

Aug. 26, 1947.

V. R. ABRAMS
DISHWASHING MACHINE
Filed Nov. 7, 1940

2,426,291

2 Sheets-Sheet 1

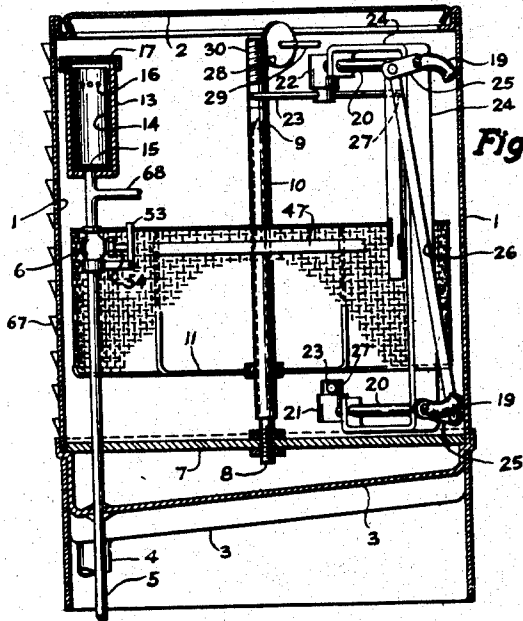


Fig. 1

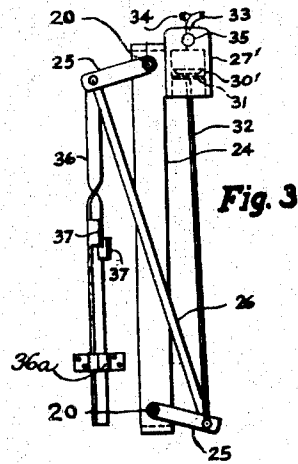


Fig. 3

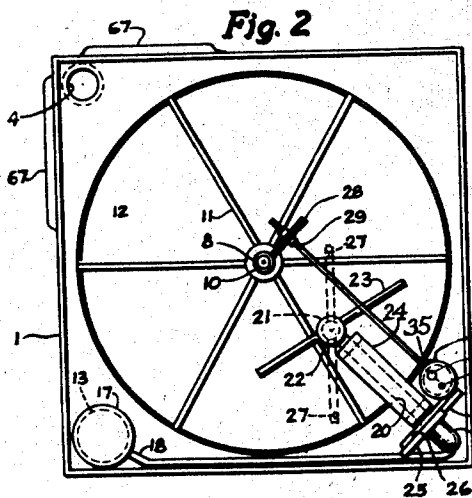


Fig. 2

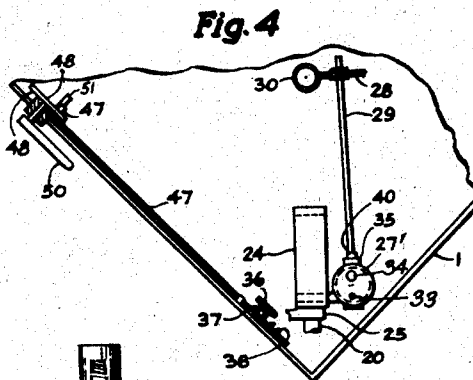


Fig. 4

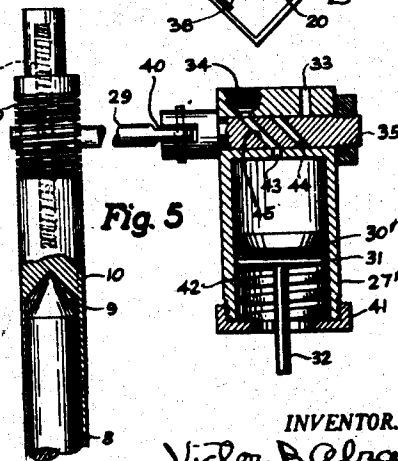


Fig. 5

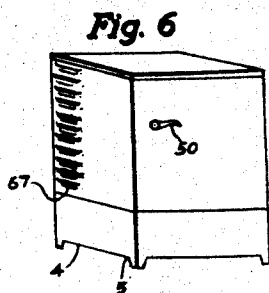


Fig. 6

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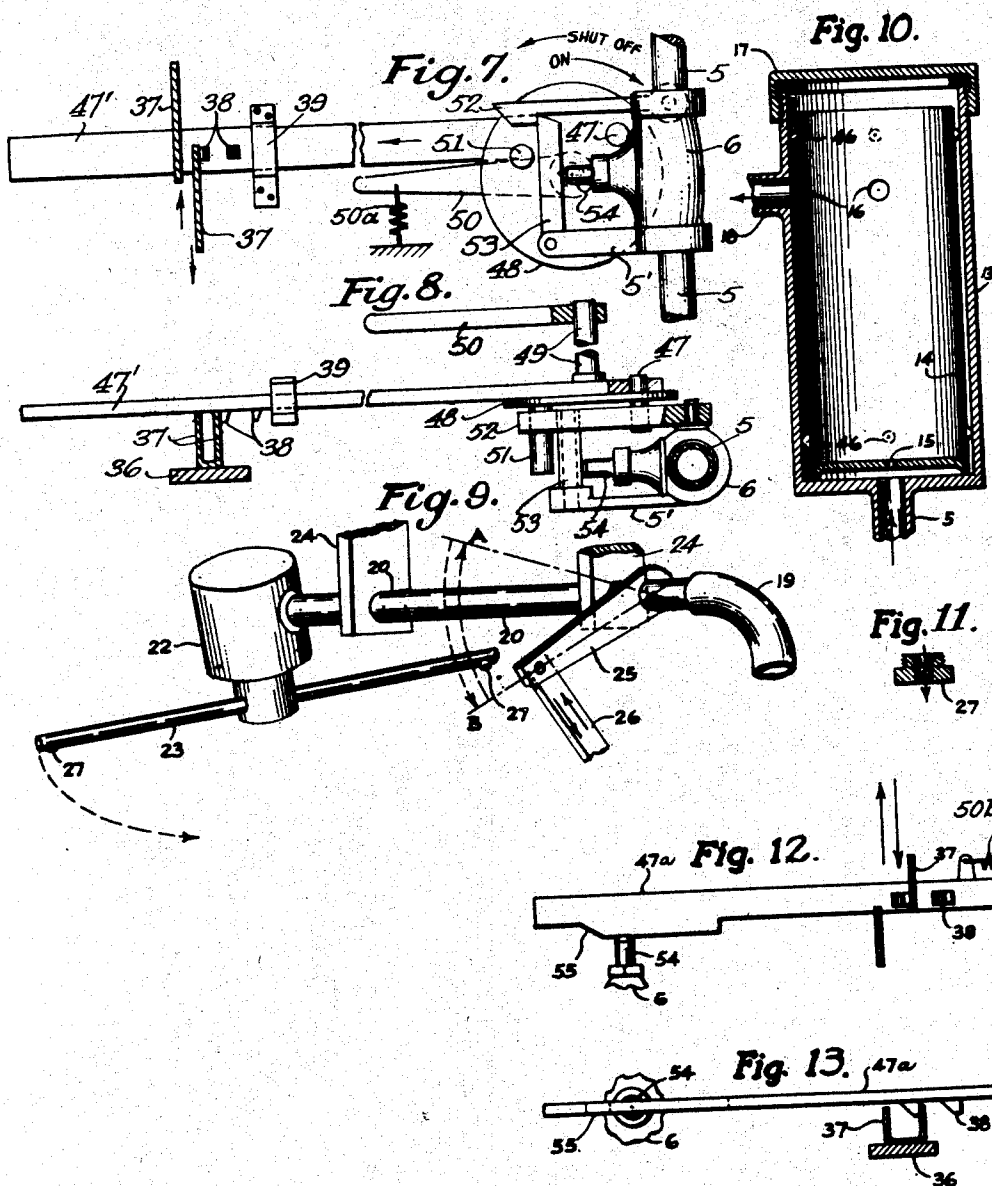
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2 Sheets-Sheet 2



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2,426,291

DISHWASHING MACHINE

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Application November 7, 1940, Serial No. 364,614

8 Claims. (Cl. 134-138)

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My invention relates to dish washing machines in which water or aqueous solutions are impinged on the articles to be cleaned by means of rotating nozzles revolving in planetary motion relative to the dishes.

The principal object of this invention is to provide simple and inexpensive devices which wash dishes clean by utilizing service or house water pressure.

