Dec. 30, 1941. A. A. KUCHER 2,268,454

WASHING MACHINE

Filed July 7, 1936 4 Sheets-Sheet 1

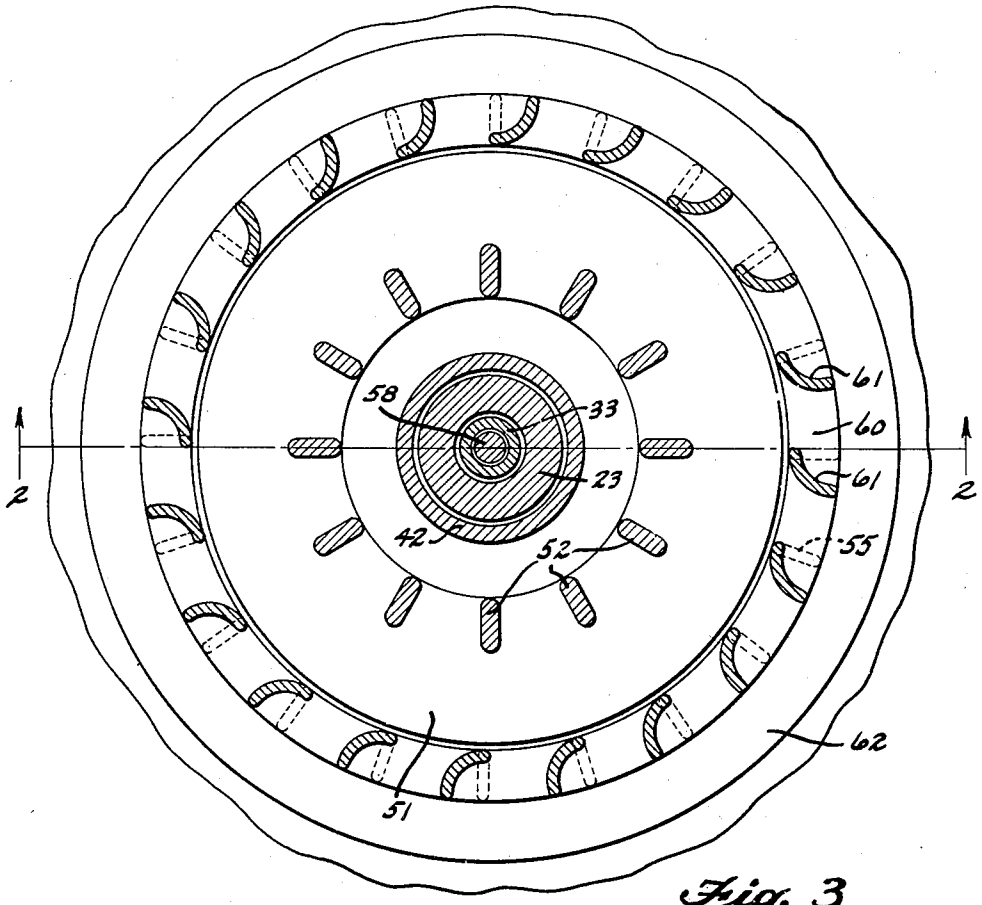


Fig. 3

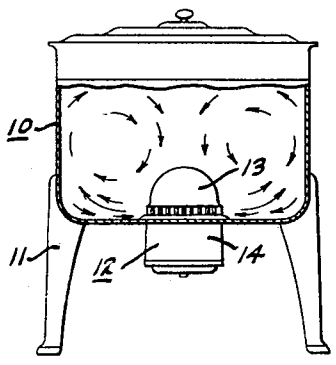


