Dec. 3, 1935. E. S. STODDARD 2,023,107

WASHING MACHINE

Filed March 19, 1928 3 Sheets-Sheet 1

Fig 1

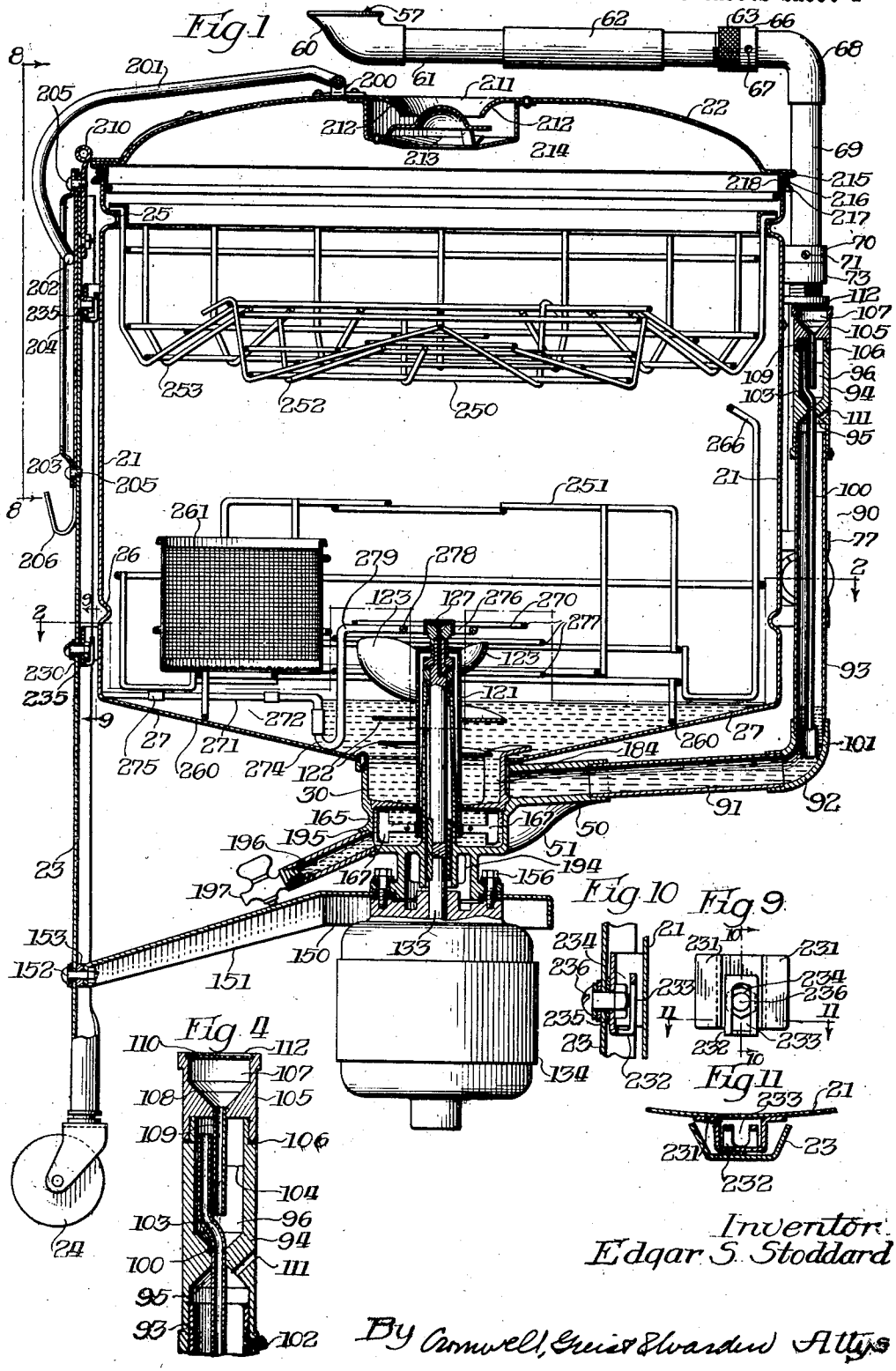


Fig 4

Fig 10

Fig 9

Fig 11

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Fig. 2

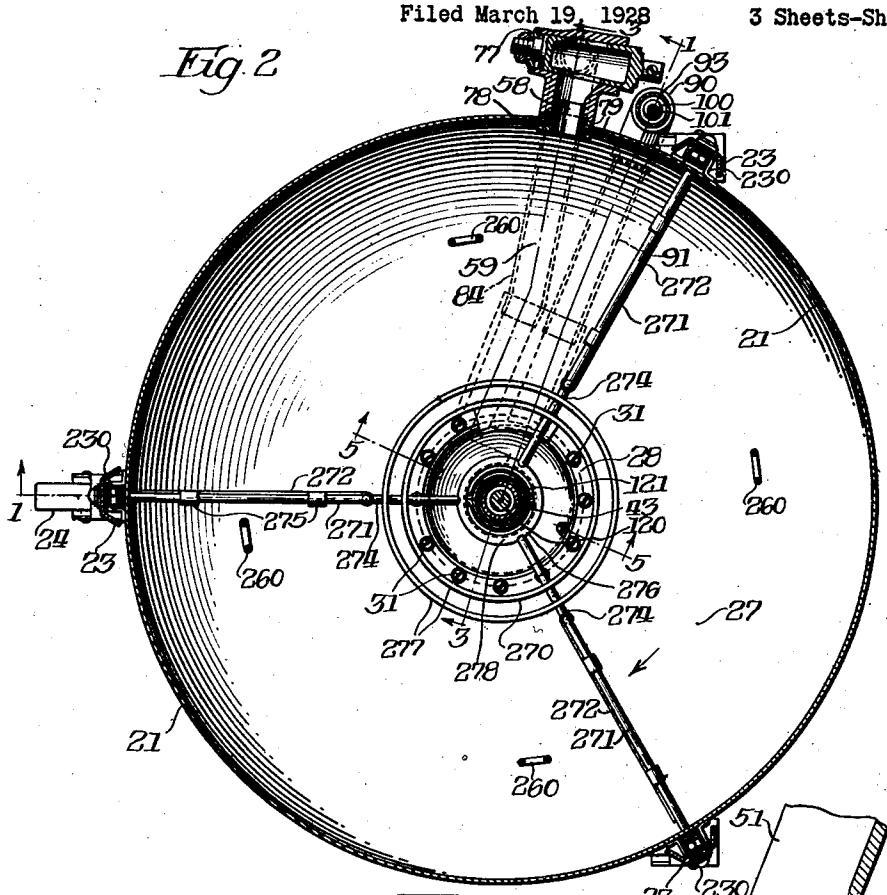


Fig. 5

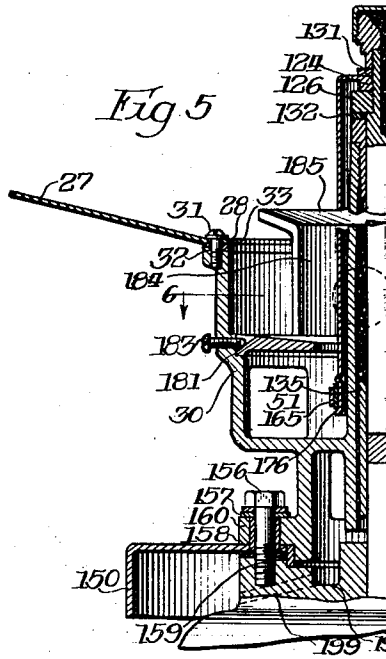
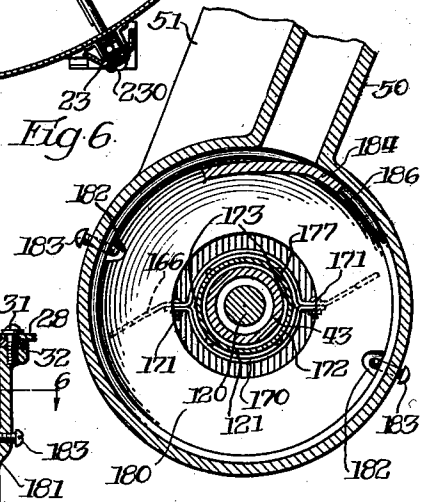


Fig. 6



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WASHING MACHINE

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Fig. 3

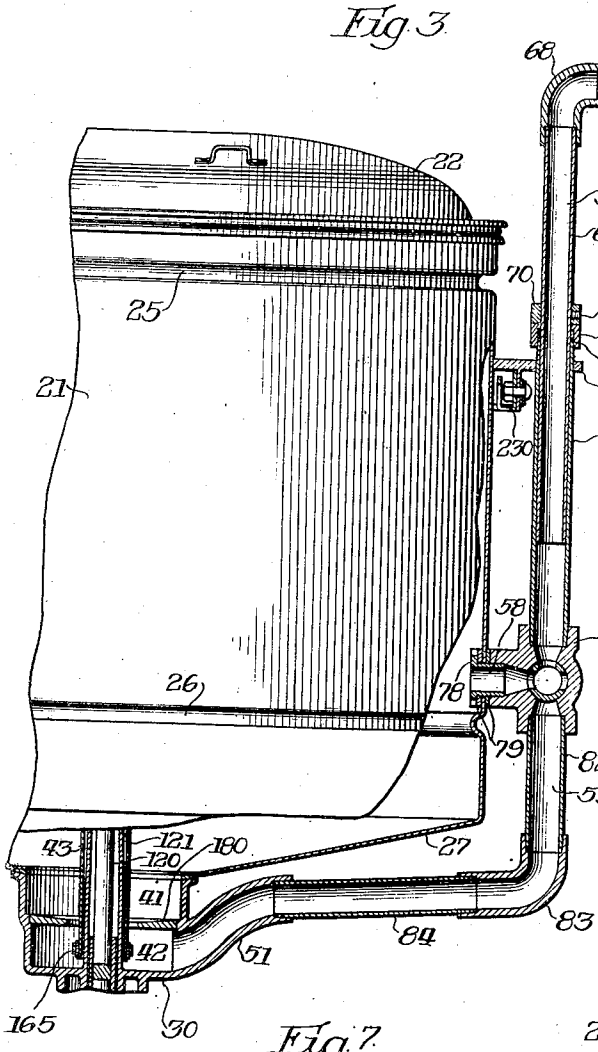


Fig. 8

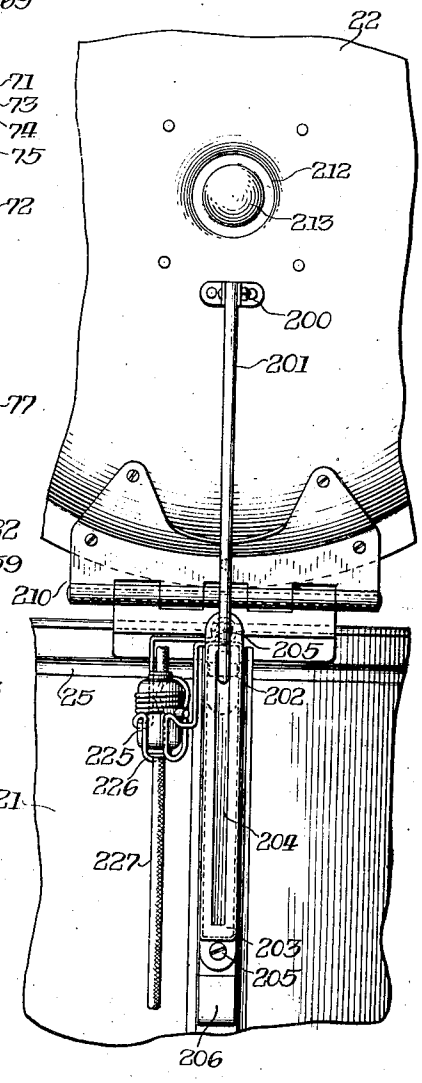
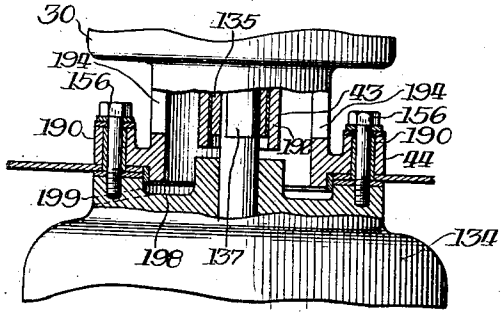


Fig. 7



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UNITED STATES PATENT OFFICE

2,023,107

WASHING MACHINE

Edgar S. Stoddard, Berwyn, Ill., assignor to The Conover Company, Chicago, Ill., a corporation of Illinois

Application March 19, 1928, Serial No. 262,652

6 Claims. (Cl. 141—9)

This invention relates to improvements in washing machines, especially to dishwashing machines of the portable type.

Much difficulty has been experienced with washing machines and especially with dishwashing machines of the portable type in adding the wash and rinse liquid thereto. In most machines it has been necessary to stop the machine if it is in operation and remove the cover. During the rinsing operation it was necessary to repeat the operation of stopping the machine, removing the cover, adding the rinsing liquid, replacing the cover and starting the machine several times to rinse the interior of the machine and the dishes therein. The rinsing, in many cases, was very difficult and had to be repeated many times due to the presence of many crevices and recesses in the machine in which dirt and grease could collect.

