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2,145,453

WASHING MACHINE

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2 Sheets-Sheet 1

Fig. 1

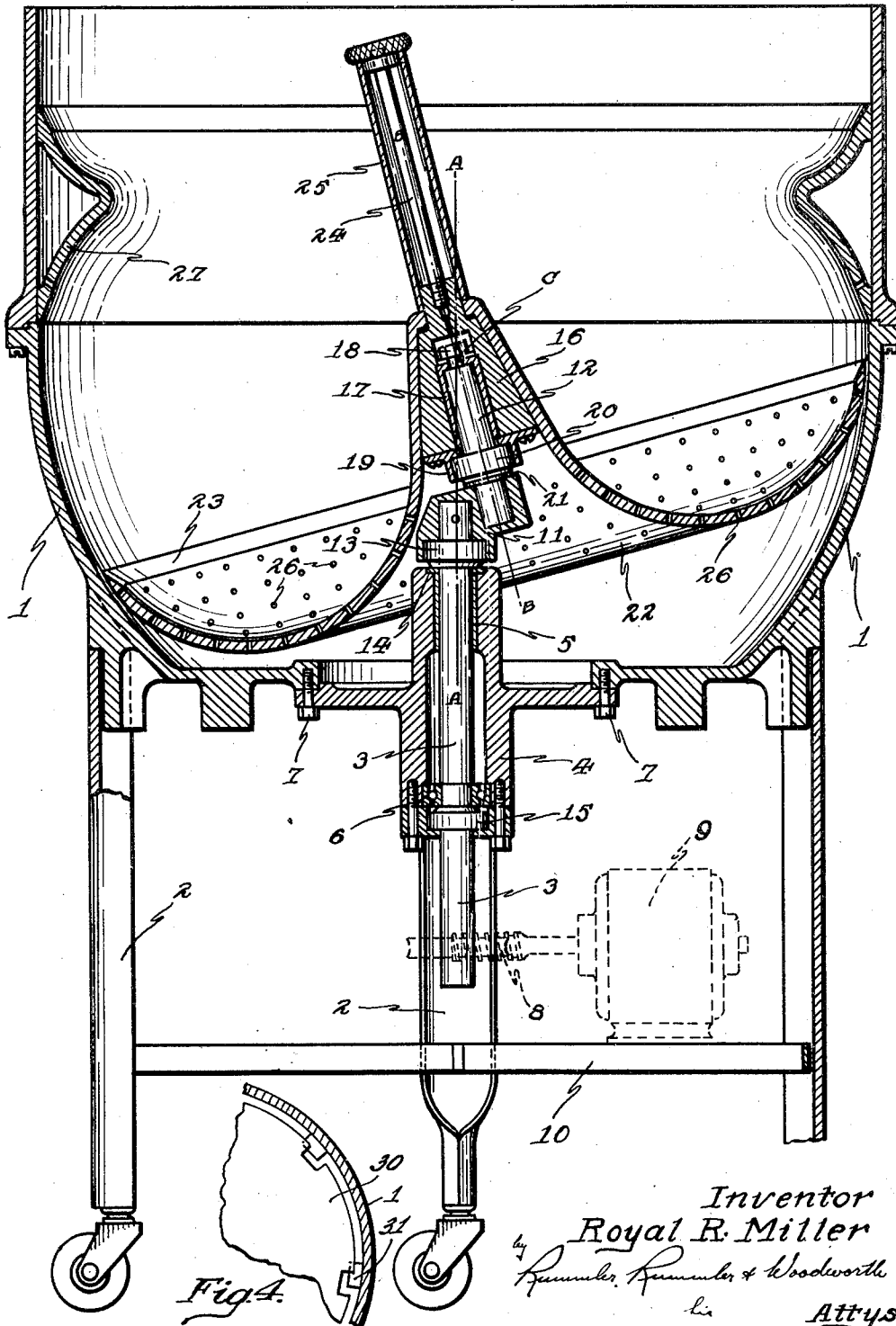


Fig. 4.

