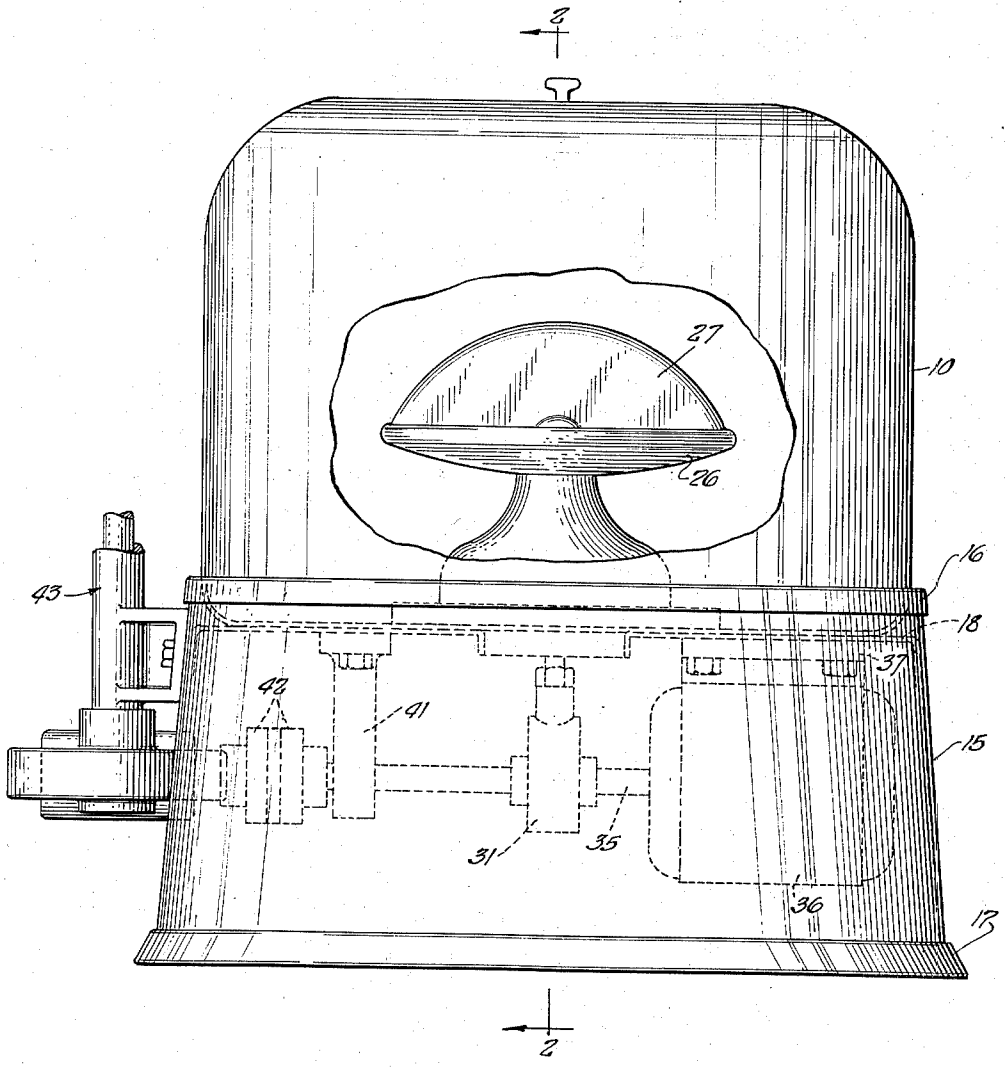
Aug. 29, 1950 M. E. RHODE 2,520,336

AGITATOR FOR LAUNDRY MACHINES

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Fig. 1



