

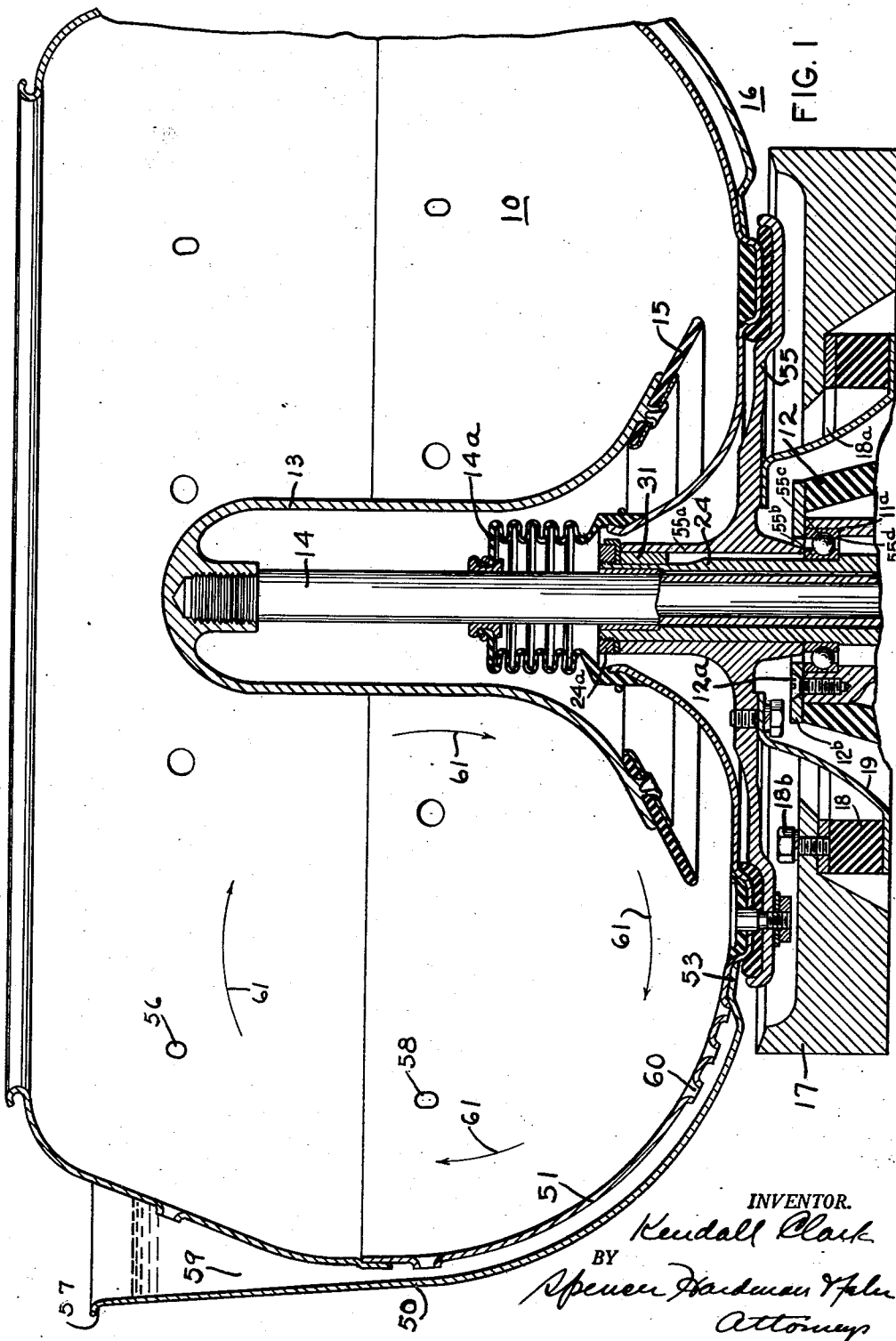
Dec. 4, 1951

K. CLARK
CENTRIFUGAL MACHINE

2,577,647

Original Filed Sept. 28, 1940