The amount of water placed in the machine could only be roughly estimated and the desired fixed operating level was usually not maintained. In addition there was no adequate provision made for removing the waste wash or rinse liquids from the interior of the machine.

An object of this invention is to provide a washing machine to which can be added wash and rinse liquids and from which waste liquids can be removed in a very convenient manner without removal of the cover and without stopping the machine.

Another object of this invention is to provide a domestic washing machine which can be readily moved about and which is adapted to cooperate with an ordinary household sink in obtaining a supply of wash and rinsing liquids and in discharging its waste liquids.

A further object of this invention is to provide a washing machine, the liquid level of which can be readily determined and controlled.

A still further object of this invention is to provide an electrical washing machine, the propelling or circulating member of which is directly connected to an interiorly disposed motor and also to provide efficient insulated, centered, lubricated and water-tight connections between said washing machine and said motor

Many other objects will appear during the course of the following specification, among the more important ones of which are to provide a self-cleaning machine, to provide an improved manner of attachment of the legs, the hinges and other elements to the sides of the tank and to provide an improved hinge connection between the cover and the tank.

Although this invention is broadluy directed to improvements in connection with all dishwashing machines, it is especially directed to improvements to be used in connection with the centrifugal spray projector-type of washing machines, which are more fully described and shown in the copending application, Serial Number 353,841 filed January 24, 1920, now Patent No. 1,679,465, and my copending application Serial No. 193,414, now Patent No. 1,943,636.

The functioning of this type of machine depends upon the operation of a small unencased screw-like impeller, with spiral blades, which impeller rotates at a high velocity of the order of 1,000 to 2,000 R. P. M. in the lower part of the tank of the machine. Only the lower part of this impeller is immersed in the shallow liquid pool in the lower part of the tank. The shallow liquid pool in the lower part of the machine is maintained in relativeley quiescent condition during the operation of the machine. As it turns, the impeller elevates the liquid from its lower spiral screw portions to its upper concavo-projectors which throw the cleansing liquid at a tremendous velocity directly upon, or into, the objects to be cleansed. Since there are no baffles or deflectors to break the force of the liquid, the total force of the projected mass of liquid is effective for cleansing purposes. Although the velocity of the cleansing liquid is very high, the volume of cleansing liquid is very small, and as a result a very effective cleansing is obtained with a minimum and most efficient use of soap and water. The projected mass of liquid at the same time keeps the interior of the tank of the machine clean and causes all the food particles and other solid matter to collect at the bottom of the casing from whence they can be readily removed. In the operation of this unencased impeller, it is important that only the lower portion of the impeller be immersed in water, since if the impeller be totally immersed, it will not result in an efficient cleansing action. In view of the fact that the dishes and other objects are kept out of contact with the body of liquid contained in the bottom of the tank, and the cleansing is solely due to contact with the projected mass of liquid, it is important that the proper operating conditions be maintained for producing such a cleansing action.

The following drawings illustrate one embodiment of the invention as applied to the centrifugal spray projector-type of dishwashing machines, to which the invention is by no means restricted.

Figure 1 represents a vertical sectional view of the washing machine upon the line 1—1 of Figure 2;

Figure 2 represents a sectional top view of the lower part of the tank of the washing machine with the basket removed upon the line 2—2 of Figure 1;

Figure 3 represents a fragmentary vertical side view showing the inlet and outlet connections of the machine upon the line 3—3 of Figure 2;

Figure 4 represents an enlarged sectional view of the upper part of the level indicating column shown in Figure 1;

Figures 5 and 6 represent sectional views upon the lines 5—5 of Figure 2, and 6—6 of Figure 5, respectively, and they show the construction of the pump well and chambers in greater detail;

Figure 7 represents a vertical sectional view and shows a modified centering connection between the motor and the tank portion;

Figure 8 represents a view upon the line 8—8 of Figure 1 and shows the hinge arrangement of the lid when the lid is raised to vertical position; and

Figures 9, 10 and 11 are detail views showing the character of the brackets which are used for attachment of the various parts to the body of the tank.

In Figure 1 the washing machine is composed of a vertical cylindrical tank 21 which is provided with a cover 22 and three symmetrically positioned legs 23 which ride upon the rollers 24 so that the washing machine can be readily moved from place to place. The tank is provided with two strengthening ribs 25 adjacent to the top thereof and 26 adjacent to the bottom thereof, and it is also provided with a centrally draining bottom 27 which may take the shape of an inverted frustrated cone. The rim of the removed apexial portion of said frustrated conical bottom 27 is flattened as indicated at 28 (see especially Figure 5). The tank of the machine can also be square, rectangular or polygonal in horizontal cross section. The bottom can be caused to drain to one side of the tank if desired. In case it is desired to be able to move the dish racks into the tank of the machine from the side, the impeller can be placed adjacent to the side or corner removed from the entrance.

The flattened rim 28 (see Figure 5) is adapted to be joined to a journal casting 30 by the screws 31 which are positioned at equal intervals around said flattened rim. The contacting edge 32 of the casting 30 is bevelled and between the flattened rim 28 and the bevelled edge 32 is clamped the circular rubber washer 33. This will insure a water-proof joint between the journal casting 30 and the body of the tank 21 since the bevelled edge 32 will compress the rubber washer along one line around the edge of the rim giving a perfect contact over the entire joint.

The casting 30 contains an upper chamber 41, (see Figure 5) a lower chamber 42, a bearing member 43 and a lower flange 44 for attachment with the motor. The upper chamber 41 (see Figure 1) is provided with a tubular projection 50 which leads to a level indicating device and the lower chamber 42 is provided with a tubular projection 51 (see also Figure 3) which leads to a liquid conduit.

The main conduit 57 is partly contained in a horizontal swaying arm which is adapted to extend away from the tank 21 so as to cooperate with the faucets or basin of a domestic household sink as shown upon Figure 3 and which is also adapted to be placed over the cover 22 of the tank 21 when the machine is not being utilized as shown in Figure 1. The main conduit 57 is also partly contained in vertical tubing which extends up along the side of the tank (see Figure 3). Adjacent to the bottom of the tank the conduit 57 can be continued into either one of two conduits, a conduit 58 leading directly into the side of the tank slightly above the dished bottom 27 and another conduit 59 which leads into a well in the bottom of tank and cooperates with the projection 51.

