Sept. 17, 1963 D. A. JAMES 3,103,938

DISHWASHING MACHINE AND LIQUID DISTRIBUTOR THEREFOR

Filed March 19, 1962 3 Sheets-Sheet 1

Fig. 1.

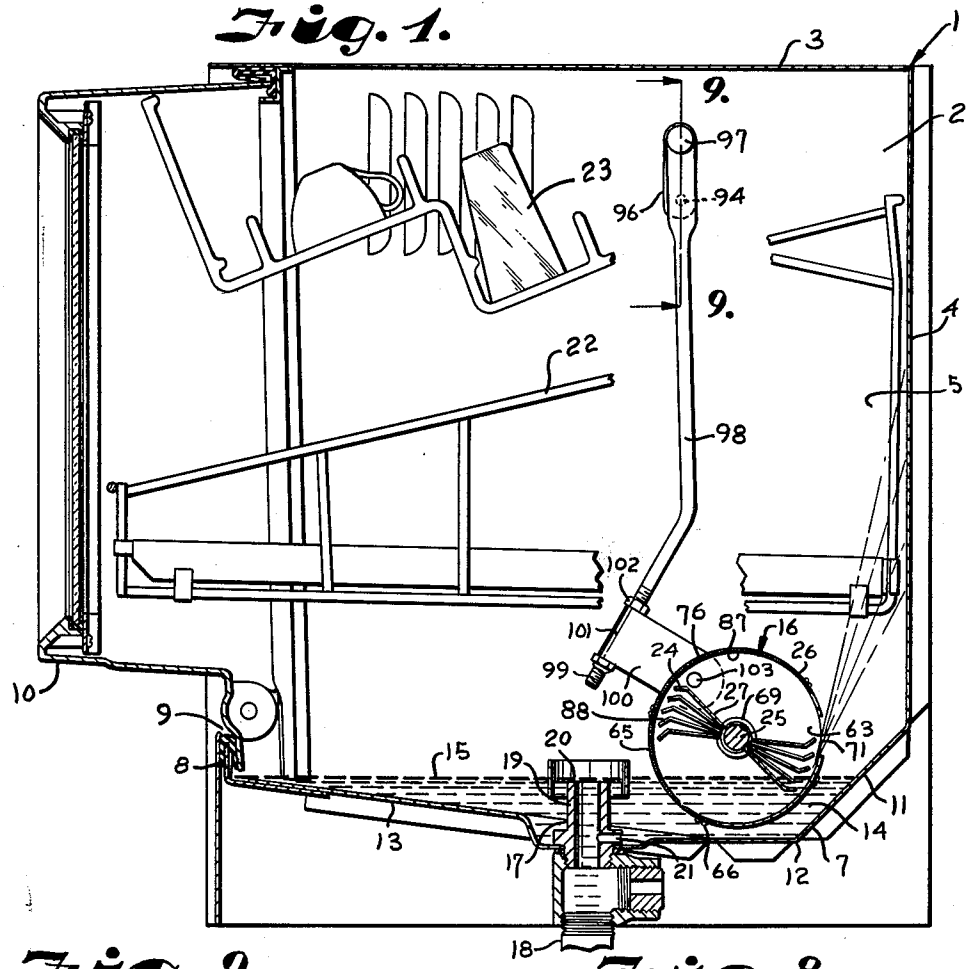


Fig. 9.

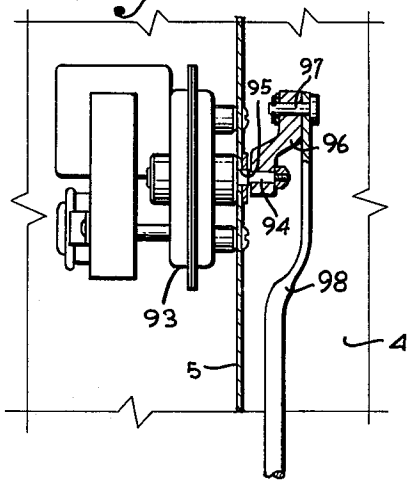
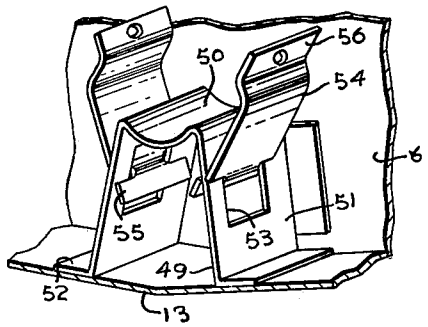


Fig. 8.



INVENTOR.
DUANE A. JAMES
BY
Fishburn & Gold
ATTORNEYS

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Filed March 19, 1962 3 Sheets-Sheet 2

Fig. 2.

