ABSTRACT

A dishwasher impeller and spray apparatus having a power-driven impeller and a hollow spray arm mounted in substantially the same plane for relative rotation about an axis. A cavity formed in the spray arm contains the impeller and has thrust members formed therein and extending inwardly toward the impeller to divert water into end portions of the spray arm from a path tangential to the periphery of the impeller. The water flowing along the tangential path impinges on the thrust members and exerts a force thereon causing the spray arm to rotate at a rate controlled by water pressure and an angle between the thrust member and the periphery of the impeller.

6 Claims, 3 Drawing Figures
This invention relates generally to spray apparatus and more particularly to a spray arm and impeller located at the bottom of a dishwasher to force wash and rinse water upwardly against the dishes during wash and rinse operations.

The prior art discloses a variety of types of spray devices that are positioned at the bottom of a dishwasher to direct water upwardly at the dishes stacked overhead. Some of these use rotating nozzles and others use fixed vanes which impart a predetermined angular direction to the water so that it is directed at the stacked dishes for cleaning.

One of the most common types of spray devices used is the simple reaction-type spray arm which has two directly opposed members rotating about a fixed shaft at the bottom of the dishwasher. A pump forces water up into the spray arm and the water is then forced under pressure out of orifices in the arm members. Most commonly, the spray arm has several orifices in the side of each of the two arm members, with the side having orifices on one arm being opposite the side having orifices on the other arm, so that the reaction of the water being expelled through the orifices in the side causes the spray arm to rotate. Alternatively, other prior art devices have employed special apparatus located below the spray arm to force water under pressure through orifices and against specially designed vanes to rotate the spray arm.

The various methods used in the prior art for rotating spray arms have usually had one of two deficiencies, namely excessive height or inefficiency.

In general, the devices that drive the spray arm directly and those using special apparatus such as vanes located above or below the arm have excessive height and result in inefficient use of space and reduced load capacity. In U.S. Pat. No. 3,312,352, issued to T. E. Jenkins, a reaction-type spray device is disclosed having inlets disposed radially outward from, and in substantially the same plane as, an impeller. The disclosed device reduced the height of the spray device thereby increasing the capacity of the wash chamber and fulfilling the objectives of the invention.

The Jenkins patent required the use of a reaction-type spray device and thus suffered from a deficiency common to all reaction-type spray devices namely inefficient use of water.

A substantial amount of water had to be directed either horizontally or in a direction opposite to the desired rotation so as to provide the reaction force to rotate the spray arm. As a result, water would only impact on one side of the dishes resulting in inefficient use of the water and improper washing.

It is, therefore, an object of the present invention to provide an impeller apparatus in a dishwasher which operates to rotate a spray arm without the need for a reaction force to rotate the arm.

Another object of the present invention is to provide a spray arm that can direct water at any desired angle in an upward direction.

It is a further object of the present invention to provide an impeller apparatus for a spray arm that maintains efficient use of the spray water and is capable of being fitted into a compact space.

**SUMMARY OF THE INVENTION**

In order to achieve the above objects the spray apparatus of the present invention has an impeller positioned in a cavity formed in a hollow spray arm such that the arm and the impeller are substantially in the same plane and rotate about the same axis. Thrust members extend radially from a wall of the cavity and have surfaces which divert the water flow into the ends of the spray arm from a path tangential to the impeller. The diverted water exerts a force on the thrust members and causes the spray arm to rotate. As a result jet action is not needed to rotate the arm and all the water can be discharged in an upward direction and at the most advantageous angles.

The impeller is rotated rapidly by an electric motor, thus causing rapid movement of the water around the impeller in the same direction. The force of the moving water against the surfaces on the thrust members causes the spray arm to rotate in the same direction as the impeller, but at a much slower speed. The rotation rate varies in corresponding relationship with the pressure of the water which is controlled by both the impeller rotation rate and the discharge rate of water through the spray arm orifices. The rotation rate is also controlled by the angle formed by the surface of the thrust member and the periphery of the impeller. The greatest flow rate is achieved when the surface is perpendicular to the periphery.

