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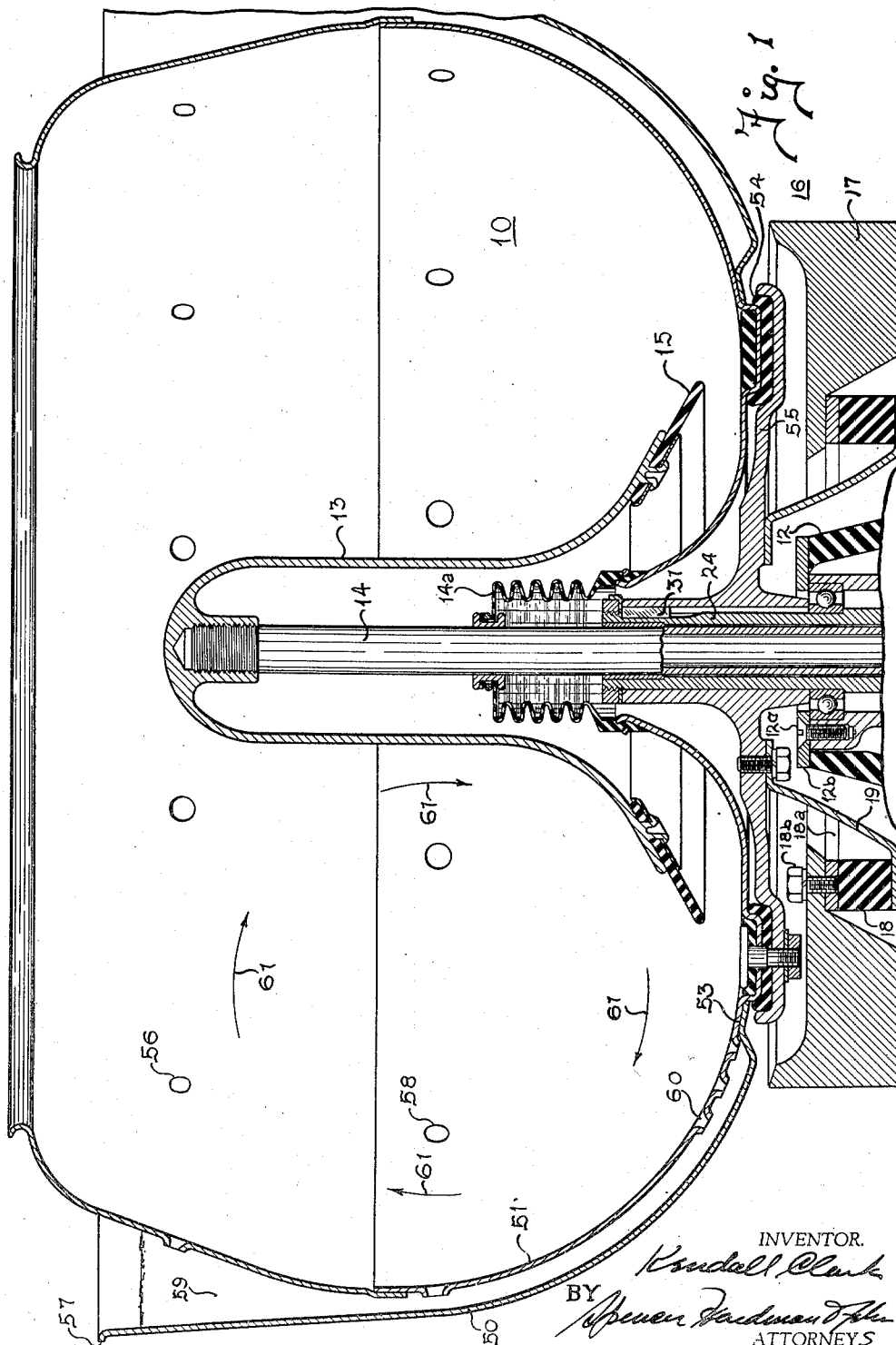
K. CLARK