Another object of this invention is to provide dish washing machines which are economical in the consumption of water and detergent.

A further object of this invention is to provide machines which, when started by the operator, will wash quickly, rinse, shut off, dry, and store dishes with no further operator attention.

A still further object is to provide dish washing machines which can be built and installed inexpensively, which are rugged and durable, and which are not subject to the electrical hazards and failures introduced by the association of water, grounded water pipes, and an electrical power supply.

The invention in its most general aspects includes a tank or container to confine spray and act as a drain basin to discharge waste liquid. This tank contains and supports a suitable basket and racks for dishes which are cleaned by the action of liquid jets issuing from rotary nozzles.

(By rotation of nozzles is meant a rotation about an internal axis similar to the rotation of the earth on its own axis, and by revolution of nozzles is meant a revolution about an external axis similar to the revolution of the earth about the sun. By planetary motion is meant a combination of these motions. Relative planetary motion may be achieved by planetary motion of the nozzles in relation to stationary dishes or by revolving the dishes under rotating nozzles or by combining these effects.) The dishes are arranged in a basket free to turn about a vertical shaft and are driven by the water impact from the rotary jets, which are set to deliver water with a velocity component in the direction of dish rotation. At intervals of time, the jets are turned through an angle which reverses the velocity component. This acts to retard and finally to reverse the direction of turn of the dish basket. Other aspects of the invention include devices for effecting this change of direction, for metering detergent to control both concentration of solution and duration of application, means to begin the cycle and effect automatic termination of operations at the proper time and means for automatically drying dishes after shut down.

For a better understanding of the present invention, reference may be had to the accompanying drawings, in which similar numbers are used

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to designate similar parts throughout the several figures.

Figure 1 illustrates a vertical section of a preferred form of the invention.

Figure 2 is a plan view of Figure 1 with the cover removed.

Figure 3 shows in elevation part of the nozzle reversing mechanism.

Figure 4 is a detail plan view partly in section and shows positioning of a part of the automatic cut-off mechanism.

Figure 5 is a detail vertical section of the reversing mechanism in greater detail.

Figure 6 is a perspective view of the tank or cabinet.

Figure 7 is a detail elevation partly in section of one form of control valve and cut-off mechanism.

Figure 8 is a plan section of the same.

Figure 9 shows in perspective a rotary nozzle and means for its inclination.

Figure 10 is a section of the detergent metering, mixing and control device.

Figure 11 is a detail section of the nozzle tip or jet orifice.

Figure 12 is view in elevation and partly in section of another form of control and shut off device.

Figure 13 is a plan view of Figure 12, partly in section.

In the form of the invention disclosed in Figures 1 and 2 and further illustrated in greater detail in Figures 3 to 13:

Numeral 1 indicates the walls of a tank of which parts 2 and 3 are the top and bottom. Numeral 3 constitutes a basin open to waste by means of drain pipe 4. Pointed vertical shaft 8 (Figure 5) is supported at the center of the tank by a spider or member 7, and forms a pivot bearing 9 to carry a free turning sleeve 10. Sleeve 10 carries dish basket and racks 11 and 12. The tank also supports by suitable brackets (not shown), bent chassis member 24 which is bored to provide free turning bearings for two horizontal tubular shafts 20 in the upper and lower ends thereof as appears in Fig. 1. To corresponding ends of shafts 20 (Figure 9), are attached bodies 21 and 22, respectively, to which are attached arms 23 and jets 27 of rotary nozzles. The other end of each shaft 20 carries a lever 25 and terminates in a rotatably flexible connection or flexible tube 19.

Member 24 also supports a power cylinder 27 (Figures 2, 3, 4 and 5), which is fitted with piston 31, piston rod 32, piston seal 30, and valve 35. When valve 35 is rotated, ports 44 and 45 therein are successively brought in communication with ports 33, 34, and 43 in cylinder 27. If port 34 communicates with an adequate pressure source

and port 33 with the atmosphere, then the piston will successively be moved outwardly by pressure and returned inwardly by spring 42. The cap 41 functions as a spring retainer and stop.