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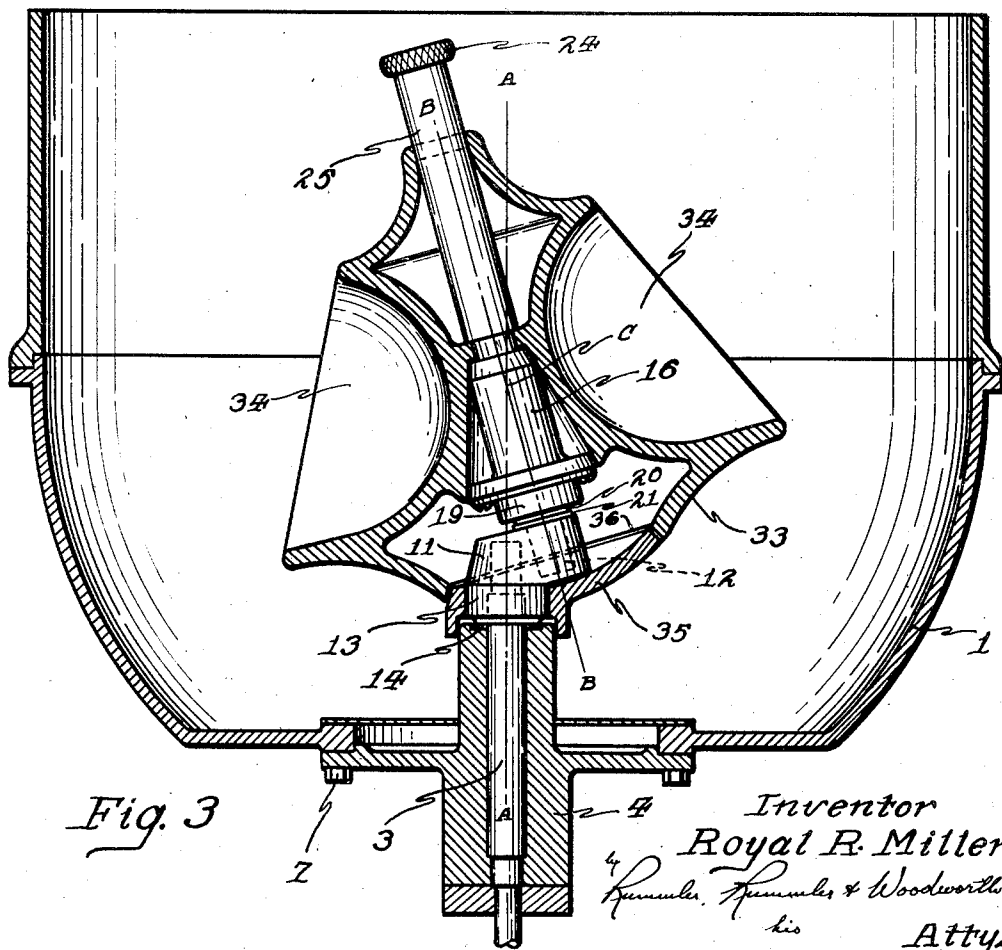
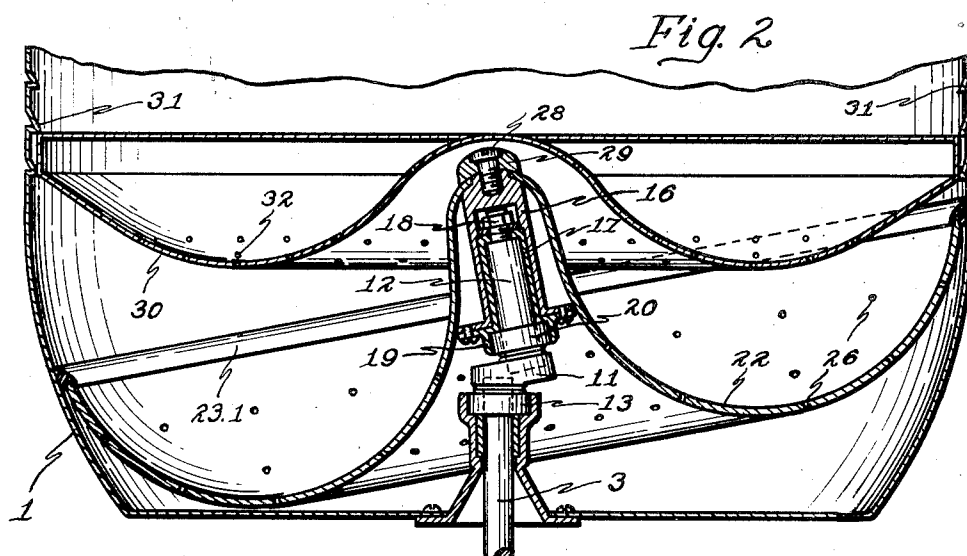
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2 Sheets-Sheet 2