Fig. 1

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WASHING MACHINE

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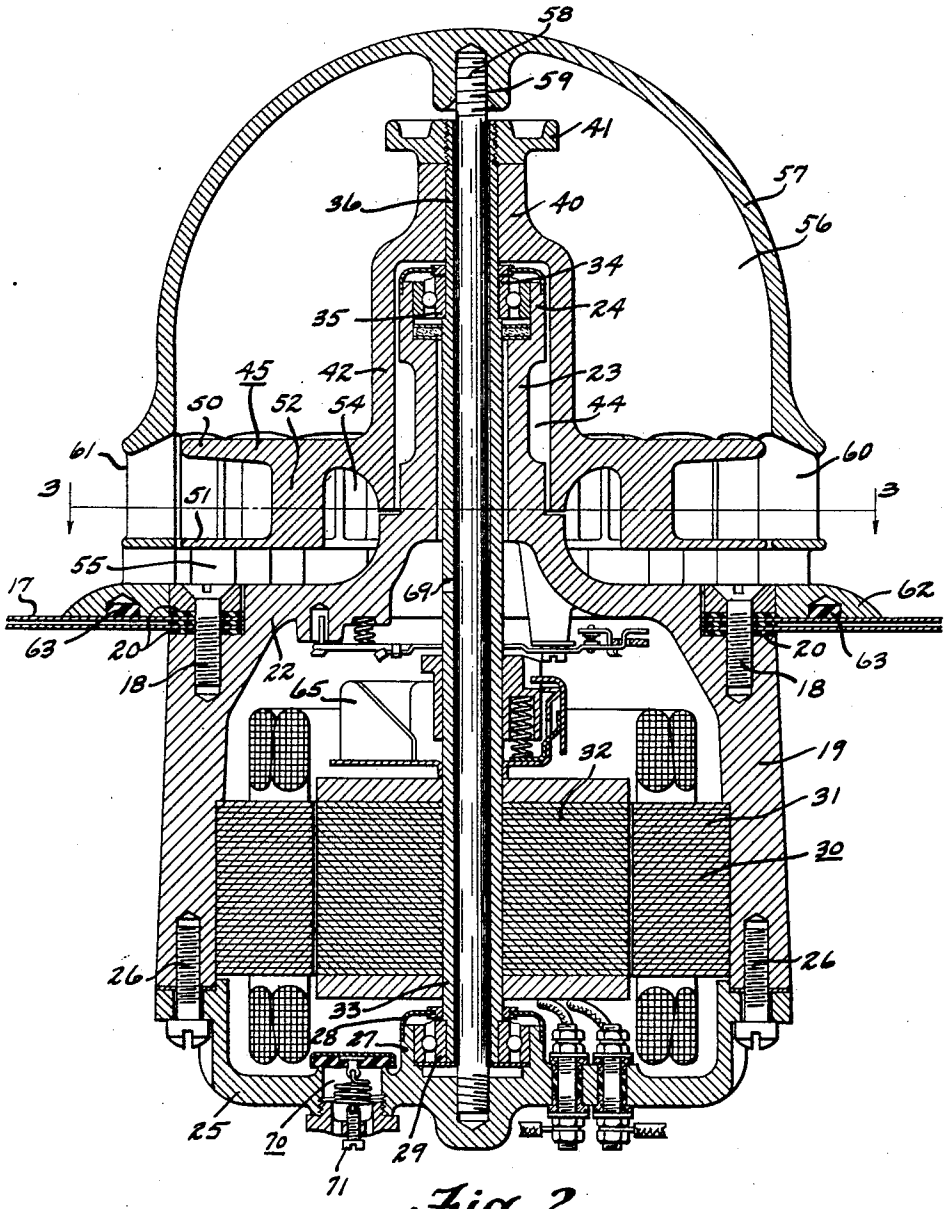