2,366,236

DOMESTIC APPLIANCE

Filed Sept. 28, 1940

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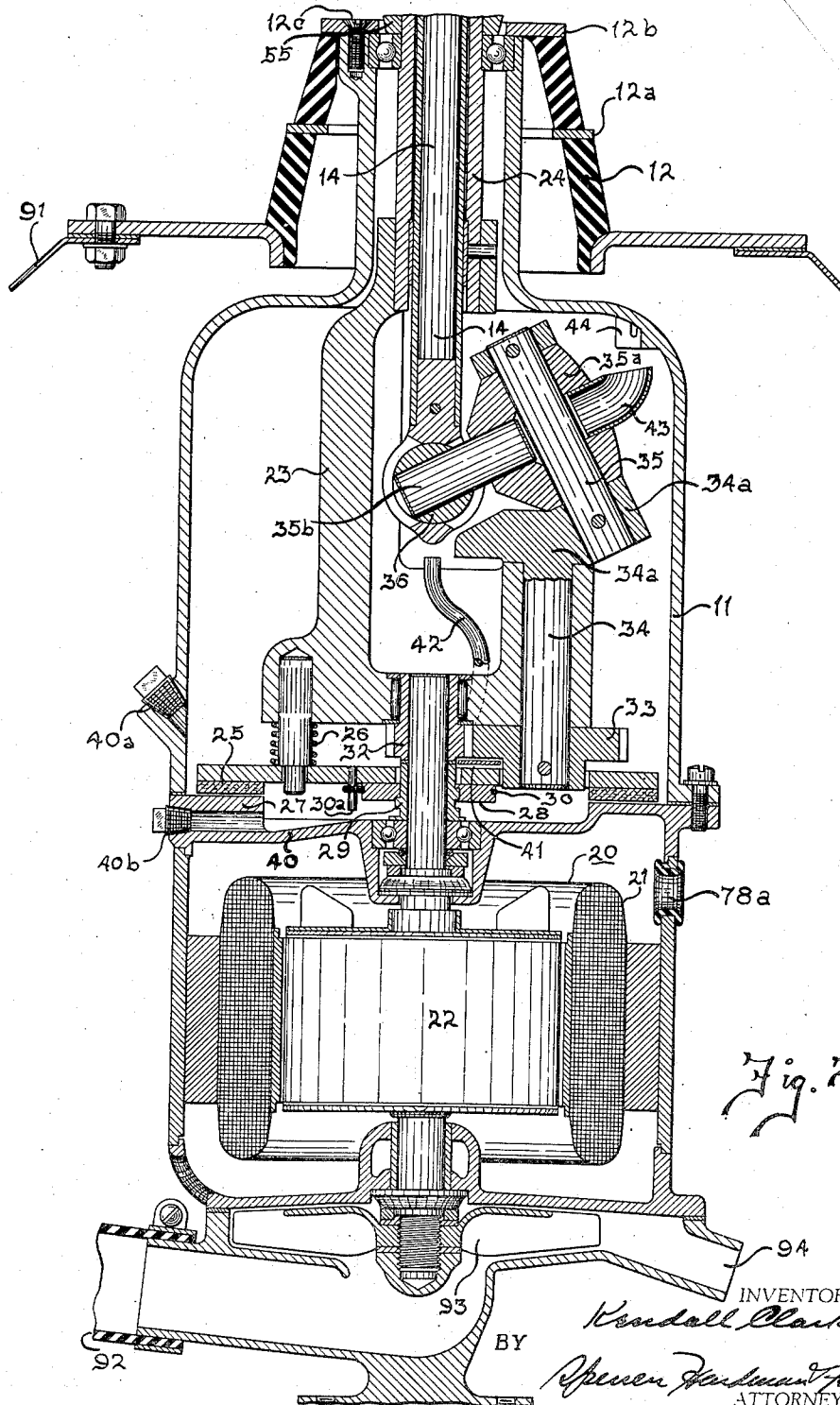
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DOMESTIC APPLIANCE