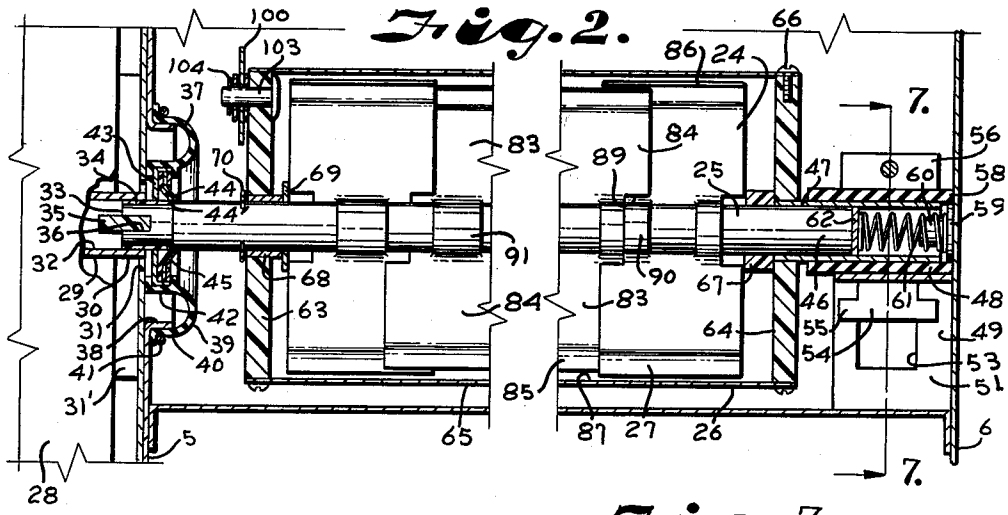


Fig. 7.

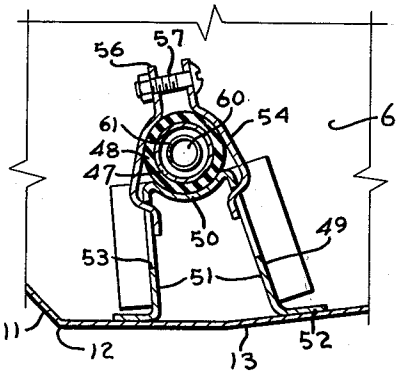


Fig. 3.

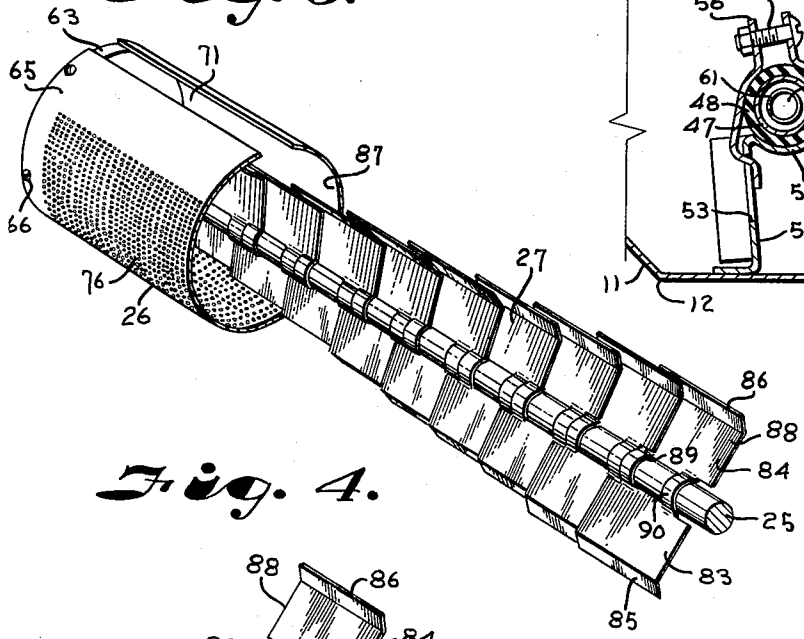
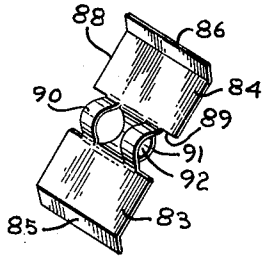


Fig. 4.



INVENTOR.
DUANE A. JAMES
BY
Fishburn & Gold
ATTORNEYS

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Filed March 19, 1962 3 Sheets-Sheet 3

Fig. 5.

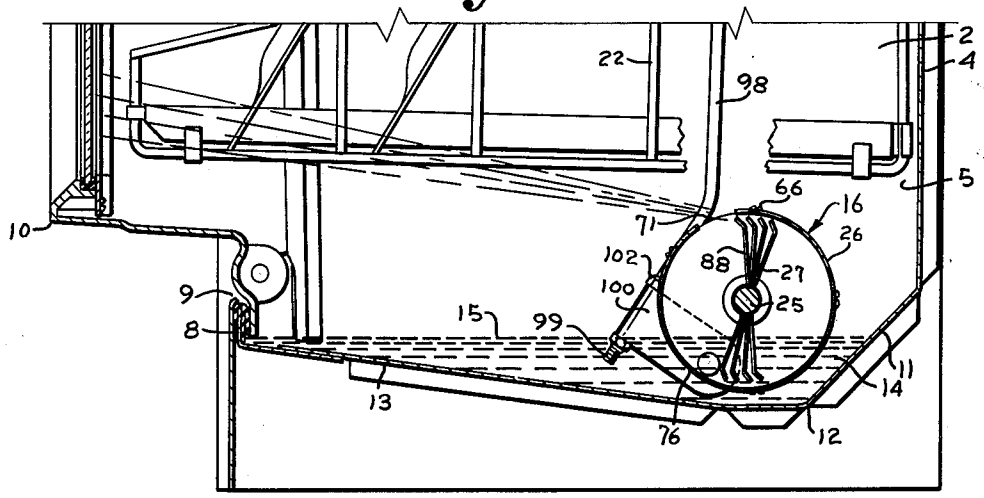
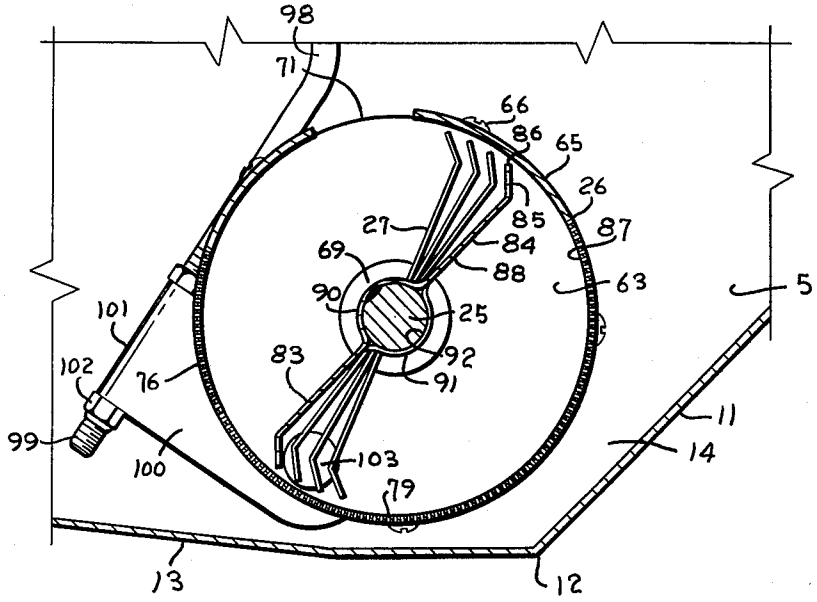


