating said agitator in said receptacle for washing, means including a brake for retarding the rotation of said receptacle, and means controlled by the frictional torque on said brake means for preventing oscillation of said agitator by said oscillating means until rotation of said receptacle has substantially stopped.

6. In a washing machine, a rotatable receptacle, means for rotating said receptacle to extract liquid from the material contained therein,

means including a brake drum for retarding the rotation of said receptacle, a brake arm carrying a brake shoe, means moving said brake arm for initially moving said brake shoe into contact with the braking surface of said drum, means utilizing the torque due to the frictional force exerted on said brake shoe by said brake drum for further moving said brake shoe against said brake drum, and spring means for resisting this further movement of the brake shoe and for returning said brake shoe to the initial position when the frictional torque decreases to a predetermined value.

7. In a washing machine, a rotatable receptacle, means for rotating said receptacle to extract liquid from the material contained therein, means including a brake drum for retarding the rotation of said receptacle, a brake shoe, movably mounted carrying means for said brake shoe arranged to permit movement of said brake shoe away from the braking surface of said drum, said carrying means being movable by the frictional torque exerted on said brake shoe by said drum and arranged to wedge said brake shoe against the braking surface of said drum by this movement, means including a spring for resisting the movement of said brake shoe away from the braking surface of said drum and for limiting the pressure between said brake shoe and said brake drum, means for moving said carrying means to relieve the brake pressure when the friction torque decreases to a predetermined value, and means for moving said brake shoe into contact with the braking surface of said drum for initiating the braking action.

8. In a washing machine, a rotatable receptacle, means for rotating said receptacle to extract liquid from the material contained therein, means including a brake drum for retarding the rotation of said receptacle, a brake shoe, carrying means for said brake shoe movable by the frictional torque exerted on said brake shoe to wedge said brake shoe against the braking surface of said drum, means including a spring for limiting the pressure between said brake shoe and said brake drum and for moving said brake shoe to release the brake pressure when the friction torque decreases to a predetermined value, and means for moving said brake shoe into contact with said brake drum for initiating the brake action.

9. In a washing machine, a rotatable receptacle, means for rotating said receptacle to extract liquid from the material contained therein, means including a brake drum for retarding the rotation of said receptacle, a brake shoe, a pivoted brake arm for carrying said brake shoe, said brake arm being movable by the frictional torque exerted on said brake shoe in a direction to wedge said brake shoe against the braking surface of said brake drum, said brake shoe being movable relative to said brake arm away from the braking surface of said drum, a spring for limiting the pressure between said brake shoe and said drum and for moving said brake arm in the direction to relieve the braking pressure when the frictional torque decreases to a predetermined value, means including a cam for moving said brake arm to a position in which said brake shoe is in contact with the braking surface of said brake drum, and means for preventing further movement of said cam until the frictional torque on said brake shoe decreases to a predetermined value.

10. In a washing machine, a rotatable receptacle, a vertical shaft for rotating said receptacle,

cle to extract liquid from the material contained therein, a brake drum connected to said shaft, a sleeve surrounding said drum, a gear casing carried by said sleeve having gearing therein for rotating said shaft, a brake adapted to engage said drum and carried by said sleeve for retarding the rotation of said receptacle, and a cam shaft carried by said gear casing for controlling said brake and said gearing.

11. In a washing machine, a receptacle for receiving liquid and material to be washed, an agitator in said receptacle, a gear casing having driving means therein for rotating said receptacle to extract liquid from the material contained therein and for moving said agitator relative to said tub for washing, braking means for retarding the rotation of said receptacle, and means including a cam shaft carried by said casing for controlling said driving and braking means.

12. In a washing machine, a rotatable receptacle, driving means for rotating said receptacle to extract liquid from the material contained therein, means including a brake for retarding the rotation of said receptacle, a control lever for controlling said driving means and said brake means, and means responsive to the braking force exerted by said brake means for holding said control lever in the braking position until rotation of the receptacle has substantially stopped.

13. In a washing machine, a rotatable receptacle, driving means for rotating said receptacle to extract liquid from the material contained therein, means including a brake for retarding the rotation of said receptacle, a control lever for controlling said driving means and said brake means, and means responsive to the braking force exerted by said brake means for preventing controlling of said driving means until rotation of said receptacle is substantially stopped.

14. In a washing machine, a rotatable receptacle, means for rotating the receptacle to extract liquid from the material contained therein, means including a brake drum for retarding the rotation of said receptacle, a brake arm carrying a brake shoe, means moving said brake arm for moving said brake shoe into contact with the braking surface of said drum, and means utilizing the torque due to the frictional force exerted on said brake shoe by said brake drum for locking said brake arm in the braking position until the frictional torque decreases to a predetermined value.

