April 14, 1953 E. M. BEWEN 2,634,736

DISHWASHING MACHINE

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FIG. 1.

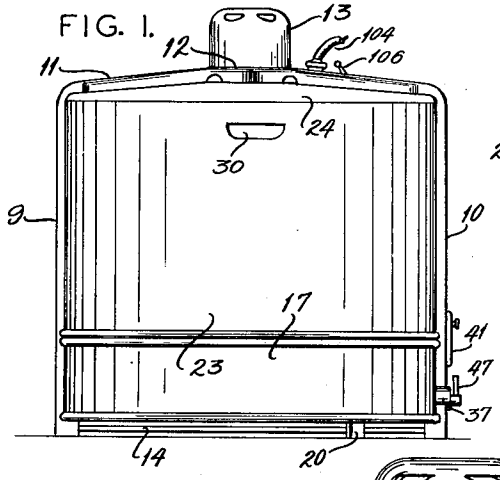

FIG. 2.

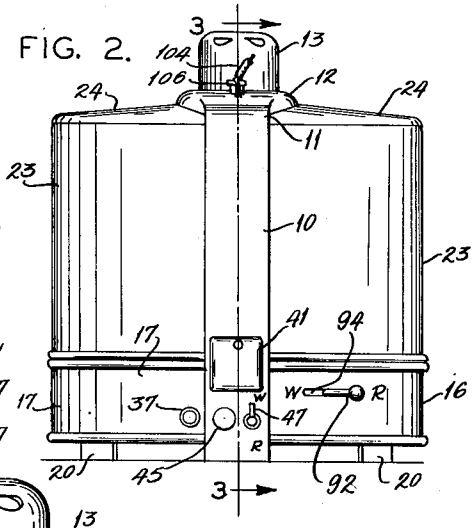

FIG. 3.

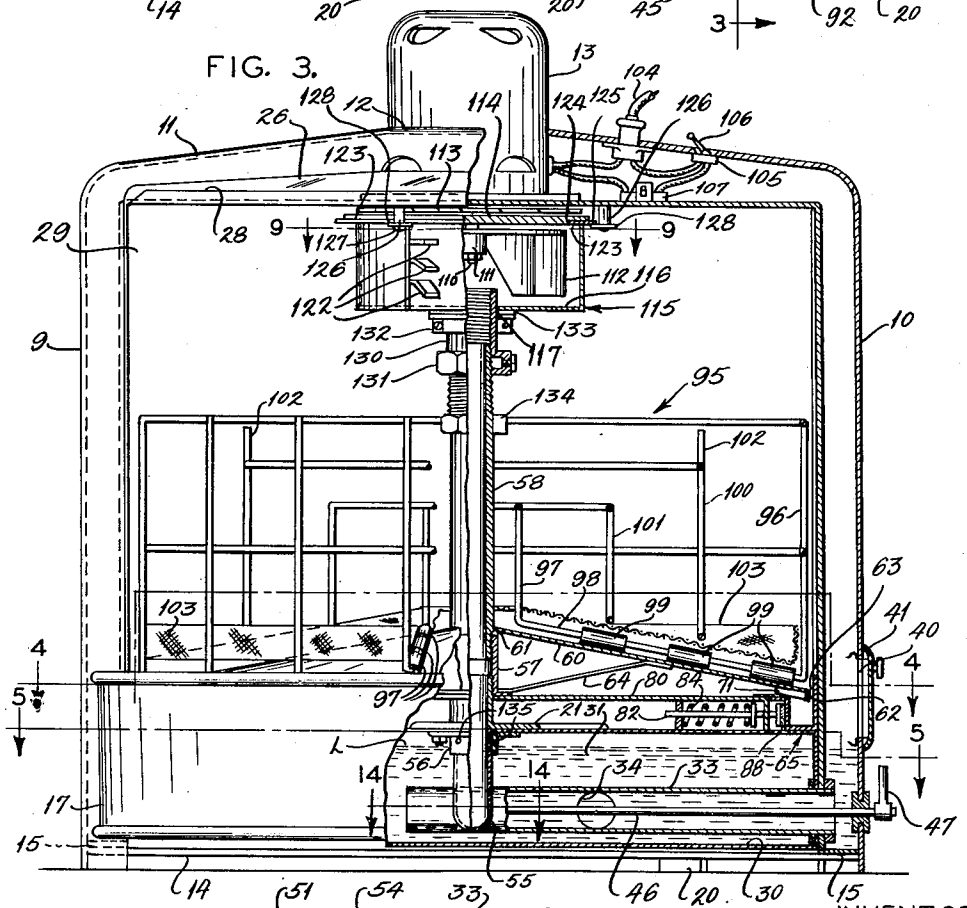

FIG. 14.

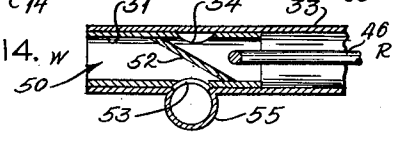

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FIG. 4.

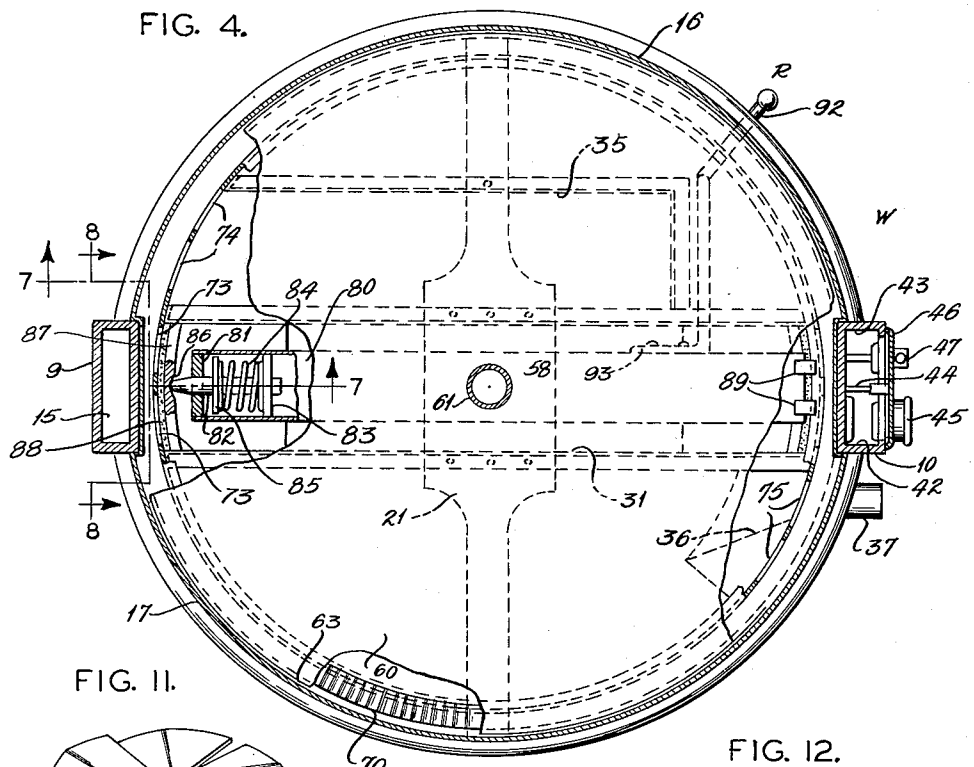

FIG. 11.

