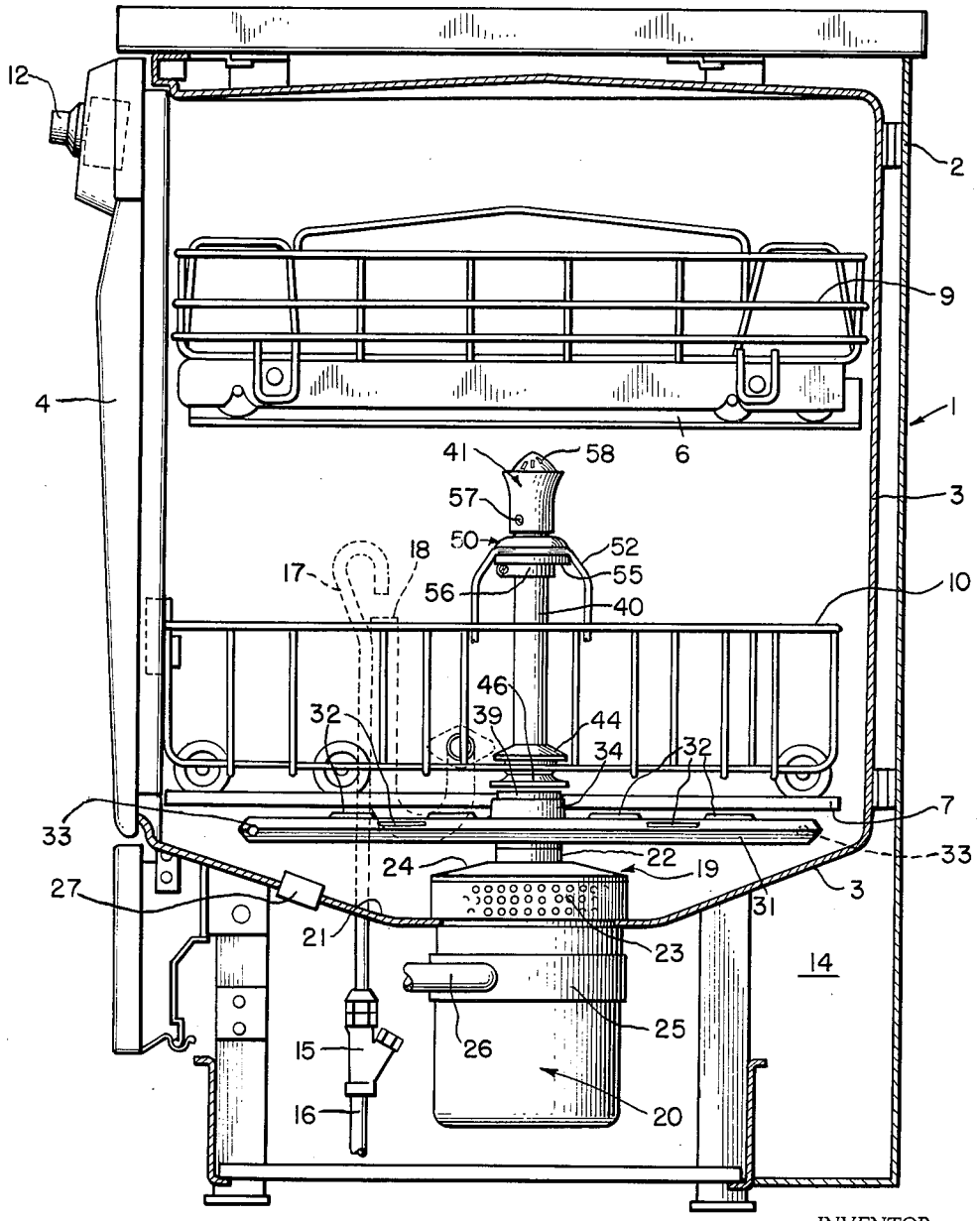
Oct. 26, 1965 L. J. MARTINIAK 3,213,866

DISHWASHING APPARATUS WITH CONICAL SPRAY DEVICE MEANS

Filed Dec. 20, 1963 2 Sheets-Sheet 1

FIG. 1



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DISHWASHING