Fig. 6.



INVENTOR.
DUANE A. JAMES
BY
Fishburn & Gold
ATTORNEYS

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3,103,938
DISHWASHING MACHINE AND LIQUID DISTRIBUTOR THEREFOR

Duane A. James, Richardson, Tex., assignor to Ling-Temco-Vought, Inc., Dallas, Tex., a corporation of Delaware

Filed Mar. 19, 1962, Ser. No. 180,480
10 Claims. (Cl. 134—111)

This invention relates to dishwashing machines, and more particularly to a dishwashing machine and liquid distributor structure and arrangement therein for moving liquid from the lower portion of a washing compartment and distributing the liquid against articles to be washed and having a liquid filter forming a part thereof.

It has been common practice to pre-rinse dishes and the like under a faucet to rinse off food particles before placing the articles in the dishwasher washing compartment because the food particles removed from the dishes and the like in the washing machine could be recirculated over the dishes during the washing cycle. In machines having filters for the liquid being recirculated, the food particles tended to close the openings in the filter and interfere with the operation. Where the filters become clogged even though having some self-cleaning action, the accessibility and removability of the structures are difficult and time-consuming whereby there has been considerable objection, both to the rinsing of the dishes before washing and to the maintenance requirements in machines where the dishes were not pre-rinsed.

The principal objects of the present invention are to provide a dishwashing machine and liquid distributor therefor that substantially eliminates the difficulties above-mentioned; to provide a distributor assembly having a housing with small openings over a substantial portion thereof forming liquid inlets and providing a filter screen for removing food particles from the liquid entering the distributor unit; to provide such a structure wherein the distributor unit includes an elongate substantially cylindrical housing with a discharge opening extending longitudinally above the liquid level with the housing oscillated whereby the discharge is directed through the discharge opening in a sweeping action through a selected angle into the upper portion of the washing compartment; to provide such a structure wherein an impeller is rotatable in the housing and includes radially extending blades terminating with end portions extending or bent toward the direction of rotation and arranged whereby the rotation of the impeller tends to draw liquid through the filter into the housing and discharges said liquid through the discharge opening with a portion of the liquid being driven outwardly through the openings of the filter to clean same of food particles and the like cleaning different areas of the filter at different intervals as it oscillates in relation to the impeller and the water level; to provide a liquid distributor unit mounting arranged for axial movement with resilient means maintaining operative connection of a drive for the impeller whereby said drive may be disconnected on endwise movement of the unit for removal of the unit from the washing compartment; to provide a liquid distributor wherein the impeller blades are a plurality of blade units arranged on the impeller shaft and extend longitudinally thereof with adjacent blade units in overlapping relation and in angular relation whereby the blade units form a generally spiral arrangement about the shaft; to provide such a structure wherein each of the blade sections are arranged with outwardly extending blade portions in planes parallel to a radial axial plane through the impeller shaft; and to provide a dishwashing machine and liquid distributor therefor which are economical to manufacture, efficient in operation for washing and rinsing dishes and the like and easily maintained.

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 vertical sectional view through a dishwasher and liquid distributor therefor embodying the features of the present invention.

FIG. 2 is a partial longitudinal sectional view through the liquid distributor and mounting therefor in the washing compartment.

FIG. 3 is a partial perspective view of the liquid distributor housing and impeller.

FIG. 4 is a perspective view of a blade section for the impeller.

FIG. 5 is a partial vertical sectional view through the dishwasher with the liquid distributor housing oscillated to one limit of its movement.

FIG. 6 is an enlarged sectional view through the liquid distributor particularly illustrating the inlet and filter openings in the housing therefor.

FIG. 7 is a vertical sectional view through the distributor support structure taken on the line 7—7, FIG. 2.

FIG. 8 is an enlarged detail perspective view of the mounting bracket for the bearing and free end of the impeller shaft.