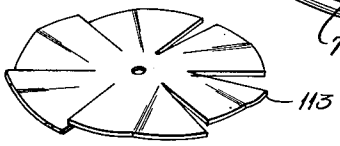

FIG. 12.

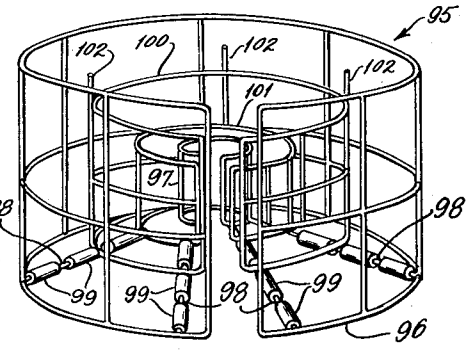

FIG. 7.

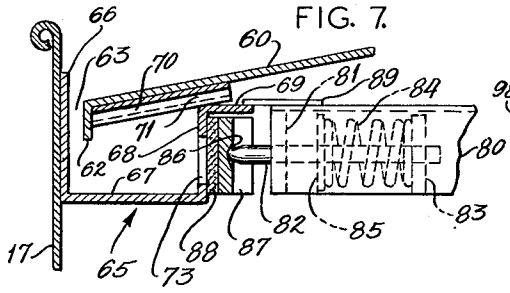

FIG. 8.

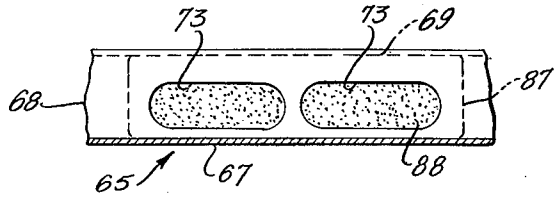

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FIG. 5.

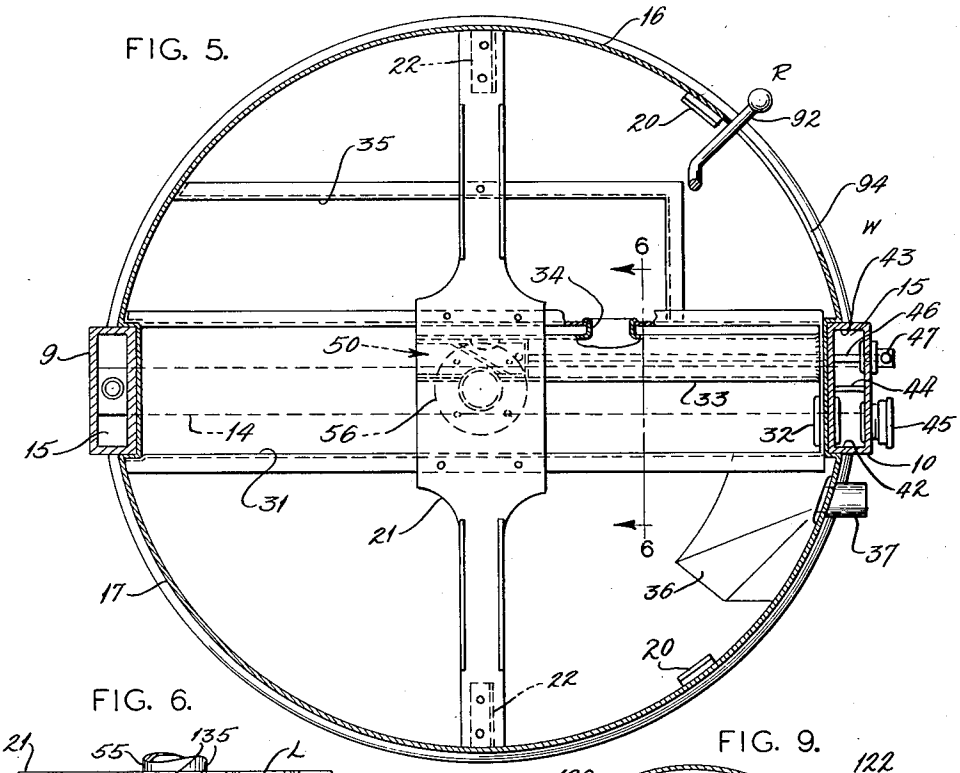


FIG. 6.

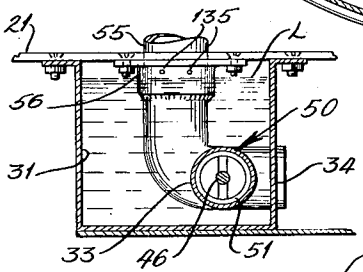


FIG. 13.

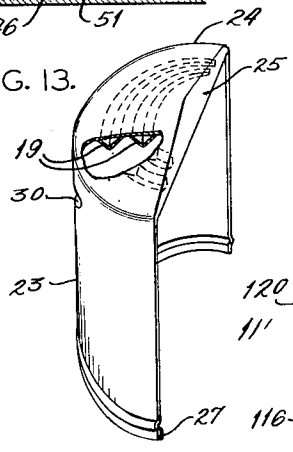


FIG. 9.

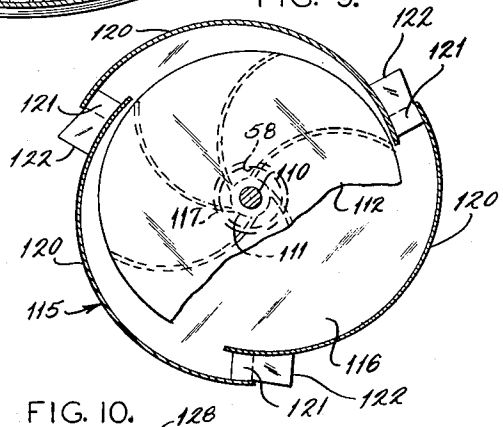
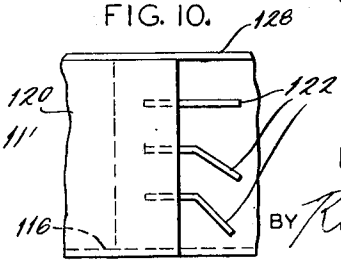


FIG. 10.



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Patented Apr. 14, 1953

2,634,736

UNITED STATES PATENT OFFICE

2,634,736

DISHWASHING MACHINE

Edward M. Bewen, St. Louis, Mo.

Application November 14, 1947, Serial No. 786,068

16 Claims. (Cl. 134—101)

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This invention relates to dishwashing machines of an improved character, and in which washing, rinsing and drying operations may be carried out easily and without danger of breakage.

One of the important objects of the present invention is to provide a low cost and simply constructed dishwashing apparatus which is fully capable of effecting a thorough washing, rinsing, and drying of dishes and the like, and in which the several phases of its operation may be easily determined and regulated.