APPARATUS WITH CONICAL SPRAY DEVICE MEANS

Filed Dec. 20, 1963 2 Sheets-Sheet 2

FIG. 4

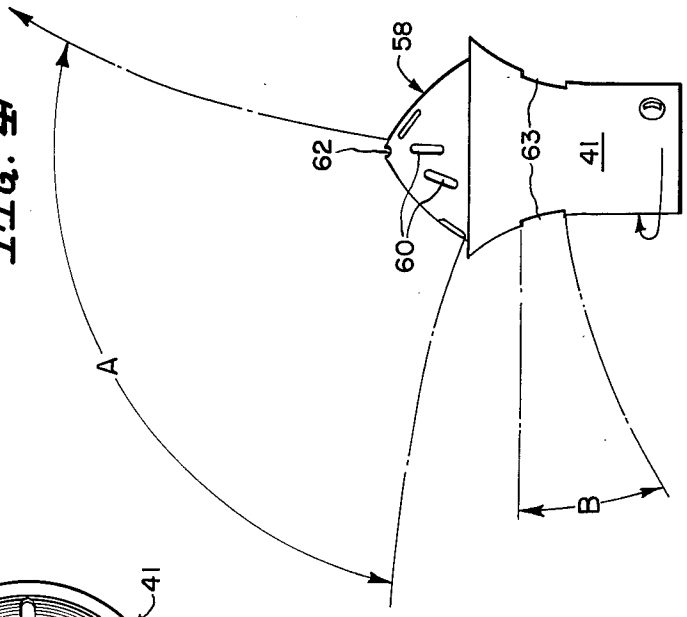


FIG. 3

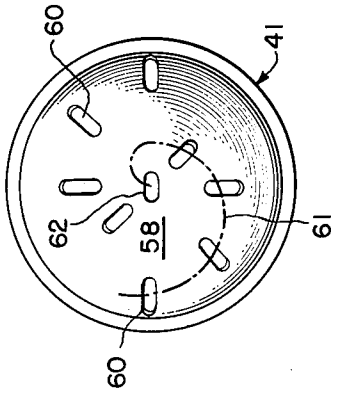
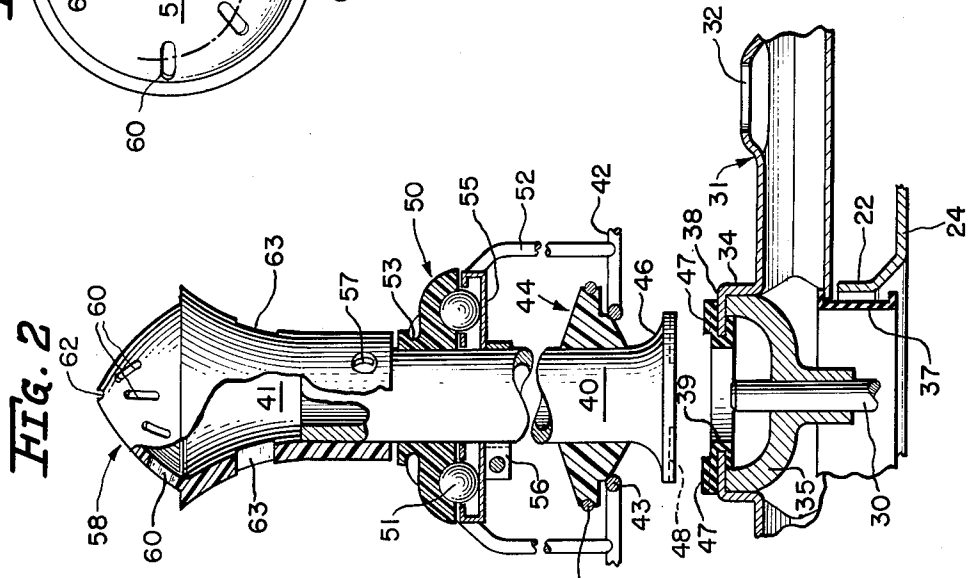