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Fig. 3

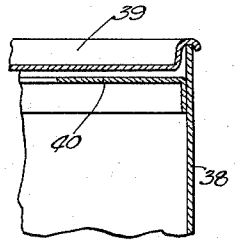
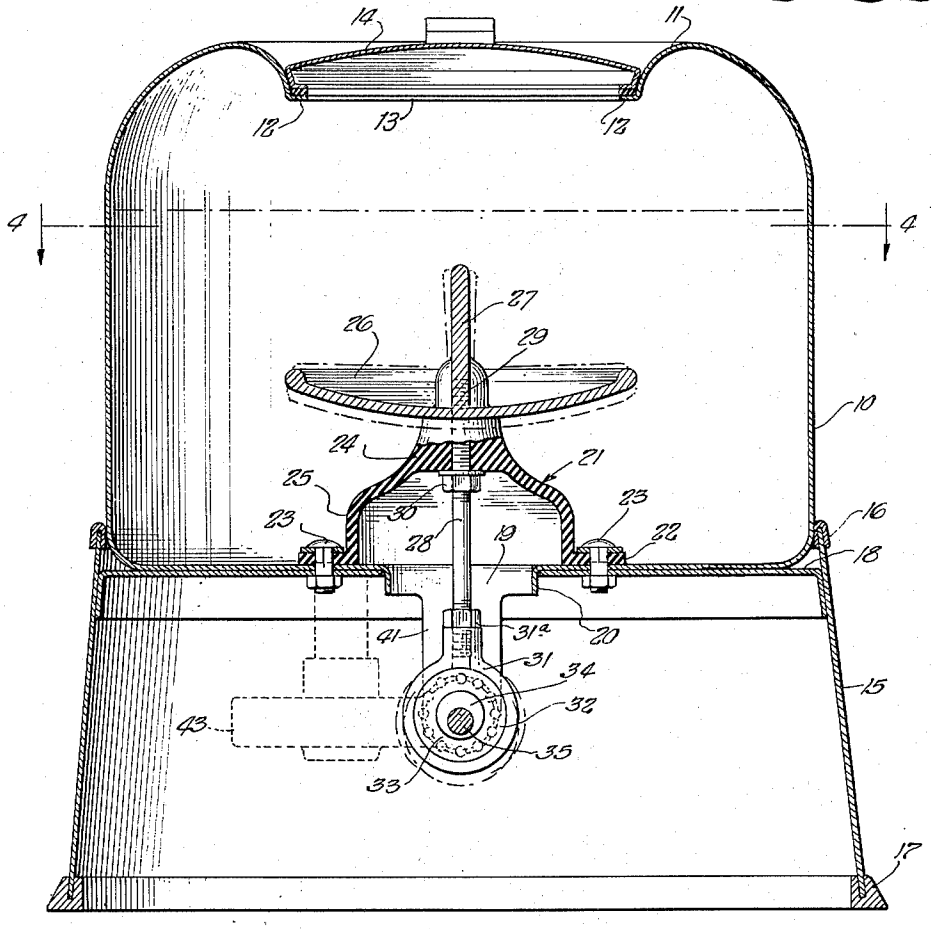