The upper end of sleeve 10 is formed as a worm 30 which drives a worm wheel 28 (Figures 1, 2, 4, and 5). These are maintained in mesh by means of any suitable bracket and bearings (not shown) supported on the sleeve 10. When dish basket 11, 12 revolves with sleeve 10, worm wheel 28 is driven and by means of shaft 29 drives valve 35 through flexible connection 40. By this means piston 31 and rod 32 will respond to, and are caused to move by, a predetermined number of revolutions of basket 11, 12. Piston rod 32 is attached to and drives bottom link 25 and hence top link 25 to which it is joined by a connecting link 26. Consequently, both shafts 20 are rotated alternately clockwise and anti-clockwise, and simultaneously in opposite directions relative to each other, when piston 31 moves upwardly and then downwardly, alternately.

Tank 1 also supports by suitable brackets (not shown) meter-device 13 which mixes cleansing agent (usually an alkaline or saponaceous soluble powder) with the water for cleansing (Figures 1, 2, and 11). This metering device consists of a cylinder 13 with a fixed bottom and a removable top 17, capable of making it liquid tight. It has an inlet 5 at the bottom and an outlet 18 on the side. Within cylinder 13 is a concentric cylinder 14 of smaller dimensions which is maintained in central position by spacing lugs 46. Cylinder 14 is free to move axially or may be fixed with clearance at the bottom. Cylinder 14 has no top closure, but is pierced at its bottom center by small orifice 15, and on its sides by one or more holes 16. Cleansing agent is introduced into cylinder 14 and cover of cylinder 13 is sealed. Water enters at 5 and impacts against orifice 15 through which a small portion passes; the remainder of the water passes around the bottom edge of 14 along the annular chamber formed between cylinders 13 and 14 and out through pipe 18. That portion of water which enters cylinder 14 forms a concentrated solution of cleansing agent and passes out of holes 16 to be mixed with the by-passed water entering pipe 18. The relative volumes of water passing through and by-passing cylinder 14 are dependent on the impact or Pitot action at orifice 15, the coefficient of discharge at 15, considered as an orifice, and the differential pressure drop across the system. These factors operate to produce a straight line relation between these relative volumes. In other words when the total water flowing through cylinder 13 varies, the proportion of the total flowing through and around cylinder 14, remains approximately constant. By this means an approximately constant proportion of concentrated solution is mixed with pure water at 18, and if the solution be saturated or reasonably constant in strength in 14, then, an approximately uniform concentration of solution is produced at, and delivered by 18. The action of this device is similar to, and comparable with, a gasoline carburetor.

Also supported on tank 1 and cooperating with piston rod 32 by means of links 25 and a link 36 slidable freely in a guide 36a and suspended from the upper link 25, is cut-off mechanism shown in detail in Figures 7 and 8 and also in Figures 3 and 4. This mechanism consists of a valve 6 which opens when valve stem 54 is depressed into the valve body. Carried on a bracket

5' fixed to pipe 5 is a vertical link 53 which may be locked by a latch 52 pivotally mounted on the valve body. A disc 48 is operated through a shaft 49 by a lever or handle 50. This handle 50 is spring pressed in one direction by tension spring 50a toward closing valve 6. The disc 48 is fitted with pins 47 and 51. A link 47' slidably received in a guide bracket 39 is rotatably mounted on pin 47 and extends horizontally across the link 36, which is supported at its upper end by means of a hinge pin or lever 25, as appears in Fig. 3. Link 36 carries two horizontally spaced and vertically staggered flat members 37 whose surfaces engage the tapered stop pins 38 carried by the link 47'. These flat members and the stop pins constitute an escapement. When valve is in off position pin 47 will be supporting the latch 52 out of engagement with link 53. Both pins 38 will be to the left of 37. When handle 50 and disc 48 are rotated in a counter clockwise direction, against spring action urging the link 47' to the right (spring not shown), pin 51 pushes link 53 and stem 54 to the right and link 52 restrains link 53. At the same time link 47' travels to the right, and pins 38 (because of spring or "give" in the mechanism) are allowed to slide by members 37 and are held in position by one of them abutting its flat side against a flat member surface. The spring or "give" in the mechanism mentioned above refers to the inherent elasticity of links 47' and 36, which are of light section, and their mountings. When pins 38, which have an inclined face, as shown in Fig. 8, are moved relative to link 37, they cause links 47' and 36 to be sprung apart to allow the pins 38 to pass over the edges of the flat members 37, due to this elasticity, in a manner comparable to a ratchet. When link 36 is driven up and down by piston rod 32, the pins 38 are released and 47' travels to the left at each up and down movement of 36 and 37. When pins 38 are clear of members 37, spring action revolves disc 48 counter-clockwise, pin 47 depresses latch 52, releasing link 53 which permits valve stem 54 to move outwardly and close valve. The valve stem may be entirely actuated by fluid pressure acting as on a plunger or the closing action may be supplemented by a spring.

