Oct. 15, 1963 L. A. JAMES 3,106,930

DISHWASHING MACHINE

Filed Jan. 29, 1962 3 Sheets-Sheet 1

Fig. 1.

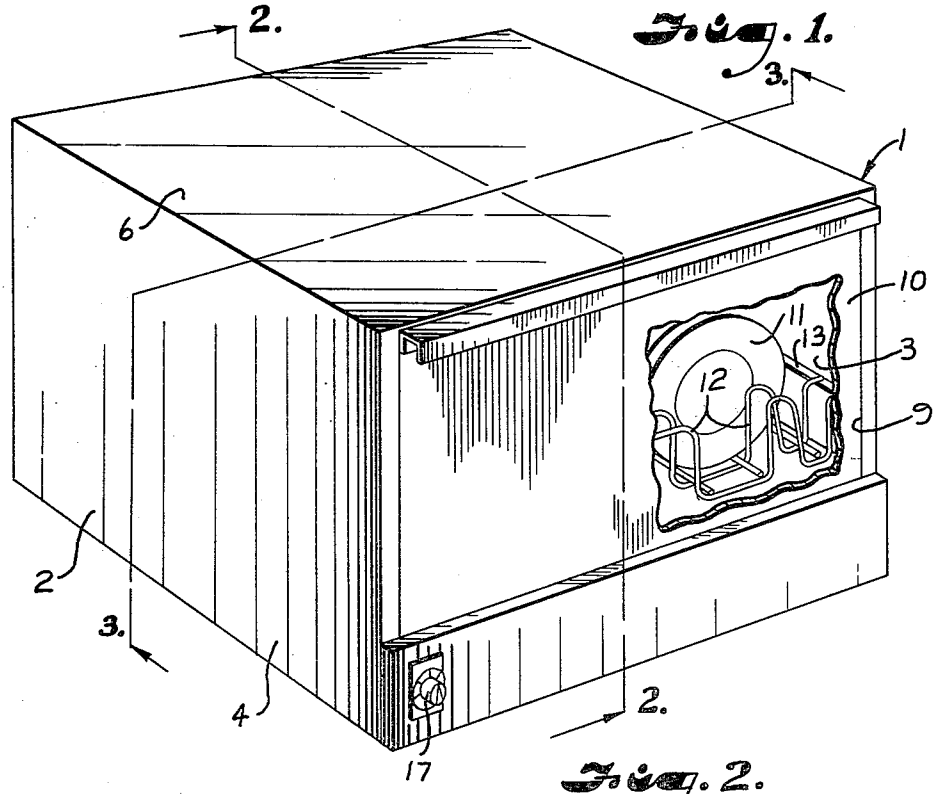
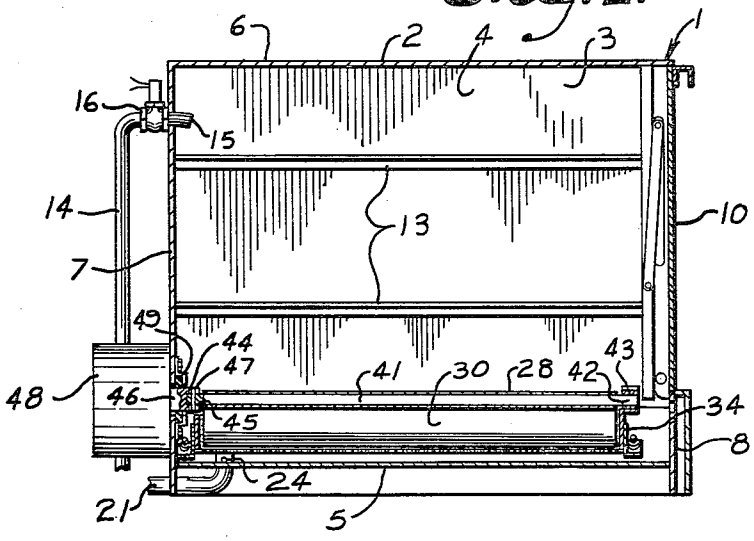


Fig. 2.



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DISHWASHING MACHINE

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Fig. 3.