Another important object of this invention is particularly embodied in an improved fluid pumping and circulating system and in a simplified arrangement of controls therefor, the pumping system hereof being provided with fluid moving means of a high-speed and relatively low lift type which is capable of circulating a liquid and air and is of a self-priming character.

A further object of the invention resides in the combination of the fluid moving means and an improved arrangement of fluid reservoirs and flow directing means for selectively determining the washing and rinsing operations of the apparatus, such flow directing means being comprised of parts and elements which constitute portions of the structure of the apparatus, whereby to enable the attainment of a compact assembly.

Another object of the present invention is to be found in the provision of improved means for supporting the dishes within a closed chamber, and in the further improvement of a removable dish supporting basket having provisions for accommodating a variety of large and small dishes or the like and for maintaining such objects in position to be fully bathed by the washing and rinsing fluids and by the drying medium, such as air.

Other objects hereof are to be found in the greatly simplified construction, assembly and general compact arrangement of the apparatus such as will result in attainment of the most satisfactory dishwashing results.

It is to be understood that only the presently preferred dishwashing apparatus will be described in detail, and that undue limitations and restrictions are not to be imposed thereon in view of the accompanying drawing disclosure, wherein:

Fig. 1 is an elevational view of the dishwashing apparatus as the same would appear in assembly and as seen from one side;

Fig. 2 is a view similar to that of the preceding figure, but showing the apparatus from one end;

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Fig. 3 is an enlarged elevational view of the dishwasher, showing broken and sectional details of the assembly as seen at line 3—3 of Fig. 2;

Fig. 4 is a plan view in section and so seen at line 4—4 of Fig. 3, there being portions broken away to show further details;

Fig. 5 is a view similar to that of Fig. 4 but taken at line 5—5 of Fig. 3;

Fig. 6 is a view in sectional elevation of a part of the fluid circulating and reservoir system as may be seen at line 6—6 of Fig. 5;

Fig. 7 is a further view in sectional elevation of another portion of the fluid circulating system as seen at line 7—7 of Fig. 4;

Fig. 8 is a fragmentary and enlarged elevational view of a fluid valve means as may be seen at line 8—8 of Fig. 4;

Fig. 9 is an enlarged, transverse view in section of the fluid pumping means as seen at line 9—9 of Fig. 3;

Fig. 10 is an enlarged detailed view of a fluid discharge orifice shown in connection with Figs. 3 and 9;

Fig. 11 is a perspective view of the spring type, frictional restraining means utilized in connection with the fluid pump casing or shroud;

Fig. 12 is a perspective view of the dish receiving and supporting basket herein preferred;

Fig. 13 is a perspective view of a typical half cover member for the apparatus, and in which a portion of the top wall is broken away to show the position of fluid deflector means therebeneath, and

Fig. 14 is a fragmentary sectional view in plan of the fluid control valve means utilized in the circulating system of the present apparatus, and as may be seen at line 14—14 of Fig. 3.

Referring in particular to Figs. 1 to 5 of the accompanying drawing, the preferred embodiment of the dishwashing apparatus may be seen to include an upright frame structure of rectangularly formed, hollow posts 9 and 10 joined at their upper ends by a suitably formed bridge member 11 having its central portion 12 enlarged to provide a recess for the mounting of a motor 13. The lower ends of the hollow posts 9 and 10 are structurally united by a tie bar or strap 14 (Figs. 1, 3 and 5), in conjunction with a pair of plate elements 15 which are secured to and disposed transversely of the strap 14 and in position to close the respective posts at a zone above the lower ends thereof. The frame structure also includes a pair of semi-circular fender or guard wall portions 16 and 17 which extend between and are disposed on opposite sides of the frame posts

9 and 10 and are secured thereto as by welding or the like. These fender portions have stiffening beads or rolled portions along the lower and upper margins, and each thereof carries a foot element 20 which is adjustably mounted to provide a means whereby the apparatus may be placed in a level position on a supporting surface, the lower end of post 9 most remote from these elements 20 being usually the third point of support. The semi-circular guard walls 16 and 17 are further strengthened by means of a brace plate 21 (Fig. 5) extending therebetween and transversely to and somewhat above the tie bar 14 between the posts 9 and 10. The opposite ends of this plate 21 are of reduced section relative to its center portion, and are fastened to the respective guards by suitable angle brackets 22.

The above described casing structure or frame assembly is intended to provide a substantially rigid and integral structure of light weight character. Half cover members 23, one of which is shown in perspective in Fig. 13, are formed of sheet metal and take the form of semi-circular members, each having an integral or separately formed and attached top wall 24 and also having an inner brace element 25 which is formed and positioned such that it will have a close fit at the matching face portion 26 (Fig. 3) provided at the side of the bridge member 11. Each of these covers 23 is further formed with a stiffening bead adjacent its lower margin and above a depending flange 27 which has a sliding fit within the upper beaded or rolled margin of the guard wall portions 16 and 17 whereby the flange serves to retain the covers in position with the respective stiffening beads in abutment. This sliding fit of the cover flange 25 will serve to hold the cover snugly against the frame posts 9 and 10 in conjunction with the interlocking fit of the brace 25 in the upturned flange 28 formed at the side of the bridge 11 such that escape of the washing fluids from the interior dish-receiving chamber 29 of the apparatus is prevented. Either of the covers 23 is easily removable for loading and unloading of the dish-receiving chamber and each is provided with a suitable hand grip in the form of a recess 30 pressed into the side wall, as indicated in Figs. 1 and 13. Each half cover member 23 is further provided at the under surface of the top 24 with one or more deflector elements 19 (two being shown in Fig. 13) which are arcuate in form and serve to direct a portion of the liquid toward the rear surfaces of the dishes placed in the chamber 29. Further reference will be made to this presently.

Turning now to Figs. 3, 5 and 6, the lower portion of the casing structure or frame, particularly that portion enclosed by the semi-circular fender members 16 and 17, encloses a fluid reservoir and flow controlling assembly. A first reservoir of open top character is indicated at 31 and is of elongate rectangular form to extend between the frame posts 9 and 10 in welded securement. One end of the reservoir 31 has an inlet connection with the interior of one of the frame posts 10, this connection being shown at 32 in the right hand portion of Fig. 5. Adjacent the fluid flow or inlet connector means 32, there is provided a fluid flow selector means which comprises an elongate tubular member or conduit 33 open at one end to the interior of the adjacent hollow post 10 and open at its opposite end to the reservoir 31. Intermediate the ends of the conduit 33 there is provided a branch flow orifice 34 of short length which opens through a side wall of the reservoir 31 to the interior of a second reservoir 35, also of open top character. The latter reservoir 35 is secured to reservoir 31 and to the inside of the fender member 16 whereby such wall surfaces may serve as wall portions thereof. As an aid to the further support of each of the reservoirs 31 and 35, suitable upper marginal flanges are formed thereon and rivet connections are made from these flanges to the brace plate 21 thereabove. In addition to these reservoirs, there is provided a drain pan or sump 36 (Fig. 5) adjacent the reservoir 31 and on the opposite side thereof from reservoir 35. This drain pan 36 is suitably dished to cause fluid flow toward a drain discharge tube 37 projecting through the fender member 17 at a zone adjacent the post 10.