FIG. 2



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DISHWASHING APPARATUS WITH CONICAL SPRAY DEVICE MEANS

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4 Claims. (Cl. 134—112)

This invention relates to dishwashing apparatus, and in particular to dishwashing apparatus having dish receiving racks arranged in vertically spaced relation within a dishwasher tub, and water spray means disposed below the lower rack and intermediate the upper and lower racks.

Dishwashing apparatus embodying the invention herein is generally of the type disclosed in my U.S. Patent 3,064,665, granted November 20, 1962, for "Dishwashing Apparatus," and assigned to my present assignee. Said apparatus provides a lower water distributor which rotates by water jet reaction forces, and an upper water distributor which is coupled to the lower water distributor during the operation thereof. In my former patent the upper water distributor comprises a spray arm extending laterally from an upstanding water conduit which is rotatably mounted in the lower rack, and is rotated by the lower water distributor while receiving water therefrom.

The present trend in dishwashers is to provide racks in which the articles to be washed may be placed according to the whim or desire of the user rather than in the former fixed pattern arrangement. The newer racks take into consideration that the home maker may wish to wash a party load of glassware or cups and saucers, and therefore requires a loading rack which gives freedom for washing such special loads while, nevertheless, being arranged to accommodate the various assortments of small plates and dishes used in ordinary dining. The present invention provides a spray pattern which is equally advantageous for all types of upper rack loading.

It is therefore an object of the present invention to provide a spray device for efficiently directing washing liquids against articles disposed in a dishwasher rack located above said spray device.

It is another object of the present invention to provide a rotary spray device located intermediate upper and lower racks in a dishwasher, said device being of small dimension and devoid of projections or extensions which might damage a fragile article if brought into contact therewith during operation of the dishwasher.

It is a still further object of the invention to provide a rotary spray device located intermediate upper and lower dishwasher racks, said device being of small diameter and arranged so that it cannot stall or be interrupted in its rotation if it comes into contact with an article being washed.

It is another object of the invention to provide a dishwasher spray device which has an improved water distribution pattern.

In a presently preferred embodiment of the invention, the water distribution device comprises an upstanding tubular conduit crowned by structure providing an upwardly and outwardly flaring body portion and a substantially conical cap portion. The conduit is rotatably supported and arranged to be engaged by the lower spray nozzle device of the dishwasher, as said lower device rotates as the result of water issuing therefrom. The coupling which interconnects the lower nozzle device with the conduit rotates the conduit at the speed and direction of the lower spray device, and supplies the conduit with a continuous flow of water at a pressure of the order of 3.5 pounds per square inch (gage). A portion of the water passing upwardly through the conduit discharges outwardly in a substantially horizontally directed path from orifices arranged in the said body portion of the

upper spray head. This discharge is particularly effective against the upper portions of large platters and the like which may be in the lower rack. The remainder is discharged in upward and outward directions through a plurality of slots in the cap portion thereof. The cap slots may be arranged in two series, each series comprising a group of axially directed slots disposed along a spiral which extends from the base of the cap to adjacent the apex. A slot at the apex, which may be said to be common to each of the two series, projects water upwardly in a vertical spiral path. In the preferred embodiment, the slots are so related to the direction of rotation of the cap that as the respective slots each pass a common point within the tub, they discharge from a higher plane. Thus, the patterns of discharge are such that there is a minimum of interference of one discharge with the immediately preceding one. For example, if the slots were arranged so that there were successively lower discharges as the respective slots passed a fixed point, the trajectory of the uppermost discharge would cause it to pass through the discharge from the next lower slot, and much of the discharge force of the stream issuing from the lower slot would be dissipated in the conflict with the immediately preceding issue.