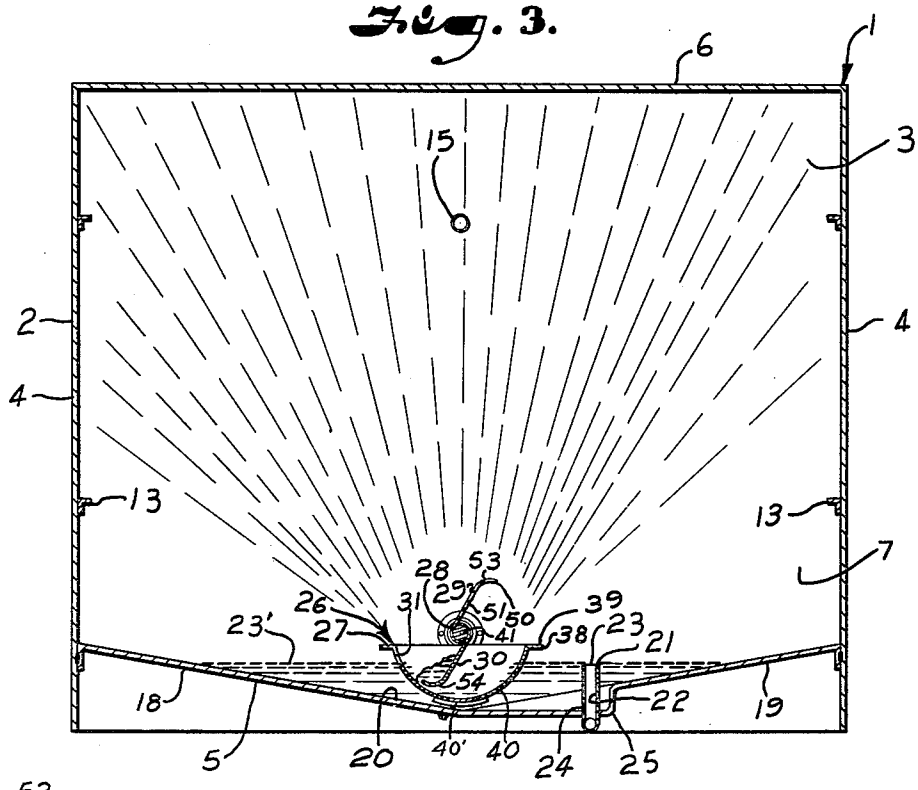
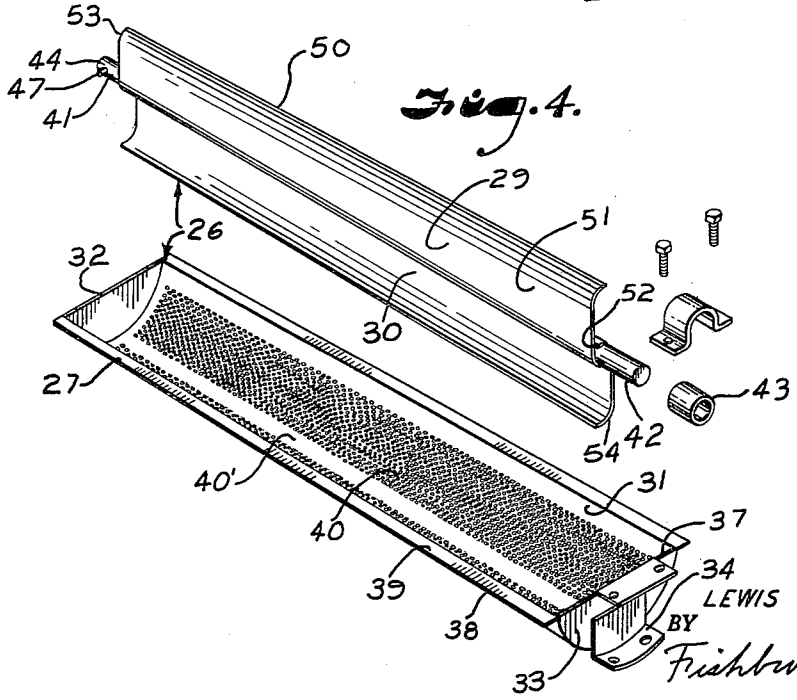


Fig. 4.



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DISHWASHING MACHINE

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Fig. 5.