Fig. 2

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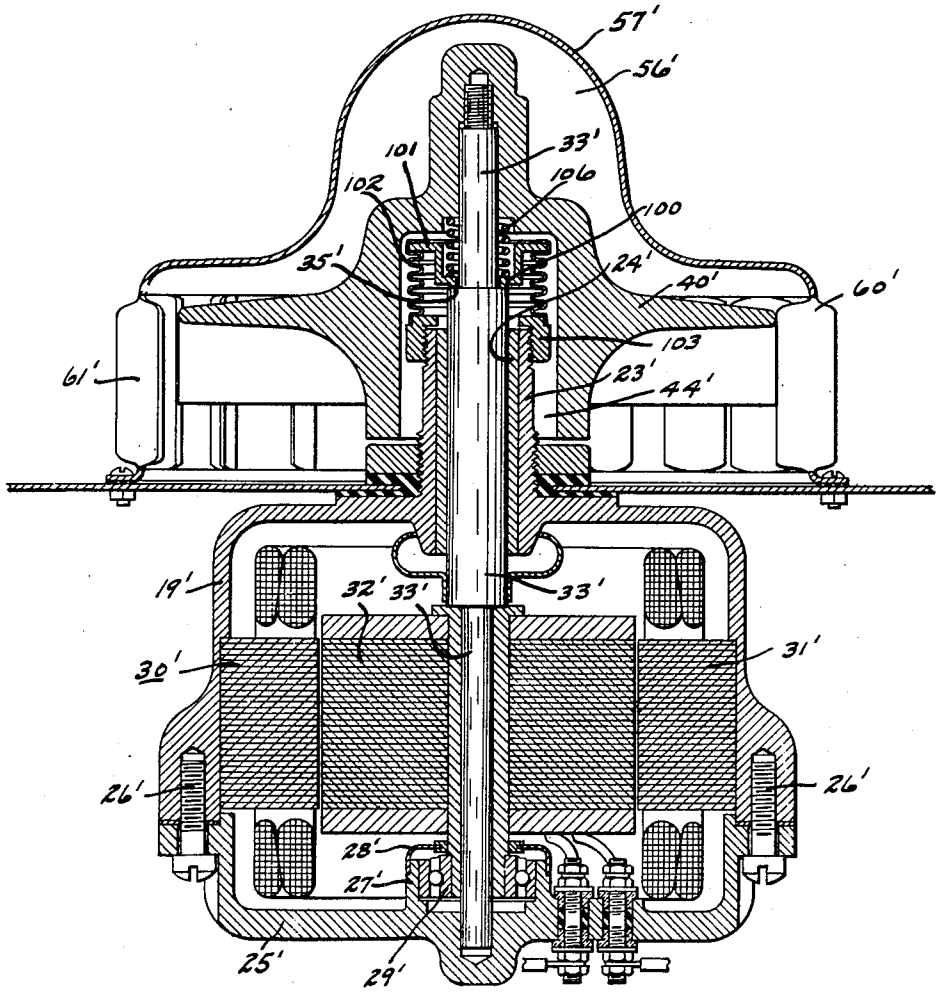


Fig. 4

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WASHING MACHINE

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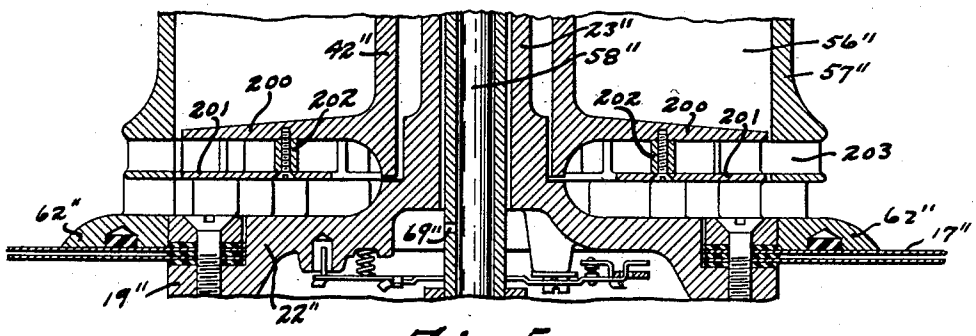