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WASHING MACHINE

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Application March 7, 1935, Serial No. 9,803

18 Claims. (Cl. 68—28)

This invention relates to washing machines and particularly to washing machines of the rotating agitator type.

The main objects of this invention are to provide an improved agitating action in washing machines; to provide an improved arrangement of agitator and bowl whereby more efficient agitation is had; to provide an improved agitator and bowl construction whereby intermittent squeezing of the material being washed is had; to provide an improved agitating element; and to provide an improved agitator actuating mechanism.

An illustrative embodiment of this invention and several modifications thereof are shown in the accompanying drawings in which:

Figure 1 is a sectional elevation of the washing machine showing the mechanism in detail.

Fig. 2 is a sectional elevation of a modified bowl and agitating mechanism, and

Fig. 3 is a sectional elevation of the bowl and agitating mechanism of another modification.

Fig. 4 is a fragmentary top plan view of the device of Fig. 2.

As shown in the drawings the washer comprises mainly an agitator arranged to move with a gyratory oscillating movement, the mechanism to impart such movement to the agitator, and an improved bowl arrangement and construction. The gyratory oscillating movement of the agitator is such that positive rotary movement of the agitator is unnecessary, and consists in a pendulous or oscillating swinging of the agitator, about a fixed point spaced above the bottom of the bowl, in such a manner that each point on the margin of the agitator is individually, and successively in one direction, raised to a maximum upper limit and then lowered to a maximum lower limit in a wavelike or undulating motion so that the high point of the agitator margin gyrates precessionally about a central axis, every marginal point of the agitator being constantly in motion vertically either toward or away from the maximum upper limit. Such motion is here accomplished by freely journaling the agitator on an inclined axis that itself gyrates about a primary central axis and which intersects the same at the point about which the agitator pendulates so that the agitator may rotate about the said inclined axis at a definite rate relative to the rate of gyration of the inclined axis about the said primary axis.

In the form shown in the drawings, the invention is embodied in a washing machine comprising a bowl or tub 1 supported by suitable legs 2 in the usual manner. The bowl 1 is formed with a partly spherical inside wall surface extending up-

wardly from a flat bottom and having an upper cylindrical rim portion which carries a removable cover (not shown).

A main or primary drive shaft 3 extends vertically through the bowl bottom and into the interior of the bowl. The shaft 3 is journaled in a suitable gland 4 which is provided with a bushing 5 at its upper end and a ball bearing 6 adjacent its lower end, the gland 4 being secured to the bowl bottom by means of cap screws 7 or the like. The lower end of the shaft 3 is connected by suitable gearing 8, with a motor 9 which is mounted on the framing 10, extending between the legs 2.

The upper end of the shaft 3 is provided with a head 11, fixed thereto, in which a second shaft 12 is mounted eccentrically with respect to the axis of the shaft 3. A seal 13 is also mounted in a counter-bore in the lower side of the head 11 and, surrounding the shaft 3, bears against an annular plate 14 in the top surface of the gland 4 to prevent the passage of any fluid along the shaft 3. Another seal 15 is also provided below the bearing 6 to prevent any leakage of fluid around the shaft 3 at this point.

The second or eccentric shaft 12, carried by the head 11, is rigidly or fixedly disposed so that its axis B—B will always intersect the axis A—A of the primary shaft 3 above the head 11 at the point C which is the spherical center of the spherical wall surfaces of the bowl 1. Thus upon rotation of the shaft 3, the secondary shaft is carried with a gyratory motion about the central axis A—A and its axis, B—B, moves in the surface of an imaginary cone.