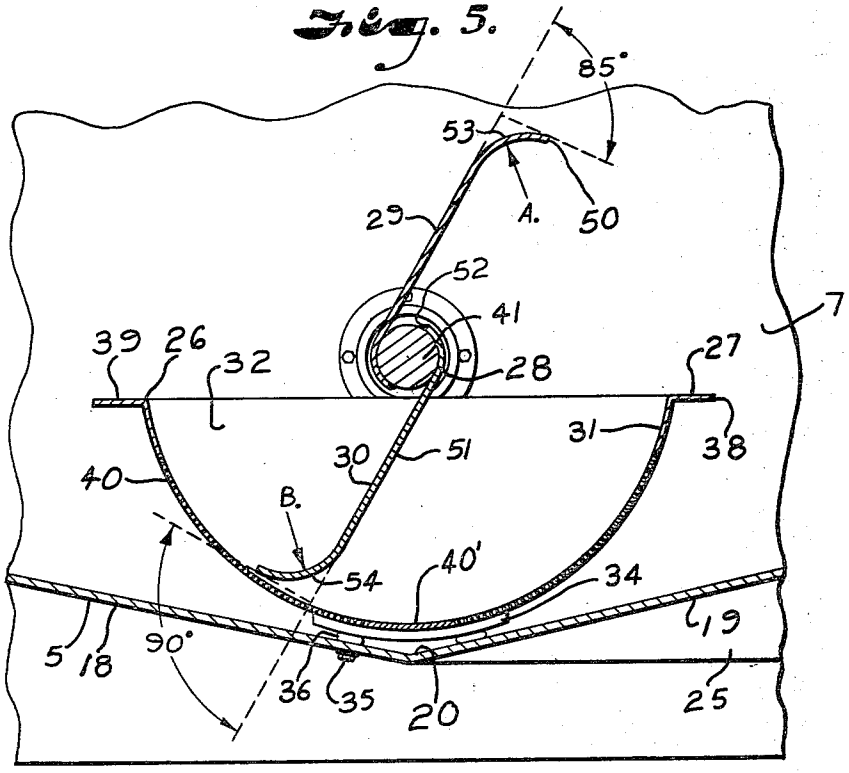


Fig. 7.

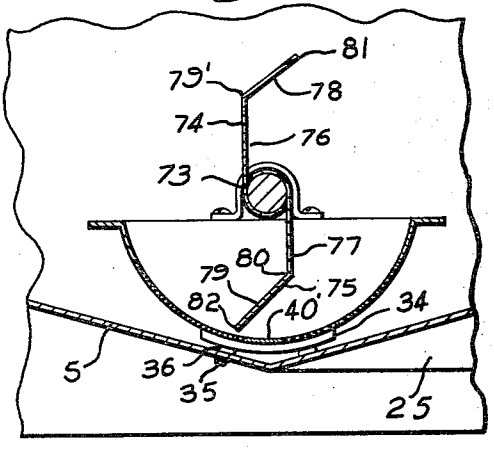
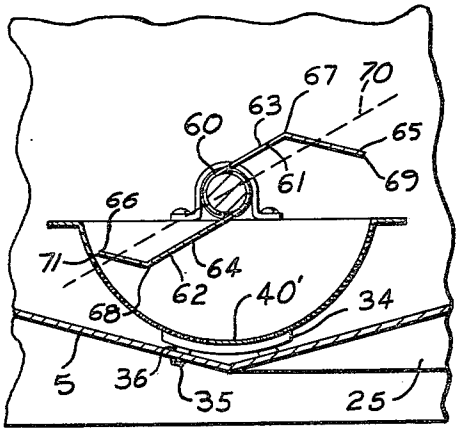


Fig. 6.



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DISHWASHING MACHINE

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Filed Jan. 29, 1962, Ser. No. 169,492
5 Claims. (Cl. 134—186)

This invention relates to dishwashing machines, and particularly to a washing liquid distributing apparatus including a rotating impeller and self-cleaning filter for directing liquid onto articles to be cleaned.