4 Sheets-Sheet 1



Dec. 4, 1951

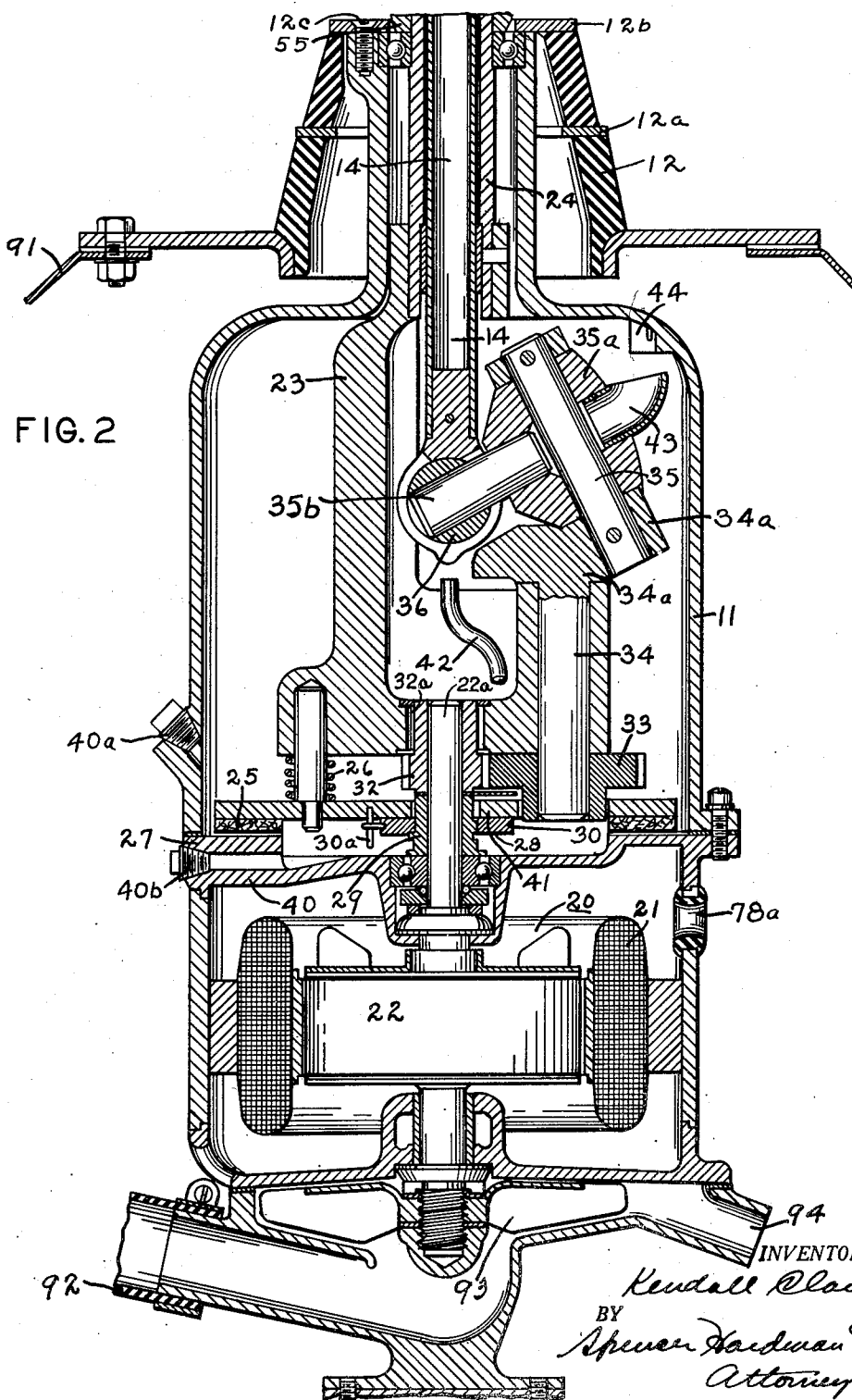