As indicated above, because the impeller is located within the cavity of the spray arm, the design is simple and compact, and because the thrust members respond directly to the force of water from the impeller, special orifices in the side of the spray arm are not needed to rotate the spray arm. Thus, the water may be directed most efficiently without the need for using a portion to provide thrust for the spray arm.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a perspective view showing a dishwasher embodying the spray apparatus of the present invention.

FIG. 2 is an elevational view in section of the spray apparatus of the present invention; and

FIG. 3 is a sectional view taken along the line 3-3 of FIG. 2.

**DETAILED DESCRIPTION OF THE INVENTION**

A perspective view illustrating the placement of the impeller and spray apparatus of the present invention in the bottom of a dishwasher cabinet is shown in FIG. 1. By way of illustration, the dishwasher cabinet 10 contains a rack 11 for the stacking of dishes. The spray device 12 is positioned below the rack 11 at the bottom of the dishwasher cabinet. The drawing in FIG. 1, of course, is greatly simplified for purposes of illustration. In a dishwasher for commercial or home use, more than one rack is generally provided, such as racks for glasses and the like. It will be apparent from the description below that one feature of the spray apparatus of the present invention is that it may be structured with a minimum elevation for most efficient use within the space below the racks.

The spray apparatus of the present invention is shown in more detail in FIGS. 2 and 3. The spray device 12 has a stationary housing 15 with a vertical wall 16 supporting a rotation arm 17. The spray arm 17 is hollow and has end portions 18 and 19 for directing wash and rinse water at the dishes positioned in the overhead racks. For simplicity of illustration, in FIG. 3 the wash or rinse water enters the spray device at chamber 20 through screen inlet 21.

The water in chamber 20 is drawn upward into a cavity 22 by an impeller 32 and is then forced into end portions 18 and 19 through openings 30 and 31 respectively, by action of impeller 32. Impeller 32 is mounted on shaft 33 for rotation in cavity 22 and in the same plane as the openings 30 and 31. Impeller 32 and shaft 33 are rotated by a motor 34 positioned at the bottom end of shaft 33 and below an inner wash chamber 23.

In operation, the blades of the impeller 32 force the water in cavity 22 outward and into the end portions 18 and 19. Each of the end portions 18 and 19 has holes 36 and/or slots 37, which direct the water forced through these openings by the pressure from impeller 32, upward against the dishes stacked in the rack 11.

As indicated above, the spray arm 17 is mounted rotatably on wall 16 of housing 15. In conventional apparatus, the end portions 18 and 19 have spray openings at the back side thereof for permitting water to escape outward and causing the spray arm to rotate as a result of the jet action of the water. In accordance with the present invention, thrust members 40 and 41 are formed in the side wall of cavity 22 surrounding impeller 32. Members 40 and 41 have surfaces 42 and 43, etc.

The invention has been described in detail with particular reference to preferred embodiments thereof. It will be understood that numerous variations and modifications can be made without departing from the spirit and scope of the invention.
respectively, on which the water, forced by the impeller, impinges and which diverts the water into end portions 18 and 19 from a path tangential to the periphery of the impeller. As a result of this impingement and diversion a force is exerted on surfaces 42 and 43 which causes the spray arm 17 to rotate.

In FIG. 2, for example, the impeller 32 rotates in a counterclockwise direction. The rotation of the impeller 32 at a relatively high speed forces the water outwardly and into end portions 18 and 19. As a result of the action of the impeller, some of the water in cavity 22 is forced against surfaces 42 and 43 and is diverted into the end portions. This diversion of the water by the surfaces 42 and 43 causes the spray arm to rotate in the same direction as impeller 32, but at a much slower rate.

The angle at which surfaces 42 and 43 intersect the flow of the water from the impeller can be changed to maximize the thrust imparted by the water to the spray arm. Maximum spray arm rotation rate is achieved when the surfaces 42 and 43 are perpendicular to the periphery of the impeller.

Without thrust members 40 and 41 the spray arm will rotate but at a slower rate and without the control provided by the angle of surfaces 42 and 43. Water flowing along a tangential path will strike the walls of end portions 18 and 19 causing spray arm 17 to rotate. The angle at which the water strikes the walls is fixed and therefore does not allow for control of rotation rate unless a thrust member is added.