Fig. 2



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Fig. 4

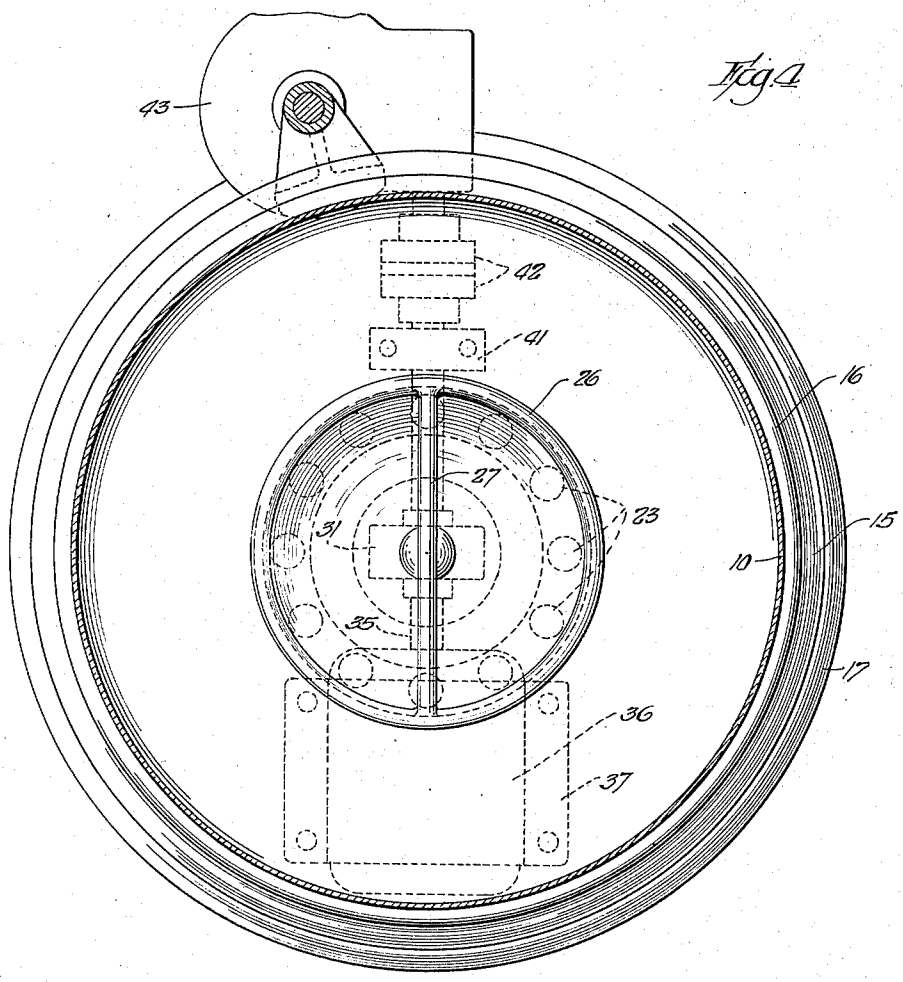
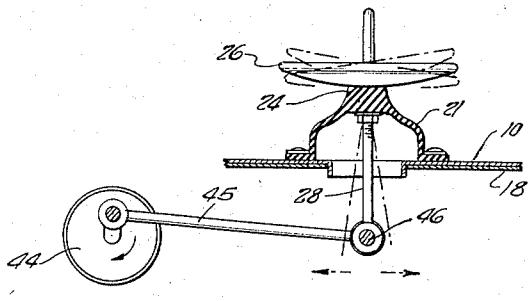


Fig. 5



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Patented Aug. 29, 1950

2,520,336

UNITED STATES PATENT OFFICE

2,520,336

AGITATOR FOR LAUNDRY MACHINES

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Application June 1, 1946, Serial No. 673,830

8 Claims. (Cl. 68—131)

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This invention relates to laundry machines, more particularly to washing and cleansing machines of the type having a movable agitator disposed within a bath of cleansing liquid in a suitable tub, and the invention has for an object the provision of an improved, inexpensive and highly efficient agitator type of machine of this character.

Washing machines of the type employing agitators as heretofore known and constructed have been provided with agitators mounted on suitable operating shafts adapted to impart to the agitator a reciprocating or a rotary oscillating movement, or even a compound reciprocatory and oscillatory movement. In the majority of cases the operating shaft, which imparts movement to the agitator, extends through a packed bearing in the bottom wall of the tub and difficulties are encountered due to leakage of the cleansing liquid through the packing.

Recognition of the difficulties involved in the use of packed bearings in machines of this character has resulted in the construction of machines wherein the agitator is suspended on a shaft extending downwardly through the open top of the tub, but the resulting obstruction of the open top or the necessity of providing means permitting swinging movement of the shaft and agitator out of the normal operating position have rendered such constructions even more unsatisfactory than those employing packed bearings.