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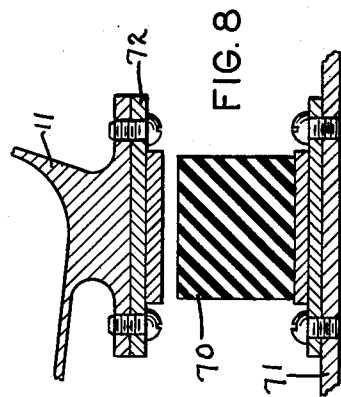
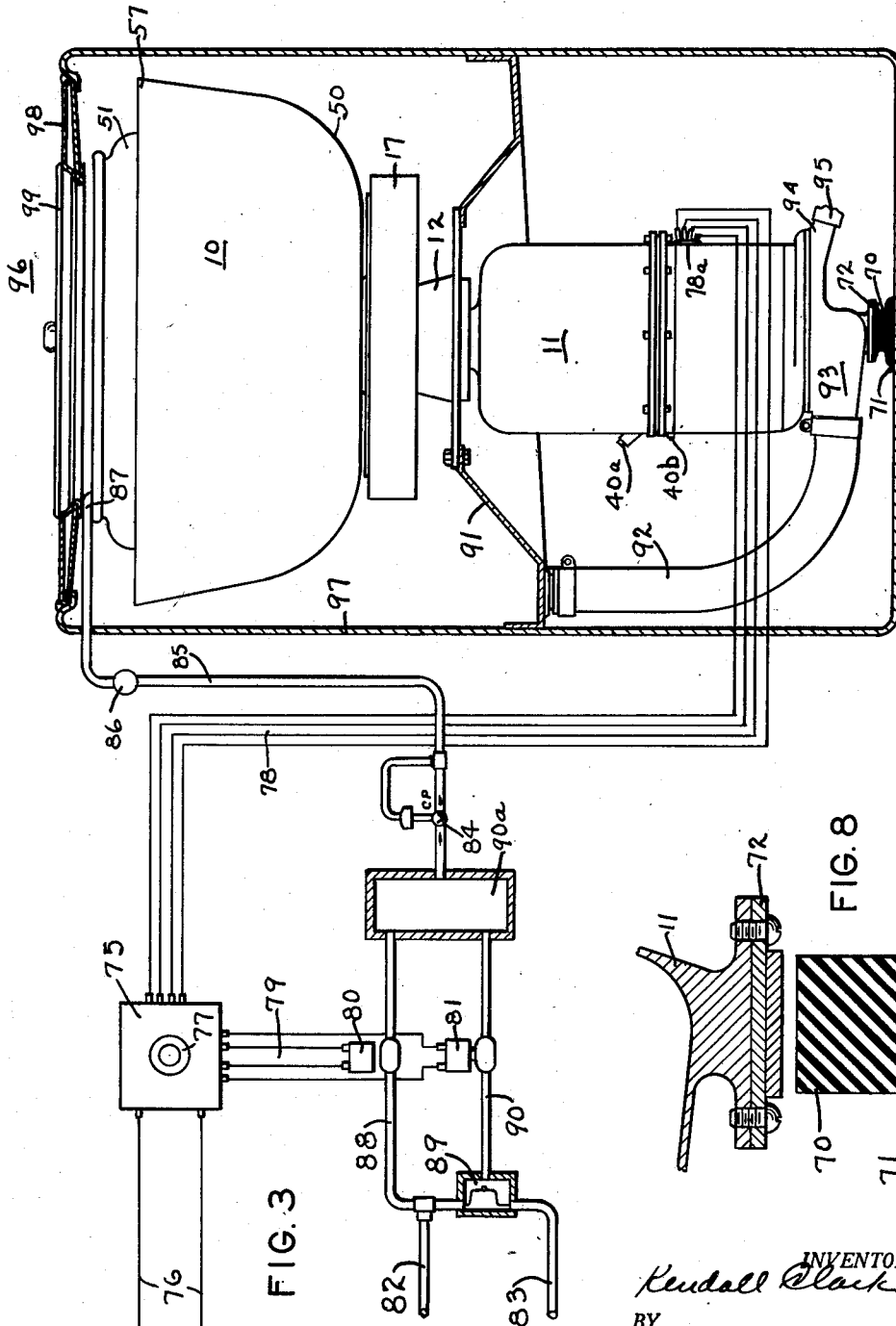