Provision for admitting fluid to the reservoirs 31 and 35 is clearly indicated in connection with Figs. 2, 3, 4 and 5. It will be observed that the post 10 has a filler opening or port 40 which is closed by a snap-on cover 41 when the washer is not in use. The filler port opens to the interior of post 10 and is of a size sufficient to communicate with a pair of inlet chambers 42 and 43, closed at the bottom by element 15 and separated by a common divider wall 44 such that the chamber 42 communicates with the inlet means 32 for reservoir 31 and chamber 43 communicates with the inlet end of the flow tube or conduit 33 positioned within reservoir 31. Chamber 42 is provided with a drain plug 45 to enable the reservoir to be emptied of its fluid and flushed out periodically. The adjacent chamber 43 has a valve control rod 46 extending therethrough from an exteriorly located control lever 47, and this rod passes into the flow tube 33 for connection beyond the branch orifice 34 with a rotary type selector valve 50 (Figs. 5, 6 and 14). Valve 50 comprises a sleeve 51 open at each end and divided intermediate the ends by a diagonally disposed baffle element 52. The sleeve is also perforated at 53 and 54 on diametrically opposed sides of the baffle element 52 whereby on rotation of the valve sleeve 51 substantially one-half turn from its position (Fig. 14) where port 53 communicates with a valve outlet conduit 55 directed tangentially of the tube 33, the port 54 may be brought into flow communication with this outlet conduit 55. Selector valve 50 thus is intended to place the reservoir 31 in communication with the outlet conduit pipe 55 while perventing any communication between this outlet pipe and the reservoir 35, and conversely to place reservoir 35 in communication with pipe 55 while closing off reservoir 31. Fig. 14 illustrates the first mentioned valve setting, and inspection of Figs. 2 and 5 will indicate that the valve control lever 47 is directed vertically upwardly to show how the valve is set. Turning of the control lever 47 to a down position will change the valve setting so that port 54 opens to the outlet pipe 55 to direct fluid from reservoir 35 through the tube 33 to the outlet, while preventing fluid flow from the reservoir 31. The views of Figs. 5 and 14 show the selector valve 50 set to a position in which the reservoir 31 is supplying liquid, it being noted that a washing liquid is contained therein.

As shown in Figs. 3 and 6, the outlet pipe 55 is directed upwardly in reservoir 31 and is received in and held by a sleeve bracket 56, the latter being riveted or otherwise attached to the brace plate 21. The upper end of the pipe 55 projects through the bracket 56 and is threadedly

connected internally of a spacer sleeve fitting 57, in turn, threadedly receiving a suction pipe 58 which passes upwardly through the center of the washing chamber 29 to a pump assembly, later to be detailed. It may be noted here that the outlet pipe 55 for the selector valve assembly 50 forms a suction fitting at the lower end of the suction pipe 58 and together these pipes constitute a suction conduit selectively connectable with reservoir 31 containing wash liquid or reservoir 35 containing rinse liquid, depending upon the rotational setting of the valve sleeve 51.

The bottom of the washing chamber 29 is defined by a conically formed drain board 60 having a central aperture 61 to receive the suction pipe 58. The drain board 60 slopes downwardly in all directions from this central aperture, and its outer circumferential margin or lip 62 is bent or turned downwardly (Fig. 7) to provide an annular drain opening 63 adjacent the inner side of the fender members 16 and 17, and at the diametrically opposite frame posts 9 and 10. An inverted conically formed plate or brace element 64, shown in Fig. 3, is positioned to support and stiffen the central area of the drain board 60 and this brace is welded to the board 60 and rests upon the lower flanged end of the spacer sleeve 57. Drain opening 63 communicates with an annular trough or gutter 65 (Figs. 3 and 7) formed with its outer wall 66 secured to the inner side of the fender member 16 and 17 and the posts 9 and 10. The gutter 65 has a bottom wall 67 which extends beneath the drain board lip 62 to an upturned inner wall 68, the margin of the latter wall being flanged at 69 for added strength. Additionally, the gutter flange 69 acts as a support for the drain board 60 through the interposition of an annular and corrugated ring 70 secured beneath the rim zone of the drain board 60 such that the corrugations thereof provide vent passages 71 leading from the top of the gutter 65 to the space inwardly thereof and under the apex zone of the drain board which is freely open to the exterior of the apparatus by way of the lower margins of the fender members 16 and 17.

Fluid running into the annular gutter 65 will be divided by and directed toward zones adjacent each of the frame posts 9 and 10 by the predetermined slope of the gutter from diametrically opposite high zones which are located substantially 90 degrees from the posts 9 and 10. Thus the fluid running off the drain board 60 will be divided into substantially two equal volumes which will then flow in the oppositely sloped portions of the gutter 65 toward the opposite posts 9 and 10. In conjunction with this division of the drain fluid, the inner gutter wall 68 is suitably apertured at zones adjacent the opposite ends of the reservoir 31 to provide a plurality of pairs of flow return ports 73. A pair of these ports 73 have been clearly shown adjacent post 9 in Fig. 4 and it is to be understood that a similar pair will be provided diametrically opposed thereto and adjacent post 10. Spaced a suitable angular distance to one side of the ports 73, a second pair of flow return ports 74 are formed in the gutter wall 68 to open to the reservoir 35, and diametrically opposite these ports 74 are provided an additional pair of ports 75 which open over the drain pan or sump 36 shown in Fig. 4.

These several pairs of flow return ports are adapted to be controlled by a swingable arm having a valve assembly at its opposite ends. The arm is constituted by an inverted channel member 80 (Figs. 3, 4 and 7) which pivots at its center about the upper end of the pipe 55 adjacent the flanged end of the spacer sleeve 57. Since each valve assembly carried at the respective end portions of the arm is substantially identical, it will be understood that like numerals of reference will apply to the similar and equivalent parts of both such valve assemblies. Accordingly, the description of the valve structure shown in Figs. 4, 7 and 8 will be typical of each such assembly. The end of the inverted channel arm 80 adjacent frame post 9 is closed by a wall element 81 in which an aperture is formed for slidably receiving a valve stem 82. The rearward end of the stem 82 passes through a plate 83 fixed to the arm 80 in spaced relation with the wall element 81. A compression spring 84 encircles the stem shank and the opposite ends respectively abut the plate 83 and a flat collar 85 fixed to the stem shank. Thus, the stem 82 is constantly urged outwardly of the end wall 81 such that its rounded tip will seat in a suitable indentation or socket 86 provided in the rear surface of a valve plate or shoe 87. Valve plate 87 is formed or curved to match the circular contour of the gutter wall 68 and carries a suitable valve element 88 at its front face, the element 88 being formed from a rubberized fabric or the like. The plate 87 and valve element 88 are elongated parts, for the purpose of effecting a closure at each of the pair of ports 73, or the pair of ports 74 and 75 when moved from the position shown in Fig. 4. In order to maintain the valve arm 80 in proper vertical alignment with the ports in the gutter wall 68, clip elements 89 are fixed on the upper surface of the arm to project over and slide upon the upper surface of the flange 69 on gutter wall 68. Actuation of the valve arm 80 is effected by means of a control lever 92 which is attached to one side of the arm at the foot plate 93 (Fig. 4). The outer end of the lever extends through an elongate slot 94 in the fender member 16, the length of the slot determining the extent of angular or swinging movement of the arm such that the respective valve elements 88 may be shifted from closure of ports 73 to closure of ports 74 and 75.