In agitator-type washing machines of the types heretofore known the agitators have uniformly been driven at relatively low speeds through suitable racks, gears or cranks, and due to the fact that most of such machines are provided with high speed electric motors for driving the agitators the employment of high ratio reduction gearing between the motor and the agitator has been necessary. Employment of such racks, gears, cranks and reduction gearing not only adds to the expense and weight of the structure, but results in excessive wear of the parts when subjected to the long and hard usage usually encountered by washing machines designed for home use. Various attempts to overcome the above indicated objections and disadvantages have not resulted in entirely satisfactory constructions, and accordingly it is a further object of this invention to provide a washing or cleansing machine of the agitator type in which the danger of leakage through packed joints or bearings is eliminated, in which the operating elements are subjected to a minimum of wear and in which the agitator is so operated as to

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impart to the cleansing liquid a substantially boiling action thereby effecting a thorough and efficient washing.

It is a further object of this invention to provide a washing machine wherein an improved washing action is obtained by imparting to the agitator thereof high-frequency low-magnitude vibrations or movements having a cyclically varying velocity.

In carrying out the invention in one form a laundry machine is provided comprising a tub, one wall of which includes a portion constituting a flexible diaphragm on which the agitator is supported within the tub, and means are provided external to the tub for imparting to the diaphragm low-magnitude high-frequency vibrations. More particularly, the means external to the tub for operating the diaphragm comprises an operating rod having one end rigidly connected to the diaphragm, the other end of the rod being connected to crank means adapted to be driven at relatively high speeds for simultaneously reciprocating and laterally oscillating the rod whereby rectilinear vibration and angular flexure of the diaphragm is effected to reciprocate and tilt the agitator within the tub.

For a more complete understanding of the invention, reference should now be had to the drawings in which:

Fig. 1 is an elevational side view of a laundry machine embodying the present invention, a portion of one wall of the tub being broken away more clearly to illustrate the construction and mounting of the agitator;

Fig. 2 is an elevational sectional view taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional view of another form of tub adapted for use in a laundry machine embodying the present invention;

Fig. 4 is a horizontal sectional view taken substantially along the line 4—4 of Fig. 2; and

Fig. 5 is a fragmentary view partly in section illustrating a modified form of operating mechanism for a laundry machine embodying the present invention.

Referring now to the drawings, the invention is shown as embodied in a laundry machine comprising a stationary tub 10 for containing a bath of washing or cleansing liquid, which tub may be of any suitable shape but is shown as provided with inturned upper edges 11 which terminate in a horizontal flange 12 defining an opening 13 through the top of the tub adapted to be closed by a suitable cover 14. The tub 10 is mounted, as shown best in Figs. 1 and 2, on a supporting

base comprising a conical skirt 15 carrying a gasket 16 at its upper end adapted to engage the side wall of the tub 10, the lower end of the skirt 15 being supported in an annular base member 17. Adjacent its upper end the skirt 15 is provided with an inwardly extending wall 18 which may be secured to the skirt 15 by welding or other suitable securing means.

As shown best in Fig. 2, the bottom wall of the tub 10 is provided with a centrally disposed opening 19 defined by a downwardly extending flange 20, the opening 19 being tightly sealed by a flexible diaphragm member 21 which is preferably of the cup shape shown in Fig. 2, and which is provided with an outwardly-extending flange 22 adapted to be secured to the bottom wall of the tub by suitable bolts 23 which extend through the bottom wall and through the wall 18 of the base so as rigidly to secure the tub on the base.

Although the diaphragm 21, which may be formed of rubber or of rubber-impregnated fabric or of any other suitable flexible material, may be of any desired shape, it is preferably of the cup shape shown in Fig. 2 and is provided with a heavy wall portion 24 and relatively thin side wall portion 25. Mounted on the upper surface of the wall 24 of the diaphragm 21 is the agitator member 26 comprising a dish-shaped base portion and an upwardly extending vane 27. The agitator member 26 may be secured to the diaphragm member 21 in any suitable manner as by molding a projection of the agitator into the diaphragm, by cementing the agitator to the diaphragm, or by threadedly securing the agitator to a threaded part projecting from the diaphragm. In the embodiment shown in the drawings a rod 28, which comprises the operating rod for the diaphragm 21, extends through the heavy upper wall 24 of the diaphragm and is threaded as indicated at 29 to receive a suitable threaded portion of the agitator 26. The rod 28 is provided below the wall 24 with a tightening nut 30, and it will be apparent that when the agitator 26 is screwed onto the upper projecting end of the rod 28 and the nut 30 tightened against the lower surface of the wall 24 of the diaphragm 21, the rod 28 and the agitator 26 will be rigidly secured to the diaphragm and any danger of leakage through the diaphragm will be effectively prevented. As previously indicated the agitator 26 may be molded into the diaphragm 21 and, likewise, the upper end of the operating rod 28 may be molded into the diaphragm if desired.