The principal objects of the present invention are to provide a dishwasher with a liquid distributor in the washing compartment for moving liquid from the bottom portion of the compartment and delivering said liquid at considerable velocity onto articles to be washed; to provide such a structure with a closed washing compartment having a downwardly sloping bottom portion to form a sump for collecting of washing liquid with a drain for limiting the maximum level of the liquid in the sump and an impeller rotatable on a horizontal axis with outwardly extending blades along the length thereof with end portions of the blades curved forwardly in the direction of rotation and adapted to dip into the liquid in the sump and pick up liquid for discharge into the washing compartment as the blades move in their path of travel above the liquid level; to provide such a structure wherein the blades of the impeller extend outwardly from the axis of rotation in substantially parallel planes and have end portions extending out of the plane of the respective blade toward the direction of rotation of the impeller with said blades having different liquid-receiving capacity as they are moved through the liquid in the sump whereby the discharge from the respective blades will be over a different extent of the path of movement of the blades and in the washing compartment above the level of liquid; to provide such a structure wherein the planar portions of the respective blades are rearwardly of a radial axial parallel plane and the free end edges are forwardly of said radial axial plane with the departure of the end portion of one blade different from the departure of the end portion of a substantially opposite blade whereby there is a difference in the delay in discharge of liquid from said blades; to provide such a structure wherein a trough member is arranged in the washing compartment adjacent and spaced from the bottom with said trough member having a wall with a curvature substantially coaxial with the axis of rotation of the impeller and a portion of the wall below the liquid level being perforated for entry of liquid into said trough member with the end portions of the impeller blades moving in close proximity to said wall during rotation of the impeller to move liquid from the trough member; to provide such a structure wherein the perforations in the trough member form a filter screen for removing food particles and the like from liquid drawn or flowing into the trough with the action of the blades of the impeller effecting outward flow of some liquid from the trough member to clean the food particles from the outer surface of the wall of the trough; to provide such a structure with an upwardly opening trough having edges spaced below the axis of the impeller to permit discharge of liquid from the impeller blades over a maximum area of the washing compartment; and to provide a dishwashing machine and liquid distributor therein which is economical to manufacture and efficient in operation for washing and rinsing dishes and the like.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a perspective view of the dishwashing machine embodying the present invention with portions of the housing being broken away to illustrate the structure therein.

FIG. 2 is a vertical sectional view through the dishwashing machine on the line 2—2, FIG. 1.

FIG. 3 is an enlarged transverse sectional view through the dishwashing machine on the line 3—3, FIG. 1.

FIG. 4 is a disassembled perspective view of the impeller and filter trough of the liquid distributor.

FIG. 5 is an enlarged partial sectional view through the lower portion of the machine, particularly showing the impeller blades.

FIG. 6 is a transverse sectional view through the lower portion of the machine with a modified form of impeller blades.

FIG. 7 is a transverse sectional view through the lower portion of the machine with a further modified form of impeller blades.

Referring more in detail to the drawings:

1 designates a dishwashing machine having a housing 2 with a washing compartment 3 formed therein by opposed side walls 4, a bottom 5, top wall 6, a rear wall 7, front wall 8 having an opening 9 normally closed by a door 10 whereby when the door 10 is opened the opening 9 provides access to the washing compartment. Articles 11 to be washed are normally supported in the washing compartment 3 by suitable racks 12 movably mounted on supports 13 such as rails carried on the side walls 4. Washing liquid such as hot water is supplied through a conduit 14 leading from a suitable source of supply such as a hot water tank (not shown) and terminating at a discharge end 15 inside of the washing compartment 3. Flow through the conduit is preferably controlled through a suitable valve such as an electrically-operated valve 16 arranged in a circuit with a timer generally designated with the numeral 17 whereby the water is discharged into the washing compartment for a predetermined time interval.

The bottom 5 preferably has side portions 18 and 19 that slope downwardly from the opposite side walls 4 to form a liquid or water-collecting area or sump 20 that preferably extends from the front wall 8 to the rear wall 7. An overflow pipe drain 21 has a flow passage 22 therein of greater capacity than the input of water through the conduit 14 and is arranged at the bottom with the overflow opening 23 spaced upwardly to limit the maximum level of liquid in the sump as at 23', said drain extending through the bottom and being adapted to communicate with a suitable place of disposal, as for example, a sewer or the like. A small opening 24 is arranged in said drain adjacent to and above the bottom wall whereby when the input of liquid to the washing compartment is stopped substantially all of the liquid in the sump will gradually drain therefrom, the rate of flow through the opening 24 being substantially less than the normal input of liquid through the conduit 14. In the structure illustrated, the bottom 5 has a depressed portion

25 extending laterally from the lower portion of the sump whereby the drain fitting is spaced laterally therefrom and assures drainage, as illustrated in FIG. 3.

