

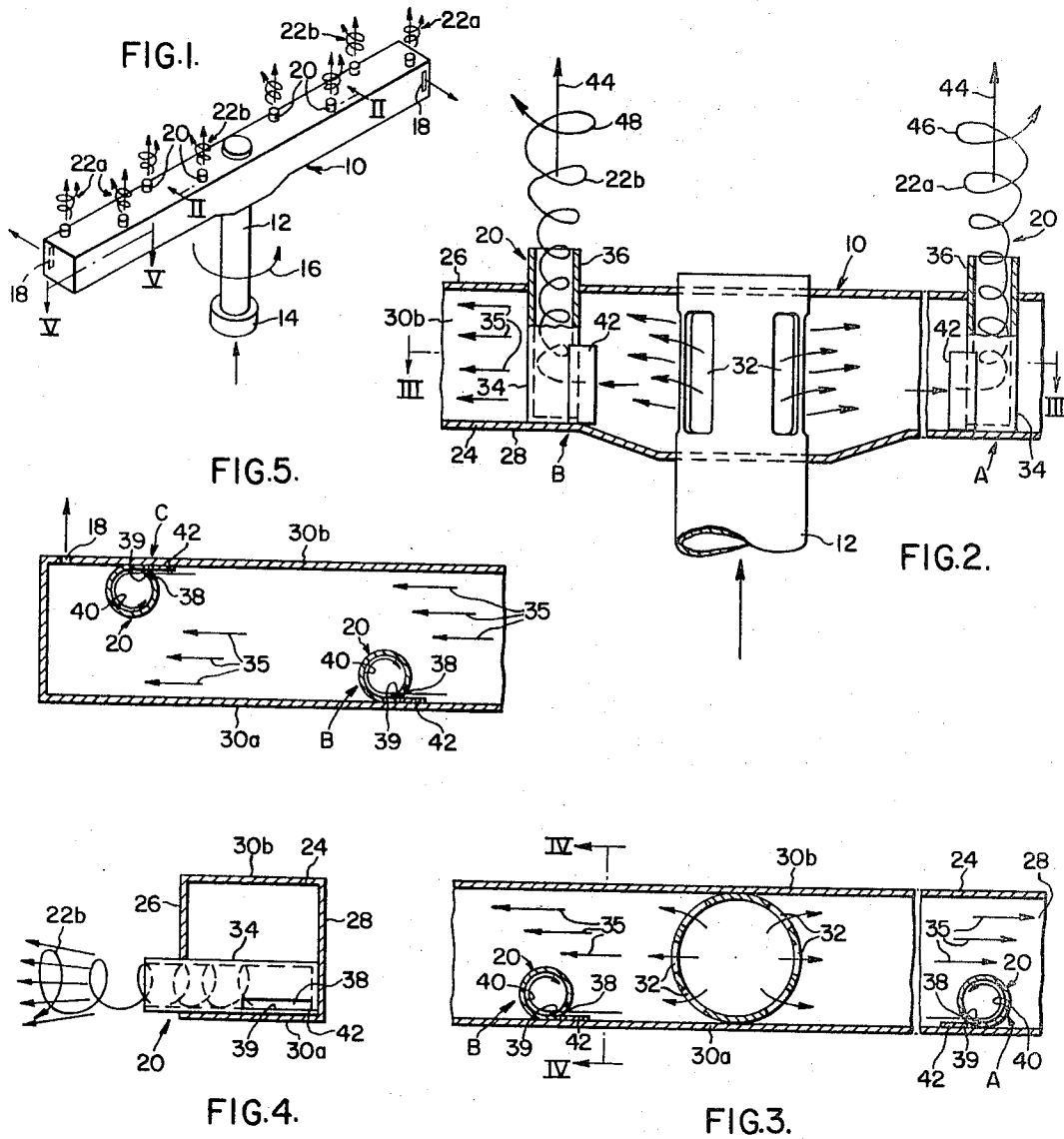
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VORTEX JET FOR DISHWASHERS

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WITNESSES

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VORTEX JET FOR DISHWASHERS

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This invention relates to vortex jets wherein a spray of fluid is given angular momentum as well as linear momentum, and more particularly to vortex jets of the type described, for use in obtaining a more vigorous cleaning action in automatic dishwashers.

As is known, many automatic dishwashers employ a pressurized-water spraying system to create a washing action for cleaning articles such as dishes, glasses and the like. A pressurized-water spraying system may comprise, for example, a spraying device having a plurality of jets which provide sprays of water for cleaning the articles. In the usual case, the jets are simply orifices, and the kinetic energy of the water spray issuing therefrom is entirely in the form of linear momentum.

To obtain a more vigorous washing action, the kinetic energy of the water may be increased by increasing the water pressure. However, one of the inherent problems of this type of pressurized-water system is that the kinetic energy of the water spray is limited by the weight of the article being cleaned or by the amount of movement permitted the article. That is, for a given article, there is a limit to the amount of kinetic energy which can be imparted to a water spray for the purpose of cleaning the article.