FIG. 9 is a partial vertical sectional view showing the motor drive to the housing oscillating link.

Referring more in detail to the drawings:

The reference numeral **1** generally designates a washing machine such as a dishwashing machine having a washing compartment **2** formed by atop wall **3**, rear wall **4**, end walls **5** and **6**, a bottom wall **7** and a front wall portion **8** with an access opening **9** at the front normally closed by a door **10**. The bottom wall **7** preferably has a portion **11** extending downwardly and forwardly from the rear wall to a line **12** and a portion **13** extending forwardly and upwardly from the line **12** to the front wall **8**, whereby said bottom forms a sump **14** extending substantially the length thereof for washing liquid **15**. The machine has a liquid inlet and control (not shown) for continuously supplying liquid to the washing compartment over a predetermined time cycle, as for example, during the cycle of operation of a liquid distributor assembly **16**. A drain structure **17** is connected to the washing compartment to provide communication therefrom to a waste pipe **18** leading to a disposal. The drain preferably has an upstanding tubular portion **19** with an open upper end **20** providing an overflow of greater capacity than the rate of inlet liquid supplied to the washing compartment whereby said upper edge **20** is at the level of maximum liquid level in the washing compartment. The drain also has a small aperture **21** adjacent the bottom wall to permit the liquid to drain from the washing compartment at the end of the washing cycle, the aperture **21** being of a size whereby the flow therethrough is substantially less than the rate of flow of the inlet liquid to the washing compartment. The washing compartment is provided with suitable racks **22** for supporting articles **23** to be washed. It is preferred that the washing compartment be relatively long in the distance between the end walls **5** and **6** and that the liquid distributor **16** be such that liquid therefrom is discharged in a stream generally longitudinally for the length of said washing compartment and sweep in an arc from an area at the rear wall below the articles to be washed to an area at the front below the articles to be washed, as later described.

The liquid distributor assembly **16** is mounted in the washing compartment **2** and suitably driven to deliver washing and/or rinse liquid at considerable velocity onto

articles 23 to be washed. The liquid distributor assembly 16 preferably is so constructed to form a unit adapted to be removably mounted in the washing compartment and extend longitudinally thereof for substantially the length of said washing compartment between the end walls 5 and 6. The liquid distributor generally consists of an impeller structure 24 having an elongate axial shaft 25 rotatably mounted in the washing compartment with an elongate housing 26 rotatably mounted on said shaft 25 and surrounding a blade portion 27 of the impeller. The shaft 25 is removably mounted in the washing compartment substantially on a horizontal axis preferably forwardly of the line 12 of the bottom wall with the lower portion of the housing below the liquid level in the washing compartment and the lowermost part of the housing spaced above the bottom wall portion 13, as illustrated in FIGS. 1 and 6, whereby liquid will enter the housing and the blade portion of the impeller will dip into the liquid in the housing and be propelled therefrom, as later described.

The impeller shaft 25 is adapted to be driven by a motor 28 having a drive shaft 29 suitably mounted in motor bearings (not shown). The drive shaft 29 has an end portion 30 positioned at an opening 31 in a motor support member 31' adjacent the wall 5 with said shaft having an axial socket or bore 32 extending therein adapted to receive an end portion 33 of the shaft 25 in supporting relation thereto with interengaging portions on the motor shaft and impeller shaft to provide a driving engagement. In the structure illustrated, the end portion 33 of the shaft 25 is of reduced size and is provided with a sleeve 34 of synthetic resin forming a good bearing surface, said sleeve being bonded to the shaft with a liquid-tight seal therebetween. The driving connection is formed by a key 35 fixed to the motor shaft and extending thereacross and adapted to engage in a transverse slot 36 in the end of the impeller shaft.

The end wall 5 of the washing compartment is provided with a seal structure 37 surrounding the shaft to provide a liquid-tight seal to prevent escape of liquid from the washing compartment along the shaft. In the structure illustrated, the end wall structure 5 is provided with a flange 38 extending into the washing compartment therefrom and coaxial with the shaft with a resilient seal ring member 39 of substantially U-shaped cross-section with one leg 40 sleeved over the flange 38 and held in gripping relation thereto by a resilient circumferential member 41. The other leg 42 of the U-shaped cross-section seal extends by a reverse bend toward the motor support member 31' and bonded in said leg 42 is a metal disc 43 having a peripheral portion with a reverse bend to grip a seal disc 44 therebetween. The inner portion of said seal disc 44 is inclined away from the disc 43 or toward the housing 26 and has an inner edge 44' engaging the sleeve 34 under pressure from resilient fingers 45 on the reverse bend portion of the metal disc whereby the seal disc 44 is maintained in sealing engagement with the rotating impeller shaft and prevents leakage of liquid from the washing compartment.

The other end 46 of the shaft 25 is rotatably mounted in a bearing sleeve 47 mounted inside of a resilient sleeve-like member 48 removably supported by a bearing standard structure 49. In the structure illustrated, the resilient sleeve 48 rests on an arcuate seat 50 carried on spaced legs 51 having outwardly turned feet 52 at the lower ends thereof suitably secured to the bottom wall portion 13. The legs have slots 53 through which lower portions of clamp members 54 extend, the clamp members having laterally extending ears 55 engaging the inner portions of the legs 51 to retain the clamp members in place. The clamp members extend upwardly in straddling relation to the resilient bearing sleeve member 48 and have upstanding fingers or flanges 56 engaged by a removable fastening device such as a bolt and nut 57 to draw the clamping members into clamping engagement with the resilient sleeve member 48 to hold same in place for supporting the free end 46 of the impeller shaft, preferably with an end 58 of the resilient sleeve in engagement with the wall 6. A spring guide member 59 is positioned in the end of the resilient sleeve and may engage the wall 6 and has an axially extending end portion 60 extending into a spring 61 that has one end engaged with the guide and the other end engaged with a bearing disc 62 that is held against the free end of the shaft 25 as the spring 61 urges the shaft toward the motor 28 and maintains the drive connection between the motor shaft 29 and the impeller shaft 25.