Fig. 5

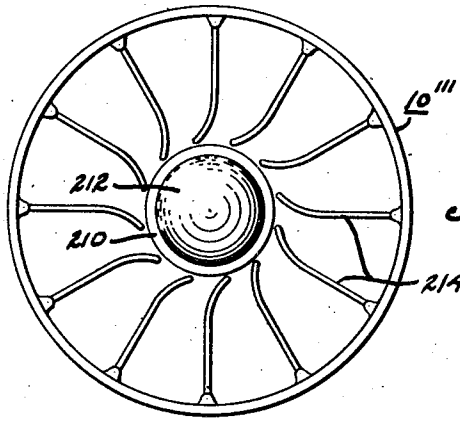


Fig. 7

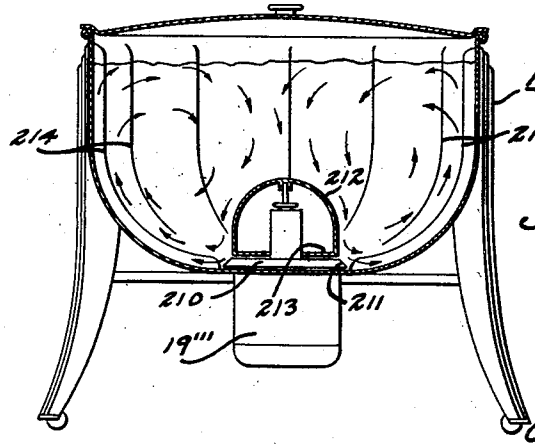


Fig. 6

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Patented Dec. 30, 1941

2,268,454

UNITED STATES PATENT OFFICE

2,268,454

WASHING MACHINE

Andrew A. Kucher, Dayton, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

Application July 7, 1936, Serial No. 89,408

19 Claims. (Cl. 68—184)

My present invention relates to washing machines.

The principal object of my present invention is to provide an improved washing machine employing a novel and efficient apparatus for agitating the liquid therein. Incident to this broad object of my invention are numerous other more specific objects, the attainment of which all materially contribute to the achievement of the principal object. These more specific objects, all of which will be apparent from the following specification, claims and drawings forming a part hereof, include the following:

1. To provide a washing machine including tub having means located therein and below the normal liquid level for agitating the liquid in the tub in a manner to provide an improved washing action.

2. To provide a washing machine wherein the impeller, operating shaft therefor and the bearing for the shaft are all located below the liquid level within the tub and having means in the form of an air lock for preventing the flow of liquid from the tub to the shaft or to the bearings for the shaft.

3. To provide a washing machine wherein the entire motor operated impeller unit is located below the normal level of liquid in the tub and wherein the flow of water from the tub to the motor is prevented by means including an air lock.

4. To provide a unitary motor operated liquid agitating unit for a washing machine wherein many of the operating elements are arranged concentrically with respect to the operating shaft to thereby materially reduce the manufacturing cost of the unit and to render all of the elements easily accessible for disassembling and cleaning by the user.

5. To provide a method of agitating the liquid within the tub whereby the liquid is circulated upwardly adjacent the outer wall of the tub and downwardly adjacent the center of the tub with a minimum amount of rotary movement of the water about the center axis of the tub.

6. To provide a washing machine wherein the entire body of liquid is circulated by the force of a relatively small fraction thereof, circulating at high rate of speed and in the same direction as the flow of the main body of liquid.

Other objects of a more specific nature will become apparent from the following specification taken with the accompanying drawings wherein

Fig. 1 is a view in elevation of my improved washing machine.

Fig. 2 is a view in vertical section through my improved motor operated circulating device.

Fig. 3 is a view in horizontal section taken on the line 3—3 of Fig. 2.

Fig. 4 is a view in vertical section of a modified form of my invention.

Fig. 5 is a vertical section through a modified form of impeller.

Fig. 6 is a section through a modified form of washer wherein an improved circulation of liquid is obtained by the use of an impeller having neither intake or outlet.