FIG. 3

FIG. 8

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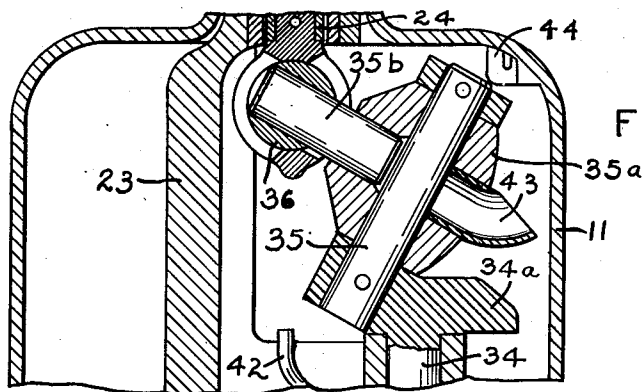


FIG. 5

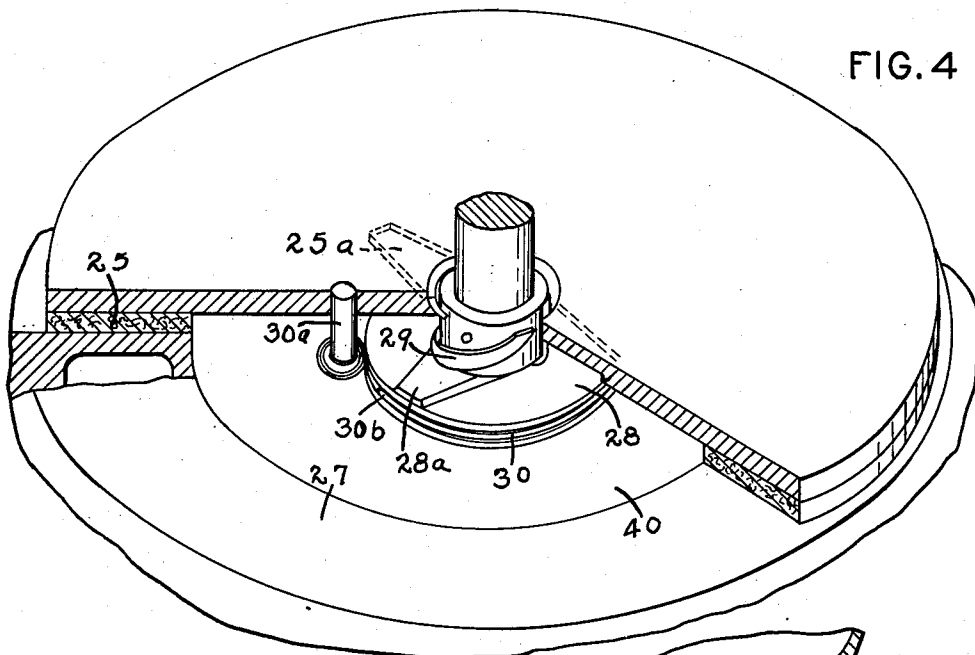


FIG. 4

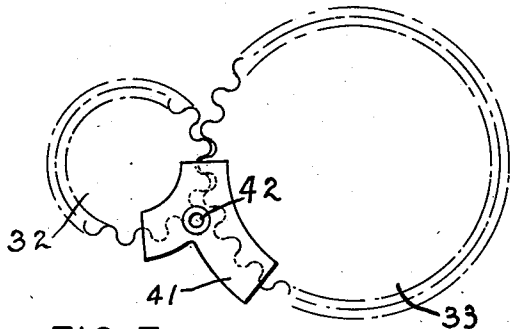


FIG. 7

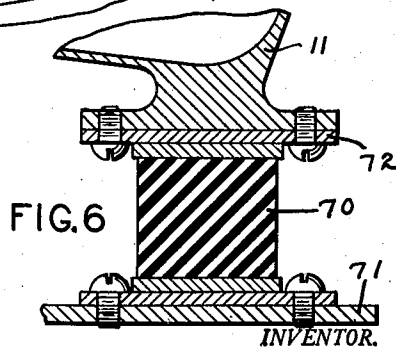


FIG. 6

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2,577,647

CENTRIFUGAL MACHINE

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Application May 8, 1944, Serial No. 536,097, which is a division of application Serial No. 358,871, September 28, 1940. Divided and this application August 17, 1945, Serial No. 610,985

3 Claims. (Cl. 210—72)

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

This application is a division of my copending application Serial No. 536,097, now abandoned, which, in turn, is a division of my application Serial No. 358,871, filed September 28, 1940, now Patent No. 2,366,236.