The main conduit is constituted in the following manner: The funnel 60, which is preferably a casting, (see Figures 1 and 3) is adapted to cooperate with an ordinary household sink. It can be turned upwardly, as indicated, so as to receive the flow of liquid from a spigot or faucet or it can be turned downwardly to permit discharge of the waste liquid from the interior of the tank into the household sink. Attached to the funnel 60 is the horizontal tube 61 to which is attached the fiber handle 62 which may also be made of hard rubber, "Bakelite" or any other heat insulating material. The handle 62 is fitted over a knurled or roughened portion of the tubing 61. To the end of the tube 61 is attached the nut 63 which is provided with a hollow portion 64 for containing suitable stuffing material. The tube 61 fits over and slides upon an inner tube 65 which is provided with a collar 66, which may be adjusted in different positions upon the tube 65 by means of a set screw 67. The tube 65 is rigidly set into the elbow 68. The tube 61 is adapted to ride back and forth so as to increase or decrease the distance between the funnel 60 and the elbow 68. The amount of friction between the tube 65 and the tube 61 can be regulated by screwing or unscrewing the nut 63 which will compress or lessen the compression upon the stuffing material in the recess 64. If it is desired to have a fixed length between the funnel 60 and the elbow 68 the length of the tube between 60 and 68 may be adjusted by loosening the set screw 67, and by moving the collar 66 along the tube 65 until it rests against the nut 63. The set screw 67 is again tightened and the distance between 60 and 68 will then be set so that the funnel may cooperate with a domestic or household sink in the desired manner. When it is desired to turn the funnel 60 so that it will discharge downwardly into the basin of the sink, such may be done by means of the handle 62. The tube 61 and the nut 63 can be turned in this manner without affecting the adjustments or the predetermined length between the funnel 60 and the elbow 68.

The downwardly extending portion of the elbow 68 is rigidly attached to a vertical tube 69 which is provided with a collar 70 which can be set in any position along the tube 69 by means of a set screw 71. The tube 69 slides within another tube 72, to the upper threaded portion of which is attached the nut 73. The nut 73 is provided with a recess 74 in which is placed a suitable stuffing material. The friction with which the tube 69 slides within the tube 72 may be regulated by tightening or loosening the nut 73. The elbow 68 can be turned at any desired angle since the tube 69 will readily turn within the tube 72. The length of the tube 69 above the nut 73 can also be readily regulated by loosening the set screw 71, elevating or lowering the elbow 68, moving the collar 70 to its new position so it will rest against the nut 73 and again tightening the

set screw 71. The tube 72 passes through the bracket 75 which is attached to the side of the tank. The tube 72 leads to the three-way valve 77. When wash or rinse water is being admitted to the tank 11, the three-way valve 77 may be so adjusted as to close the connection between the conduits 57 and 59 and open the connection between the conduit 57 and the conduit 58. When waste liquid is being removed from the tank 11 the three-way valve 77 may be so adjusted that it will open the passage between the conduit 59 and the conduit 57 and close the passage between the conduit 57 and the conduit 58. The valve 77 is attached to the side of the tank by means of the nut 78, the enlarged portion of which is positioned within the interior of the tank 11. The two rubber washers 79 are firmly clamped between the three-way valve 77 and the nut 78. The conduit 59 is contained in a vertical tube 82, an elbow 83 and a slanting tube 84 which latter fits into the tubular projecting hollow portion 51 which communicates with the lower chamber of the casting 30.

If the wash and rinse water is run into the machine while the water propelling or circulating device is not in operation, the conduit 58 may be cut out entirely and the combined conduits 57 and 59 utilized both for conducting the wash and rinse water into the bottom of the tank below the water actuating device and for conducting the wash liquids away from the bottom of the tank.

The upper chamber of the casing 30 (see Figures 1 and 4) is connected to the column 90. The column 90 comprises a slanting tube 91 which fits into the tubular projecting portion 50 of the casting 30. The tube 91 fits into the elbow 92 which in turn fits into the vertical tube 93 which extends up along the side of the tank 21. To the upper part of the tube 93 is attached the gauge bottom 94, each side of which is bored so as to form the chambers 95 and 96. Through the center of the member 94 is drilled a hole between the cup-shaped openings 95 and 96 through which is passed, and to which is soldered, a pressure tube 100. This pressure tube 100 extends downwardly into the tube 93 and terminates in a pressure bell 101 which is positioned in the lower part of the column 90 so that it will be partly submerged. The gauge bottom 94 may be set in a fixed position upon the tube 93 by means of the set screw 102. The upper portion of the pressure tube 100 is bent over as indicated at 103 and then extends upwardly into the reservoir chamber 96. The cylindrical portion of the reservoir chamber 96 is provided with an indicating line 104.

The upper portion of gauge bottom 94 is threaded and the gauge top 105 is screwed upon it. The rubber washer 106 insures an air-tight fit between the gauge top 105 and the gauge bottom 94. The upper part of the gauge is drilled out and countersunk so as to form a gauge chamber 107. The conical portion of this indicating chamber 107 is provided with the gauge line 108. In the lower portion of the gauge 105 is drilled a hole in which is inserted the tube 109 which is soldered to the gauge top 105. The tube 109 extends downwardly and under the surface of the indicating liquid in the reservoir 96. The top of the gauge chamber is covered by a piece of celluloid or other transparent material 110. The pressure tube 103 need not be bent as shown. The tube may be straight, if it is set off center in the gauge bottom 94 or if the tube 109 is either bent off center in the reservoir chamber 96 or set off center in the gauge top 105.

The column 90 is connected to the upper chamber of the casting 30 so that any change of level in the tank is readily communicated to the gauge 94. The column 90 is ordinarily filled with water up to the level of the liquid in the washing chamber of the tank 11. This water will trap a column of air in the pressure bell 101 and in the pressure tube 100. As the liquid level in the tank 11 rises the air which has been trapped in the bell 101 and in the tube 100 will be forced upwardly into the reservoir chamber 96. The indicating liquid in the reservoir chamber 96 will then be forced up through the tube 109 into the gauge chamber 107. When the liquid reaches the line 108 the proper level inside the tank 11 will have been reached.

The indicating liquid which is used should have a higher specific gravity than water and a much higher boiling point than water so that it will not readily evaporate. The indicating liquid must indicate the level of both hot water and cold water and the liquid must function practically the same without substantial expansion or evaporation between the temperatures of about 60° F. and 212° F. The liquid should have a higher specific gravity than water for the reason that slight changes in the specific gravity of the liquid in the tank 11 should not materially change the rise in the level of the indicating liquid. There is frequently a layer of suds upon the top of the water in the lower part of the column 90, that is in the elbow 92 or in the tube 93. This layer of suds is liable to materially affect the level of the liquid in the gauge chamber 107 unless a liquid of higher specific gravity than water is used. In this latter case the effect will be very small and may be neglected. As a general rule it is preferred to use liquids which are colored, or colorless liquids in which dyes can be readily dissolved, which are odorless, which have a higher boiling point than water, and which also have a substantially higher specific gravity. The liquids utilized should also be of low viscosity so that they will readily move in tubes of small diameter with slight changes in pressure. Alcohols, especially the polyhydric alcohols such as ethylene glycol have been found useful for this purpose. Some alcohols may have to be slightly diluted with water to reduce their viscosity, but the amount of water should be kept down so that there will not be any material increase in the vapor pressure of the indicating liquid. The reservoir chamber should be protected from the heat of the wash and rinse liquids in the washing chamber so as to prevent excessive changes in temperature. The exterior of the gauge bottom 94 is glass-enamelled or surfaced with a reflecting material and is separated from the wall of the tank 21 by an air gap. The reservoir bottom is also insulated from the hot water in the bottom of the column 90 by the air columns inside of the tubes 93 and 100.