Accordingly, as an overall object, the present invention seeks to provide means by which the kinetic energy imparted to a cleaning fluid may be increased so as to obtain a more vigorous cleaning action, without increasing the linear reaction of the fluid spray on the articles.

Another object of the invention is to provide a vortex jet wherein the cleaning fluid is given angular motion as well as linear motion so that a more vigorous and efficient cleaning action is achieved.

A further object of the invention is to provide an improved jet whereby a better distribution of the cleaning fluid over the articles being cleaned is achieved.

A still further object of the invention is to provide an improved jet affording better angular impingement of the fluid spray on the articles, thereby increasing the efficiency of the cleaning action.

In accordance with the invention, a vortex jet is provided which allows the kinetic energy of the cleaning fluid to be increased without increasing the linear reaction of the fluid spray on the articles being cleaned. That is to say, even though the article is being impinged by a fluid spray having a greater kinetic energy, the linear momentum of the fluid spray is substantially the same and, hence, the linear reaction of the spray on the article also is substantially the same.

The increased energy is accomplished by converting a part of the linear kinetic energy of the fluid spray into angular kinetic energy, i.e., the fluid flowing through the vortex jet is given angular movement as well as linear movement. A fluid spray having angular movement is considerably more efficient for cleaning than a fluid spray having only linear movement since a better angle of impingement of the fluid spray on the article is achieved. Therefore, a fluid spray having both angular movement and linear movement is even more efficient.

Although part of the angular momentum or angular kinetic energy of the fluid spray will be transferred to the article, i.e., momentum transfer due to viscosity and momentum transfer due to the cleaning action, the angular momentum transfer is considerably less than the linear

momentum transfer. Hence, the total reaction of the fluid spray on the article is substantially the same as a fluid spray having only linear momentum.

The above and other objects and advantages of the present invention will become apparent from the following detailed description by reference to the accompanying drawings, in which:

FIGURE 1 is an isometric view of a fluid distributing arm provided with the vortex jets of the present invention;

FIG. 2 is a cross-sectional view taken along the line II-II of FIG. 1;

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

FIG. 4 is a cross-sectional view taken along the line IV-IV of FIG. 3; and

FIG. 5 is a cross-sectional view taken along the line V-V of FIG. 1.

Referring now to FIG. 1, there is illustrated one form of a sprayer device comprising a fluid distributing arm 10 mounted at the upper end of a support conduit 12 which, in turn, is rotatably supported by a bearing element 14 for rotation about a vertical axis, for example, in the direction indicated by the arrow 16. As is conventional, slots 18 may be provided in the opposite ends of the fluid distributing arm 10 which produce sprays of the cleaning fluid for rotating the fluid distributing arm 10.

Distributed along the upper face of the fluid distributing arm 10 is a plurality of vortex jets 20 providing a plurality of fluid sprays 22a, 22b. The difference between the fluid sprays 22a, 22b is that the fluid sprays 22a swirl in a counterclockwise direction whereas the fluid sprays 22b swirl in a clockwise direction. As will be described, the vortex jets 20 give the fluid sprays their swirling motions while the position of the vortex jet 20 with respect to the flow path of the cleaning fluid through the distributing arm 10 determines the direction in which the fluid sprays swirl.

Referring now to FIGS. 2-4, the distributing arm 10 preferably comprises a square conduit 24 having top and bottom walls 26, 28 and side walls 30, 30a, 30b. The upper end of the support conduit 12 is positioned at the center of the square conduit 24 and is provided with a plurality of openings 32 which communicate the cleaning fluid into the interior of the square conduit 24. The cleaning fluid flows axially through the square conduit 24 toward either end whereby a major portion of the cleaning fluid will be sprayed out through the vortex nozzles 20 and a minor portion of the cleaning fluid will be sprayed out through the slots 18 to provide propulsion for rotating the distributing arm 10.

As can best be seen in FIGS. 2 and 4, the vortex nozzle 20 preferably comprises a guide channel or tubular segment having a closed end portion 34 residing within the square conduit 24 and an open end portion 36 projecting upwardly of the top wall 26. Each of the vortex nozzles 20 extends transversely of the flow of the cleaning fluid indicated by the arrows 35 and preferably is secured to one of the side walls 30a, 30b. An elongated slot 38 is provided in the closed end of each of the vortex jets 20. The slot 38 extends parallel to the longitudinal axis of the vortex jet 20 and has a long edge 39 extending parallel to the side wall 30a and tangent to the inner wall 40 of the vortex jet 20. The elongated slot 38 comprises a tangential orifice means which introduces the cleaning fluid tangentially of the interior of the vortex jet 20 whereby the cleaning fluid is given angular momentum, that is, a swirling motion. The cleaning fluid also has linear momentum due to its flow axially through the vortex jet 20.