Fig. 7 is a plan view of the apparatus of Fig. 6 with the top cover plate of the tub removed.

With reference to Fig. 1, I have shown a tub 10 supported on legs 11 and provided with a motor operated liquid circulating device generally indicated at 12. The motor operated circulating device 12 includes an upper portion 13 located within the tub and a lower portion 14 located outside of and below the tub. Modified forms of the motor operated liquid circulating device are shown in Figs. 2 to 6 inclusive.

With reference to Figs. 2 and 3, wherein I have shown one form of my improved motor operated liquid circulating unit 12, the bottom wall of the tub 10 is indicated at 17. To this wall is attached, by means of screw bolts 18, a lower or motor casing 19. Gaskets 20 are provided between the wall 17 and the casing 19 whereby leakage of liquid from the tub 10 at this point is prevented.

The casing 19 is generally cylindrical in configuration and its upper horizontal wall 22 is extended upwardly near the center to form a vertically extending sleeve 23 notched at its upper end to receive a bearing 24. The lower wall of the casing 19 is in the form of a removable plate 25 secured to the casing 19 in fluid tight relation therewith by means of the screw bolts 26. Near the center of the plate 25 is an annular upstanding lip 27 forming a cup 28 for receiving and supporting a bearing 29.

The motor 30 within the casing 19 includes a stator 31 pressed into the casing 19 and the rotor 32 carried by the hollow armature shaft 33, rotatably mounted, at its lower end in the bearing 29, and near its upper end in the bearing 24, the inner race 34 of which abuts the shoulder 35 formed on the shaft 33.

Slidingly keyed to the extended portion 36 of the shaft 33 is a liquid circulating device generally indicated at 40. A hand wheel 41 threaded onto the upper end of shaft 33 holds the device 40 securely in position on the shaft 33.

The circulating device 40 includes the vertical portion 42 and the horizontal portion 45. The vertical portion 42 surrounds in rather closely spaced relation the sleeve 23 and forms with the sleeve 23 a vertically extending pocket 44 for a purpose hereafter more fully described. The horizontal portion 45 constitutes the impeller proper and includes the upper horizontal wall 50, the lower horizontal wall 51 and the vertical impeller blades 52 therebetween. The lower horizontal wall 51 terminates short of the inner end of the upper horizontal wall to provide the central circular opening 54 and the entire circulating device is so mounted on the shaft 33 as to form between the lower horizontal wall 51 and the horizontal wall 22 of the casing 19 an annular space 55.

The entire circulating device is housed within a chamber 56 formed by the shell 57. This shell 57 is threaded to a rod 58, as at 59, which rod extends downwardly through the hollow shaft 33, and has its lower end screw threaded into the bottom wall 25 of the casing 19. Shell 57 is provided with an opening 60 opposite the impeller blades 52 and in this opening are located the louvers 61 providing means for straightening the stream of liquid from the impeller blades 52, as more fully described hereinafter.

Around the lower edge of the shell 57 is provided an annular flange 62 having formed therein recesses for receiving rubber buffers 63.

As so far described, the apparatus operates as follows. The tub 10 is normally filled with water or other washing fluid to a level substantially as indicated by the irregular line in Fig. 1. At this level the liquid circulating device is entirely submerged in the liquid. Operation of the impeller causes a circulation of liquid outwardly, thence upwardly along the outer upright walls of the tub 10 and finally downwardly adjacent the center of the tub, all as shown by the arrows in Fig. 1. Circulation of the liquid about the vertical center axis of the tub is prevented by means of the louvers 61. Liquid enters the impeller through the circular opening 54 from the space 55.

An important feature of my invention is the provision of means for preventing the flow of liquid from the tub 10 to the hollow shaft 33, bearing 24 and the motor casing 19, during the operation of the washer. In this connection, it should be noted that the motor casing 19 is sealed at its lower end by the plate 25. Consequently, air can escape therefrom or enter thereto only through the sleeve 23 and hollow shaft 33.