To adjust the column so that the level of the indicating liquid will be exactly at the line 108 when the tank contains six quarts of water the following procedure may be adopted. Six quarts of water are put into the machine which should be previously emptied of liquid. Six quarts of water will just fill the bottom of the machine including the two chambers in the cup-shaped part of the journal casting 30, and the frustrated conical bottom with communicating pipes and tubes up to the desired level. This will immerse the elevating portion of the water actuat-

ing member. The normal level will just be at the point where the frusto conical bottom 27 joins the cylindrical sides of the tank 21. The reservoir chamber 96 of the gauge is then filled with the liquid up to the line 104. The gauge top 105 including the gauge chamber 107 is then screwed on to the threaded portion at the top of the reservoir chamber 94 with the rubber washer 106 in place. The combined gauge top and bottom 94 is then moved along the tube 93 until the level of liquid in the gauge chamber 107 is at the line 108. The set screw 102 is then tightened so that the combined gauge top and bottom will be held in fixed position upon the tube 93. The pressure in the upper part of the tube 93 in the upper portion of the chamber 107 is maintained at atmospheric pressure by means of the openings 111 and 112 respectively. The interior of the chamber 107 is preferably coated with a layer of white "Duco" or is nickel plated so that the color of the indicating liquid, which is preferably red, will be strongly contrasted against it.

It will be noted that the gauge is so arranged and positioned that the level indication will be vertically discernible to one standing at the machine and adjusting the swinging arm 60—61 or valve 77. The device is especially advantageous over the horizontal view tubular gauge glasses since it is not necessary to utilize double seals to fix the tube in position and no grease from the cleansing or rinsing liquids can come into contact with the gauge and obscure it.

The operation of the level indicator may be briefly summarized as follows: The liquid in the tank actuates an air column, which in turn actuates another liquid column, which forms a manometer with a broken column in which liquid will not be lost when inverted or syphoned out when the tank is drained. When the tank 21 is drained the liquid in the lower part of the column 90 will also be drained.

The tubular member 43 (see Figures 1 and 5) in the particular embodiment of the invention shown contains the bearing for the driving shaft 120 of the water impelling member in the lower part of the tank 21. The water impelling member consists of a cylindrical shell 121 to the upper exterior of which are attached the circular inclined blades 122 which terminate in enlarged concavo centrifugal spray-projectors 123. The upper part of the shell 121 (see especially Figure 5) is welded to the nut 124 which is screwed upon the upper part of the shaft 120. The nut 124 is screwed down to and rests upon a nut 126 which is also screwed upon the top of the shaft 120 and rests upon a shoulder thereupon. Upon the top of this shaft is screwed a greasecup 127 which has a knurled cap 128 by means of which the pressure upon the grease can be regulated. A conduit 129 leads from the grease compartment within the cup to the upper bearing 130. The upper bearing 130 consists of a bearing nut which is screwed into the top of the tubular portion 43 of the casting 30. The bearing 130 is separated from the nut 126 by a fibre washer 132. The impeller shaft and the motor shaft are operatively connected by means of a hollow cylindrical coupling shell provided with interiorly flattened portions which engage corresponding flattened portions or recesses on the ends of the impeller or motor shafts. The shaft 120 is connected to the shaft 133 of the motor 134 by means of the insulating coupling 135. The space between the end of the shaft 120 and the end of the shaft 133 is filled with a rubber disk cemented in place so that no water can complete the circuit between the shafts. The insulating coupling 135 drives the impeller by means of the flattened portions 137 (shown more fully on Figure 7). This coupling consists of a tubular-like piece of "Bakelite" or other insulating material which is surrounded by a thin sleeve of steel tubing. The steel tubing is provided with several holes so that if Bakelite or a similar material is molded within it, there will be a place for a firm attachment between the insulating material and the sleeve. In the space between the shaft 120 and the interior of the tubular member 43 and between the upper bearing 130 and the lower bearing 135 is positioned felt or other absorbent material soaked with grease to avoid the necessity of frequent oiling. The gap between the ends of the shafts 120 and 133 is closed by a cylindrical piece of rubber cemented therein so as to prevent short circuiting due to collection of electrolyte in such gap.

The motor is centered in the following manner (see Figures 1 and 5). The motor is supported partially by a spider 150 which has three supporting arms 151 which are attached to the three legs 23 which support the tank. The spider arms 151 are attached to the legs by means of the machine screws 152. The ends of the legs 151 are separated from the legs supporting the tank by the lead washers 153. The lower part of the casting 30 has a flange 44 which is provided with the circular shoulder 45. The upper part of the motor casing is similarly shouldered as indicated at 154 and these two shoulders are adapted to cooperate and hold the motor shaft firmly centered in respect to the impeller shaft 120. The flange 44 is provided with a series of symmetrically arranged holes through which bolts 156 may be passed. These bolts screw into suitable openings in the end bell of the motor 134. These bolts 156 will pass through the spider 150 and firmly clamp the spider between the flange 44 and the motor 134. The bolts 156 are insulated from the journal casting 30 by means of the fiber washers 157, the fiber annular ring 158 and the vertical fiber ring 159 which latter rests between the cooperating shoulders 45 and 154. In addition there is a fiber sleeve 160 which fits over the portion of the bolt which passes through the flange 44.

The lower part of the impeller shell 121 (see Figures 1, 5 and 6) is provided with a centrifugal device 165. This centrifugal device is adapted to turn in a lower chamber 42 of the casting 30. The centrifugal member consists of a brass strip 166 the ends of which are widened as indicated at 167 (see especially Figure 1). This brass strip is bent (see Figure 6) so that it can be adjusted to give it a suitable amount of centrifugal force to remove the liquids from the tank 21. The brass strip 166 has a central portion which partially embraces the shell 121 of the impeller and around the other side of the shell or impeller is a cooperating strip 170 which is bolted to the main strip at 171. This brass strip is preferably separated from the impeller sleeve or shell by a lead strip 172 which fits adjacent to, and around, the lower part of the impeller sleeve or shell 121. The lead strip prevents cracking of the glass enamel. The lower part of the impeller shell at diametrically opposite points is provided with driving buttons 173 over which the lead strips fit thus causing slight elevations in the lead strip. The centrifugal pump member 165 is po-

sitioned over the lead strip 172 so that the elevations, due to the driving buttons 173 on the lower part of the impeller shell 121 will fit into the openings which are caused by the jointure between the opposite clamped strips 166 and 170 of the centrifugal device. This will prevent the centrifugal device 165 from sliding around on the lower part of the impeller shell 121 and will cause it to rotate therewith. The centrifugal device 165 is held in position by means of the lower flared edge 176 of the impeller sleeve or shell 121 and four buttons 177 which are symmetrically positioned around the impeller shell just above the position of the lead and brass strips.