A liquid distributor 26 extends longitudinally of the sump in the washing compartment in upwardly spaced relation from the lower portion of the bottom forming said sump. The distributor includes a filter trough 27 and an impeller 28, the impeller being rotatable on a horizontal axis whereby opposed blades 29 and 30 of the impeller have end portions that will dip into the liquid below the level thereof in the sump during rotation of the impeller to move said liquid and discharge same over the interior of the washing compartment. In the structure illustrated, the filter trough 27 has a wall 31 curved to form a portion of the cylinder with said wall arranged in the washing compartment below the impeller whereby the portions of the cylindrical wall 31 are equally spaced from the axis and define an upwardly opening trough. The sides of the trough may extend above the axis of the impeller to limit the angle through which liquid is distributed, however for maximum angle of distribution the sides are preferably below the axis of the impeller. The trough wall 31 is of greater length than the impeller blades 29 and 30 with the ends of the trough being closed by end walls or members 32 and 33, said trough having mounting brackets 34 for securing same in the washing compartment with the wall 31 in upwardly spaced relation from the portion of the bottom wall 5 defining the lower portion of the sump 20. The trough end wall 32 is preferably arranged adjacent the rear wall 7 with the trough end wall 33 adjacent the forward wall 8, said trough being secured to the bottom wall 5 by suitable fastening devices 35 with resilient or cushion members or washers 36 interposed between the brackets 34 and said bottom wall 5 to provide a cushion mounting for the trough and substantially eliminate transmission of vibrations from the trough to the walls of the compartment 3. In the structure illustrated, the upper edges 37 of the trough walls terminate below the axis of the impeller and the edges 38 of the wall 31 are preferably turned outwardly to define flanges 39 to provide stiffening and rigidity to the structure. The wall 31 is preferably perforated to provide a plurality of small openings 40 that extend from just below the normal water level 23' over a bottom portion of the trough. It is preferred that the openings 40 be less than 1/16-inch in diameter whereby food particles and the like in the water in the sump tending to flow inwardly into the trough from the sump 20 will be restrained or screened from the water. It is preferred that the perforations 40 be arranged in spaced areas whereby the bottom portion is solid as at 40' for a width, as for example, in the order of 1-inch as it is found such spacing of the filter or perforated area reduces noise in the washing operation.

The impeller 28 is suitably supported on bearings for rotation and, in the structure illustrated, the impeller includes a shaft or axial member 41 having a forward end portion 42 rotatably mounted in a bearing member 43 mounted on the forward bracket 34. The other end 44 of the axial member extends into a bore 45 of a motor shaft 46 and is suitably keyed thereto as by a pin 47. The shaft 46 extends from a housing of a motor 48 that is suitably secured and supported on the machine, as for example on the rear wall 7, whereby the shaft extends through said rear wall with a liquid-tight seal 49 surrounding said shaft adjacent said wall to prevent leakage of water therefrom. With this arrangement, the rear end of the impeller shaft is supported by the conventional motor bearings (not shown). The blades 29 and 30 of the impeller preferably extend longitudinally thereof with ends terminating adjacent to and inside of the trough end walls 32 and 33. The blades have free end edges 50 which, in their rotation, move in close proximity to the inner surface of the wall 31 of the trough, the clearance preferably being in the nature of 1/16-inch.

In the structure illustrated, the blades 29 and 30 are generally opposed with the inner portions fixed to the axial member 41 with flat planar portions 51 of said blades extending outwardly from said axial member preferably in spaced parallel planes wherein the planar portion of the respective blades trail or are rearwardly relative to the direction of rotation of the impeller from an axial radial plane parallel to said planar portions 51. In the structure illustrated, the inner portions of the blades 29 and 30 are curved around the axial member or shaft 41 and secured thereto as by welding as at 52 with the planar portions 51 extending substantially tangentially outwardly therefrom. Shaft location will stop water at shaft. The outer end portions 53 and 54 of the blades 29 and 30 respectively extend out of the plane of the respective planar portion forwardly in the direction of rotation of the impeller and terminate in the free edges 50 which are spaced forwardly in the direction of rotation relative to said axial radial plane, as illustrated in FIG. 5. With liquid in the sump 20, said liquid flows through the perforations or openings 40 into the trough and then, on rotation of the impeller, the ends of the blades dip into the liquid in the trough, collecting a portion of said liquid on the forward side of the blades between the free edges 50 and the shaft 41 and carry said portion of the liquid upwardly above the upper edges of the trough and, then, through the centrifugal force acting on the liquid in the blades, said liquid is discharged from the free edges 50 upwardly into the washing compartment. The arrangement of the blades 29 and 30 relative to the shaft 41 provides a dipper structure with an inner obstruction which in the illustrated structure is said shaft 41 that limits inward movement of liquid on the blades as they pass through the trough so the picked up liquid is held until discharged by centrifugal force. Also as the blades pick up water in the trough they form a suction at the rear thereof to draw liquid through the perforations into the trough providing a supply for the next blade during high speed rotation.