Figures 12 and 13 show another form which the shut-off mechanism may take. Shut off valve 6 is operated as before by valve stem 54. Link 47a is shaped to form cam surface 55. Link 47a is spring pressed in one direction by tension spring 50b toward closing valve 6. When link 47a moves to left, stem 54 is depressed by cam face and valve is opened. Action of link 36, members 37, and pins 38 are as previously described. When pins 38 are released by members 37, link 47a moves to right by spring action, and valve stem rises to close valve. The manual control of link 47a for opening valve may be done in any suitable way.

To operate this invention, as a dishwasher, dishes and the like are arranged in basket 12 and positioned in suitable racks or supports. Into cylinder 14 is put a requisite supply of cleansing powder, and the chamber 13 is closed. Valve lever 50 is revolved to open valve 6, which by means of pipe 5, connected to a supply of hot water under pressure, permits water to flow into chamber 13 and tube 68. Chamber 13 charges the water which flows through it with cleansing solution which passes through tube 18 and flexible connections 19 through tubular shafts 20 and thence is discharged at jets 27 and causes nozzles to rotate by reaction. Tube 68 connects with a port to valve

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35 at 34 (Figure 5). Depending on the position of valve 35, piston 31 will be at either the top or bottom of cylinder 27' and consequently, rotary nozzles (Figure 9) will be in either the A or B position. In either one of these positions, the axis of hyperboloids of revolution, which represent the loci of the issuing streams, will form an angle with a plane passed through the axis of basket revolution and the center about which the nozzles rotate. Consequently, the issuing streams will have a component of motion across the radii of the basket and will exert force by impact to cause it to revolve. The basket revolves in one direction under and above the whirling jets until valve 35 makes an approximate half revolution. Then the piston 31 makes a stroke, the nozzles turn about shafts 20, the jets reverse their direction of discharge, and the basket is gradually brought to rest and begins to revolve in the other direction.

This reversing action is essential to wash dishes clean, because dishes have two sides. The reversal of the discharge of the jets permits both sides to be subject to direct water action. The slowing action of the basket and its subsequent speeding up in the opposite direction also introduces a cleansing action. Every position of the jets with respect to the basket between minimum and maximum speed of rotation of the basket involves a different relative velocity and angle of attack so that by reversal of discharge under the conditions outlined water streams are induced to strike the dishes at an infinite number of angles and velocities.

Simultaneously, with reversal, the cut-off escapement 37, 38 effects a progressive release. When the desired number of reversals are accomplished, valve 6 is closed by cut-off mechanism, and liquid ceases to flow. The cleansing powder in cylinder 14 is introduced in such quantity that the metered stream through orifice 15 causes an approximately saturated solution to be formed in cylinder 14 for about three quarters of the time that the machine operates. Then a gradual decrease in concentration occurs so that at the last the dishes are rinsed with practically clear water.

The drying operation takes place automatically when the machine is stopped after the dishes are rinsed with clear water. Louvers 61 are arranged to hold in spray, but to admit air. (Figures 1, 2 and 6.) Drying is done by cool dry air entering by the lower louvers, taking up moisture from the heated dishes, and, after becoming warmed and moist, passing out of the upper louvers.

The operation of this invention can be illustrated by the performance of a typical machine.

Example

Capacity—Forty average dishes.
Water consumption—About nine gallons.
Cleansing Powder—Two tablespoonfuls.
Operating Time—Three and one-half minutes.
Operation—Automatic.
Reversals—Two complete cycles.
Orifice jets (27)—Four, .061" diameter.
Metering Orifice (15)—One, .037" diameter.
Revolutions per reversal—Twenty-two.
Louver openings—40 square inches.