In operation, the normal level of liquid within the tub 10 is above the top of the shell 57. In the act of filling the tub 10, the liquid tends to force the air from beneath the shell 57 and from the pocket 44 into the motor casing 19 through the hollow shaft 33 and the sleeve 23 respectively. However, since the motor casing is sealed, the air cannot escape therefrom, and consequently it is trapped beneath the shell 57 and in the pocket 44 forming air locks. The heights of the casing 57 and the pocket 44 are so calculated that the air trapped therein while water is contained in the tub will always maintain the level of liquid beneath the shell 57 and in the pocket 44 well below the open end of the shaft 33 and well below the bearing 24.

In this manner, the flow of liquid from the tub 10 to the motor casing 19 or to the bearing 24 is prevented without the use of stuffing boxes.

In actual operation, I have found that the flow of liquid outwardly from the impeller through the openings 60 produces a venturi effect that tends to evacuate air from beneath the shell 57 and from within the pocket 44. I make use of this effect to continuously supply air to the circulating stream of water without losing the benefits of the air locks hereinbefore described. To accomplish this feature, I provide in the lower plate 25 a check or one-way valve 70 adapted to open when the air pressure within the motor casing 19 is reduced to a predetermined pressure.

Thus, air withdrawn from the chamber 56 and pocket 44, and forced into the stream of circulating liquid by the venturi effect of the liquid, as hereinbefore described, is immediately replaced by air flowing into the casing 19 through the valve 70 and thence through the opening 69 in the hollow shaft into the chamber 56.

Specifically, this valve may be a spring loaded valve which may be regulated by means of the screw 71.

In the embodiment shown in Figs. 2 and 3, the shell 57 is shown as a casting with the louvers 61 integral therewith. Also the circulating device is shown as a casting with the impeller blades 52 cast integral with the upper and lower horizontal plates 50 and 51. It should be understood that such represent specific manufacturing methods only and that such elements could be made by other processes.

It should be noted that the concentric arrangement of the various parts renders the various elements easily accessible for disassembling and cleaning by the user. For example, to disassemble the parts, the shell 57 may be unscrewed from the shaft 58 and removed, thereby exposing the circulating device. The hand wheel 41 may then be unscrewed and the entire circulating device 40 removed from the hollow shaft 33. If access to the motor compartment is necessary, this may be accomplished by removing the plate 25.

In the embodiment shown in Figs. 2 and 3, the motor is shown as provided with a mechanically operated starting relay indicated generally at 65.

The embodiment of my invention disclosed in Fig. 4 differs from that shown in Figs. 2 and 3, primarily in that the air lock is formed by the use of a Sylphon seal. In this modification, the motor casing need not be sealed.

With reference to Fig. 4, the motor casing 19' houses the motor 30' whose rotor 32' is fixed to a shaft 33' extending upwardly through the sleeve 23' formed by the upstanding wall of the motor casing. This rotor 32' and the shaft 33' at its lower end, are supported in the bearing 29' and at its upper end the shaft 33' is supported in the bearing 24'. The shaft 33' is provided with a shoulder 35' against which bears the sealing ring surface 100 of a Sylphon seal 101. This seal includes the flexible bellows 102 secured at one end to the annular member 103 threaded to the upstanding sleeve 23'. At its other end, the flexible bellows is secured to the outwardly extending flange of the sealing ring 100. A spring 106 bearing against the wall of the circulating device 40' and the ring 100 holds the sealing ring surface 100 against the shoulder 35' to thereby seal the pocket 44' against the flow of air therefrom downwardly along the shaft to the motor casing.

The remaining elements, corresponding to the elements of Figs. 2 and 3 have been indicated by the same reference characters primed and a

complete description thereof is obviously unnecessary.