It has been found that with an impeller having a diameter in the nature of 4-inches and rotated at a speed of approximately 1750 r.p.m., the liquid will be discharged from the blades with sufficient force to impinge against the articles to be washed to provide a thorough cleaning action thereon. With this size impeller rotating at about the designated speed, a peripheral speed of the impeller will be in the nature of 1800 feet per minute, which has been found to be the most efficient speed for proper picking up of the liquid from the trough and discharging same into the washing compartment with an effective distribution. The impeller structure is such that the pick-up capacity of one blade is different than the pick-up capacity of the other, the variation being such that the discharge from said one blade will be delayed with the result that said other blade will discharge the principal portion of its liquid in the compartment to the left of the vertical axial plane through the impeller (FIG. 3) while said one blade will delay its discharge whereby a principal portion thereof is to the right of a central vertical axial plane (FIG. 3) and thereby provide a substantially uniform distribution of liquid discharge over the entire washing compartment above the trough. This variation in capacity of the blades may be by difference in angle of departure or in difference in the length of the forwardly curved or bent portions of the respective blades.

In the form of the invention illustrated in FIGS. 1 to 5 inclusive, the impeller has blades with planar portions 51 extending generally oppositely from the axial member 41 in substantially parallel planes, each of which is spaced rearwardly relative to the direction of rotation of the impeller from an intermediate axial plane parallel thereto. The end portions 53 and 54 are curved forwardly out of the plane of said planar portions 51 with one blade 29 having the end portion 53 of a radius or angle of departure greater than the other, as for example, the radius A of

the end portion 53 of one blade 29 may be greater than the radius B of the end portion 54 of the other blade 30. It has been found that where the diameter of the impeller is approximately 4-inches the radii is preferably of from 5/16 to 3/4-inch. The end portion 53 formed by the radius A of said one blade is preferably such that the degree of curvature provides a blade wherein a tangent to the free end of the blade forms an angle of departure with the planar portion of the respective blade within approximately 85-degrees, and the degree of curvature of the end portion 54 of the other blade formed by the radius B is such that the tangent thereto at the free end forms an angle of departure with the planar portion of the respective blade within approximately 90-degrees. With this arrangement, rotation of the impeller causes the blades to move through the liquid in the trough and, while some of the liquid in the trough is forced outwardly through the perforations therein and provides a self-cleaning action, liquid is also forced inwardly from the end portions of the respective blades to pick up a quantity of water on the blades with the blade having the greater angle of departure having the greater capacity. As the blades move out of the trough, centrifugal force acting on the water carried by the respective blades causes same to be propelled therefrom with the discharge of the liquid from the blades being retarded by the greater angle of departure whereby the blade 29 having the radius A and the lesser angle of departure tends to discharge a substantial portion of the liquid carried by the blade to the left side of the central vertical plane (FIG. 3). However, the capacity of such blade causes some of the water to be carried over and discharged over on the righthand side of said vertical plane. The other blade 30 having the radius B with the greater angle of departure, as for example within 90-degrees, will tend to carry a substantial portion of the water or liquid therewith whereby it is discharged on the righthand side of the vertical plane (FIG. 3) with the result that the discharge of the liquid is over the entire area of the washing compartment. It has been determined that with a 4-inch diameter impeller, rotated at approximately 1750 r.p.m., two blades provide optimum results because while one blade tends to sweep the liquid from the trough the liquid has an opportunity to re-enter the trough through the perforations or openings 40 to provide a supply for the next blade. Also, while the blades have a tendency to have unequal loading or capacity, this unequal loading results in a different pulsation or vibration that results in lesser noise than is usually provided wherein the blades have equal capacity.

In the operation of a dishwasher constructed and assembled as described, the door 10 is opened and articles to be washed loaded into the racks 12. Suitable detergent is placed in the compartment 3 and the door 10 is then closed and the timer switch 17 actuated to energize an electric circuit to the valve 16 and motor 48 whereby the motor rotates the impeller and the valve opens for flow of liquid into the washing compartment 3. The liquid accumulates to a level as determined by the overflow opening 23 of the drain, and rotation of the impeller blades through the liquid in the trough 27 projects the liquid upwardly and distributes same over the entire area of the washing compartment, causing said water to impinge on the articles to clean same. It is preferred that the dishwasher operate on a continuous flow of liquid; however, it may be arranged for a controlled input of liquid and draining whereby the water is changed on a periodic basis. It is preferred that in the operation of the dishwasher to have a continuous flow of water into the washing compartment and a continuous draining of the water therefrom during the predetermined period of washing, the detergent facilitates the cleaning of the articles, and then the detergent gradually is carried with the water through the drain, gradually lessening the detergent present in the washing water in the sump whereby, when the operation is substantially complete, only detergent-free water is supplied wherein the dishes are thoroughly rinsed. When the time cycle is completed, the timer switch 17 interrupts the circuit to the valve and motor, closing the valve and stopping the impeller, and then the remaining liquid in the sump drains through the opening or aperture 24 through the drain to empty the compartment.