Other features and advantages of the invention will best be understood from the following detailed description of a presently preferred embodiment, read in connection with the accompanying drawings, in which:

FIG. 1 is a side sectional elevation of a dishwasher embodying the present invention;

FIG. 2 is an enlarged fragmentary elevational view, partly in vertical section, showing details of the mounting arrangement for the column supporting the upper spray head;

FIG. 3 is a plan view of the cap portion of the spray head; and

FIG. 4 is a schematic view showing the water pattern issuing from said cap portion.

Referring first to FIG. 1, my invention is illustrated as used in an otherwise conventional domestic dishwasher in which an outer casing **1** includes a suitable structure **2** for the support of the dishwasher tub **3**. The tub and outer structure are constructed to provide registering front wall openings with respect to which the door **4** is hinged at its bottom to be swingable between a normally closed vertical position and a horizontal open position. Suitable gasket means (not shown) are interposed between the door and the periphery of the tub opening to provide for sealing against the escape of water during the operation of the machine.

Suitably mounted on opposite side walls of the tub are upper and lower guide rails, respectively **6** and **7**, which accommodate the upper roller provided rack **9** and the lower roller provided rack **10**. As is well known in the art, the respective racks are constructed to receive in suitable position for washing a varied assortment of dishes, glassware and the like (not shown). According to well known present day constructions, the racks are arranged so that there is no specific pattern or arrangement which must be followed in loading the dishwasher with the articles to be washed; the upper rack particularly is adapted to accommodate loads which may be substantially all glassware or substantially all cups and saucers. It is customary also to provide a silverware basket (not shown), usually removably positioned in a suitable location within the lower rack. When the door **4** is in its horizontal open position each of the racks may be withdrawn through the front wall opening to facilitate the loading of the dishes, whereupon the racks are returned to their illustrated operating position within the tub.

A conventional time cycle control **12** is mounted at a convenient location in the upper portion of the door;

and by conventional and well-known circuitry, is arranged to control the operating mechanism disposed in a machinery compartment **14** below the tub and program said mechanism to provide a desired plurality of washing and rinsing operations, and a final drying operation. The mechanism will include a solenoid valve **15** connected by piping **16** to the hot water supply (not shown) of the building, and supplying water to the interior of the tub **3** by way of the pipe **17** arranged in relation to the side wall inlet fitting **18** to provide the usual one-inch air gap required by plumbing codes. Also, the operating components include a pump **19** arranged to be driven by a reversible electric motor **20** and providing for the circulation of water from the sump portion **21** of the tub through a cylindrical pump discharge neck **22**. Such recirculation system includes a peripheral inlet to the pump, provided with any suitable screening or filter device **23**. The pump **19** is essentially of a centrifugal type, having a shroud or cover **24** which diverts the pump discharge from the usual radial pattern to a vertical flow through the outlet **22**. The pump structure also includes in its lower portion a secondary pump chamber **25** containing a bladed rotor (not shown) which is an efficient pumping mechanism when rotating in one direction, but has substantially no pumping action when rotated in the opposite direction. Accordingly, the discharge pump casing has a valveless discharge conduit **26** which communicates in any known fashion with the waste lines (not shown) of the building plumbing system. Also, the operating mechanism may include any conventional pressure-operated switch **27**, which by well known electrical circuitry, will open the circuit to the solenoid valve **15** to prevent the accumulation of more than a predetermined amount of water within the dishwasher tub. It will be understood, also, that within the door there are arranged suitable means for the introduction of a charge of detergent at each of two separate washing actions, and that the door may also include means for introducing a small amount of a wetting agent into the final rinse water during the operational cycle of the machine immediately preceding the final drying operation. Although the present invention is not restricted to any particular forms of detergent dispenser and wetting agent dispenser these devices may respectively be of the type disclosed in Re-issue Patent 24,198, re-issued August 21, 1956, in which I am a joint inventor with John C. Sharp, and in the Fink et al. Patent 3,098,826, which issued April 17, 1962; both of said patents are assigned to my assignee herein.