This application is directed to an apparatus in which a snubbing action is produced at the bottom of the machine by frictional surface, together with all of the advantages accruing from such a construction. Other objects of the invention herein disclosed, are covered by other applications.

An object of this invention is to provide a centrifugal machine for washing clothes or the like, having a rotatable basket, an agitator within the basket, a rotatable cage fixedly secured to the basket, planetary gearing in the cage operably connected to the agitator and driving means selectively rotating the cage and basket or reciprocating the agitator.

Another 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 counterbalanced 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;

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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;

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

Fig. 8 is a view similar to Fig. 6, showing the parts separated, as hereinafter described.

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 counteract 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 resilient supporting means including 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 or sleeve 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 counterbalancing means 16 is secured to the basket which automatically tends to counterbalance any unequal eccentric load produced by such uneven distribution of the clothes. Preferably this counterbalancing means is in the form of a counterbalancing 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 counterbalancing 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 counterbalancing 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 or frame 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 32 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 which is fixed on motor shaft 22a and journaled in cage 23 at 32a then drives the gear 33 and shaft 34 to rotate the inclined shaft 35 about 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 imperforate 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 hub 55a of the spider 55 is locked on the shaft 24 between the inner ring 55b of the thrust bearing 55c and the nut 24a threaded on the shaft 24. The outer ring 55d of the thrust bearing 55c is locked between the flange 11a of the casing 11 and the plate 12b, thus aiding in supporting the basket 10, shaft 24 and cage 23 by means of the thrust bearing 55c.

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 counterbalancing 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 ef-

fective 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, as shown in Fig. 8. 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 counterbalance any uneven load in the machine.

Automatic controls for the machine may be provided. To this end a timer 75, such as disclosed in the patent to Dyer, 2,331,897, 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 18 may be vulcanized to the support 19 and to the counterbalancing 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 13, which allows the ring 17 to vibrate vertically while the agitator 13 is reciprocating, and thus tends 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 59 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. Certain features disclosed herein are claimed in other of my applications and patents in accordance with requirements for division. The tub filling features are claimed in my copending application S. N. 489,937. Features of the one-way clutch 28, 36 etc., per se, are claimed in my copending application S. N. 524,695, now Patent No. 2,461,629, February 15, 1949. Features of the drive mechanism in casing 11, per se, are claimed in my Patent No. 2,346,152. Features of the counterbalancing means 16, per se, are claimed in my Patent No. 2,366,236. Features relating to the combination of the receptacle, agitator, and drive shaft are claimed in copending application S. N. 536,097.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms

might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A centrifugal machine including a frame means, a movable assembly comprising a vertical basket and driving means located below said basket for rotating said basket generally upon a vertical axis, a damping means extending between the lower portion of said driving means and said frame means, said damping means having means forming a plurality of relatively movable generally horizontal frictional surfaces maintained in contact with each other solely by downward gravitational and upward resilient reaction, and a resilient supporting means extending from said frame means for upwardly supporting said movable assembly adjacent the upper end of the driving means.

2. A centrifugal machine including a frame member, a movable member comprising a vertical basket and driving means located below said basket for rotating said basket generally upon a vertical axis, a damping means extending between the lower portion of said movable member and said frame member, said damping means including resilient means between said members below said driving means, and a second resilient means extending from said frame member to said movable member intermediate said basket and driving means and supporting said movable member from said frame member, said first named resilient means being secured to one of said members and being of limited expansion and thickness to be separable from the other of said members while liquid is centrifugally discharged from said basket.

3. A centrifugal machine including a frame member, a movable member comprising a vertical basket and driving means located below said basket for rotating said basket generally upon a vertical axis, a resilient means extending from said frame member to said movable member intermediate said basket and driving means and upwardly supporting said movable member, a snubber resilient means secured to one of said members and having a horizontal frictional relatively movable surface contact with the other of said members, said frictional contact being maintained solely by downward gravitational and upward resilient reaction.

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