Turning now to Figs. 3 and 12, there is shown a dish holding basket 95 formed of suitable guage wire to afford a substantially rigid support. It is preferred that the basket 95 be formed with an outer circular frame portion 96, an inner and substantially concentrically positioned frame portion 97, and plurality of radially directed and interconnecting frame elements 98 upon which a plurality of rollers 99 are mounted to support and permit easy, rolling movement on the drain board while the basket is being turned for loading and unloading. The basket 95, when positioned in chamber 29, has its frame 97 relatively closely fitting about the vertical suction pipe 58, and it is to be noted that the frame portions 96 and 97 are so formed as to be capable of being parted at a common radial zone to enable insertion or removal of the basket. The view of Fig. 12 illustrates the basket 95 as the same appears when the inner and outer frame portions 96 and 97 are sprung open to provide the necessary radial channel way as defined by and between the vertical frame elements. Normally the resiliency of the frame wire will act to maintain the frame elements 99 in close adjacence. In cooperation with the inner frame 97 and the outer frame 96, there is provided a pair of loosely mounted intermediate frames 100 and 101 which may assume

positions eccentric to the inner and outer frames for accommodation of various large and small dishes and the like. Each of these intermediate frames 100 and 101 is capable of being sprung to an open position (Fig. 12) whereby to pass the suction pipe 58 when inserting or removing the basket assembly 95. This latter feature is clearly shown in Fig. 12, and in addition the larger frame 100 of the intermediate pair is provided at its upper margin or rim with a series of upstanding prongs 102 which act to prevent the larger dishes from falling inwardly to blanket smaller dishes which are usually set toward the center of the basket.

The operative mounting of the basket 95 is shown in Fig. 3, and it will be observed that a trash screen or refuse collecting meshed member 103 is positioned over the bottom area of the basket to hold back bits of food and the like which otherwise would be carried into the fluid circulating system of the machine. This screen 103 is placed in proper position between the inner and outer frames 97 and 96 respectively prior to insertion of the loosely disposed intermediate frames 100 and 101.

Particular references will now be made to Figs. 3, 9, 10 and 11 for an understanding of the construction, assembly and operation of the fluid circulating pump which is driven by the electric motor means 13 previously noted. Electrical power for the motor 13 is supplied by the cord 104 in circuit association with a toggle type start and stop switch 105 set in the bridge 11 with its actuating arm 106 projecting through the top wall, and a pair of safety switches 107, one only being indicated in Fig. 3. The safety switches 107 cooperate with and automatically open the power supply circuit to the motor 13 when either cover member 23 is removed or improperly positioned. Thus the machine cannot be operated until both half covers 23 are in place, regardless of the setting of the toggle switch 105.

The fluid pump preferred for use in this dishwasher may be described as embodying an impeller member of a high speed and low lift type which is capable of moving either a relatively high density fluid such as liquid with air entrained in the liquid column, or a relatively low density fluid, as air alone. This is of particular advantage in a dishwasher, as it enables the use of one pump assembly for the dual purpose of circulating the washing and rinsing fluids, and of circulating air for drying. The importance of this dual function will appear presently.

Motor 13 is positioned with its drive shaft 110 projecting below the bottom wall of the frame bridge 11 to receive the hub 111 of the vane type impeller member 112, there first being mounted over the shaft a wave type plate spring 113 (Fig. 11) and the cover plate 114 of the impeller housing 115. Housing 115 is preferably formed with a bottom wall 116 having a central aperture 117 which opens to the suction eye of the pump impeller, and side wall portions 120 of arcuate form and eccentrically positioned with respect to the pump axis, thereby defining a plurality of circumferentially spaced and substantially tangentially opening outlet orifices 121. The present embodiment (Fig. 9) is provided with three side wall portions 120 which define in the zones of their adjacent and overlapping edges the outlet orifices 121. Each of the outlet orifices is provided with a plurality of baffle elements 122 (three being shown) welded in place and extending transversely of the vertical axis of the orifice such that the outwardly directed baffle lip portions may be bent or turned up or down relative to the general horizontal setting of the housing for directing the discharging fluid stream in desired directions within the chamber 29 of the machine. The upper margins of the housing wall portions 120 are integrally connected by a horizontally directed flange ring 123 having seating engagement in a cover recess 124. This flange ring 123 has an outward lip 125 which is adapted to be engaged and centered by at least three flanged roller elements 126, each roller being removably and adjustably carried in the underwall of the bridge 11 by the screw element 127. Roller flange 128 engages the housing ring flange lip 125 but is set to permit rotary movement of the housing 115 to the extent determined by the frictional resistance imposed thereon by the wave type plate spring 113.

The rotation of the housing 115 is induced by the drag of the fluid on the internal surfaces and by the thrust reaction of the fluid impinging on the baffle elements 122 at the discharge orifices 121. Thus the housing 115 will tend to approach the speed and direction of rotation of the impeller 112, but some external resistance to this rotation is desirable for reducing the speed of the housing and thereby gaining a fluid discharge velocity of the proper degree for best results in washing. While the wave type spring 113 has proved to be a very satisfactory means for giving the correct degree of resistance to housing rotation, it will be appreciated that other means may be utilized for the same purpose. For example, the spring 113 can be eliminated and the rollers 126 properly set and adjusted to impose sufficient frictional resistance to housing rotation. Therefore I do not wish to be limited to the specific means shown except as it may be necessary to indicate the presence of frictional type means for reducing the rotational velocity of the pump housing 115.

In the course of assembly of the pump parts above detailed, the upper end of the suction pipe 58 rising through the center of the chamber 29 is provided with an adjustable and threaded sleeve extension element 130 which passes into the inlet aperture 117 and opens to the eye or suction zone of the impeller 112. This extension element is held in place by the lock ring 131. A further means for supporting the housing 115 is provided by the positionment of a split collar 132 about the sleeve element 130 in conjunction with a suitable sealing ring washer 133 adjacent the housing aperture 117. The suction pipe 58 is provided with a tool engaging boss 134 to enable the pipe to be held during threading adjustment of the sleeve element 130, and to enable mounting of the pipe in its lower supporting sleeve 57.

The desired operation of the present high speed and low lift pump impeller is materially and importantly realized through the provision of a plurality of restricted orifices or breather holes 135 opening to the suction pipe 55 in the upper zone of reservoir 31 and preferably at the collar 56 (Figs. 3 and 6). The location of these holes 135 is determined by the fact that a maximum quantity of fluid is desired in reservoir 31 and that at no time must they be covered by the liquid therein, since submergence thereof will simply prevent effective fluid flow upwardly in conduit 58. The presence of these holes 135 above the greatest possible depth of fluid in reservoir

31 enables the entrainment at all times of a sufficient volume of air to accomplish automatic operation of the pump when liquid is to be circulated by aeration of the column of the liquid being moved upwardly through the suction pipe 58. In this manner, a highly turbulent mixture of air and liquid is brought to the impeller and a most satisfactory solution has been found whereby to enable circulation selectively of a liquid medium and a gaseous medium by the use of a single pump installation.