The housing 26 in the illustrated structure has end members 63 and 64 adjacent the end walls 5 and 6 respectively, said end members supporting a substantially cylindrical shell 65 that is secured to the end members by suitable fastening devices such as screws 66. The housing is rotatably mounted relative to the shaft 25 and, in the illustrated structure, the end member 64 is rotatably mounted on a portion of the bearing sleeve 47 extending from the resilient sleeve 48, as illustrated in FIG. 2, the spacing between the end members 64 and the blade portion 27 of the impeller being maintained by a bushing 67 sleeved on the impeller shaft. The end member 63 of the housing is rotatably mounted on the shaft by a bearing sleeve 68 with the spacing between the end member 63 and the blade portion 27 of the impeller being maintained by said bearing sleeve 68 and a washer 69 adjacent the blade portion and a removable keeper 70 mounted on the shaft and engaging the bearing sleeve 68 and end surface of the end member 63 on the exterior of the housing 26.

The shell 65 is preferably formed of sheet metal and arranged to provide an elongate slot or liquid discharge opening 71 extending for the length of the housing and positioned whereby said discharge slot is above the level of the liquid in the washing compartment during the oscillation of the housing. The shell 65 has a plurality of openings and portions thereof spaced from the discharge opening 71 for entry of liquid into the impeller housing. It is preferred that the entrance openings be arranged to form a filter to substantially exclude particles of food and the like from entering the housing. In the structure illustrated, the entry openings are in the form of perforations 76 in the housing or shell over an area in the nature of two-thirds of the circumference thereof. It is preferred that the perforations 76 be in the nature of .040 inch in diameter, with all of the perforations providing a combined opening area of approximately 30 percent of the surface area of the shell having the perforations therein. This arrangement of the openings provides a substantial filtering of the liquid entering the housing and also a low noise factor that would normally be created by vibrations resulting from reversals of water flow due to the movement of the impeller.

In the blade portion 27 of the impeller structure, blade portions 83 and 84 extend outwardly from the shaft, said blade portions extending longitudinally of the shaft and generally in a spiral about the shaft, the blade portions terminating in flanges 85 bent forwardly in the direction of rotation of the impeller, with the outer edges 86 at the periphery being arranged to move in close proximity to the inner surface 87 of the shell whereby the blade portions dip into the liquid in the housing and through centrifugal force throw the liquid upwardly in the shell and through the opening 71 in a substantially flat sheet of high velocity liquid, the portion of the sheet of liquid being discharged through the opening progressively moving longitudinally thereof as the impeller is rotated.

In the structure illustrated, the blade portion 27 of the impeller is formed by a plurality of blade sections 88 formed of sheet material with an intermediate portion notched as at 89 and with the sheet between the notched portion deformed to provide strap-like members 90 and 91 with an opening 92 therebetween whereby the

sections are adapted to be sleeved onto the shaft 25. In the structure illustrated, each of the sections are arranged whereby the blade portions 83 and 84 are opposed and extend substantially radially outwardly from the axis of the shaft and terminate in the flanges 85. The blade sections 88 are sleeved on the shaft with the notches 89 being such that the blade portions overlap the adjacent portions for a width substantially corresponding to the combined depths of the notches 89 of adjacent sides of the respective sections. The adjacent blade portions are arranged whereby the blade members 83 and 84 engage the overlapped portions of the adjacent section at the inner portions or connection with the straps 90 and 91 whereby the outer portions of the blade members are spaced from the adjacent overlapped portions or are in angular relation, as illustrated in FIGS. 1 and 6. Each of the blade members 83 and 84 are in a respective axial radial plane whereby upon rotation of the impeller liquid propelled by the respective blade members is such that hte droplets or liquid particles tend to move in a line that is in a plane normal to the axis of the impeller shaft 25. The blade sections are fixed to the impeller shaft as by welding or the like to maintain their relative positions.

The housing 26 is oscillated by a motor 93 exteriorly of the washing compartment, said motor having a shaft 94 extending through an aperture 95 in the upper portion of the wall 5 and having a crank arm 96 fixed on the end thereof. The free end of the crank arm is pivotally connected as by a crank pin 97 to one end of a link 98 with the other end of the link suitably connected to the housing 26. In the structure illustrated, the free or other end of the link 98 has a threaded shank 99 with an arm 100 provided with a tubular portion 101 sleeved on said threaded shank and being adjustable thereon by suitable nuts or the like 102. The arm 100 extends from the link and has the free end thereof pivotally connected by a pin 103 to the housing, a keeper 104 retaining the arm mounted on said pin 103. The motor 93 is arranged whereby the shaft 94 is rotated at a relatively slow speed so that the water discharged from the discharge opening 71 of the housing 26 sweeps back and forth over the articles to be washed.