As shown in Fig. 1 the second shaft 12 supports the hub 16 within which is a bushing 17 freely journaled on the shaft 12 and locked against axial movement by the nut 18. The hub 16 is secured to the bushing 17 by means of a flanged collar 19 which is bolted to the lower side of the hub and which bears against the lower edge of the bushing 17. The collar 19 also houses a seal 20 which bears against a gasket 21 on the head 11 and which is designed to prevent the passage of any fluid along the surface of the shaft 12.

Mounted on the hub 16 is an agitator, or agitating element, 22 which, in Figs. 1 and 2, is in the nature of an annular bowl having a raised center and a concaved upper surface terminating in an annular upwardly extending rim 23 which closely follows the wall of the tub 1 and is tapered to an edge like a squeegee. The agitator 22 is formed so that its raised central portion houses and rests upon the hub 16, and so that its annular

margin substantially fits the spherical inner surface of the tub or bowl 1, the practical clearance between the agitator margin and the spherical surface being from $\frac{1}{16}$ th to $\frac{1}{8}$ th of an inch.

5 The agitator 22 is secured on the hub 16 by means of a headed bolt 24 which is screwed into the top portion of the hub and which clamps a collar 25 between its head and the top of the raised central portion of the agitator. As shown
10 in Fig. 1, the bolt 24 and collar 25 extend for some distance beyond the point C where the axes A—A and B—B intersect and will, therefore, gyrate about the central axis A—A and impart a stirring action to the water held in the tub 1. The agi-
15 tator is also provided with perforations as at 26 which permit the passage of water through the agitator from and into the space below the agitator.

Upon rotation of the shaft 3 the second shaft
20 12 is carried in a gyrating motion about the axis A—A of the shaft 3. However, since the mechanism is arranged so that the agitator is freely rotatable on the axis B—B of the shaft 12, the agitator has a tendency to oscillate about the
25 point C rather than rotate about the axis A—A. That is, with the agitator rotating about the axis B—B at a definite rate relative to the rate of rotation of the shaft 3, any point on the margin of the agitator moves, generally, in a vertical di-
30 rection only and the motion of the agitator is pendulous. Thus, while such an arrangement is not shown, the agitator might be prevented from bodily rotating with respect to the bowl without affecting the desired action of the agitator.

35 The motion of the high point of the agitator rim is, however, in the form shown, precessional in the direction of gyration of the second shaft 12 and the effect is similar to the movement of the crest of a uniform water wave or swell. It is for
40 this reason that the movement of the agitator, upon rotation of the primary shaft 3, may be described as a gyratory oscillating motion. The high point of the agitator rim gyrates about the primary or central axis A—A while the agitator
45 itself wobbles or oscillates and its rim or margin may or may not rotate relative to the bowl wall according to the resistance it happens to meet.

In the form shown in Fig. 1, the washing machine is provided with an annular inwardly converging or overhanging portion 27, adjacent the
50 margin of the bowl 1, which is in the nature of a continuation of the spherical surface of the bowl above the point of maximum height to which the margin of the agitator is raised in the course
55 of its movement. This inwardly converging portion 27 serves the purpose of directing inwardly the water raised by the agitator during its movement and increases the agitating effect upon the contents of the washing machine.

60 In the modification shown in Fig. 2, the agitating mechanism is substantially the same as that shown in Fig. 1 except that the bolt and collar 28 and 29, which hold the agitator 22 on the hub 16, are made as short as possible. This is
65 done to accommodate a closure member 30 which is disposed above the agitator and arranged to be vertically adjustable toward or away from the same. The closure member 30 is provided with an annularly convex lower surface surrounding a
70 central concaved portion and this surface is preferably formed to be somewhat complementary to the upper surface of the agitator.

75 The agitator 22, as shown in Fig. 2, may be provided with a flexible squeegee 23.1 on its rim which engages the wall of the tub or bowl 1 and

positively prevents any of the material being washed from becoming caught between the rim of the agitator and the sides of the tub.