Referring to FIG. 2, a pin **30** fixed within the pump housing and coaxial with the pump discharge neck **22** mounts the lower reaction spray device **31**. Said device has diametrically opposed tubular arms each provided with appropriately sized and spaced discharge orifices **32**. The orifices in each spray arm are symmetrically arranged, but at the extremity of each arm there is one or more reaction-jet orifices **33**, said latter orifices being directed so that upon the issuance of water therefrom the spray device **31** is caused to rotate at a relatively rapid rate; for example, 32–40 r.p.m. The tubular hub **34** has a spider **35** supporting the bearing **36** for rotation about the pin **30**. Also, the hub **34** is equipped with a tubular seal **37** for rotation therewith; when the device **31** lifts upwardly on the pin **30**, as subsequently described the seal will come into operative relationship with the smooth interior of the discharge neck **22**. Tub **34** also has an inwardly directed flange **38** fitted with a rubber grommet **39**. It will be observed that the grommet defines an opening which is coaxial with the hub **34**, but of substantially less diameter; whereupon when water discharges upwardly into the hub from the pump **19**, the reaction spray device **31** rises on the pin **30**.

The lower rack **10** is a conventional structure fabricated of welded wire pursuant to prior art practices. Certain of the wire structures are arranged to rotatably support a tubular column providing a conduit which is coaxial with the reaction spray device hub **34** when the rack is in its operating position within the tub. Accordingly, certain wire portions of the rack are formed to receive and support guiding and bearing devices for the column **40** which supports the spray head **41** and supplies water under pressure thereto. The first of the guiding means is essentially a centering device to insure registry of the conduit **40** with the impeller hub and its grommet **39**. One of the wire components **42** of the lower rack **10** is therefore configurated to provide a circular structure **43** which receives a lower conical portion of a diametrically split bearing member **44** which is frictionally held on the conduit **40** by any conventional means such as a split ring **45**. The bearing member **44** is axially adjustable on the conduit **40** and therefore places the open ended bell portion **46** of the conduit in desired vertical spaced relation to the lower spray device **31**. The spacing is important because under the pressure of the water discharging from the pump into the hub **34** of the spray device, the latter rises into engagement until it seats against the end of the conduit **40**. To couple the conduit **40** to the hub **34** so that rotation of the hub effects a concomitant rotation of the conduit, the grommet **39** has ribs **47** which engage with grooves **48** in the bell portion **46** of the conduit. The entire conduit **40** is urged upwardly by the engagement of the hub therewith, whereupon the bearing **44** disengages from the ring structure **43** of the rack. The conduit **40** thereupon becomes rotatably supported by the bearing pin **30** about which the lower spray device rotates and by an upper bearing structure **50**. This latter structure provides a bearing race for the balls **51** which are advantageously formed of nylon or the like. A pair of wire supporting standards, of which the standard **52** is one, rises from the lower rack structure to enter into the circular groove **53** in the upper portion of the bearing structure, it being understood that there are two standards **52** diametrically opposed relative to the bearing structure **50** and that each standard terminates in an arcuate portion which enters the groove **53**. These arcuate portions are not quite semi-circular in extent. A bearing cage **55** is mounted on the conduit **40** by any suitable means such as a clamping strap **56**.

It will be understood that the conduit **40** telescopes into the spray head **41** which is secured thereon by a screw **57**. The spray head may be inserted after the positioning of the respective upper bearing elements.

Looking now at FIGS. 3 and 4, it will be seen that the cap **58** of the spray head **41** is essentially conical, although in fact it is generated by an arc having a radius approximately equal to the inside diameter of the cap. In the present commercial embodiment of the spray head **41** the cap has a wall thickness of the order of .105 inch. The cap is provided with two series of radially oriented slots **60** arranged on a spiral **61** which winds upwardly about the cap **58**. The two series of slots **60** are in diametric opposition. At the apex of the cap is a diametrically extending slot **62**. By way of example and not limitation it is noted that each of the slots **60** is seven sixteenths of an inch long at the inner surface of the cap **58** and one half inch long at the outer face and .100 inch in width, whereupon a fan shaped sheet of water will issue therefrom. The apex slot **62** may be somewhat shorter while being of the same width.