15. In a washing machine, a rotatable receptacle, means for rotating said receptacle to extract liquid from the material contained therein, means including a brake drum for retarding the rotation of said receptacle, a brake arm carrying a brake shoe, a cam co-operating with said brake arm to move the brake shoe into contact with the braking surface of said drum, said cam and said brake arm having co-operating parts for locking the brake arm in the braking position, and means for utilizing the torque due to the frictional force exerted on said brake shoe by said brake drum for effecting engagement of said co-operating parts to lock said brake arm in the braking position.

16. In a washing machine, a rotatable receptacle, driving means for rotating the receptacle to extract liquid from the material contained therein, means including a brake drum for retarding the rotation of the receptacle, a brake shoe, means for moving said brake shoe into contact with the braking surface of said drum,

cam means for controlling said braking and said driving means, and means utilizing the frictional force exerted on said brake shoe by said brake drum for opposing movement of said cam means to control said driving means until the frictional force decreases to a predetermined value.

17. In a washing machine, a rotatable receptacle, a gear casing having a vertical shaft carried therein and having gearing therein for rotating said shaft, means including said shaft for rotating said receptacle to extract liquid from the material contained therein, a brake drum carried by said shaft, a brake carried by said gear casing and arranged to engage said drum for retarding the rotation of said receptacle, and control means carried on said gear casing for controlling said brake and said gearing.

18. In a washing machine, a receptacle for receiving liquid and material to be washed, an agitator in said receptacle, a gear casing having gearing therein, means including said gearing for moving said agitator in the receptacle for washing, means including said gearing for rotating said receptacle to extract liquid from the material contained therein, braking means carried by said casing for retarding the rotation of the receptacle, and means including a cam shaft carried by the gear casing for controlling said gearing and said braking means.

19. In a washing machine, a rotatable receptacle, driving means for rotating said receptacle to extract liquid from the material contained therein, means including a brake for retarding the rotation of said receptacle, and means controlled by said brake means for opposing rotation of said receptacle by said driving means during the high speed rotation of the receptacle.

20. In a washing machine, a rotatable receptacle, driving means for rotating said receptacle to extract liquid from the material contained therein, means including a brake for retarding the rotation of said receptacle, a control lever for controlling said driving means, and means controlled by said brake means for holding said control lever in the braking position until rotation of said receptacle has substantially stopped.

21. In a washing machine, a rotatable receptacle for receiving liquid and material to be washed, mechanism for effecting washing in the receptacle and for rotating the receptacle at high speed to extract liquid from the material contained therein, brake means for retarding the rotation of the receptacle, and means controlled by said brake means for opposing operation of said mechanism during the high speed rotation of the receptacle.

22. In a washing machine, a rotatable receptacle for receiving liquid and material to be washed, mechanism for effecting washing in the receptacle and for rotating the receptacle at high speed to extract liquid from the material contained therein, brake means for retarding the rotation of the receptacle, and means controlled by the frictional torque on said brake means for opposing operation of said mechanism during the high speed rotation of the receptacle.

23. In a washing machine, a rotatable receptacle, driving means for rotating said receptacle to extract liquid from the material contained therein, an agitator in said receptacle, means for moving the agitator relative to the receptacle for washing, means including a brake for retarding the rotation of said receptacle, and means controlled by the frictional torque on said brake

means for opposing operation of the agitator during rotation of the receptacle.

24. In a washing machine, a rotatable receptacle, means for rotating said receptacle to extract liquid from the material contained therein, means including a brake drum for retarding the rotation of said receptacle, a brake shoe, carrying means for said brake shoe movable by the frictional torque exerted on said brake shoe to wedge said brake shoe against the braking surface of said drum, spring means opposing the movement of brake shoe carrying means by the frictional torque, and means for moving said brake shoe into contact with said brake drum for initiating the brake action.

25. In a washing machine, a rotatable receptacle, means for rotating said receptacle to extract liquid from the material contained therein, means including a brake drum for retarding the rotation of said receptacle, a brake shoe, a pivoted brake arm for carrying said brake shoe, said brake arm being movable by the frictional torque exerted on said brake shoe in a direction to wedge said brake shoe against the braking surface of said brake drum, said brake shoe being movable relative to said brake arm away from the braking surface of said drum, and a spring for limiting the pressure between said brake shoe and said drum and for moving said brake arm in the direction to relieve the braking pressure when the frictional torque decreases to a predetermined value.