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4 Sheets-Sheet 2



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DOMESTIC APPLIANCE

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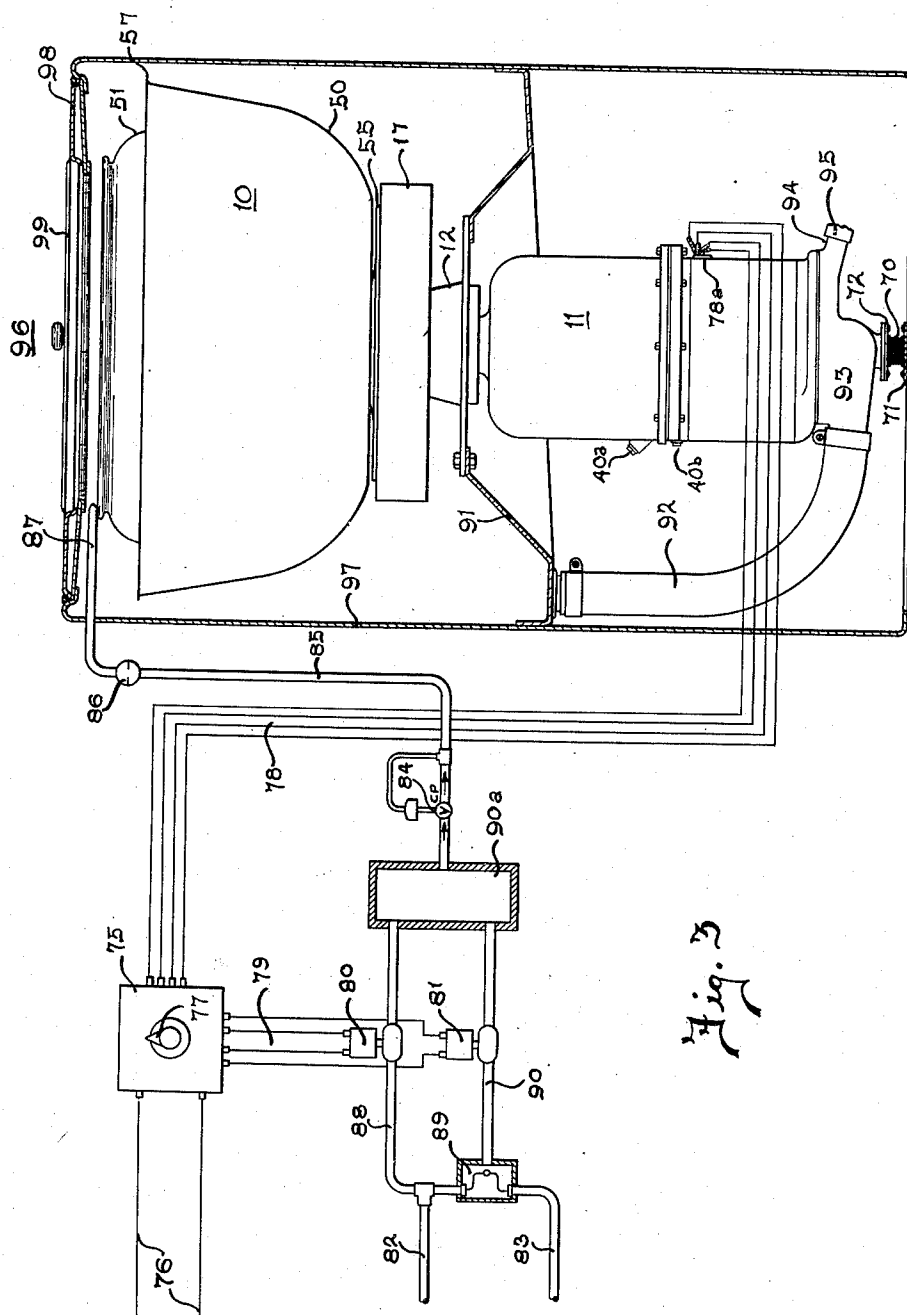


Fig. 3

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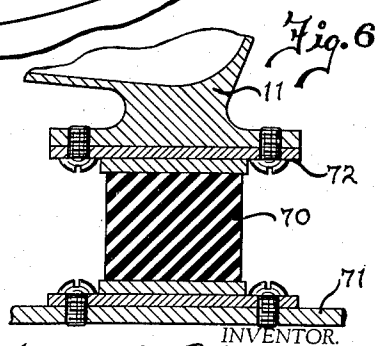
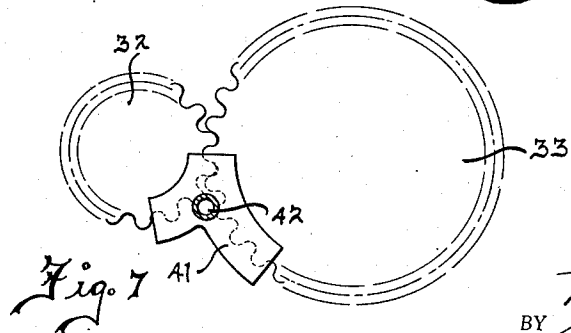
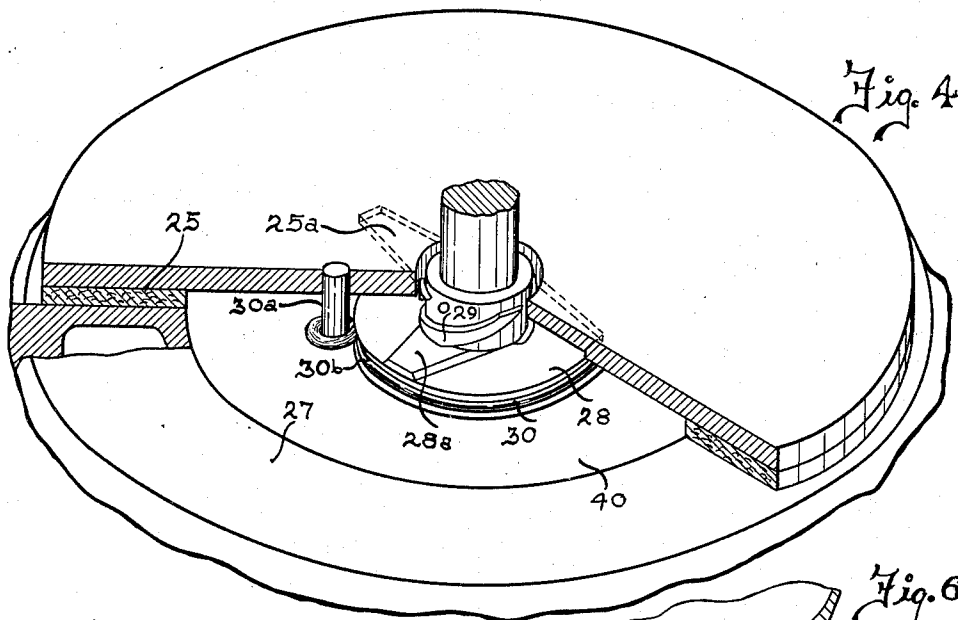
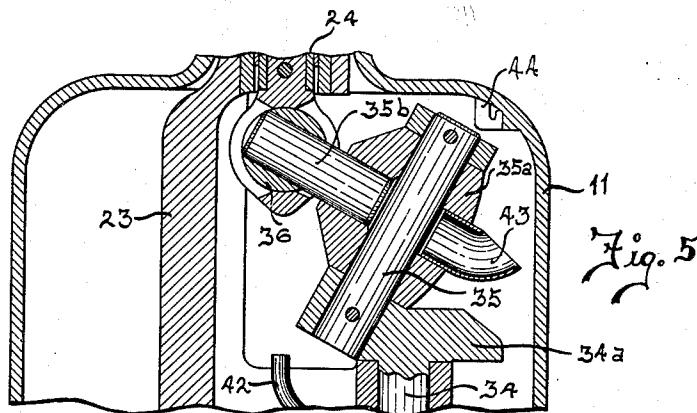
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DOMESTIC APPLIANCE