A plate segment 42 is secured to the side wall 30a and in abutment with the long edge 39 of the elongated slot 38. The plate segment 42 comprises means for directing

the cleaning fluid into the elongated slot 38. As should be apparent, the plate segment 42 provides for a smooth flow of the cleaning fluid into the elongated slot 38 and prevents the undesirable turbulence which would occur at the entrance of the slot 38 in the absence of the plate segment 42.

As stated above, the position of the vortex jet 20 with respect to the flow of cleaning fluid through the square conduit 24 determines the direction in which the cleaning fluid will swirl through the vortex jets 20. Referring now to FIGS. 2 and 3, two of the vortex jets 20 are illustrated whose positions are indicated by the letters A, B. Both of the vortex jets 20 are engaged with the same side wall 30a of the square conduit 24.

The vortex jet 20 at position A, receives the cleaning fluid through its left side, as viewed in FIGS. 2 and 3, and therefore will impart a counterclockwise rotation to the cleaning fluid flowing axially therethrough. Thus, the fluid spray 22a will have linear momentum indicated by the arrow 44 and angular momentum indicated by the helical arrow 46 which, of course, swirls in a counterclockwise direction.

On the other hand, the vortex jet 20 at position B, receives the cleaning fluid through its right side, as viewed in FIGS. 2 and 3, and therefore will impart clockwise rotation to the cleaning fluid flowing axially therethrough. Thus, the fluid spray 22b will have linear momentum indicated by the arrow 44 and angular momentum indicated by the helical arrow 48 which, of course, swirls in a clockwise direction.

Referring to FIG. 5, two of the vortex jets 20 are illustrated whose positions are indicated by the letters B, C. The vortex jet 20 at position B is secured to the side wall 30a and produces a fluid spray which swirls in a clockwise direction as described above. The vortex jet 20 at position C, however, is secured to the opposite side wall 30b and the slot 38 is positioned so as to impart counterclockwise swirling motion to the cleaning fluid. Again, the relative positions of the vortex jets 20 with respect to the side walls 30a, 30b of the arm 10 determines the direction in which the cleaning fluid will swirl.

In accordance with the present invention, then, a sprayer device is provided having a plurality of fluid sprays some of which swirl in a clockwise direction and some of which swirl in a counterclockwise direction. Since all of the fluid sprays have linear momentum and angular momentum, the cleaning efficiency of the fluid sprays is greater than the cleaning action of fluid sprays provided by conventional orifices wherein the fluid sprays have only linear momentum.

In the case of the distributing arm 10, however, a plurality of fluid sprays 22a is provided which swirl in a counterclockwise direction and a plurality of fluid sprays 22b is provided which swirl in a clockwise direction. The cleaning efficiency of the sprays 22a, 22b is increased further since the distributing arm 10 also is rotated. The end result is the provision of rotated, swirling fluid sprays having a greater cleaning efficiency and which

are more uniformly distributed over the articles being cleaned.

Although the invention has been illustrated in connection with one specific embodiment, it will be apparent to those skilled in the art that various changes in form and arrangement of parts may be made to suit requirements without departing from the spirit and scope of the invention.

I claim as my invention:

1. In a domestic dishwasher, a water spray arm comprising:
 - a conduit through which water is forced longitudinally; a plurality of jet outlets spaced apart from each other along the length of said conduit;
 - each of said outlets comprising a cylindrical tube of substantially uniform cross-section from end-to-end, each said tube having one fully open end and an opposite closed end, and being positioned transversely of the flow of said water through said conduit with the major portion of said tube with said closed end disposed within said conduit, said major portion including a single tangential inlet open in an upstream direction, relative to the direction of flow of said water in said conduit, to admit said water into said tube to impart a component of angular momentum to said water as it passes through said tube to said open end thereof, said conduit having a generally rectangular cross-section and each said tangential inlet comprises an elongated slot disposed closely adjacent the side wall of said conduit so that the water is directed into said inlet by said side wall.
2. In a dishwasher according to claim 1 including:
 - guide means comprising a plate extending parallel to the direction of flow of said water in said conduit and disposed adjacent said elongated slot to direct said water into said slot.
3. In a dishwasher according to claim 1:
 - said tubes are located along both sidewalls of said conduit with each elongated slot being adjacent the respective conduit sidewall so that counterclockwise swirling motion is imparted to the water entering said tubes along one sidewall, and clockwise swirling motion is imparted to the water entering said tubes along the other sidewall.

References Cited

UNITED STATES PATENTS

850,216	4/1907	Dornfeld	239—492
1,485,796	3/1924	Merseles et al.	239—251
1,813,807	7/1931	Kettering et al.	239—246
2,409,371	10/1946	Mart	239—490
2,568,240	9/1951	Mart	239—463
2,778,680	1/1957	Bonser	239—521

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