In the form of the invention illustrated in FIG. 6, the impeller 60 has blades 61 and 62 with outwardly extending planar portions 63 and 64 respectively in parallel oppositely extending relation, with end portions 65 and 66 respectively extending out of the plane of the planar portions toward the direction of rotation of the impeller, said end portions having the same angle of departure which, in the illustrated structure, is in the nature of 45-degrees. In this arrangement, the planar portion 63 is shorter than the planar portion 64 whereby the end portion 65 is longer from the point of bend 67 than the end portion 66 from the point of bend 68 of the blade 62. With this arrangement, the free end 69 of the blade 61 is spaced a greater distance forwardly of a central axial plane 70 that is parallel to the planar portions 63 and 64 whereby the effect is that the free end 71 has less forward projection and the blade 61 has greater liquid capacity and greater retardation of centrifugal discharge and the liquid picked up by the blade 61 tends to be carried further than the liquid in the blade 62. This results in the blade 62 discharging the liquid in the area of the compartment on the side of the axis of the impeller toward the point where the blades leave the trough, and the blade 61 tends to carry the water on the other side of said axis to provide a uniform distribution of liquid in the washing compartment.

In the form of the invention illustrated in FIG. 7, the impeller 73 is arranged with blades 74 and 75 having oppositely extending parallel planar portions 76 and 77 respectively. In this structure, the end portion 78 of the blade 74 has a greater angle of departure from the planar portion of said blade than is provided in the angle of departure of the end portion 79 relative to the planar portion 77 of the blade 75. In the structure illustrated, the angle of departure of the blade portion 78 is in the nature of 53-degrees while the angle of departure of the end portion 79 is in the nature of 45-degrees. With this arrangement, the radial distance to the bent point 79' of the blade 74 is greater than the radial distance to the bend point 80 of the blade 75. Also, the length of the end portion of the blade 74 between the bend point 79' and the free end 81 is lesser than the length from the bend point 80 to the free end 82 of the blade 75. This arrangement results in a differential between the liquid capacity of the two blades and the resistance to discharge of the liquid from the blade having the lesser angle of departure is less than that of the blade having the end portion of the greater angle of departure. In the structure illustrated, the blade 75 tends to discharge the liquid carried thereby closer to to the point of leaving the trough in its rotation than the blade 74 whereby the structure has an arrangement with unequal capacities of liquid pick-up of the respective blades and a difference in the rate of discharge of the liquid from the blades during their rotation so there is an improved distribution of the liquid over the washing compartment, as well as the reduction in noise of operation from that usually provided by vane-type impellers in dishwashing machines.

It is to be understood that while I have illustrated and described certain forms of my invention, it is not to be limited to the specific forms or arrangement of parts herein described and shown except insofar as such limitations are included in the claims.

What I claim and desire to secure by Letters Patent is:

1. A dishwashing machine comprising,

(*a*) a housing having a bottom wall and a sump portion therein for collecting of liquid,

(*b*) rotatable means including oppositely directed blades extending generally longitudinally of the axis thereof

and arranged to dip into said sump for impelling liquid from said sump throughout a portion of the interior of said housing,

(c) said blades each having a planar portion extending outwardly of said axis and an end portion along the length thereof curved forwardly in the direction of rotation of said rotatable means, said end portions terminating in free ends with the extent of curvature of the end portion of one of the blades being different than the extent of curvature of the end portion of the other blade whereby the liquid-dipping capacity of said blades is unequal and the discharge of the liquid from the blades during rotation is for a different extent of the interior of the housing.

2. In a dishwashing machine having a housing for containing articles to be washed with a downwardly sloping bottom to provide a sump for collecting of liquid and an overflow drain for limiting the maximum level of liquid in said sump:

(a) an impeller rotatably journalled in the housing above the sum and extending longitudinally thereof,

(b) said impeller having opposed blades extending generally longitudinally thereof and of a radial length to dip into the liquid in the sump,

(c) said impeller blades having substantially planar portions extending outwardly of the impeller axis with end portions along the length thereof curved toward the direction of rotation of the impeller with the degree of curvature of said end portions being such that free ends thereof are equally spaced from the impeller axis and a tangent to said free ends forms an angle of departure within 90-degrees,

(d) the extent of curvature of one end portion being different than the extent of curvature of the end portion of the other blade whereby the liquid-propelling capacity of the blades are unequal and the distribution of liquid propelled by the blades is in different extents of the interior of the housing.