In its initial fluid pumping action, the impeller member 112 will create a sufficient vacuum in the suction conduit 58, aided by the sealing ring 133, to lift or cause an initial rise of the fluid into the conduit to a level above the restricted breather holes 135. This is followed by the inflow of air at these holes, such air automatically mingling with the fluid to create a highly turbulent mass in which the said fluid column is thoroughly broken up and conditioned to flow rapidly into the impeller vanes. The theory of operation of the present pump will be better appreciated when it is realized that the maximum obtainable suction effect at the eye of the impeller 112 is limited by the number of orifices 121 in the peripheral walls 120, of the housing 115. This suction effect is directly related with the weight of the medium to be moved through the conduit 58. When the medium is relatively heavy, as in the case of liquid such as water, the gravitational and frictional resistance to its flow upwardly in the conduit 58 toward the impeller 112 is sufficient to induce leakage or eddy losses at the impeller housing through the discharge orifices 121. When the medium is relatively light, as air, the resistance to its flow in the conduit 58 is materially reduced and little or no pump eddy losses are induced so that the maximum suction effect of the impeller is available. Therefore, this dual purpose, high speed pump may be described as one having low lift characteristics, especially when it is required to move a liquid. The provision of the breather holes 135 constitutes an important feature of the pump system, as it enables the admixture of a lighter medium with the liquid to reduce the weight of the latter to a point such that its resistance to the pump suction effect is reduced. The effect of these holes 135 is to enable the introduction of a limited but desired volume of air into the liquid being sucked up by the pump to reduce the weight of the liquid so lifted to an extent enabling its flow into the pump. The entrained air and liquid, upon reaching the pump, is then blown out of the pump casing orifices with the correct force.

The operation of the present dishwashing machine will now be described, but no specific reference will be made to the loading and unloading of the chamber 29 except to state that with the half cover members 23 properly assembled the starting switch 105 in the motor circuit will be conditioned to supply current to motor 13. Prior to starting the motor 13, the filling cap 41 on frame post 10 is removed and a hot detergent solution is poured into the filling chamber 42 to fill the reservoir 31 with the proper volume of washing fluid. This volume of washing fluid is easily ascertained by the fact that the top edge of the divider wall 44 and the lower edge of the filler port 40 are located at a zone just below the planar location of the breather holes 135 in the pipe 55 and collar 56. The maximum level of the washing fluid in reservoir 31, when the machine is properly leveled by adjustment of foot elements 20, is indicated by the dashed line identified by the reference character L in Figs. 3 and 6. When filling with the detergent washing fluid or any other suitable fluid, valve lever 47 is first turned to its up position indicated by the letter "W" stamped or painted on the frame post 10 as in Fig. 2, and this lever setting will condition the sleeve valve 51 for flow connection with the reservoir 31 and the suction pipe 55 as illustrated in Fig. 14. At the same time, the valve lever 92 projecting from the slot 94 in fender member 16 must be moved to its "wash" setting, that is from the position of Fig. 4 to the end of the slot marked "W" in which position the arm 80 carrying the valve means 88 will be shifted to a position clockwise of that shown in Fig. 4 whereby the drain ports 74 leading from the gutter 65 to reservoir 35, and the ports 75 opening above the drain pan 36 will be closed. This then opens the ports 73 at each end of the reservoir 31 in the gutter 65. The pump motor 13 may now be energized by throwing the toggle lever 106 to its "on" position. Operation of the pump will lift the hot washing fluid through the suction conduit 58, entraining air at breather holes 135 to break up the high-density character of the liquid column, and effect its flow into the housing 115 and rapid discharge at the several orifices 121 in the housing. The liquid discharge action at the orifices will generate a reactionary or rotating movement of the housing 115 in the direction of pump vane movement and thereby thoroughly distribute a liquid spray over the entire area of chamber 29, such spray sweeping across and cascading downwardly over the dishes in basket 95 with sufficient force to dislodge food particles and thoroughly cleanse the same. A part of this spray will be deflected by the arcuate means 19 in the top of the covers 23 to reach the rear surfaces of the outermost dishes. Once the liquid traverses the zone of the dishes, it will be directed outwardly by the slope of the drain board 60 to collect in the gutter 65 and flow toward the oppositely located pairs of ports 73 for return to the reservoir 31 and recirculation as above noted. Obviously, electrical type heating units (not shown) may be placed under the reservoir 31 to maintain the temperature of the washing liquid as it is constantly circulated through the chamber 29. Since all of the wash liquid is returnable to the reservoir 31, at its opposite ends, the washing phase or cycle of the machine may be continued as long as desired.

During the time the machine is set to circulate the washing fluid, a volume of clear rinse water may be introduced to the filler chamber 43 through port 40, and this water will flow through the conduit 33 and branch orifice 34 to reservoir 35, its flow to the suction pipe 55 being prevented by the setting of the valve baffle 52 (Fig. 14). Too great a quantity of rinse water cannot be collected in reservoir 35 as the excess will run over the lower edge of filling port 40 to the exterior of the machine. When the washing phase of the operation is completed, the washing liquid may be drained to waste by removal of the plug 45 positioned in the lower portion of the filling chamber 42, and the plug being replaced after the system has emptied itself. Following this, the lever 47 is turned to the "rinse" or down position indicated by the letter "R" on post 10 (Fig. 2) and the lever 92 is also required to be moved to the opposite end or "rinse" position of the slot 94 which is that end marked "R." Lever 47 ro-

tates the valve sleeve 51 to place the inner zone of the tube 33 and suction pipe 55 in communication. Lever 92 shifts the valve arm 80 to the position shown in Fig. 4 and thereby opens ports 74 to reservoir 35 and ports 75 to the drain pan 36 while closing the opposed pairs of ports 73 at the ends of the reservoir 31. The pump will now draw the rinse water from reservoir 35 and spray the same throughout chamber 29 for rinsing the dishes in what may be termed a first rinse cycle. During the rinse water circulation, the column of water in suction conduit 58 will entrain air admitted at the breather holes 135 to result in the action previously described.

The first cycle or rinsing operation of the machine is, by reason of the oppositely sloped portions of gutter 65, conditioned to discharge a substantial portion (approximately one-half) of the water to the drain 36 for flow through the waste pipe 37, while the remainder flows to the reservoir 35 by way of the ports 74 in gutter wall 68 for recirculation to the chamber 29. The volume of liquid available for recirculation will then be further diminished in a like manner until the remaining or residual liquid is insufficient to be lifted by the pump. A second rinsing cycle can be initiated by refilling reservoir 35 with clear water, and it is to be preferred at this time that a supply of rinse water at the filler port 40 be maintained by means of a hose connected from a convenient water tap, and to regulate the rate of the replenishing supply such that a full volume of rinse liquid can be maintained despite the flow to drain of a portion thereof, and such that little or no spill over will occur at this filler port. The division of the rinse water between that which is run off at the drain pipe 37 and that which is recirculated is effected by the predetermined slope given the gutter 65 at zones spaced substantially 90 degrees from each of the frame posts 9 and 10. The second mentioned rinsing phase of the operation may be continued as long as desired, or until the drain water runs clear.