In operation of this embodiment of my improved washer, air is trapped within the pocket 44' by the seal 100 and consequently liquid cannot flow from the tub to the motor casing for the air trapped within the pocket 44' is always sufficient to maintain the level of liquid in the pocket below the seal 101.

A modification of impeller is shown in Fig. 5 as including plates 200 and 201 held in spaced relation by means of the spacers 202. This form of impeller employs no vanes. It imparts centrifugal movement to the body of liquid between the plates and the centrifugal movement of this relatively small body of liquid imparts motion to the main body of liquid. In this modification as in Figs. 2 and 3, the vanes 203 are employed to straighten the currents of liquid leaving the space between the plates 200 and 201.

Figs. 6 and 7 show a further modified arrangement of washer in which the impeller is provided with neither an intake nor a discharge. In this form, the impeller consists of a substantially flat plate 210, the peripheral edge of which is formed with a conical surface 211. The dome or housing 212 corresponding to the housing 57 of Fig. 2, is arranged to direct the liquid in the tub downwardly into contact with the conical surface 211 of the impeller 210 and the inwardly extending partition 213 formed on the housing prevents, to a large extent, the entrance of liquid to the chamber beneath the housing.

In this modification, the air lock may be used as in the other modifications. Other elements that may correspond to elements of Figs. 2 and 3 have been indicated by means of the same reference characters triple primed.

In the operation of the device disclosed in these figures the large body of water within the tub is caused to circulate by reason of the rapid circulation of a small portion thereof. For example, a thin film of water contacting the conical surface of the impeller is moved rapidly outwardly by the movement of the impeller itself. This movement is caused to be radial by the provision of the ribs 214 on the inner side of the tub.

The rapid movement of this thin film of liquid in the same general direction as the flow of the large body induces a flow in the large body and causes a rapid agitation of the water therein.

While certain forms of my invention have been described in connection with the drawings, it should be understood that other forms thereof could be substituted, all within the scope of my invention as defined in the appended claims.

I claim:

1. In a device of the class described, the combination of a tub, an impeller within the tub below the normal liquid level therein, a drive shaft for said impeller, and means including an air lock formed by a casing outside said tub for preventing the flow of liquid from said tub to said shaft.

2. In a device of the class described, the combination of a tub, an impeller within said tub and below the level of liquid therein, a drive shaft for said impeller, a bearing for said shaft, and means including an air lock formed by a casing outside said tub for preventing the flow of liquid from said tub to said shaft and said bearing.

3. In a device of the class described, the combination of a tub, an impeller within said tub and located below the normal liquid level therein, a motor for driving said impeller, a casing for said motor, said motor and casing being located below said impeller, and means including an air lock formed by said motor casing for preventing the flow of liquid from said tub to said motor.

4. In a device of the class described, the combination of a tub, an impeller within said tub and located below the normal liquid level therein, a motor having its armature shaft directly connected to said impeller and having a motor casing, bearings for said shaft, and means including an air lock formed by said motor casing for preventing the flow of liquid from said tub to said motor, said shaft and to said bearings.

5. In a device of the class described, the combination of a tub, an impeller within said tub and below the liquid level therein, a motor for driving said impeller, and means including an air lock formed by a casing outside said tub for preventing the flow of liquid from said tub to said motor.

6. In a device of the class described, the combination of a tub, a motor operated liquid circulating device associated with said tub, said circulating device including a casing having means therein for dividing said casing into two compartments, a motor in one of said compartments, an impeller in another of said compartments, and means including an air lock formed by said casing for preventing the flow of liquid from said impeller compartment to said motor compartment.

7. In a device of the class described, the combination of a tub, a motor operated liquid circulating device associated with said tub, said circulating device including a casing having means therein for dividing said casing into two compartments, one above the other, an impeller in one of said compartments, a motor within the other of said compartments, both of said compartments being located below the normal liquid level within said tub, and means including an air lock formed by said casing for preventing the flow of liquid from said tub to said motor compartment.