The upper wall of the tub or bowl 1 of Fig. 2 is provided with inwardly extending lugs or pro-
5 jections 31 which are spaced apart vertically and which are engaged by the periphery of the member 30 to hold the same at the desired level above the agitator 22. The periphery of the member
10 30 may be notched or otherwise formed, in a manner not shown, to permit the passage of the portions 31 when the member 30 is being raised or lowered. While the arrangement of the por-
15 tions 31 and the means for their passage in the member 30 are not shown in detail, it will be apparent that the member 30 may be securely held at the desired level against any upward or
20 downward movement, due to the application of force against the upper or lower surfaces thereof, by this or any other suitable means.

In operation of the device shown in Fig. 2, the agitator moves with the same gyratory oscillating movement as described for the device of Fig. 1. However, the material in the washer that is adja-
25 cent the raised portion of the agitator is squeezed between the agitator and the member 30 and then, as the raised portion of the agitator progresses gyratorally, the material that has been squeezed is released and allowed to expand in the
30 water held by the tub 1. Thus, due to the precessional movement of the raised portion of the agitator, all the material in the washer is alternately squeezed with a kneading action and then released so that a very thorough and efficient
35 washing action is had.

As shown in Fig. 2, the member 30 is provided with a plurality of perforations 32 in its lower
40 surface so that during the squeezing action upon the material in the washer, the water held by the material will be more readily squeezed out of the same.

The modification of the hereindescribed invention shown in Fig. 3 involves mainly a different
45 form of agitator; namely, one whose margin is spaced well away from the inner surface of the tub or bowl 1. As shown in Fig. 3 the agitator 33 is mounted on the second or gyrating shaft 12 in substantially the same manner shown in the
50 arrangement of Fig. 1. However, the agitator 33 is provided with radial fins 34 which engage the material held within the washer so as to efficiently agitate such material.

In this arrangement the motion of the agitator is the same as that of the agitator in device shown in Fig. 1. That is the agitator oscillates and the
55 high point of the periphery gyrates precessionally. The material within the washer is not, however, maintained above the driving mechanism as in the other forms of washers shown and for this reason a provision must be made to keep the ma-
60 terial from becoming caught and tangled in the rotating parts. This is accomplished by providing a closure plate or member 35 for the end opening 36 of the agitator, which opening is nec-
65 essary for mounting the agitator upon the hub 16. The opening 36 and the plate 35 are arranged concentric with the axis of the shaft 12 and the plate 35 is fixedly mounted on the head 11 so as to rotate therewith. However, since the plate 35
70 and the opening 36 are concentric with the axis of the shaft 12, the agitator is freely rotatable on its axis and through engagement of the fins 34 with the material in the washer will be substantially held against a simple gyratory movement with the shaft 12.

As shown in Fig. 3, the plate 35 is formed so that the possibility of material catching on the moving parts is obviated. Also the hub portion of the plate 35, where it is mounted on the head 11 is counter-bored so as to receive the upper end of the gland 4, thus shrouding the space between the head 11 and the end of the gland 4 that would otherwise provide a groove in which light-weight or thin material might become caught and wound about the head 11.

In the operation of the devices shown in Figures 1 and 2, the oscillating movement of the agitator 22 causes the water held within the washer to flow outwardly and upwardly, relative to bottom center of the washer and then, at the upper part of the same, inwardly toward the central axis A—A and downward toward the agitator, at the same time moving generally around the said central axis rotationally. This movement of the water causes the material being washed to take, generally, the same path so that the material is being constantly turned over and shifted from the center of the device to the outer walls thereof and then back to the center, the material moving downwardly at the center and upwardly at the sides.

The agitator perforations 26, indicated in Figures 1 and 2, are preferably more numerous than as shown and, because of the oscillating movement of the agitator, cause the water to be forced upwardly in small jets during downward movement of the agitator and produce a suction during upward movement of the agitator. The small jets force the water into the material being washed and generally assist in the agitation and to keep the material in suspension in the water; and the suction assists in maintaining the turning-over effect on the material.

While the driving arrangement shown in Fig. 1 is arranged for unidirectional rotary movement of the shaft 3, it will be readily understood that the driving means 8 and 9 may be arranged for angular oscillation of the shaft 3, in accordance with the well-known practice in the washing machine art, wherein the shaft is rotated first in one direction and then in the opposite direction, turning about five-eighths of a revolution each time. A specific arrangement for such a drive is not shown for the reason that several such methods are well known to all those skilled in the art.