Having now completed the washing and rinsing phases, the water supply is cut off and after a time the remaining water in the system will not be sufficient to fill the suction pipe 58 thereby terminating the liquid pumping action of the pump. Thereafter the pump will circulate a high velocity stream of air taken through the tube 33 from the space defined by reservoir 35, and from the filler chamber 43. This air will be discharged into the chamber 29 for circulation upon and around the dishes to evaporate the moisture. The moisture laden air is then exhaused by way of the gutter 65 where it will pass out to atmosphere by way of the plurality of vents 71 formed in and by the corrugated ring 70 at the under margin of the drain board (Fig. 7). The air circulation may be continued until the dishes in the basket 95 have dried sufficiently to warrant their removal without further attention. This additional step of air drying of the dishes is thought to be particularly novel and important. The usual dishwashing machines make no provision for drying and thus require a separate wiping operation after the machine is unloaded. Moreover, the prior machines do not permit efficient or rapid drying of the dishes, if they are allowed to remain in the machine, since the heat and moisture remaining after the washing and rinsing steps is not conducive to any great degree of drying action. On the other hand, the present dishwasher embodies provisions for drying by the forced circulation of a large volume of relatively high velocity air which will effect a rapid and most satisfactory drying step, thereby enabling the entire dish washing operation to be completed with little or no additional bother to the user of the machine.

It should be noted that the present dual-purpose centrifugal pump and fluid-dispersing pump housing, are of particular advantage in a portable machine. Such unit provides a large volume air flow for drying, and since it displaces an air-liquid mixture, will handle an adequate volume of such mixture either for washing or rinsing.

The foregoing descriptive detail of structure, assembly and operation of the presently preferred dishwashing machine is believed to be fully informative of the essential and important characteristics of the machine. The disclosure here given should not be taken as limiting the same to the precise details, since it is within the spirit and intent of the invention that certain modifications, alterations, and substitutions of equivalent parts, sub-assemblies and the like may be made herein, and the same is to be included in the scope of the following claims.

I claim:

1. A dishwasher comprising a frame structure having spaced post members and a bridge member extending therebetween, cover members positionable at opposite sides of said frame structure to form a dish-receiving chamber therewith, a drainboard carried by said frame structure and arranged with its margins spaced therefrom and from said cover members to provide a drain opening from the chamber, a fluid reservoir positioned between said post members, fluid collecting means communicating with said reservoir and positioned to receive fluid flowing from said drainboard through the marginal drain opening, one of said post members being formed to provide a fluid filling chamber in communication with said reservoir to enable initial filling thereof, a suction conduit communicating with said reservoir and extending into the dish-receiving chamber, and fluid pump means supplied from the suction conduit for drawing fluid from said reservoir for dispersal throughout the chamber thereby resulting in return flow by drainage to said collecting means for recirculation from said reservoir.

2. A dishwasher comprising a casing structure having a dish-receiving chamber therein, a drainboard positioned in said chamber, a fluid reservoir below the dish-receiving chamber and drainboard, fluid collecting means disposed below said drainboard for directing fluid draining from the latter and from the dish-receiving chamber into said reservoir, fluid circulating means located in said chamber above the drainboard, and a suction conduit extending from said reservoir into said circulating means, said conduit having restricted orifices opening thereto for ingress of air whereby to aid in the flow of fluid from said reservoir toward said circulating means.

3. A dishwasher comprising a casing structure providing a dish-receiving chamber, drainboard means defining the bottom of the chamber and forming with the casing a fluid drain opening, fluid collecting gutter means located below the fluid drain opening, a fluid reservoir having communication with said gutter means, fluid circulating means positioned in said dish-receiving chamber, and a suction conduit between said reservoir and fluid circulating means, said conduit being provided with a plurality of restricted openings located above the liquid level in said

reservoir whereby the column of fluid rising in the conduit upon operating of the circulating means is co-mingled with air entering at said openings to form a turbulent mass of air and fluid capable of rapid flow to said circulating means for discharge to the dish-receiving chamber.

4. In a dishwasher, the combination of a casing structure providing a dish-receiving chamber, pump means located in the chamber and including discharge means opening to the chamber, a suction conduit connected with said pump means, a plurality of liquid reservoirs located below said chamber, one of said reservoirs being adapted to receive a charge of a washing liquid and another thereof a charge of a rinsing liquid, liquid flow means adapted to connect said reservoirs with said suction conduit including a valve operably positioned therein and arranged for selective positionment whereby washing liquid and rinsing liquid are separately admitted to the suction conduit during operation of said pump means, and the suction conduit being formed to aid in the flow and enhance lift of liquid to the pump means, said suction conduit being provided for such purpose with an air inlet at a zone free of liquid immersion whereby air may enter and be entrained in the column of liquid moving to said pump means.

5. In a dishwasher, the combination of a casing structure providing a dish-receiving chamber, a pair of liquid reservoirs in said casing structure, said casing structure providing a pair of filling chambers and a filling port opening from the exterior thereof to said chambers, one of said filling chambers having direct communication with one of said reservoirs, a liquid flow directing conduit communicating with the other of said filling chambers and extending into said one reservoir, a branch conduit opening between said flow directing conduit and the other of said reservoirs, a suction conduit extending into said dish-receiving chamber and having a connection with said flow directing conduit, pump means located in said dish-receiving chamber and acting to draw liquid through said suction conduit for discharge throughout the latter chamber, and valve means operably disposed in said flow directing conduit for selectively establishing liquid flow communication from one of said reservoirs to said suction conduit.

6. In a dishwasher, the combination of a casing structure defining a dish-receiving chamber, a pair of liquid reservoirs in said casing structure, one of said reservoirs having a filling port opening to the exterior of the casing structure, liquid flow selector means positioned in said one reservoir, said means including a flow conduit at one end to the exterior of the casing structure and opening intermediate its ends to the other of said reservoirs, and a valve operably disposed in the opposite end zone of said conduit, a suction conduit connected with said flow conduit adjacent said valve and extending into the dish-receiving chamber, pump means having its inlet in communication with said suction conduit, and means for operating said valve whereby liquid from either of said reservoirs may be selected for flow into said flow conduit and to said suction conduit past said valve.

7. A dishwasher comprising, in combination, a casing structure providing a chamber adapted to receive dishes to be washed, rinsed and dried, drainboard means defining the bottom of the chamber and arranged to provide a peripheral fluid drain opening, fluid collecting gutter means located below the peripheral drain opening and formed with an inner wall portion having a plurality of spaced ports opening therethrough, a first reservoir for wash fluid carried by said structure and located to communicate with certain of said spaced ports, a second reservoir for rinse fluid carried by said structure and located to communicate with others of said spaced parts, fluid circulating means in said structure including a pump in an upper portion of the dish chamber and a suction conduit directed to the pump and supplied from the reservoirs one at a time, being so arranged and constructed to draw fluid from said reservoirs for discharge to the chamber and flow into said gutter means through said peripheral drain opening, said circulating means further including a selector valve operable to permit fluid flow from one of said reservoirs while preventing such flow from the other thereof, valve means operably arranged to control said plurality of spaced ports such that fluid collecting in said gutter means is directed to flow toward said one reservoir for recirculation and is prevented from flow to said other reservoir, and means for draining both the wash and rinse fluids from the reservoirs whereby said pump, during continued operation, is free to draw air through said suction conduit for discharge to the chamber and flow over the dishes therein to effect a drying action.