The lower chamber 42 of the journal casting 30 in which the centrifugal device 165 rotates is separated from the upper chamber 41 by means of the plate 180. The plate 180 rests upon the shoulder 181 in the wall of upwardly facing cup of the journal casting and is held in position and kept from turning by means of the set screws 183 which fit into the beveled recesses 182. The plate 180 has a large central opening which permits passage of liquids between the chambers 41 and 42. Cast integrally with this plate and projecting upwardly therefrom is the vertical cylindrical plate 184 (see Figures 5 and 6) to which is attached a sloping horizontal plate 185 (see Figure 5). These plates are adjacent to the side of the chamber 41 and the lower part of the frustrated conical portion 27 of the tank 21 and are positioned so that they will form pockets in conjunction with the side of chamber 41 and the bottom of the tank 27. The impeller usually is intended to turn clock-wise if one looks downwardly thereupon. The impeller forces an amount of water into the open space between the plates 184 and 185 and the walls 41 and 32. This water will increase the level indication in the gauge 89 so that it is possible to calibrate and operate the gauge 89 when the impeller is in motion. It is obvious, of course, that when a machine is operating a certain amount of water will have been elevated and will be in the form of a spray in the open body of the machine or it may be hanging as droplets on the side of the various racks and articles above the water level on the interior of the tank 21. This will obviously decrease the amount of water which is contained in the frustrated conical bottom 27 and the chambers 41 and 42 of the journal casting 30. In order to get the correct six quart level both when the actuating device is in motion and when the machine is operating it is necessary to position some means such as that shown to increase the level which will be indicated by the gauge 90. As can be seen from Figure 6 the portion of the plate 184 which is adapted to rest adjacent to the side of the chamber 41 forces an additional amount of liquid into the column 90. A certain amount of liquid, of course, will pass between the closely adjacent edges of the plate 184 and the side of the chamber 41. This amount of leakage can be increased by cutting grooves in the portion of the plate 184 which is closely adjacent to the side of the chamber 41 or it can be restricted by attaching a plate of sheet copper 186 (see Figure 6) on the rear side of the plate 184 which will closely contact with the wall of the chamber 41. By making adjustments of this character it is possible to obtain a correct indication of the amount of water in the tank while the impeller is in operation. In preferred construction it may be desirable to omit the plates 184 and 185 since they tend to accumulate dirt and food particles and they are not essential if the gauge is not to be operative when the impeller is in motion.

The top of the impeller shell will be elevated above the normal water level. There will be very little tendency for water leakage to take place past the bearings of the shaft 120 under normal conditions. It will be noted that the impeller shell 121 forms an apron-like sleeve over the top of the tubular bearing member 43 so that an air pocket is formed between the impeller shell and the tubular bearing.

The outside diameter of the journal member 43 (see Figure 5) is caused to increase as such journal member 43 approaches the lower portion of the impeller shell 121. The impeller shell is made substantially cylindrical with the same interior diameter from top to bottom. As a result there will be a much smaller annular space 187 between the impeller shell 121 and the tubular bearing member 43 at the lower part of the impeller shell than there will be adjacent to the upper part of the impeller shell. The air trapped in this annular space inside of the impeller shell further reduces the leakage. The air which is trapped in this annular space will be prevented from leaking through the bearing 130 by the lubricant contained in such bearing and it will be prevented from leaking past the nut 124 adjacent to the grease cup attachment by means of the compressible washer 131 which is between the grease cup 127 and the top of the impeller sleeve 124.

Figure 7 shows a modification of the connections between the supporting spider, the motor and the casting 34 adapted to overcome insulating difficulties. In the arrangement shown in Figure 5 it has been found that it is sometime possible for water to leakdown upon the upper part of the flange 44 and to connect electrically the bolts 156 to the casting 30. The bolts 156 are attached to the end bell of the motor. It is very possible for an electrical charge to get into the body of the machine from the motor and to shock the user thereof. In Figure 7 the ports of the flange 44 through which the bolts 156 are passed are provided with the bosses 190 so that the water will readily drain away from the top of the flange without causing electrical connection between the bolts 156 and the journal casting 30. In the portion of the journal casting which surrounds the depending part 192 on the journal member 43 (see Figures 1, 5 and 7) there are a series of openings 194 so as to ventilate and make access possible to the space therein. The channel 198 (see Figures 5 and 7) in the end bell of the motor 134 is drained to the exterior by drain hole or slot 199 so that no water accumulates to ground the motor on the tank.

The lowest part of the lower chamber 42 of the journal casting 30 is provided with a tapped projection 195 (see Figure 1). Into this tapped projection is screwed a downwardly projecting tube 196 to the end of which is attached the pet cock 197. In case it is desired to drain the pump chamber of all liquid such pet cock may be opened and the small amount of liquid left in the chamber 42, after the centrifugal pump has substantially exhausted the liquid from the interior of the machine, can be removed. Ordinarily the amount of liquid left in the interior will be less than one pint and this will be principally clean rinse water which can be left in the chamber 42 of casting 30 without harm.

Figures 1 and 8 show details of the improved lid, the air vent therein and the means of hinging the lid to the body of the machine. The lid is provided with a handle which is opposite and beyond the center from the back leg of the machine. The position of the handle is approximately shown on Figure 3. To the back portion of the lid adjacent to the air vent therein is attached a bracket 200 to which is pivoted the rod 201. The rod 201 is bent in such a manner that it is adapted to support the lid in inverted horizontal position when the machine is opened. This rod 201 is also sufficiently strong to enable the lid to support the top rack containing the dishes before or after such dishes have been washed in the machine. The other end of the rod 102 is provided with a T-shaped piece 202 which is adapted to slide up and down in the slot 204 of the slotted member 203 (see Figures 1 and 8). The slot 204 is of sufficient width to permit the rod 201 to slide freely. Between the slotted member 203 and the rear leg, forming a back of the slotted member is a backing strip of sheet metal 206 which terminates in an external hook for use in supporting the motor cord when the machine is not connected to an electrical outlet. The slotted member and the backing strip 206 are attached to the rear leg of the machine as by the two machine screws 205. Figure 1 shows the position of the rod 201 when the lid is covering the machine. Figure 8 shows the position of the rod 201 when the lid has been moved 90° from the position in Figure 1. It will be noted that the T-portion 202 has raised a slight bit during this movement so that it is adjacent to the top of the slot 204. During the next 90° of movement the moving T portion 202 will slide down in the slot 204 until the lid reaches a horizontal position extending outwardly from the tank 21. At such time the T portion will be supported at the bottom of the slot. The curvature of the rod 201 is such that the danger of squeezing the operator's fingers is minimized and the maximum strength of the rod will be utilized. The back edge of the cover is hinged to the top of the tank as indicated at 210.