Adjacent its lower end the operating rod 28 engages the outer ring 31 of an eccentric, the rod being threaded into the eccentric ring and provided with a locking nut 31*a* as shown. The inner surface of the eccentric ring 31 is adapted to engage the outer race 32 of a suitable ball bearing, the inner race 33 of the ball bearing being supported on an eccentric 34 mounted on a driving shaft 35.

As shown best in Fig. 1, the driving shaft 35 constitutes the rotating shaft of a conventional electric motor 36 which is supported on a suitable hanger 37 from the wall portion 18 of the supporting base. Preferably, a rubber or other resilient mounting is employed for the motor, in order to reduce vibration.

When the electric motor 36 is energized the shaft 35 on which the eccentric is mounted rotates at a high speed, depending upon the design of the motor, which speed may be in the neighborhood of 1800 revolutions per minute, and consequently the lower end of the operating rod 28 will move in a circular path so as to impart to the diaphragm 21 both a vertical reciprocating movement and an angular tilting movement. Thus the rod 28 not only moves up and down through a distance determined by a throw of the eccentric 34, but also tilts angularly about a pivot point intermediate its ends so as to impart to the diaphragm 21 not only a reciprocatory but also an angular flexing movement.

The limits of movement of the rod 28, diaphragm 21 and the agitator 26 which is supported on the diaphragm, are indicated in Fig. 2 by broken lines, the heavy line showing of the agitator (Fig. 2) indicating its uppermost central position. Thus there is imparted to the agitator a compound movement of high-frequency and low-magnitude, and it will be observed that this compound movement has a cyclically varying velocity. For example, assuming that the eccentric is in the position shown in Fig. 2 and is rotating in a clockwise direction, it will be apparent that during the first 90 degrees of rotation the rod 28 moves downwardly thus tending to lower the outer peripheral edges of the agitator 26. At the same time, however, the lower end of the rod 28 is moving to the right tending to tilt upwardly the right-hand edge of the agitator 26, thereby compensating in part for the downward movement of the agitator as a whole. Consequently, only a slight movement of the right-hand edge of the agitator occurs during this quarter cycle. During this same quarter cycle, however, the movement of the lower end of the rod 28 in a right-hand direction tends to tilt the agitator so as to move the left-hand edge thereof downwardly, thus adding to the downward movement of the left-hand edge resulting from the bodily downward movement of the agitator as a whole. Consequently, the left-hand edge of the agitator moves at a high speed during this quarter cycle.

During the next quarter cycle the rod 28 continues to move downwardly but the lower end thereof moves in a left-hand direction back toward its central position, tending to tilt the agitator in a direction such as to lower the right-hand edge and raise the left-hand edge. Consequently, during this quarter cycle the right-hand edge of the agitator, as viewed in Fig. 2, moves at a high speed while the left-hand edge moves at a lower speed, the tilting movement tending to compensate for the downward movement of the agitator as a whole.

By virtue of the high-frequency low-magnitude movement of cyclically varying velocity imparted to the agitator 26 the bath of cleansing liquid within the tub 10 is given a substantially boiling movement which forces the cleansing liquid through the clothes or other articles contained in the bath, so as to accomplish a highly efficient washing operation. It has been found that the movement imparted to the bath of cleansing liquid is such as to force the liquid up the outer walls of the tub and, if a conventional open top tub were employed having no inturned portion corresponding to the portions 11 of the tube 10, a portion of the cleansing liquid would be caused to flow over the upper edges of the tub. This discharge of the cleansing liquid from the tub is prevented, however, by the inturned upper portions 11 on the walls of the tub 10.