In the structure such as illustrated and described, the liquid distributor unit may be easily removed and replaced by removing the keeper 104 whereby the arm 100 is disconnected from the pins 103 and by removing the fastening device 57 the clamp members 54 are released from the resilient sleeve 48 and then the impeller shaft is pushed toward the wall 6 to effect releasing of the engagement of the shaft with the socket 32 in the motor shaft 29. The entire unit may be replaced by inserting the end of the shaft 25 into the socket of the motor shaft 29 and effecting engagement of the slot 36 with the key 35 and then moving the resilient sleeve into the seat 50 and clamping said resilient sleeve in place by the clamp member 54 and the fastening device 57. The arm 100 is then connected to the housing pin 103 and the keeper 104 inserted and the structure is again ready for operation.

In the operation of the dishwasher, articles 23 to be washed are placed on the racks 22 and then liquid is started to flowing into the washing compartment, and the motors 28 and 93 are energized to effect rotation of the impeller 24 and oscillation of the housing 26. In the continuous flow operation of the liquid, a portion of the liquid will flow out of the aperture 21 through the drain, but the rate of inlet flow causes the liquid to collect in the washing compartment and rise to a maximum level at the upper portion of the tubular member 19. The housing is oscillated through an arc whereby the discharge opening 71 is moved from one extremity of the oscillation as shown in FIG. 1 wherein the liquid discharged therefrom is directed toward the rear wall 4 substantially at the bottom of the racks to the other extremity of the oscillation as illustrated in FIG. 5 wherein the liquid discharged through the opening 71 is directed toward the front of the washing compartment at the bottom of the racks 22. The rotation of the impeller shaft 25 causes the impeller blade portions 83 and 84 and flanges 85 thereon to dip into liquid in the lower portion of the housing 26 and moves same around the inside of the shell to the opening 71 whereby it is discharged therefrom. The movement of the impeller blades within the peripheral portion in close proximity to the inner surface of the shell also creates a suction that tends to draw liquid through the perforations of the shell that are below the liquid level whereby liquid is available for the next trailing blade portion. The perforations tend to filter food particles from the liquid drawn into the housing whereby only clean liquid is discharged therefrom. Some of the liquid moved by the impeller blades escapes through the perforations 76 before reaching the discharge opening 71. Additional liquid tends to move beyond the opening 71 and be thrown through the perforations in the shell that are above the liquid level and remove particles therefrom so as to provide a self-cleaning action. This same action is also present under the liquid level as a portion of the liquid forwardly of the blade portions tends to move outwardly of the perforations but a substantial quantity of the liquid is carried by the blades and directed through the opening 71. As the housing 26 oscillates, perforations which were water inlet openings change to water outlet openings, and each oscillation cleanses the filter. The sectional blade arrangement of the impeller 24 is such that there is a spiral arrangement whereby a blade section at one end of the impeller tends to move liquid and direct it outwardly of the opening 71 and then the next adjacent blade delivers liquid therefrom whereby the effect is a delivery of liquid from one end of the housing in the form of a sheet with the discharge progressively along the slot longitudinally of the housing 26 and, at the same time, the housing is oscillating so that the sheet of water is discharged at high velocity from the housing through the opening 71 whereby there is a concentration of the discharge water in a jet action that progressively sweeps back and forth from front to rear and also moves longitudinally of the washing compartment. This provides substantially the entire washing action of the high velocity liquid to only a few articles at a time and provides a short soaking period between the intervals at which the liquid sheets are directed against the articles. In actual practice, in a dishwasher with the impeller blade portion 27 being approximately 24 inches long and 3 inches in diameter and rotated at 1750 r.p.m., delivers a quantity in the nature of 100 gallons per minute over the articles being washed yet the total quantity of water used is small as it is being recirculated. However, during this washing action, there is a continuous flow of liquid into the washing compartment and a draining of liquid therefrom to maintain the liquid level therein so that liquid passing through the drain carries food particles therewith. Also, the detergent that is introduced into the washing machine at the start of the washing cycle is gradually depleted whereby at the end of the washing cycle substantially clear water is present in the washing compartment and serves as a rinse. The arrangement of the perforations in the various sections is such that the reversal of movement of the liquid in passing through the perforations provides an interference tending to alter any frequencies of vibration and thereby reducing noise.

It is believed obvious that I have provided a dishwashing apparatus and liquid distributor therefor for efficiently washing and rinsing dishes and the like, that is easily maintained and of particular ease in removal and replacement of the liquid distributor.

It is to be understood that while I have illustrated and described one form of my invention, it is not to be limited to the specific form 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 liquid distributor for dishwashing machines comprising,

(*a*) an elongate substantially cylindrical housing adapted to be oscillated on a horizontal axis with the lower portion below the level of liquid used in washing dishes, said housing having an opening extending longitudinally thereof in an upper portion above the liquid level and forming a liquid discharge opening, said housing having an area of small perforations in the lower portion forming inlet openings for liquid to enter said housing,

(*b*) an impeller shaft rotatably mounted in the housing and extending longitudinally axially thereof,

(*c*) impeller blades fixed on the impeller shaft and extending generally longitudinally thereof, said blades having substantially radially extending portions adapted to move in close proximity to said housing whereby said blades discharge liquid through said housing discharge opening in response to rotation of said impeller shaft,

(*d*) the impeller blades being in sections arranged longitudinally of the impeller shaft with portions of adjacent blades overlapping with the blades of adjacent sections arranged whereby the blade of one section trails the blade of another and the liquid discharged from the housing discharge opening by said blades is substantially in flat streams.