The cover 22 (see Figure 1) is made smooth and it is provided in the preferred form with a central opening 211, the edges 212 of which are bent downwardly. Below the opening 211 is placed a dome 213 which is supported in a depending well 214 which is attached to the cover 22. Between the dome 213 and the depending well 214 is a large area of openings through which air can escape. The dome structure will prevent any spray from escaping from the apparatus, acting as sort of a baffle separator. It will be noted that the lower horizontal portion of the depending well 214 slopes inwardly and downwardly so that any moisture separated by the dome 213 can readily drain back into the body of the tank through the lower opening in 214.

The edge of the lid is provided with a lip 215 below which is stretched a hollow rubber tube 216. When the lid is closed this hollow rubber tube is compressed between the projecting lip 215 of the cover and the top rim 217 of the tank. The lid 22 is also provided with a depending portion 218 which is adapted to fit into the upper vertical portion of the tank 21 and assist the sealing action. The rubber gasket 216 is fitted around the cylindrical portion 218. When the impeller is in operation the lid 22 is clamped to the tank in such a manner that the rubber ring 216 will be compressed. This will produce a very effective moisture tight joint between the lid and the body of the tank.

The electrical connection to the motor may be actuated by the switch 225 (see Figure 8) which is placed adjacent to the rear top of the tank. This switch is held in a hook shaped member 226 which is attached to the body of the tank by the upper machine screw 205. The cable 227 leads down along the side of the tank to the motor 134.

The legs 23 (see Figures 1 and 2) and the bracket 75 (see Figure 3) are attached to the side of the tank by the brackets 230. These brackets are shown in greater detail in Figures 9, 10 and 11. The brackets are made of one piece of metal which has two flat portions 231 which are adapted to be attached to the side of the tank 21 preferably by welding. The bracket also has a rebent portion 232 which is slotted as indicated at 233. This rebent portion forms a sort of receptacle which is adapted to guide the nut 234. The position of the nut 234 may be adjusted through the slot 233 so that it will come opposite the opening for the bolt 236. The bolt 236 will also pass through the member, as for example the leg 23, which it is desired to attach to the body of the tank. In this manner a very firm and rigid connection between the leg and other members of the tank is obtained without holes in the body of the tank, thus further insuring against leakage past any openings due to the presence of loosened bolts. The upper rack structure 250 and the lower rack structure 251 are shown in vertical section in Figure 1. The rack construction is more fully shown and described in a copending application. The upper rack structure is made in two parts; an interior portion 252 and an exterior portion 253. The interior portion 252 hangs upon the inner edge of the exterior portion. The exterior portion 253 is suspended from the upper strengthening groove 25. The upper rack is designed to hold the cups, glasses and deep vessels which are usually placed thereon with their basin portions downward. It will be noted that the basin portions of these articles will face toward the impeller to a greater or less degree so that the cleansing spray will strike them in a most effective manner. In the case of such vessels it is preferred that their basin portions be turned toward the cleansing projected stream in such a manner that the stream will strike the center inside bottom of the basin portion perpendicularly and then will be thrown out toward the sides of the basin portion. The outer portions of these objects which are more readily cleansed will be struck by the returning spray. The center portion of the upper rack 252 or the complete upper rack can be removed or placed in the cover 22 when the same is turned back in inverted horizontal position. The dishes can be conveniently placed in such a rack while it is positioned in such cover and moreover if the dishes have been washed and rinsed with hot water they can be placed in such inverted cover for drying purposes without removal from the rack. The inner upper rack 252 can be removed without moving the outer upper rack 253 and in this manner ready access can be had to the lower rack 251 and to the bottom of the tank. The lower rack 251 may be supported upon the bottom of the tank by the four symmetrically positioned legs 260 or/and the impeller guard member 270. Preferably the lower rack is supported on the impeller guard 270 alone when in place in the machine. The legs are attached primarily

for supporting the rack when it is outside of the tank so as to prevent any downwardly projecting portions of the dishes from being chipped and otherwise marred. These legs also form a convenient means of supporting the rack on uneven surfaces such as fluted drain boards. Three legs or any other number may be utilized. The lower rack contains a special perforated sheet metal holder 261 which is positioned in such a manner that knives, forks and spoons will receive the full effect of the cleansing spray. The height of the holder 261 is such that those portions of the knives, forks and spoons which come into contact with the food will be exposed to the direct action of the water without interference by the supporting screens. A series of wire holders are arranged in said lower rack so as to provide a holder for the dishes which were not placed in the upper rack. The impeller turns clockwise looking down and the concavo portion of the dishes are placed so that they will face the spray which is hurled or projected by such rapidly rotating impeller. The backs of the plates which are more readily cleansed will receive the returning spray and streams or droplets of water. This lower rack is provided with handles 266 which enable it to be readily removed from the tank.

In the lower part of the tank is an impeller guard (see Figures 1 and 2) which is provided with three outwardly projecting wires 271, one of which is shown in Figure 1. These projecting wires 271 are supported at their extremities on the bottom of the tank adjacent to the jointure of the dished bottom 27 and cylindrical walls of the tank 21. They are also positioned on the dished bottom of the tank adjacent to the impeller by a right-angular and U-bend portion 274. The length of the wires 271 is such that the wires will always be in tight contact with the tank at their extremities so as to position the impeller guard 270 and the vertical plate 272 in their proper positions. To each one of these projecting members is attached an aluminum plate or a plate of an enamelled sheet metal or some other non-corrodible material 272. This aluminum plate will materially prevent whirling movement of the water contained in the frusto-conical portion 27 of the tank 21 and will maintain the pool in a relatively quiescent condition. These plates are attached to the projecting arms 271 in such a manner that their smooth surface will face away from the direction of rotation of the water while their irregular inner portions will face toward the direction of rotation of the water so that they will be automatically cleansed. If desired more or less than three symmetrically positioned plates 272 can be utilized, but three plates are preferred. In the embodiment shown, the plates 272 are attached to the wires 271 by the folding ears 275. The plates 272 may also be attached to the wires 271 by welding. The center portion of the guard 270 consists of a protective cage. The protective cage is formed of a series of concentric wire rings 277 welded to the vertical and horizontal portions 279 of the main wires 271 adjacent to the impeller. The main wires 271 terminate at, and are welded to, a heavy wire ring 278 which is above the impeller shaft. The protective cage will prevent the dishes and the hands from coming in contact under normal circumstances with the turning impeller. The upper part of the cage is left open as indicated so that ready access will be had to the grease cup 127 without removing the guard.