8. A dishwasher comprising in combination, a chambered casing structure for receiving a load of dishes to be washed, rinsed and dried, separate reservoir means respectively containing separate washing and rinsing liquids, a suction conduit extending into the casing chamber and communicating with one of said reservoirs, first valve means located adjacent the suction end of said conduit and operable in a manner separately to effect a connection with said washing and rinsing liquid reservoirs for flow of the selected liquid to said conduit, pump means of high-speed character communicating with said conduit and adapted to discharge fluid into the chamber, a liquid drain sump having a drain opening to the exterior of said casing structure, means constructed and arranged to collect the liquid discharged to and passing through the chamber, said liquid collecting means providing separate ports opening to each of said reservoirs and to said sump, and second valve means cooperating with the ports in said collecting means and movable between a position effective to direct the washing liquid to its said reservoir, and a position to direct the rising liquid to its said reservoir and to said sump simultaneously, said second valve means being effective, when conditioned to permit re-circulation of rinsing liquid by said pump means, to permit a progressive reduction in the volume of rinsing liquid by its flow to said drain sump, whereby the liquid suction action of said pump means is gradually brought to an end and thereafter a high velocity volume of air is circulated into the chamber for dish drying action.

9. In a portable dishwasher, the combination of a casing structure including spaced posts and a bridge member connecting said posts, a pair of hollow side-and-top elements removably engaging the posts and bridge member, said structure providing a chamber for dishes and the like, motor means carried by said bridge member with its drive shaft projecting into said cham-

ber, a fluid displacement device in the chamber, driven by the motor shaft, a liquid receiving reservoir positioned below the chamber, and a combined liquid and air suction conduit opening at one end to the liquid in said reservoir and connected at its opposite end to the displacement device, said conduit being provided with an air inlet passage that is considerably smaller than the cross section of said conduit.

10. In a portable dishwasher assembly, a frame structure providing spaced posts and a bridge member therefor, fixed enclosure members carried by said posts, removable covers engaging said fixed members and abutting said posts and bridge member at the opposite sides thereof to form an enclosing chamber for dishes, a motor operated impeller dependingly carried centrally of said bridge member, a liquid reservoir on said frame structure, a conduit extending between said reservoir and impeller, said removable covers each being substantially semi-cylindrical in form, and the posts and bridge member being relatively narrow, whereby upon removal of the covers, free access is had to all parts of the dish chamber and impeller, from either side of the assembly.

11. In a dishwasher, a frame structure providing spaced posts and a bridge member, fender means fixed between and at opposite sides of said posts, removable covers engageable with said fender means and at opposite sides of said posts and bridge member to form a chamber for dishes, liquid reservoir means at the lower portion of said frame structure, a motor operated liquid spraying pump carried by said bridge member, and depending therefrom into the chamber for dishes, a liquid conduit connected between said reservoir and pump, and liquid deflector means located peripherally of an upper portion of each removable cover, and so positioned to direct liquid sprayed by said pump downwardly in said chamber.

12. In a dishwasher, a frame structure partly defining a chamber for dishes, removable cover means positionable on said frame structure to complete the chamber, liquid reservoir means in said frame structure below said chamber, a motor operated pump located in the upper zone of said chamber so as to discharge liquid directly upon the dishes therein, a conduit extending from said reservoir means to said pump, said conduit being provided with a restricted air inlet passage for admitting air thereto during pump operation, liquid with entrained air being sprayed into said chamber, and deflector means fixed to peripheral portions of said cover means for directing the liquid and air spray downwardly in said chamber.

13. In a dishwasher, the combination of a casing structure defining a dish-receiving chamber, a pair of liquid reservoirs in said casing structure, one of said reservoirs having a filling port opening to the exterior of the casing structure, liquid flow-selector means positioned at least partly in said one reservoir, said means including a flow conduit opening at one end to the exterior of the casing structure and having an opening intermediate its ends to provide communication with the other of said reservoirs, and a valve operably disposed in the opposite end zone of said conduit, a suction conduit connected with said flow conduit adjacent said valve and extending into the dish-receiving chamber, pump means having its inlet in communication with said suction conduit, and means for operating said valve whereby liquid from either of said reservoirs may be selected for flow to said suction conduit through said valve.

14. A dishwasher comprising a casing structure having a dish-receiving chamber therein, a drainboard positioned in said chamber, a fluid reservoir below the dish-receiving chamber and drainboard, fluid collecting means disposed below said drainboard for directing fluid draining from the latter and from the dish-receiving chamber into said reservoir, fluid circulating means located in said chamber above the drainboard, a suction conduit extending from said reservoir into said circulating means, said conduit having restricted orifices opening thereto for ingress of air whereby to aid in the flow of fluid from said reservoir toward said circulating means, and means for draining the reservoir whereby air may be drawn through the suction conduit to said circulating means for discharge to the chamber and flow over the dishes therein to effect a drying action.

15. A dishwasher comprising a frame structure having spaced post members and a bridge member extending therebetween, cover members positionable at opposite sides of said frame structure to form a dish-receiving chamber therewith, a drainboard carried by said frame structure and arranged with its margins spaced therefrom and said cover members to provide a drain opening from the chamber, a plurality of fluid reservoirs positioned between said post members, fluid collecting means communicating with said reservoirs and positioned to receive fluid flowing from said drainboard through the marginal drain opening, one of said post members being formed to provide a fluid filling chamber in communication with one of said reservoirs to enable initial filling thereof, a suction conduit extending into the dish-receiving chamber, means adapted to connect said reservoirs with said suction conduit including a valve operable to permit fluid flow from one of said reservoirs while preventing such flow from the other thereof, and fluid pump means supplied from the suction conduit for drawing fluid from said reservoirs one at a time for dispersal throughout the chamber thereby resulting in return flow by drainage to said collecting means for recirculation from said reservoirs.

16. In a dishwasher, the combination of a casing structure providing a dish-receiving chamber, a pair of liquid reservoirs in said casing structure, said casing structure providing a pair of filling chambers and a filling port opening from the exterior thereof to said chambers, one of said filling chambers having direct communication with one of said reservoirs, a liquid flow-directing conduit communicating with the other of said filling chambers and extending into said one reservoir, a branch conduit opening between said flow directing conduit and the other of said reservoirs, a suction conduit extending into said dish-receiving chamber and having a connection with said flow directing conduit, pump means located in said dish-receiving chamber, said suction conduit being provided with a restricted air inlet passage to aid the flow and enhance the lift of liquid to the pump means, the pump means acting to draw a mixture of liquid and air through said suction conduit for discharge throughout the latter chamber, and valve means operably disposed in said flow directing conduit for selectively establishing liquid flow

communication from one of said reservoirs to said suction conduit.

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