If for structural reasons it is desired to employ a cylindrical tub, such for example as the tub 38, a portion of which is shown in Fig. 3 having a cover 39 adapted to rest on the upper edge of the cylindrical walls, an inwardly extending flange

40 may be secured to the walls of the tub 38 adjacent the open upper end in order to minimize the tendency of the cleansing liquid to boil or be discharged over the upper edges of the tub.

As shown best in Fig. 1, the operating shaft 35 for the eccentric 34 extends through the eccentric and is supported in spaced relation thereto by a suitable hanger 41 supported, as shown, on the wall 18 of the base structure and, if desired, an extension of the shaft 35 may be provided with a suitable clutch 42 for connecting the shaft 35 to a conventional wringer mechanism 43 only a portion of which is shown in the drawing.

Although it has been found that an exceptionally efficient agitation of the cleansing liquid and a correspondingly efficient washing action is obtained by imparting to the diaphragm 21 and the agitator 26 the cyclically varying compound movement achieved by the eccentric arrangement heretofore described, the invention is not limited thereto and in Fig. 5 I have shown a portion of another type of operating mechanism embodying the present invention. In Fig. 5 similar parts are designated by similar reference numerals, but in this embodiment of the invention the operating mechanism comprises a crank disk 44 driven, for example, by the shaft 35 and connected by means of a connecting rod 45 and a pin 46 to the lower end of the operating rod 28. The pin 46 connecting the rods 28 and 45 may be supported in any suitable fashion for either arcuate or reciprocatory oscillating movement. Thus pin 46 may be carried on a crank having a greater radius than the crank disc 44 so as to guide the pin 46 for arcuate oscillatory movement, or the pin 46 may be mounted in suitable slides whereby it receives a rectilinear substantially horizontal oscillatory movement. In either event the movement imparted to the dipahragm 21 by the rod 28 consists primarily of a tilting movement, there being no substantial vetrical movement of the diaphragm as compared to the compound movement attained by the operating mechanism shown in Figs. 1 and 2. In Fig. 5 the rod 28 and the diaphragm 26 are shown in substantially their respective center positions, the limits of movement imparted thereto by the crank disc 44 being indicated in broken lines.

In agitator-type washing machines heretofore known, the agitator member is ordinarily moved at a relatively low speed through a substantial range of movement. For example, in one type of machine the agitator is oscillated through a horizontal arc of approximately 180 degrees at a speed of approximately 50 oscillations per minute. In the applicant's improved washing machine the agitator is given no oscillation in a horizontal plane but is, instead, reciprocated and tilted through a relatively small range of movement at a relatively high speed and the frequency of vibration or movement is of a high order of magnitude as compared to conventional washing machines. In the claims the terms "low-magnitude" and "high-frequency" are respectively intended to mean movements of only a few inches and frequencies of the order obtainable by direct connection to conventional electric motors, which frequencies may vary from approximately 500 per minute up to 1800 or more per minute.

While I have shown particular embodiments of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modification may be made, and I, therefore, contemplate by the appended claims to cover any

such modifications as fall within the true spirit and scope of my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a laundry machine, the combination of a tub for containing a bath of cleansing liquid, said tub having an aperture in the bottom wall thereof, a cup-shaped flexible diaphragm secured to said bottom wall in inverted relation to seal said aperture, an agitator secured to the upper surface of the closed end of said cup, an operating rod secured to and depending from the lower surface of said closed end of said cup, an eccentric disposed below said rod and rotatable about an axis extending substantially at right angles to said rod, and a strap surrounding said eccentric connected rigidly to said rod whereby rotation of said eccentric imparts to said agitator through said diaphragm a compound reciprocating and wobbling movement for producing a substantially boiling movement of said liquid.