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4 Sheets-Sheet 4



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DOMESTIC APPLIANCE

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Application September 28, 1940, Serial No. 358,871

8 Claims. (Cl. 210—71)

This invention relates to domestic appliances and more particularly to a clothes washing machine of the centrifugal type.

An object of this invention is to provide a centrifugal machine which automatically counterbalances the variable load produced by unequal distribution of clothes within the centrifugal basket.

Another object of this invention is to provide a centrifugal washing machine with a reversible motor effective to produce centrifugal drying action when the motor is rotated in one direction and to produce agitation of the clothes when the motor is rotated in another direction.

Another object of this invention is to provide a compact arrangement of centrifugal basket, agitator, pump and motor so that the machine is automatically effective to discharge water into a sink or other elevated outlet.

Another object of this invention is to provide a centrifugal machine which is automatically counter-balanced above the critical speed, and in which deflections are limited below the critical speed.

Another object of this invention is to provide an improved hot and cold water flow control means for automatically supplying the desired amount of water to the machine.

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

In the drawings:

Fig. 1 is a vertical cross-section of the upper part of the machine;

Fig. 2 is a vertical cross-section of the lower part of the machine;

Fig. 3 is a diagrammatic representation of the machine together with water-flow connections;

Fig. 4 is a view in perspective mainly of the brake means for the transmission;

Fig. 5 is a vertical cross-section of a portion of the mechanism shown in Fig. 2, but in another position;

Fig. 6 is an enlarged view of the damping means effective below critical speed; and

Fig. 7 is a diagrammatic view showing the lubricant pump.

In a machine wherein clothes are subjected to centrifugal action to remove water from them, an off-balance distribution of the clothes creates a whipping action during rotation, which is objectionable and even dangerous. Such off-balance distribution of clothes is difficult to counter-

act because it varies in magnitude and location in the centrifugal basket.

I have invented a washing machine which utilizes the centrifugal principle to wring the clothes, but I have provided efficient means to counteract the effect of off-balance distribution of clothes. In addition I have provided washing means within the centrifugal basket which tends to distribute the clothes more or less evenly around the basket. Thus I have provided a washing machine in which liability of uneven distribution of clothes is reduced and in which such uneven distribution as may occur is efficiently counteracted.

To accomplish this, my washing machine includes, in general, a rotatable basket 10 driven by a mechanism 11. These are pivotally or resiliently supported by a cylindrical support 12, preferably made of rubber or a similar resilient material. The basket 10 is supported above on said resilient support 12 while the power casing 11 is suspended below from said resilient support 12.

An agitator 13 is located inside of the basket 10 and is reciprocated preferably vertically by means of a shaft 14. This agitator preferably is rapidly reciprocated at about 300 cycles per minute with an amplitude of about 1½ inch when the size of the washing machine is suitable for domestic purposes. The agitator is provided with a flexible collar 15, made of rubber or the like at its lower periphery which increases the agitating power on the downward stroke. The oscillations are sufficiently rapid to produce a toroidal action of the water and clothes within the basket.

This tends to arrange the clothes in a doughnut-like ring within the basket during the washing period when the basket is stationary and the agitator is operating. Because of this, the clothes are somewhat evenly distributed when centrifugal action begins; but naturally some unbalance in the distribution of clothes is present, which tends to deflect the basket when it is rapidly rotated.