It may be observed that the end portion 18 and 19 as shown in FIG. 3 are offset from the centerline crossing through the shaft 33. This offsetting of the end portions prevents the pressure in one arm from affecting the pressure in the opposing arm. Thus, in the complete washer, if it is desirable to have one arm with higher pressure or shorter length to direct water to special areas for washing of the dishes, it is possible to do so without substantially affecting the pressure in the opposing arm.

It may be noted, as shown in FIG. 2, that the end portions are tilted slightly upward from the horizontal in order to direct the water most efficiently against the dishes stacked overhead. This tilting of the arms, however, is arbitrary and does not affect the operation of the spray device in accordance with the present invention. Notwithstanding the slight angle of the end portions, the spray arm and the cavity is maintained in substantially the same plane as the impeller 32 and, therefore, compact design of the spray unit is achieved.

Spray arm 17 may be comprised of three separate members without diverting from the teachings of this invention. The spray arm may comprise a housing portion containing the cavity and two extending arms forming the end portions.

It may be observed from the above description, that the present impeller and spray apparatus are not dependent upon the jet action of the water being forced out of orifices for rotation, so that the water may be directed most efficiently at the dishes stacked in the racks overhead. In addition, since the impeller imparts thrust to members 40 and 41 directly surrounding the impeller, and since the spray arm 17 is substantially in the same plane as the impeller, the unit may be positioned in a compact space, with a minimum of height, at the bottom of a dishwasher cabinet for the most efficient use of the space available.

What is claimed is:
1. In a spray apparatus, the combination comprising: a power-driven impeller rotating about a predetermined axis; a spray arm mounted for rotation about said impeller and in substantially the same plane as said impeller; and a surface in said arm positioned for diverting the flow of liquid moved by said impeller to thereby cause said arm to rotate.
2. In a spray apparatus, the combination comprising: a power-driven impeller rotating about a predetermined axis; and a spray arm mounted for rotating about said axis in substantially the same plane as said impeller, a portion of said arm having a surface positioned for diverting the flow of liquid moved by said impeller to thereby cause said arm to rotate.
3. Spray apparatus for a dishwasher comprising: a power-driven shaft; a housing positioned for rotation about said shaft; means for supplying water to said housing; an arm member extending from said housing and having an opening to permit water to enter from said housing; an impeller attached to said shaft and rotating in said housing in the same plane as the opening of said arm member for forcing water from said housing into said arm member; and a thrust member in said housing adjacent to the opening for said arm member, said thrust member having a surface extending inward from said housing toward said impeller for changing the direction of flow of water moved by said impeller so that said housing and arm member are caused to rotate about said impeller and shaft.
4. Spray apparatus for a dishwasher, comprising: a power-driven shaft; a housing positioned for rotation about said shaft; means for supplying water to said housing; first and second arm members extending from said housing, each arm member having an opening to permit water to enter from said housing; said first arm member extending in a direction opposite that of said second arm member, said arm member being offset from a line intersecting the axis of said shaft and parallel to said members; an impeller attached to said shaft and rotating in said housing in the same plane as the openings of said arm members for forcing water from said housing into said arm members; and a thrust member attached to said housing between the openings for said arm members, said thrust member having a surface extending inward from said housing toward said impeller for changing the direction of flow of water moved by said impeller so that said housing and arm members are caused to rotate in the same direction as the rotation of said impeller and shaft.
5. Spray apparatus for a dishwasher, comprising: a shaft mounted for rotation about an axis; means for rotating said shaft; an impeller attached to said shaft; a spray member, mounted for rotation about the axis, having a cavity formed therein and a hollow portion extending from the cavity, the impeller being positioned within the cavity and in substantially the same plane as the hollow portion; and a thrust member positioned in said cavity and having a surface to divert liquid flow from the impeller into the hollow portion, whereby the diverted liquid exerts a force on the surface causing rotation of the spray member about the axis.
6. Spray apparatus as described in claim 5, additionally comprising: a plurality of hollow portions extending from the cavity; and a plurality of thrust members associated with the hollow portions.