26. In a washing machine, a rotatable receptacle, driving means for effecting washing in the receptacle and for rotating the receptacle to extract liquid from the material contained therein, means including a brake drum for retarding the rotation of the receptacle, a brake shoe, means for moving said brake shoe into contact with the braking surface of said drum, cam means for controlling said braking and said driving means, and means utilizing the frictional force exerted on said brake shoe by said brake drum for opposing movement of said cam means to control said driving means until the frictional force decreases to a predetermined value.

27. In a washing machine, a receptacle for receiving liquid and material to be washed, an agitator in said receptacle, a gear casing having gearing therein, means including said gearing effecting washing in the receptacle and for rotating said receptacle to extract liquid from the material contained therein, braking means carried by said casing for retarding the rotation of the receptacle, and means including a cam shaft carried by the gear casing for controlling said gearing and said braking means.

28. In a combined washing and drying machine, a rotatable receptacle for receiving material to be washed, a washing element therein, a shaft extending along the axis of the receptacle having driving connections to the washing element and receptacle whereby upon rotation of the shaft at high speed the receptacle is rotated for extracting and upon rotation of the shaft at a lower speed the washing element is operated for washing, driving mechanism for operating the shaft at washing and extracting speeds, means including a brake for retarding the rotation of said receptacle at the conclusion of the extracting operation, and means controlled by said brake means for preventing operation of said shaft at its washing speed by said driving

mechanism until said rotation of the receptacle has substantially stopped.

29. In a combined washing and drying machine, a rotatable receptacle for receiving material to be washed, a washing element therein, a shaft extending along the axis of the receptacle having driving connections to the washing element and receptacle whereby upon rotation of the shaft at high speed the receptacle is rotated for extracting and upon rotation of the shaft at a lower speed the washing element is operated for washing, driving mechanism for operating the shaft at washing and extracting speeds, means including a brake for retarding the rotation of said receptacle at the conclusion of the extracting operation, and means controlled by the frictional torque on said brake for preventing operation of said shaft at its washing speed by said driving mechanism until said rotation of the receptacle has substantially stopped.

30. In a combined washing and drying machine, a shaft, a rotatable receptacle for receiving material to be washed surrounding the shaft, a washing element in the receptacle connected to the shaft, driving mechanism for selectively oscillating the shaft at a low speed and rotating the shaft at a high speed, a driving connection from the shaft to the receptacle effective during rotation of the shaft to rotate the receptacle for extracting, a brake acting on the shaft for retarding rotation of the receptacle at the conclusion of the extracting operation, and means controlled by said brake for preventing oscillation of the shaft by said driving mechanism until rotation of the receptacle has substantially stopped.

31. In a washing machine, a vertical shaft, a receptacle for receiving liquid and material to be washed having a hub rotatably surrounding the upper end of the shaft, a washing element in the receptacle movable relative thereto, a thrust bearing between the receptacle hub and the shaft for supporting the receptacle on the shaft, a guide bearing for the receptacle, said bearings journaling the receptacle in rotatable relation to the shaft and being spaced apart sufficiently to prevent tipping of the receptacle, a driving connection between the washing element and the receptacle by rotation of the shaft relative to the receptacle to agitate the liquid and material therein for washing, a driving connection between the shaft and the receptacle for rotating the receptacle for extracting, and means resiliently supporting the shaft for gyratory movement about its lower end whereby the receptacle may rotate about its center of mass during extracting.

32. In a combined washing and drying machine, a receptacle for receiving liquid and material to be washed adapted for rotation on a vertical axis to centrifugally extract liquid from the material contained therein, a casing serving as a storage tank having sufficient space below the receptacle during extracting to store the liquid contents of the receptacle, an agitator in the receptacle, a vertical agitator shaft for operating the agitator to agitate the liquid and material for washing, a thrust bearing between the agitator shaft and the receptacle for supporting the receptacle on the shaft, a guide bearing for the receptacle, said bearings journaling the receptacle in rotatable relation to the shaft and being spaced apart sufficiently to prevent tipping of the receptacle, a driving connection between

the shaft and receptacle for rotating the receptacle for extracting, driving mechanism, a universal driving connection between the driving mechanism and the shaft for permitting gyratory movement of the shaft relative to the driving mechanism and to the casing, and means

for resiliently supporting the agitator shaft and receptacle for gyratory movement relative to the driving mechanism and to the casing whereby the receptacle may rotate about its center of mass during extracting.

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