A counter-balancing means 16 is secured to the basket which automatically tends to counter-balance any unequal eccentric load produced by such uneven distribution of the clothes. Preferably this counter-balancing means is in the form of a counter-balancing ring 17 pivotally or swingingly supported by means of the resilient support 18 which is connected to the basket 10 by means of the collar 19. The support 18 may be a ring made of rubber or other resilient material. The frequency of vibration of the ring 17 on its support 18 is so related to the speed of rotation

of the basket that it causes the ring or weight 17 to exert an automatic counter-balancing reaction to the variable eccentric load produced in the basket by the uneven distribution of the clothes. I have found that theoretically it would be desirable to make the period of oscillation (time consumed during one complete oscillation) equal to the period of rotation (time consumed by one complete revolution), but practically I find it better to make the period of oscillation slightly longer than the period of fastest rotation, in order that the weight 17 shall be effective through a greater range of speed while the basket is accelerating, and also to compensate for the change in the resiliency of the rubber when it ages. The weight of the ring 17 is so chosen that it is heavy enough to provide the necessary counter-balancing effect for the maximum expected eccentric load within the basket. The mass of the ring is also made sufficiently great to reduce materially the critical speed of the basket; but the mass is made sufficiently light to allow the motor to accelerate the basket through critical speed sufficiently fast to prevent any undue deflections at that time. Further information regarding the relative weight of the ring 17 is given elsewhere.

The mechanism casing 11 contains a motor 20 having stator 21 and a rotor 22. The casing 11 also contains means effective to produce rotation of the basket when the motor is rotated in one direction and to reciprocate the agitator 13 when the motor is rotated in the other direction. For this purpose a transmission cage 23 is secured to the rotatable shaft 24. When the cage 23 is allowed to rotate, the basket 10 is caused to rotate through the medium of shaft 24. When the cage 23 is prevented from rotating, the agitator is reciprocated through the medium of shaft 14. In order to provide means for selectively allowing cage 23 to rotate and for preventing its rotation a brake is provided. Brake 25 is urged downwardly by the springs 26 against the brake surface 27 of the casing 11. The brake 25 is moved upwardly when the motor rotates in one direction and moves downwardly when the motor is deenergized or rotates in the other direction. To accomplish this a series of springs 26 are provided which urge the brake 25 downwardly. Upward movement of the brake 25 is provided when the motor is rotated in one direction by a collar 28 which is mounted on the screw-thread 29, fixed on the motor shaft, the collar 28 being retained from relative rotation to the brake 25 in one direction by the spring coil 30 which is secured to the pin 30a and is wrapped around a groove in the periphery of the collar and terminates at 30b. The construction is such that, when the motor rotates in one direction, the screw-thread 29 exerts upward force on the collar 28, and this in turn lifts the brake 25 and allows the transmission cage 23 to rotate and to impart its rotation to the shaft 24, which, in turn, rotates the basket through the key connection 31.

This collar 28 may be provided with a ridge 28a which serves as face for engagement with a corresponding groove 25a in the brake plate 25. The engagement takes place when the collar 28 is lifting the brake plate 25.

No reciprocation is imparted to the agitator under these conditions because the cage 23 rotates at the same speed as the motor shaft, and this causes the shaft 34 to move in an orbit around the gear 23 at the same speed. This prevents

rotation of shaft 34 about its own axis, and thus prevents reciprocation of the agitator.

Rotation of the motor in the opposite direction produces reciprocation of the agitator 13, because such rotation causes the collar 28 to assume or retain its lower position and thus allows the brake 25 to rest on the brake surface 27 to maintain the transmission cage 23 stationary. The gear 32 then drives the gear 33 and shaft 34 to rotate the inclined shaft 35 above the axis of shaft 34. This in turn produces a reciprocating motion in the knuckle joint 36 as is apparent from an inspection of Figs. 2 and 5. This reciprocating motion is imparted to the shaft 14, which is inside the shaft 24, and in turn to the agitator 13.

The reciprocating motion of shaft 14 is produced when the shaft 34 is rotated because the shaft 35 is carried by the rigid extension 34a of the shaft 34. A sleeve 35a is loosely mounted around the shaft 35, and a pin 35b is rigidly secured to the sleeve 35a. The pin 35b is inserted into the block 36 of the knuckle joint. Since the inclination of the shaft 35 is changed in direction, as clearly illustrated by comparison of Figs. 2 and 5, a reciprocating action is imparted to the shaft 14.

By this construction the basket may be rotated at motor speed and the agitator may be reciprocated at less than motor speed. The windings of the motor may be such that the motor rotates at one speed in one direction and rotates at a different speed in the other direction. By this motor construction the desired speed of tub rotation and the desired speed of agitation may be obtained and need not be limited to a fixed ratio.

A rubber or metal bellows 14a is provided to prevent the flow of liquid downwardly through the center of the basket. The bellows 14a is secured in liquid-tight relation to the shaft 14 and to the basket 10. When the basket rotates, the agitator 13 rotates with the basket at the same speed, due to the transmission construction, and hence no torsional strains are placed on the bellows 14a.