The action of the agitator 22 with such a drive arrangement is, however, substantially the same as with a full rotary drive with the exception that the high point on the agitator periphery instead of progressing gyratorily for a full revolution only travels as far as the shaft is turned and then returns in the opposite direction. The agitator still retains its general gyratory-oscillating movement and the water and material held in the tub 1 is given the same rolling movement in a vertical plane as heretofore described.

An outstanding feature of this arrangement of drive is, however, the fact that the water and material in the tub will travel in one direction only around the central axis A—A and will not reverse upon gyratory motion of the agitator in the opposite direction.

Thus, in spite of the angular oscillatory motion of the agitator, the effect upon the contents of the tub is substantially the same as that described for the full rotary motion of the agitator drive shaft as far as the kind and direction of movement of the tub contents are concerned, the main difference being only in the somewhat increased or more rapid agitation of the water with the

oscillating shaft movement. The sudden reversal of direction of the shaft 3 and agitator 22 causes more of a beating action on the water at the bottom of the tub with the result that the water is forced upwardly through the perforations 26 more rapidly and in stronger, more penetrating, jets.

It is also to be noted that in spite of the oscillating drive arrangement, above described, the agitator itself does not necessarily rotate relative to the side wall of the tub 1 and ordinarily has only a slight tendency to do so, this being due to the free pivotal movement of the agitator about the axis B—B of the shaft 12.

The terms "oscillate", "oscillating" and "oscillatory", as used herein to describe the movement of the agitator, refer to a vertical projection of the agitator motion, and the term "gyratory", as used in describing the agitator movement, refers to a horizontal projection of the motion of the agitator about the axis A—A of the shaft 3.

The main advantages of the herein-described invention lie in the fact that the tub contents is thoroughly agitated and rolled over and over in both vertical and horizontal planes without the use of radial fins or blades on the agitating element. Thus the material being washed is not only kept virtually in suspension but is also relieved of the destructive beating effect that is always present where radial fins or blades are employed and the material is utterly free of any tendency to tangle or become compacted into a heavy mass.

Several specific embodiments of this invention are herein shown and described, but it will be understood that details of the constructions may be otherwise altered or omitted without departing from the spirit of this invention as defined in the following claims:

I claim:

1. A device of the class described comprising a bowl having a spherical inside wall surface, a rotatable shaft extending into said bowl through the bottom thereof, a head fixed on said shaft within said bowl, a second shaft carried by said head and positioned eccentrically with its axis intersecting that of the first shaft at substantially the spherical center of said bowl wall surface, and an agitator mounted on said second shaft above said head and extending transversely of the first shaft, said agitator being rotatable about the axis of said second shaft and having an annular margin the entire periphery of which substantially engages the spherical wall of said bowl.

2. A device of the class described comprising a bowl having a spherical inside wall surface, said wall surface converging inwardly adjacent the margin of said bowl, a rotatable shaft extending into said bowl through the bottom thereof, a head fixed on said shaft within said bowl adjacent the bottom thereof, a second shaft carried by said head and positioned eccentrically with its axis intersecting that of the first shaft above said head, and an agitator mounted on said second shaft above said head and below the margin of said bowl, said agitator being freely rotatable on the axis of said second shaft.

3. A device of the class described comprising a bowl having a spherical inside wall surface, a rotatable shaft extending into said bowl through the bottom thereof, a head fixed on said shaft on said bowl and adjacent the bottom thereof, a second shaft carried by said head and positioned eccentrically with its axis intersecting that of the first shaft above said head, an agitator mounted

above said head on said second shaft and rotatable on the axis thereof whereby said agitator moves with a rotary pendulous motion relative to the first shaft and the point of intersection of the axis thereof with the axis of said second shaft, said agitator extending transversely of said bowl and having an annular margin, the periphery of which follows a vertical path parallel with the spherical wall of said bowl during the pendulous movement of said agitator, and a closure member arranged to fit into said bowl above said agitator and to be adjustably spaced therefrom to provide means against which material held in said bowl will be squeezed during oscillating movement of said agitator.