2. A liquid distributor for dishwashing machines comprising,

(*a*) an elongate substantially cylindrical housing adapted to be oscillated on a horizontal axis with the lower portion below the level of liquid used in washing dishes, said housing having spaced end members connected by a thin cylindrical shell with an opening extending longitudinally thereof in an upper portion above the liquid level and substantially in a radial plane through said horizontal axis and forming a liquid discharge opening, said housing having an area of small perforations in the lower portion of the shell forming inlet openings for liquid to enter said housing,

(*b*) an impeller shaft rotatably mounted in the housing extending longitudinally axially thereof,

(*c*) impeller blades fixed on the impeller shaft and extending generally longitudinally thereof in a spiral about said shaft, said blades having substantially radially extending portions adapted to move in close proximity to said housing shell whereby said blades discharge liquid through said housing discharge opening in response to rotation of said impeller shaft,

(*d*) means operatively connected with said housing for oscillating same whereby the liquid discharged from the housing is directed in a sweeping action through a selected angle above said housing,

(*e*) the impeller blades being in sections arranged longitudinally of the impeller shaft with portions of blades of a section overlapping with the blades of an adjacent section arranged whereby the blade of one section trails the blade of another and the liquid discharged from the housing discharge opening is substantially in a flat stream that moves progressively longitudinally of the housing.

3. A liquid distributor for dishwashing machines comprising,

(*a*) an elongate substantially cylindrical housing adapted to be oscillated on a horizontal axis with the lower portion below the level of liquid used in washing dishes, said housing having spaced end members connected by a thin cylindrical shell with an opening extending longitudinally thereof in an upper portion above the liquid level and substantially in a radial plane through said horizontal axis and forming a liquid discharge opening, said housing having an area of small perforations in the lower portion of the shell forming inlet openings for liquid to enter said housing,

(*b*) an impeller shaft rotatably mounted in the housing and extending longitudinally axially thereof,

(*c*) impeller blades fixed on the impeller shaft and extending generally longitudinally thereof in a spiral about said shaft, said blades having substantially radially extending portions terminating in marginal flanges turned in the direction of rotation of said impeller shaft and adapted to move in close proximity to said housing shell whereby said blades discharge liquid through said housing discharge opening in response to rotation of said impeller shaft,

(*d*) means operatively connected with said housing for oscillating same whereby the liquid discharged from the housing is directed in a sweeping action through a selected angle above said housing,

(*e*) said inlet openings in the housing shell being small and forming a filter to restrain particles of food and the like from entering the housing with the oscillation of the housing moving the portion thereof having the inlet openings in and out of the liquid at the bottom of the washing compartment whereby liquid moved by the impeller blades in the housing is discharged through said inlet openings to clean same.

4. In a dishwashing machine having a washing compartment with a bottom forming a liquid-collecting sump and a liquid supply and a drain communicating with the washing compartment and operable to maintain a maximum liquid level during a washing cycle, in combination,

(*a*) an impeller shaft adapted to be positioned in the washing compartment on a horizontal axis in upwardly spaced relation to the bottom,

(*b*) a motor driven drive shaft supported exteriorly of the washing compartment and having an end portion extending to the interior of the washing compartment in coaxial relation with the impeller shaft,

(*c*) one end of said impeller shaft being removably connected and movable longitudinally relative to said end of the drive shaft in driven relation thereto,

(*d*) seal means in the washing compartment surrounding one of said shafts adjacent said end portion thereof and having sealing engagement therewith to retain liquid in the washing compartment from moving along said shaft to the exterior of the washing compartment,

(*e*) means in the washing compartment at the end of said impeller shaft remote from said motor removably, slidably and rotatably supporting the other end of the impeller shaft, resilient means in the washing compartment and associated with the impeller shaft to bias same longitudinally toward the drive shaft,

(*f*) an elongate substantially cylindrical housing having end portions rotatably mounted on said impeller shaft adjacent the ends thereof, said housing having a thin-walled shell extending between said end members and secured thereto with an opening extending longitudinally thereof in an upper portion above the liquid level and forming a liquid discharge opening, said housing having a lower portion below the liquid level in the washing compartment with closely spaced inlet openings therein,

(*g*) blades on the impeller shaft in the housing and arranged longitudinally thereof, said impeller blades terminating in marginal flanges turned in the direction of rotation of said impeller shaft whereby rotation of the impeller shaft moves the blades through liquid in the lower portion of the housing and discharges said liquid through the discharge opening of the housing, and

(*h*) means operatively connected with said housing for oscillating same whereby the liquid discharged from the housing is directing in a sweeping action through a selected angle above said housing.