Lubrication of the parts of the mechanism within the upper half of the casing 11 is provided. Oil is introduced to a sufficient level above the floor 40 through a plugged opening 40a so that the gears 32 and 33 are submerged in oil. An oil retaining cage 41 envelops the gears 32 and 33 near the point where they mesh (Fig. 7), and this cage 41 is connected to a pipe 42 which is directed at the parts to be lubricated, such as the knuckle joint 36. In addition, a cup 43 is provided to catch splashed oil dripping from the lug 44 to provide additional lubrication as indicated. Plug 40b is provided for draining the oil from the casing.

The centrifugal basket preferably is made to retain liquid while the basket is stationary, and discharge it when the basket is rotated. To this end, the basket is made with an outer perforate cup 50 and an inner perforate cup 51. These cups may be welded together at 53, where the outer cup 50 terminates. This structure is supported, by rubber cushions 54, on a supporting plate or spider 55 which is keyed to the shaft 24 at 31. The outer cup 51 retains the liquid. The preferred charge of liquid is to a level slightly above the holes 56. When the basket is rotated water is discharged over the rim 57 of the cup 50.

The perforations 58 and 60 cooperate with the perforations 56, during agitation, to produce a preliminary separation of floating particles in the pocket 59. The toroidal action produced by

the agitator 13, as indicated by the arrows 61, causes a certain amount of the water to flow outwardly through the perforations 60 and 58 into the space between the cups 50 and 51, and to return into the interior of cup 51 through the openings 56. However, because of the quiescent condition in the upper part of pocket 59, the lighter particles of scum and the like are retained in a floating condition in the upper part of the pocket 59.

A skimming action is provided at the beginning of the centrifugal action. This skimming action is produced by the fact that a large amount of water rushes through the openings 60 at a time when a vortex is produced in the water in the inner tub 51 by the rotation of the tub. Scum and other floating particles tend to float to the bottom of the vortex from whence they are skimmed or drawn by the rush of water through the openings 60 before the floating particles have an opportunity to settle on the clothes which are at that time against the middle portion of the basket, near the holes 58.

The counter-balancing action of the weight 17 is effective from a time slightly above the critical speed of the machine to the maximum speed of the machine. In order to prevent extreme deflection of the basket at critical speed or below, a damper 70 is provided. This damper 70 may be made of resilient material, such as rubber. It may be secured to the lower portion 71 of the base of the machine and also to the lower portion 72 of the casing 11. The internal friction of this block of rubber, together with its stretching limit, provides a resistance to extreme deflections of the basket. This resistance is effective at the critical speed and at speeds below critical speed. If desired, the block 70 need not be secured to the lower part of the casing 11; but may be made of such size that the lower part of the casing 11 rests on the block 70 when the tub is filled with water. The block 70 is then effective to limit oscillations or deflections while the tub is full of water and is being accelerated. After the tub begins to discharge water, the weight of the basket is decreased and the collar 12 lifts the lower part of the casing 11 from the block 70. This allows the basket, motor, etc., to swing freely about the collar 12 at high speeds. At these high speeds the weight 17 becomes effective to counter-balance any uneven load in the machine.

Automatic controls for the machine may be provided. To this end a timer 75 is provided which is connected to the power lines 76. A winding and setting handle 77 is provided which sets the timer to close certain contacts in the timer at the correct intervals of time to distribute electrical power as required by the machine. The lines 78, passing through lead in opening 78a (Fig. 2) are connected to the motor, and the timer 75 sends power through these lines to rotate the motor in one direction when agitation is required and to rotate the motor in the opposite direction when rotation is required. The timer is also connected by lines 79 with solenoid valves 80 and 81. The valves 80 and 81 control the water from the hot water connection 82 and the cold water connection 83 into the tub. The timer maintains the valves 80 and 81 open for the correct length of time to fill the tub. Variations in city water pressure are compensated by a constant pressure valve 84 which maintains a constant pressure in the line 85 and thus permits the fixed orifice 86 to produce a uniform velocity of water-flow at the nozzle 87 into the tub. By this construction the

valves 80 and 81 may be timed by the timer 75 to fill the tub to the correct level regardless of variations in city water pressure. The hot water connection 82 is connected to a hot water by-pass 88 and is also connected to a thermostatic mixing valve 89. The cold water connection 83 is connected to the mixing valve 89, which mixing valve is connected to the tepid or mixed water line 90. The thermostatic valve 89 controls the flow of cold and hot water into the valve so that the mixed water is of the desired temperature. The lines 88 and 90 are connected to a common chamber 90a. The chamber 90a discharges into the constant pressure valve 84.