4. A device of the class described comprising a bowl having a spherical inside wall surface, a rotatable shaft extending into said bowl through the bottom thereof, a head fixed on said shaft within said bowl, a second shaft carried by said head and positioned eccentrically with its axis intersecting that of the first shaft above said head, an agitator mounted above said head on said second shaft and rotatable on the axis thereof whereby said agitator moves with a rotatably pendulous motion relative to the point of intersection of the axes of said shafts, said agitator having an annular concaved upper surface extending transversely of said bowl substantially to the spherical wall thereof, and a closure member arranged to fit within said bowl above said agitator and having an annular convexed lower surface to provide means against which material held in said bowl will be squeezed during pendulous movement of said agitator.

5. A washing machine comprising a bowl, a rotatable shaft extending into said bowl through the bottom thereof, a head fixed on said shaft within said bowl, a second shaft carried by said head and positioned in angular relation with its axis intersecting the axis of the first shaft above said head, and an agitator mounted on said second shaft above said head and below the intersection of said axes and having portions extending transversely of said bowl, said agitator being rotatable on the axis of said second shaft whereby said agitator moves with a rotary pendulous motion relative to the point of intersection of the axes of said shafts when the first shaft is rotated.

6. A washing machine comprising a bowl having a spherical inside wall surface, an annular dish-like agitator extending transversely of said bowl and spaced above the bottom thereof, said agitator having its margins extending substantially to the wall of said bowl, and rotatable means extending into said bowl through the bottom thereof arranged to support said agitator and to impart movement to said agitator such that its central transverse axis describes a cone, with the apex of the cone above the agitator and at the spherical center of the said bowl.

7. A washing machine comprising a bowl, a rotatable shaft extending into said bowl through the bottom thereof, a head mounted on said shaft within said bowl, a second shaft carried by said head and extending angularly upward therefrom with its axis intersecting the axis of the first shaft above said head, a dish-like agitator mounted on said second shaft and extending transversely of said bowl, said agitator being rotatable on the axis of said second shaft whereby said agitator moves with a rotary pendulous motion relative to the point of intersection of the axes of said shafts upon rotation of the first-mentioned shaft, and a closure member arranged to fit into said bowl

above said agitator and to be adjustably spaced therefrom to provide means against which material in said bowl may be squeezed during oscillating movement of said agitator.

8. A washing machine comprising a bowl, a rotatable shaft extending into said bowl through the bottom thereof, a head fixed on said shaft within said bowl, a second shaft carried by said head and positioned in angular relation with its axis intersecting the axis of the first shaft above said head, an agitator mounted on said second shaft above said head and having portions disposed below the point of intersection of the axes of said shafts and extending transversely of said bowl, and an upwardly extending portion on said agitator substantially concentric with the axis of said second shaft and extending beyond the point of intersection of the axes of said shafts, said agitator being rotatable on the axis of said second shaft.

9. A washing machine comprising a bowl, a rotatable shaft extending into said bowl through the bottom thereof, a head mounted on said shaft within said bowl, a second shaft carried by said head and extending angularly upward therefrom with its axis intersecting the axis of the first shaft above said head, a perforated dish-like agitator mounted on said second shaft below the point of intersection of the axes of said shafts and extending transversely of said bowl, and an upwardly extending portion on said agitator disposed substantially concentric with the axis of said second shaft and extending beyond the point of intersection of the axes of said shafts, said agitator being rotatable on the axis of said second shaft whereby said agitator moves with a rotary pendulous motion relative to the point of intersection of the axes of said shafts upon rotation of the first-mentioned shaft.

10. In a washing machine, a tub arranged for holding a washing liquid and having a top opening, driving means extending upwardly from the bottom of said tub, an agitator disposed in said tub and adapted for agitating the liquid therein, said agitator comprising an annular transversely extending member having an inwardly and upwardly sloping central portion arising from its main surface normal thereto and extending to adjacent said top opening, and a connection between said driving means and said central portion for supporting said agitator so that the agitator is disposed non-parallel with the bottom of said tub and with its central transverse axis intersecting the axis of said driving means above said agitator.