5. In a dishwashing machine having a washing compartment with a bottom forming a liquid-collecting sump

and a liquid supply and a drain communicating with the washing compartment and operable to maintain a maximum liquid level during a washing cycle, in combination,

(*a*) an impeller shaft adapted to be positioned in the washing compartment on a horizontal axis in upwardly spaced relation to the bottom,

(*b*) a motor driven drive shaft supported exteriorly of the washing compartment and having a tubular end portion extending to the interior of the washing compartment in coaxial relation with the impeller shaft,

(*c*) one end of said impeller shaft being sleeved into said tubular end of the drive shaft and removably supported thereby in driven relation thereto,

(*d*) seal means in the washing compartment surrounding said impeller shaft adjacent said end portion and having sealing engagement therewith to retain liquid in the washing compartment from moving along said shaft to the exterior of the washing compartment,

(*e*) a standard in the washing compartment at the end of said impeller shaft remote from said motor,

(*f*) resiliently supported bearing means removably mounted on said standard and sleeved on said other end of the impeller shaft to rotatably and slidably support same, resilient means urging said impeller shaft toward said motor to maintain the driving engagement therewith,

(*g*) an elongated substantially cylindrical housing having end portions rotatably mounted on said impeller shaft adjacent the ends thereof, said housing having a thin-walled shell extending between said end members and secured thereto with an opening extending longitudinally thereof in an upper portion above the liquid level and forming a liquid discharge opening, said housing having a major portion with closely spaced inlet openings therein,

(*h*) blades on the impeller shaft in the housing and arranged longitudinally thereof, said impeller blades terminating in marginal flanges turned in the direction of rotation of said impeller shaft whereby rotation of the impeller shaft moves the blades through liquid in the lower portion of the housing and discharges said liquid through the discharge opening of the housing, and

(*i*) means operatively connected with said housing for oscillating same whereby the liquid discharged from the housing is directed in a sweeping action through a selected angle above said housing.

6. A dishwasher structure as set forth in claim 5 wherein:

(*a*) the inlet openings in the housing are small and form a filter to restrain particles of food and the like from entering the housing and the oscillation of the housing moves the portion thereof having the inlet openings in and out of the liquid at the bottom of the washing compartment whereby liquid moved by the impeller blades in the housing is discharged through said inlet openings to clean same.

7. A dishwasher as set forth in claim 5 wherein:

(*a*) the bearing means supporting said other end of the impeller shaft is mounted in a resilient sleeve seated on the standard, and

(*b*) clamping means mounted on the standard to clamp the resilient sleeve to retain same thereon.

8. In a dishwashing machine having a washing compartment with a bottom forming a liquid-collecting sump and a liquid supply and a drain communicating with the washing compartment and operable to maintain a maximum liquid level during a washing cycle, in combination,

(*a*) an impeller shaft adapted to be positioned in the washing compartment on a horizontal axis in upwardly spaced relation to the bottom,

(*b*) a motor supported exteriorly of the washing compartment and having a drive shaft with a tubular end portion extending to the interior of the washing compartment in coaxial relation with the impeller shaft,

(*c*) one end of said impeller shaft being sleeved into said tubular end of the motor shaft and removably supported thereby in driven relation thereto,

(*d*) seal means in the washing compartment surrounding said impeller shaft adjacent said end portion and having sealing engagement therewith to retain liquid in the washing compartment from moving along said shaft to the exterior of the washing compartment,

(*e*) a standard in the washing compartment at the end of said impeller shaft remote from said motor,

(*f*) resiliently supported bearing means removably mounted on said standard and sleeved on said other end of the impeller shaft to rotatably and slidably support same, resilient means urging said impeller shaft toward said motor to maintain the driving engagement therewith,

(*g*) an elongate substantially cylindrical housing having end portions rotatably mounted on said impeller shaft adjacent the ends thereof, said housing having a thin-walled shell extending between said end members and secured thereto with an opening extending longitudinally thereof in an upper portion above the liquid level and forming a liquid discharge opening, said housing having a major portion with closely spaced inlet openings therein,

(*h*) a plurality of blade sections on the impeller shaft in the housing and arranged longitudinally thereof, said impeller sections each including substantially radially extending blade portions, said blade sections being arranged whereby marginal portions of adjacent sections overlap with the blades of one section in angular relation to the blades of the next adjacent section and thereby trail in the rotation with peripheral portions of the blade sections moving in close proximity to said shell whereby rotation of the impeller shaft moves the blades through liquid in the lower portion of the housing and discharges said liquid through the discharge opening of the housing, and

(*i*) means operatively connected with said housing for oscillating same whereby the liquid discharged from the housing is directed in a sweeping action through a selected angle above said housing with the blades of the impeller effecting a movement of the liquid in streams progressively moving longitudinally of the housing.

9. A dishwasher as set forth in claim 8 wherein:

(*a*) the bearing means supporting said other end of the impeller shaft is mounted in a resilient sleeve seated on the standard, and

(*b*) clamping means mounted on the standard to clamp the resilient sleeve to retain same thereon.

10. In a dishwasher,

(*a*) a washing compartment adapted for the collection of water in the lower part thereof,

(*b*) an elongated substantially cylindrical housing,

(*c*) means for mounting said housing in said lower part of said compartment with the axis thereof extending horizontally,

(1) said housing being formed with a longitudinal opening in the upper portion thereof above the level of the water collected in said compartment,

(2) the portion of said housing opposite said opening having an area of perforations which are sufficiently small to constitute a liquid filter,

(*d*) an impeller shaft rotatably mounted coaxially in said cylindrical housing,

(*e*) impeller blades fixed on said shaft and extending longitudinally substantially the entire length of said housing,

(1) said blades extending generally radially from

said shaft and terminating in close proximity to the inner surface of said housing,

(*f*) means for rotating said shaft at a relatively high speed to cause said blades to discharge water through said opening in a substantially flat sheet,

(*g*) and means for oscillating said housing about its axis at a relatively slow rate through an angle sufficient to cause said sheet to sweep back and forth across substantially the entire washing compartment and to cause a major portion of said area of perforations to move back and forth from below to above the surface of the water collected in the lower part of said compartment.

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