By the action of the above automatic controls, the clothes may be placed in the basket and the timer 75 set by the handle 77. Soap may be introduced into the basket. Thereafter the controls introduce a proper amount of hot water into the tub and the agitator is then operated for the required length of time to wash the clothes. Reciprocation of the agitator is then stopped and the basket is rotated to discharge the washing fluid into the trough 91 from whence it flows through flexible hose 92 to the pump 93 at the lower end of the motor, and the water may be discharged through the outlet 94 and the flexible hose 95 to a sink or other elevated outlet. Thereafter the tub is filled with a first hot rinse followed by the short agitation and a subsequent centrifugal action. If desired a second tepid rinse, agitation and final rotation may be provided. All of these sequences may be produced by the timer 75 which, is old per se and is well known in the art, and hence is not further described.

The rubber ring may be vulcanized to the support 19 and to the counter-balancing ring 17. Preferably the ring 18 is vulcanized to a separate ring 18a to which the ring 17 may be secured by bolts 18b.

The ring 17 also serves to aid in damping vertical vibrations due to the vertical reciprocation of the agitator 13. This is accomplished by resiliency of supporting ring 18, which allows the ring 17 to vibrate vertically while the agitator 13 is reciprocating, and thus tend to damp vertical vibrations in the machine. In this embodiment the ring 18 is under compression, which aids in its efficiency as a vertical vibration damper.

The ring 17 is shown supported adjacent the tub structure. However, the ring, or corresponding weight may be supported anywhere where it is effective to perform its functions.

The outer cabinet 96 preferably is made of a piece of sheet metal 97 bent into rectangular or circular cross-section to which the combined trough and machine support 91 is welded. A collar 98 is placed at the top which may be readily removable, if desired. A cover 99 rests on the collar 98.

The collar 12 may be reinforced by a steel ring 12a to prevent buckling. The ring 12a may be vulcanized to the rubber portions of ring 12. Likewise, the ring 12b may be vulcanized to the upper edge of ring 12 and may, in turn, be secured by bolts 12c to the top of mechanism casing 11.

The following sizes and proportions for a suitable machine are given by way of example and not with any intention of being limited by the specific information thus given. The tub 50 may be 20 inches at its greatest diameter and may have a depth of 11½ inches from the bottom of the tub to the rim 57. The agitator 13 may be 9 inches

high from its highest point to the lowest point of the flange 15. The agitator flange 15 may be 9 inches in diameter, and may be made of rubber of 40° durometer hardness. The diameter of the upper cylindrical portion of the agitator may be 3 inches. The weight 17 may have an external diameter of 15 inches, and a weight of 60 lbs. The rubber support 18 may have an external diameter of 8 inches, and its thickness chosen so as to give a period of vibration as previously disclosed. The tub may be rotated at 1140 R. P. M., and the weight 17 may oscillate between 1100 and 1200 oscillations per minute. The mechanism casing 11 may have a height of approximately 20 inches and the structure below the collar 12 may have a weight of approximately 105 lbs.

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

What is claimed is as follows:

1. A centrifugal machine comprising a rotatable basket and power means unitarily secured together, said basket being located above said power means and connected to said power means for rotation about a vertical axis, a flexible support for said basket and power means located below said basket and above said power means and permitting horizontal oscillation of said basket and power means, said basket having a critical speed of rotation, said power means accelerating said basket through said critical speed to a predetermined substantially constant speed of rotation above said critical speed, and a counterbalancing ring secured to said basket by a resilient support and rotating with said basket, said ring being coaxial with said basket, and having a frequency of oscillation on its resilient support with respect to said basket substantially equal to the frequency of rotation of said basket at said constant speed of rotation.

2. A centrifugal machine comprising a rotatable basket and power means unitarily secured together, said basket being located above said power means and connected to said power means for rotation about a vertical axis, a flexible support for said basket and power means permitting horizontal oscillation of said basket and power means, said basket having a critical speed of rotation, said power means accelerating said basket through said critical speed to a predetermined substantially constant speed of rotation above said critical speed, and a counterbalancing ring secured to said basket by a resilient support and rotating with said basket, said ring being coaxial with said basket, and having a frequency of oscillation on its resilient support with respect to said basket substantially equal to the frequency of rotation of said basket at said constant speed of rotation.

3. A centrifugal machine comprising a rotatable basket and power means unitarily secured together and connected to said power means for rotation about a vertical axis, a flexible support for said basket and power means permitting horizontal oscillation of said basket and power means, said basket having a critical speed of rotation, said power means accelerating said basket through said critical speed to a predetermined substantially constant speed of rotation above said critical speed, and a counterbalancing ring secured to said basket by a resilient support and rotating with said basket, said ring being co-

axial with said basket, and having a frequency of oscillation on its resilient support with respect to said basket substantially equal to the frequency of rotation of said basket at said constant speed of rotation.