In the preferred form both the interior and exterior of the lid and tank body are coated with glass enamel preferably white in color, so that the amount of heat transference therethrough will be reduced to a minimum. The use of glass enamel will give a much better appearance to the machine and will also enable the machine to be much more readily cleansed. It will be noted that the interior of the tank contains practically no crevices or recesses into which dirt can collect which are not subjected to the cleansing action of the spray projected by the impeller. The use of a smooth inner coating of glass enamel will greatly increase the self-cleansing properties of the machine. It will be noted that there is nothing over the water impeller in the center of the machine to interfere with the direct action between the projected spray and the articles upon the upper rack.

The machine is operated in the following manner: The dishes and articles to be cleansed are placed in the upper and lower racks and the racks are then placed in the machine with the upper rack supported on the horizontally inverted cover. If desired the lower rack can be loaded in place in the machine. After the loaded racks are placed in the tank the cover is closed and clamped in place. Before the cover is closed a tablespoon full of soap flakes is preferably placed in the tank of the machine. If ordinary water is being used it is best to place a teaspoon full or a sufficient quantity of a water softener, say tri-sodium phosphate, in the funnel 60 of the swinging arm containing the conduit 57. It is assumed that this arm has already been adjusted so it will be of the proper height and length to cooperate with the faucet of the sink. The funnel is then rotated so that it will face upwardly, if it is not already in this position, and it is placed under the spigot of the sink. The three-way cock 77 is then manipulated so that the conduit 57 will open into the conduit 58. If the impeller is not in operation the conduit 57 may be allowed to open into the conduit 59. Hot water is then run from the faucet into the funnel until the level of the red indicating liquid in the gauge reaches the line 108, which shows that the proper amount of liquid has been received in the machine. The supply of water is then turned off, the switch 225 is actuated so as to initiate rotation of the impeller and the dishes are allowed to wash for about five minutes or longer depending on the conddition of the dishes. The funnel 60 on the swinging arm containing the conduit 57 is then rotated so that it will face downwardly and the three-way valve 77 is moved so that it will connect the passage 59 with the passage 57. Since the motor is still running the centrifugal device 165 will exhaust substantially all of the waste liquid from the tank. The three way valve is then turned so as to connect the passages 57 and 58. After placing a teaspoon full or a sufficient quantity of water softener, to prevent the dishes and apparatus from being coated with lime soaps, in the funnel 60 the first rinse water is allowed to run into the tank until the indicating column 90 shows that the proper amount has been received. The machine is then allowed to operate for a minute, the funnel is then turned downwardly and the cock 77 is turned so that the passages 59 and 57 will be in communication. The waste rinse water will then be exhausted to the sink. The machine may then again be rinsed in a similar manner by preferably using clear hot water without the softener to decrease tendency of spotting due to a lessened

amount of solids in solution in the rinsing water. After exhausting the second rinse the cover of the machine is removed and the upper rack of hot dishes is lifted from the machine and placed in the open cover to hasten drying. In case too much soap is put in the machine the suds will become so thick it will be difficult to pump out. In such a case additional water is allowed to enter the machine so as to dilute the suds and enable them to be removed.

What is claimed is:

1. In a washing machine, a tank, a tubular bearing member extending upwardly from the bottom of the tank, a motor positioned exterior of the tank, an apron shell spaced from said tubular bearing and extending downwardly thereabout, the diameter of said tubular bearing with respect to said apron being less adjacent the upper portion of said bearing than at the lower portion thereof, thereby decreasing the space between said apron and said tubular bearing as the apron approaches the bottom of the bearing, a water impeller blade mounted on said apron, and a shaft extending through said tubular bearing operatively connecting the top of said apron with said motor.

2. In a washing machine, a tank having a dished bottom adapted to receive washing liquids, a spray projector positioned adjacent the lower part of the tank, a wire cage adapted to enclose said spray projector resting upon the dished bottom, outwardly extending radial arms on said cage, and vertical baffle plates attached to said radial arms.

3. In a washing machine, a tank having a centrally and downwardly sloping bottom terminating in a well chamber, an unenclosed upright impeller rotatably mounted in the lower portion of said tank to pick up water and hurl the same against objects thereabove, said impeller being substantially spaced from the bottom of said tank, said well chamber being divided into an upper compartment and a lower ejecting chamber communicating therewith and vertical baffle plates positioned on the sloping bottom of said tank but spaced a substantial distance from said well chamber to maintain a body of liquid in the bottom of said tank in a relatively quiescent state.

4. In a washing machine, a tank having a centrally and downwardly sloping bottom provided with an opening in the lower portion thereof, a well chamber mounted to the bottom of said tank around the opening therein, said chamber being divided into an upper compartment and a lower compartment communicating therewith, an outlet conduit communicating with said lower compartment, a centrifugal pump in said lower compartment adapted to eject water through said outlet conduit, a spray projecting impeller rotatably mounted on a substantially vertical axis in the lower portion of said tank above said well chamber, rotatable driving means extending through said well chamber and operatively connecting said pump and said impeller, and baffle plates radially positioned upon the sloping bottom of the tank, said plates being spaced laterally a substantial distance from said impeller and adapted to maintain a body of liquid in said tank in a relatively quiescent state.

5. In a washing machine, a tank having a centrally and downwardly sloping bottom provided with an opening in the lower portion thereof, a well chamber secured to the bottom of said tank around the opening therein, an outlet conduit communicating with said well chamber, a pump in said well chamber to forcibly discharge liquid into said outlet conduit, a spray projecting water impeller rotatably mounted on a substantially vertical axis above said well chamber, driving means for said impeller and said pump and baffle plates positioned on the bottom of said tank, said plates being spaced laterally a substantial distance from said impeller.

6. In a washing machine, a tank having a centrally and downwardly sloping bottom provided with an opening in the lower portion thereof, a well chamber secured to the bottom of the tank around the opening therein, a centrally perforated plate in said well chamber dividing the same into an upper compartment and a lower compartment, an outlet conduit communicating with said lower compartment, a centrifugal pump in said lower compartment adapted to eject water through said outlet conduit, a spray projecting rotatable impeller mounted on a substantially vertical axis in said tank above said well chamber, rotatable driving means extending upwardly through said well chamber and operatively connecting said pump and said impeller, a plurality of baffle plates positioned on said sloping bottom, said baffles being spaced laterally a substantial distance from said impeller and adapted to maintain liquid in said tank in a relatively quiescent state.

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