2. In a laundry machine, the combination of a tub for containing a bath of cleansing liquid, said tub having an aperture in the bottom wall thereof, a cup-shaped diaphragm disposed over said aperture and secured to said bottom wall in inverted relation to seal said aperture, said cup-shaped diaphragm having a heavy end wall and relatively thin flexible side walls, an agitator mounted on the upper surface of said end wall, an operating rod rigidly secured to said agitator and to said end wall and depending therefrom, and crank means associated with the lower end of said rod for moving said lower end through a substantially circular path in a vertical plane to effect a compound reciprocating and tilting movement of said agitator.

3. In a laundry machine, the combination of a tub for containing a bath of cleansing liquid, said tub having an aperture in the bottom wall thereof, a cup-shaped diaphragm disposed over said aperture and secured to said bottom wall in inverted relation to seal said aperture, said cup-shaped diaphragm having a heavy end wall and relatively thin flexible side walls, an agitator mounted on the upper surface of said end wall, an operating rod rigidly secured to said agitator and to said end wall and depending therefrom, and means for imparting to the lower end of said rod a high speed substantially circular movement in a vertical plane to impart to said agitator a high-frequency low-magnitude compound movement having a cyclically varying velocity, whereby a substantially boiling movement of said liquid is obtained.

4. In a laundry machine, the combination of a tub for containing a bath of cleansing liquid, said tub having an aperture in the bottom wall thereof, a flexible diaphragm disposed over said aperture and secured to said bottom wall, an agitator rigidly secured to the upper surface of said diaphragm, a rigid operating member rod rigidly secured to said agitator and said diaphragm and depending therefrom, and an eccentric means for moving the lower end of said member through a substantially circular path in a plane coincident with the center line of said member to impart to said agitator a simultaneous reciprocating and tilting movement.

5. In a laundry machine, the combination of a tub for containing a bath of cleansing liquid, said tub having an aperture in the bottom wall thereof, a flexible diaphragm disposed over said aperture and secured to said bottom wall, a substantially disc-shaped agitator rigidly secured to

the upper surface of said diaphragm within said tub and spaced from the bottom wall thereof, an operating rod rigidly secured to said agitator and said diaphragm and depending therefrom, an eccentric means for moving the lower end of said rod through a substantially circular path in a plane coincident with the center line of said rod to impart to said agitator a simultaneous reciprocating and tilting movement, means for rotating said eccentric at a speed to produce a substantially boiling movement of said liquid in said tub, and an inwardly extending peripheral flange adjacent the top walls of said tub for preventing overflow of fluid during movement of the agitator.

6. In a laundry machine, the combination of a tub the bottom wall of which includes a portion comprising a flexible diaphragm, an agitator in said tub spaced from the bottom wall thereof and rigidly secured to said diaphragm, an operating member rigidly secured to said agitator and depending from said diaphragm, and means operably connected to the depending portion of said operating member for simultaneously imparting to said diaphragm and agitator an angular tilting motion and rectilinear vibration in a direction substantially perpendicular thereto.

7. The device recited in claim 6 wherein said last mentioned means comprises an eccentric mounted on said depending portion of said operating member and secured to a power shaft extended in a direction substantially perpendicular to said operating rod.

8. In a laundry machine, the combination of a tub having an aperture in the bottom wall thereof, a cup-shaped diaphragm disposed over said aperture and secured to said bottom wall in inverted relation to seal said aperture, an agitator rigidly secured to said diaphragm and projecting into said tub, said cup-shaped diaphragm having end wall and side wall portions extending angularly with respect to each other and capable of flexure to permit angular tilting and rectilinear motion of said agitator with respect to the bottom wall of the tub without stretching of said walls, an operating connector rigidly secured to said agitator and depending from said end wall, and means cooperating with said connector for simultaneously imparting to said end wall and agitator an angular tilting motion and rectilinear vibration in a direction substantially perpendicular thereto.

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Certificate of Correction

Patent No. 2,520,336 August 29, 1950

MARTIN E. RHODE

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 4, line 65, for "tube 10" read *tub 10*; column 6, line 62, strike out the word "rod";

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of November, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.