4. A centrifugal machine comprising a power casing, power means in said casing, a shaft extending from said casing, said power means being drivingly connected to rotate said shaft, a basket fixed on said shaft and rotated thereby, a flexible support tending to maintain said basket and shaft so that said basket and shaft rotate about a vertical axis, said flexible support permitting horizontal oscillation of said basket, shaft and casing, said power means being so constructed as to accelerate the rotation of said basket through its critical speed to a predetermined constant speed of rotation above said critical speed, and a counterbalancing ring secured to said basket by a resilient support and being rotatable with said basket, said ring being coaxial with the axis of rotation of said basket, and having a frequency of oscillation on its resilient support with respect to said basket substantially equal to the frequency of rotation of said basket at said constant speed of rotation.

5. A centrifugal machine comprising a rotatable basket, a support for said basket permitting lateral movement thereof when an unbalanced load is in said basket, said basket having a critical speed of rotation on said support, power means connected to said basket to accelerate said basket through its critical speed and thereafter to maintain said basket at a predetermined substantially constant speed of rotation above its critical speed, and means for counterbalancing variable unbalanced loads in said basket thereby substantially to prevent lateral movement of said basket due to an unbalanced load, said counterbalancing means comprising a mass, a periodically vibratable resilient support means having one portion secured to and supporting said mass in coaxial relation with said basket when the basket is stationary and another portion secured to said basket, said mass and its resilient connecting means having a frequency of vibration substantially equal to the R. P. M. of said basket at said predetermined speed of rotation, said support means restraining said mass from substantial displacement during rotation at said critical speed, and permitting said mass substantially to counterbalance said unbalanced load at said constant speed.

6. A centrifugal machine comprising a rotatable basket, a support for said basket permitting lateral movement thereof when an unbalanced load is in said basket, said basket having a critical speed of rotation on said support, power means connected to said basket to accelerate said basket through its critical speed and thereafter to maintain said basket at a predetermined substantially constant speed of rotation above its critical speed, counterbalancing weight means symmetrically arranged with respect to the axis of rotation of said basket, and a periodically vibratable resilient support means having one portion secured to and supporting said weight means in coaxial relation with said basket when the basket is stationary and another portion rigidly secured to said basket, said weight means and said resilient connecting means together having a frequency of vibration substantially equal to the R. P. M. of said basket at said predetermined speed of rotation, said support means restraining said counterbalancing weight means from

substantial displacement during rotation at said critical speed, and permitting said counterbalancing weight means substantially to counterbalance said unbalanced load, at said constant speed.

7. A centrifugal machine comprising a primary mass including a basket having a shaft, said primary mass being rotatable about an axis extending longitudinally through the said shaft, a resilient support for said basket and shaft permitting lateral movement thereof when an unbalanced load is in said basket, said basket and shaft having a critical speed of rotation on said support, means for accelerating said primary mass through its critical speed of rotation and for thereafter substantially maintaining its speed at a predetermined speed of rotation above its critical speed, means for counterbalancing variable unbalanced loads in said basket thereby substantially to prevent lateral movement of said basket due to an unbalanced load, said counterbalancing means comprising a secondary mass, and a periodically vibratable resilient means having one portion secured to and supporting said secondary mass in coaxial relation with said basket when the basket is stationary and another portion secured to said primary mass and urging said secondary mass towards the axis of the aforesaid shaft, said resilient connecting means causing said secondary mass to rotate at substantially the same speed as the primary mass, said secondary mass and its resilient support together having a frequency of vibration substantially equal to the R. P. M. of the primary mass at the aforesaid predetermined speed of rotation, said secondary mass having its center of gravity coincidental with the aforesaid axis when said primary mass is at rest, and, when said primary mass is rotating at said predetermined speed, having its center of gravity located on the side

of the aforesaid axis opposite to the side of said axis on which is located the center of gravity of the unbalanced load in the basket, said support means restraining said secondary mass from substantial displacement during rotation at said critical speed, and permitting said secondary mass substantially to counterbalance said unbalanced load at said constant speed.

8. A centrifugal machine comprising a rotatable basket, a flexible support for said basket limiting rotation of said basket to rotation about a vertical axis and permitting horizontal movement of said basket when an unbalanced load is in said basket, said basket having a critical speed of rotation on said support, power means connected to said basket to accelerate said basket through its critical speed and thereafter to maintain rotation of said basket at a predetermined substantially constant speed of rotation above its critical speed, a ring-shaped weight normally substantially coaxial with said vertical axis constituting a secondary mass for counterbalancing variable unbalanced loads in said basket thereby substantially to prevent lateral movement of said basket due to an unbalanced load, and a resilient vibratable support secured to and supporting said ring-shaped weight on said basket in coaxial relation with the basket when the basket is stationary, said ring-shaped weight and resilient vibratable support having a frequency of vibration with respect to said basket substantially equal to the frequency of said constant speed of rotation of said basket, said resilient vibratable support limiting outward movement of said ring-shaped weight at said critical speed and permitting said ring-shaped weight substantially to counterbalance said unbalanced load in said basket at said constant speed of rotation.

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