The slots in the cap **58** are for the express purpose of providing water sprays for washing and rinsing the articles in the upper rack. Dishes in the lower rack are washed and rinsed by sheets of water discharged from the various orifices of the lower spray device **31** supplemented by discharge sprays from diametrically opposed slot **63** in the body portion of the spray head **41**; said slots **63** are arranged to project generally horizontal slots of water to wash and rinse upper portions of large platters or the like which may be blanketed by other articles in the lower rack so as not to be wholly subject to the upwardly issuing sprays from the device **31**.

It is not, of course, the fact that each of the issuing sprays from either of the spray devices maintains its own individuality; as the respective devices rotate the several sprays are in a spiral pattern according to the initial directions of issuance. For example, the essentially upwardly directed sprays of the lower device **31** produce spiral patterns which assume an upwardly and outwardly directed contour; the discharge from the orifice **63** spirals about the axis of the conduit **40**; the discharge from the cap **58** has a unique spiral pattern established by the shape of the cap and the spiral distribution of the slots thereon. The total water effort derives from circulation of a nominal tub fill of about 2.5 gallons at the rate of about 45 gallons per minute and at a pump discharge pressure of the order of 3.5 pounds per square inch.

A feature of my invention as respects the arrangement discharge from the cap orifices **60** is that as the respective orifices pass a common point within the tub, each discharge from a higher level than the immediately preceding one. This results from the fact that the spiral line on which the respective orifices of a group are arranged rises in the direction of rotation. Because of the angular spacing between the orifices and the natural trajectory of the streams issuing therefrom, the lower spray is dropping as the next higher spray reaches the point from which the lower spray was ejected. Thus there is a minimum of conflict between the sprays. On the other hand, if the higher spray issued first considered with respect to the rotation of the spray head relative to a fixed point, each succeeding higher spray would drop through the next lower spray and a substantial loss in the kinetric energy of the sprays could occur. It is well known that in dishwashing apparatus much of the soil dislodgement results from the impact of water streams against the soiled ware.

In FIG. 4 the respective spray patterns A and B are typical of those which would issue from each half of the spray head **41** if said spray head could be operated so that a momentary jet would issue in quick succession from each orifice **60** (and **62**) as each orifice came into the vertical plane just vacated by the preceding orifice. The representation is intended to show the cumulative coverage of the several jets. When it is considered that because of the continuous issuance of liquid from the orifices and the continuous rotation of the spray head the respective sprays intermingle, the spray pattern is essentially spherical in which the sphere of water action is outlined by individual fan-shaped jets which follow a spiral pattern. This spray pattern is particularly advantageous with respect to the upper rack because this rack normally accommodates glassware and cups which are arranged in an inverted posture. The upwardly spiraling sprays flush out the interiors of the cups and glasses, and the more laterally directed sprays sweep the exteriors.

The spray head is advantageously formed of a material such as polypropylene, which is impervious to the detergents presently used in dishwashers, and shows substantialy no distortion after being soaked for two hours in a detergent solution held at 280° F. A further advantage of polypropylene derives from the fact that the cap and body portions may be spin-welded, a process in which the parts are positioned in their final positions with respect to each other, and one is rotated at high speed. The heat of friction quickly attains the fusion point, whereupon rotation is stopped and permanent securement of the respective parts occurs.

The design of the spray head insures that it will not damage any dish or fragile article which may come into contact with it during the rotation of the head, and that the spray head cannot be held against rotation by reason of such a contact. The upward and outward flare of the body portion, and the spherical cap contour, offer no projections or surfaces which could be of a potentially damaging nature.

While there has been described what is at present

thought to be a preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications which fall within the true spirit and scope of the invention.