11. In a washing machine, a tub arranged for holding a washing liquid, a vertically disposed rotatable shaft extending upwardly from the tub bottom and having an upwardly extending angularly disposed bearing at the upper end thereof, and an agitator having a hub supported by said bearing so as to be freely rotatable relative thereto, said hub having a transversely extending portion disposed adjacent the bottom of said tub, and the plane of said agitator being angularly disposed relative to the horizontal with its central axis intersecting the axis of said shaft above said transversely extending portion.

12. In a washing machine, a tub having a bowl-shaped bottom portion, a vertically disposed rotatable shaft extending upwardly from the tub bottom and having an angularly disposed bearing at the upper end of said shaft, and an agitator having a hub supported by said bearing so as to be freely rotatable relative thereto, said agi-

tator hub having a concentric annular transversely extending portion disposed angularly relative to the horizontal and positioned in said tub so that the entire periphery of said transversely extending portion is disposed in close proximity to the inner surface of said bowl-shaped portion, all arranged so that the material being washed is maintained wholly above said agitator.

13. A device of the class described comprising a bowl having a spherical inside wall surface, a rotatable shaft extending into said bowl from the bottom thereof, a head fixed on said shaft within said bowl, a second shaft carried by said head and positioned eccentrically with its axis intersecting that of the first shaft at substantially the spherical center of said bowl-wall surface, and an agitator mounted on said second shaft above said head and extending transversely of the first shaft, said agitator having an annular margin the entire periphery of which closely follows the spherical wall of said bowl when said agitator is actuated.

14. A washing machine comprising a bowl having a spherical inside wall surface, an annular agitator extending transversely of said bowl and spaced above the bottom thereof, said agitator having its margins extending substantially to the wall of said bowl, and a rotatable means extending into said bowl from the bottom thereof arranged to support said agitator and to impart a rotary pendulous movement to said agitator relative to the spherical center of said bowl.

15. A washing machine comprising a bowl having a spherical inside wall surface, an annular agitator extending transversely of said bowl and spaced above the bottom thereof and below the spherical center of said inside wall surface, said agitator having its margins extending substantially to the wall of said bowl, and rotatable means extending into said bowl from the bottom thereof arranged to support said agitator and to impart movement to said agitator such that its central transverse axis describes a cone, with the apex of the cone above the agitator at the spherical center of the tub.

16. In a washing machine, a tub arranged for holding a washing liquid, a rotatable drive shaft extending upwardly from the bottom of said tub,

an agitator comprising a central hub portion adapted to be mounted on the end of said drive shaft, said hub having a central opening to receive said shaft and an annular inwardly extending rim surrounding said opening concentrically therewith, and an annular closure plate arranged to fit concentrically within the said rim of said agitator, said closure plate being mounted on said drive shaft.

17. In a washing machine, a tub arranged for holding a washing liquid, a rotatable drive shaft extending upwardly from the bottom of said tub, a head fixed on said drive shaft within said bowl, a second shaft carried by said head and positioned in an angular relation with its axis intersecting the axis of the first shaft above said head, an agitator having a central hub portion arranged to be mounted on said second shaft above said head, said hub portion having an annular concentric opening arranged to receive said second shaft and an annular inwardly extending rim concentric with said opening of said hub portion, and a closure plate disposed concentrically with said annular rim and arranged to fit the margins thereof, said closure plate being fixedly mounted on the said first shaft adjacent the lower portion of said head.

18. In a washing machine, a tub having a spheroidal bowl-shaped bottom portion, rotatable driving means extending upwardly from the bottom of said tub, a downwardly dished discoidal agitator disposed in said tub and adapted for agitating the liquid therein, and a pivotal connection between said driving means and said agitator for rotatably supporting said agitator eccentrically relative to the axis of said driving means and so that the central axis of rotation of said agitator is angularly inclined relative to the vertical axis of said tub and intersects the same above the main body part of said agitator and centrally of the spheroidal portion of the bottom, said agitator having an annular transversely extending rim portion positioned in said tub so that its entire margin is ever disposed approximately in sliding contact with the inner surface of said bowl-shaped portion of said tub, all arranged whereby the material being washed is maintained wholly above said agitator.

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