3. In a dishwashing machine having a housing for containing articles to be washed with a downwardly sloping bottom to provide a sump for collecting of liquid and an overflow drain for limiting the maximum level of liquid in said sump:

(a) an impeller journalled in the housing above the sump and extending longitudinally thereof,

(b) said impeller having opposed blades extending generally longitudinally thereof and of a radial length to dip into the liquid in the sump,

(c) an upwardly opening trough member having a wall substantially coaxially of said impeller, said wall having a perforate area in its lower portion,

(d) means mounting the trough in the housing in fixed relation with the wall of the trough spaced from the bottom whereby the perforate area of the trough terminates below and adjacent the level of the liquid in the sump,

(e) said impeller being rotatable with the blades having outer edges moving in close proximity to said trough wall,

(f) said impeller blades having planar portions extending outwardly of the impeller axis in spaced parallel planes with each of said planar portions terminating in end portions curved out of the planes of said planar portions toward the direction of rotation of the impeller with the degree of curvature of said end portions being such that a tangent to the free ends forms an angle of departure with the respective planar portions within 90-degrees,

(g) the curvature of each end portion being uniform along the length thereof and the extent of curvature of one end portion being different than the extent of curvature of the end portion of the other blade whereby the liquid-propelling capacity of the blades are unequal and the distribution of liquid propelled by the blades is in different extents of the interior of the housing.

4. In a dishwashing machine having a housing for containing articles to be washed with a downwardly sloping bottom to provide a sump for collecting of liquid and an overflow drain for limiting the maximum level of liquid in said sump:

(a) an impeller journalled in the housing above the sump and extending longitudinally thereof,

(b) said impeller having opposed blades extending generally longitudinally thereof and of a radial length to dip into the liquid in the sump,

(c) said impeller being rotatable,

(d) said impeller blades having planar portions extending outwardly of the impeller axis in generally opposite relation and in spaced parallel planes whereby said planar portions are in trailing relation relative to the direction of rotation of a radial axial plane parallel to said planar portions,

(e) said impeller blades having end portions along the length thereof with each end portion uniformly extending out of the plane of the planar portion of the respective blade and toward the direction of rotation of the impeller at a maximum angle of departure in the nature of 90-degrees and terminating in free ends in advance of said radial axial plane that is parallel to the planar portions to provide delayed discharge of liquid therefrom,

(f) the extent of departure of the end portion of one blade being different than the extent of departure of the end portion of the other blade from their respective planar portions whereby said blades have different liquid-propelling capacity and different extent of discharge of liquid in the interior of the housing,

(g) said free ends of the blades along the length thereof having equal radial spacing from the impeller axis.

5. In a dishwashing machine having a housing for containing articles to be washed with a downwardly sloping bottom to provide a sump for collecting of liquid and an overflow drain for limiting the maximum level of liquid in said sump:

(a) an impeller journalled in the housing above the sump and extending longitudinally thereof,

(b) said impeller having opposed blades extending generally longitudinally thereof and of a radial length to dip into the liquid in the sump,

(c) an upwardly opening trough member having a wall substantially coaxial of said impeller, said wall having a perforate area in its lower portion,

(d) means mounting the trough in the housing in fixed relation with the wall of the trough spaced from the bottom and the upper limits of the perforate area of the trough terminating below and adjacent the level of the liquid in the sump,

(e) said impeller being rotatable with the blades having outer edges moving in substantially uniform close proximity to said through wall,

(f) said impeller blades having planar portions extending outwardly of the impeller axis in generally opposite relation and in spaced parallel planes whereby said planar portions are in trailing relation relative to the direction of rotation of a radial axial plane parallel to said planar portions,

(g) said impeller blades having end portions along the length thereof and extending out of the planes of the planar portions of the respective blades and toward the direction of rotation of the impeller at a maximum angle of departure in the nature of 90-degrees and terminating in free ends in advance of said radial axial plane that is parallel to the planar portions to provide delayed discharge of liquid therefrom,

(h) the extent of departure of the end portion of one blade being different than the extent of departure of the end portion of the other blade from their re-

spective planar portions whereby said blades have different liquid-propelling capacity and different extent of discharge of liquid in the interior of the housing.

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