I claim:

1. Dishwashing apparatus comprising, in combination:
an enclosed tub;
upper and lower openwork racks within said tub arranged to support articles to be washed;
a reaction spray device including an open-ended tubular hub portion and spray arms extending radially therefrom,
means for mounting said spray device for rotation about a vertical axis below said lower rack;
means for supplying a quantity of water to said tub;
pumping means for withdrawing water from said tub and discharging it vertically into said hub, said spray arms receiving water therefrom for discharge through a plurality of orifice directed against said lower rack and other orifices providing reaction jets to enforce rotation of said spray device;
an upstanding conduit mounted in said lower rack for rotation about a vertical axis coincident with the axis of rotation of said spray device;
a spray head mounted on the upper end of said conduit intermediate said upper and lower racks, said spray head having a substantially conical cap;
means comprising a plurality of slot-like orifices disposed about said cap along a spiral line extending from the base of said cap to the apex thereof whereupon to direct sprays of water in an upward and outward direction from below said upper rack;
means respectively on said hub and said conduit to provide mechanism whereby said conduit may be mechanically coupled for rotation by said hub while receiving water therefrom during rotation of said lower spray device;
and means for effecting engagement of said mechanical coupling mechanism only during rotation of said lower spray device;
the orifices of said cap member being arranged relative to the direction of rotation so that as each of the orifices of said cap pass a fixed point within said tub, the respective orifices discharge from successively higher levels.

2. Dishwashing apparatus comprising, in combination:
an enclosed tub;
upper and lower openwork racks within said tub arranged to support articles to be washed;
a reaction spray device including an open-ended tubular hub portion and spray arms extending therefrom,
means for mounting said spray device for rotation about a vertical axis below said lower rack;
means for supplying a quantity of water to said tub;
pumping means for withdrawing water from said tub and discharging it vertically into said hub, said spray arms receiving water therefrom for effecting rotation of said spray device while discharging water through a plurality of orifices directed upwardly against said rack;
an upstanding conduit mounted in said lower rack for rotation about a vertical axis coincident with the axis of rotation of said spray device;
an upwardly and outwardly curving circular spray head mounted on the upper end of said conduit intermediate said upper and lower racks, said spray head having a substantially conical cap;
means comprising a plurality of slot-like orifices disposed about said cap along a spiral line extending from the base of said cap to the apex thereof whereupon to direct sprays of water in an upward and outward direction from below said upper rack;
means respectively on said hub and said conduit to

provide a driving and water transmission mechanism whereby said conduit may be mechanically coupled for rotation by said by said hub while receiving water therefrom during rotation of said lower spray device;

means for effecting said mechanical coupling action only during rotation of said lower spray device;

the orifices of said cap being arranged relative to the direction of rotation so that as each of the orifices of said cap pass a fixed point within said hub, the respective orifices discharge from successively higher levels.

3. Dishwashing apparatus comprising, in combination:

(a) an enclosed tub having upper and lower racks both formed to receive articles to be washed;

(b) vertically extending water conduit mounted for rotation about its axis within said tub;

(c) a hollow substantially conical water discharge device fixed to the upper end of said conduit in communication therewith between said racks;

(d) said device and said conduit being formed between said racks as substantially continuous surfaces of revolution without projections, said device having port means arranged to discharge water during rotation of said device upwardly against all parts of the rack thereabove;

(e) the connection of said conduit to said discharge device being formed as a smoothly curved section flaring outwardly from said conduit to the base of said discharge device whereby liquid within said conduit reaches said port means substantially without a change in the direction of flow; and

(f) means beneath said conduit for rotating said conduit and said discharge device;

(g) said discharge device being arranged relative to the direction of rotation so that as each port of the port means pass a fixed point within said tub, the respective ports discharge from successively higher levels.

4. The apparatus defined in claim 3 including a reaction spray device below said lower rack with spray arms extending radially therefrom, said spray device being mounted for rotation about the axis of said conduit and said discharge device, and means for mechanically coupling said reaction spray device to said conduit and said discharge device at least during reception of water by said spray device.

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