8. In a device of the class described, the combination of a tub, a motor operated liquid circulating device comprising a unitary structure including a hermetically sealed motor compartment housing a motor, and a compartment housing an impeller and means including an air lock formed by said hermetically sealed motor compartment for preventing the flow of liquid from one compartment to the other.

9. In a device of the class described, the combination of a tub, an impeller within the tub, a motor for operating said impeller, said motor being located below the level of liquid in the tub, and means including an air lock formed by a hermetically sealed casing for preventing the flow of liquid from the tub to the motor.

10. In a device of the class described, the combination of a tub, a unitary motor-impeller associated with said tub having a portion extending into the tub and a hermetic casing portion without the tub, and means including an air lock formed by said hermetic casing portion for preventing the flow of liquid from the portion within the tub to the portion outside of the tub.

11. The combination comprising a washing machine tub, an impeller on the bottom of said tub, said impeller comprising a single substantially flat plate directly contacting the large

body of liquid in said tub, means for rotating said impeller at a high rate of speed, and a cover for the impeller extending substantially to the periphery of the impeller.

12. A washing machine comprising a tub, an impeller within said tub rotatable about a vertical axis, a motor for rotating said impeller, said impeller comprising a single disc shaped plate having its peripheral edge tapered outwardly and downwardly, and cover means extending substantially to the upper peripheral edge of the plate for directing the liquid downwardly into contact with said tapered peripheral edge.

13. A washing machine comprising a tub, an impeller within said tub rotatable about a vertical axis, a motor for rotating said impeller, said impeller comprising a single disc shaped plate having its peripheral edge tapered outwardly and downwardly, and means for directing the liquid downwardly into contact with said tapered peripheral edge, said means including a shell for substantially enclosing the top surface of said impeller.

14. The combination comprising a washing machine tub, a disc shaped impeller in close relationship with the bottom of said tub and rotatable about a vertical axis, means for rotating the impeller at a high rate of speed; and a cover for the top surface of the impeller extending substantially to the periphery of the impeller.

15. A washing machine comprising a closed tub, an impeller in said tub, a dome within the tub and substantially covering said impeller and providing an air bell, and means forming a conduit connecting the upper part of the dome with the exterior of the tub, the peripheral edge of said impeller and the bottom peripheral edge of the dome terminating adjacent one another and cooperating to provide means for withdrawing air from the dome and for ejecting such air into the water in the tub.

16. A washing machine comprising in combination, a tub; an impeller in the tub, said impeller including a rotatable element; means adjacent the periphery of the rotatable element for directing whirling liquid substantially directly toward the side walls of the tub; means forming a cover for the top of the rotating element; and means for rotating the element about a vertical axis.

17. A washing machine comprising in combination, a tub; an impeller in the tub including a rotatable plate and means on the plate for impelling liquid radially when the plate is rotated, said plate having an opening adjacent the center thereof and being disposed adjacent the bottom of the tub; means for directing liquid upwardly into said opening, said plate, tub bottom and the last mentioned means forming an inlet for the impeller; means forming a conduit connecting the inlet with the exterior of the tub; and means for rotating the plate.

18. A washing machine comprising in combination, a tub; a disc shaped plate in the bottom of the tub; means for rotating the plate; a shell over the plate having an upwardly extending wall in substantial alignment with the peripheral edge of the plate, said shell having an opening directly above the plate for the withdrawal of air from the shell by the rotary action of the plate; and means forming a conduit between the upper part of the interior of the shell and the exterior of the tub.

19. A washing machine comprising in combination, a tub; means forming an inclosure in the tub comprising a liquid impeller and a shell disposed thereabove, said impeller having a liquid inlet and a liquid outlet for circulating water within the tub, said means having a passage disposed for withdrawing air from the interior of the inclosure by the action of the impeller and having a passage communicating with the exterior of the inclosure for the ingress of air to the shell; and means for actuating the impeller.

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