Complete automatic operation is achieved by co-ordinating the several inventive features described. To illustrate, unless the metering chamber provides first a cleansing solution and a final rinsing water, an automatic shut-off and drying arrangement would have little value, because

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manual operation to rinse would be required. Obviously, the several automatic operations may be manually done—reversal of nozzles, shut-off of water supply, opening of air doors, or removal of basket for drying, may all be done by hand but the resulting machine will no longer be self-operating or as closely coordinated in its functions. Louvers placed diagonally opposite the nozzles adequately prevent spray from escaping the machine. If it is desired that vapor be retained during the running cycles, these louvers may be fitted with shutters to be operated by a cylinder similar to 27'. This cylinder would be connected to pipe 68 and would close the shutters when valve 6 admits fluid pressure and by spring action open them when valve 6 closes.

In the average home where hot water is limited in supply and expensive to heat, it becomes essential that it be efficiently used. This is done by effectively utilizing for cleaning the scouring energy of water at high velocity. Jet orifice 27 (Figure 11) is designed as a bell mouth cylinder and gives a coefficient of discharge approaching unity; consequently the stream emitted is cylindrical, solid, of high velocity, and though the diameter is small, it exerts real scouring action on the surfaces to be cleaned. For very great variations in supply pressure, it is necessary to change the size of jets 27, but because discharge varies according to the square root of the head, ordinary variations will be compensated for by the characteristics of the machine. For instance, if the pressure at the jet is decreased from one hundred pounds per square inch to eighty-one pounds per square inch, the rate of discharge will fall in the ratio of ten to nine or but ten per cent. At the lower rate of discharge less impact energy will be imparted to the dish basket which will revolve and reverse more slowly and thus operate for a longer time. Thus substantially the same amount of water will be used and approximately the same washing effect achieved.

While the invention has been described with reference to a number of different forms, it should be understood that there may be other variations of these forms of the invention, such as movement of the basket, plus complete planetary movement of the nozzles. More or less nozzles may be used and their location changed. Any number of reversals may be practiced, by changing the number of escapement pins. Other arrangements of parts may be employed. Orifice 15 may depend on pressure drop or on a Venturi effect for its differential pressure. Therefore, the forms of the invention described should be considered as illustrative only, and not as limiting the scope of the following claims.

I claim:

1. In a washing machine, a frame structure, a basket rotatably mounted therein to turn about a vertical axis and having a supporting surface perpendicular to its axis of rotation, a rockable supporting member at each side of said surface and spaced laterally from said axis, each supporting member having an appreciable dimension in the general direction of said surface, a reaction tube rotatably carried by each supporting member on an axis substantially parallel to the first named axis of rotation, jets extending from each tube at opposite sides of its axis of rotation and directed toward said supporting surface, the jets of each tube forming diverging planes with the tube, means for rocking said supporting members in unison each about a substantially horizontal axis so that the jets from

both tubes converge toward said supporting surface in substantially all positions of said rocking members, whereby the streams from each set of jets tend to rotate said basket in the same direction in any given position of said rockable members and whereby the basket is caused to be rotated in one direction by the streams from said jets when rocked to one side and rotated in the opposite direction when rocked to the other side.

2. In a washing machine, a frame structure, a basket rotatably mounted therein to turn on a vertical axis, a rockable supporting member spaced laterally from the axis of rotation of said basket and having an appreciable dimension in the general direction of said axis, a reaction tube rotatably carried by said member on an axis of rotation substantially parallel to the first named axis of rotation, jets extending from said tube at opposite sides of its axis of rotation, said jets being directed toward said basket and forming divergent planes with said tube, and means for rocking said supporting member about a substantially horizontal axis so that the streams from said jets act against the basket when said supporting member is inclined in one direction to exert a force against dishes in the basket and thereby cause rotation of the basket in one direction, and said streams from said jets act when said supporting member is inclined in the opposite direction to thereby cause rotation of said basket in the opposite direction, said rocking means being mechanically connected by gearing to said basket, whereby said means is actuated in fixed relation to a predetermined number of revolutions of said basket.

3. In a washing machine, a frame structure, a basket rotatably mounted therein to turn on a vertical axis, a rockable supporting member spaced laterally from the axis of rotation of said basket and having an appreciable dimension in the general direction of said axis, a reaction tube rotatably carried by said member on an axis of rotation substantially parallel to the first named axis of rotation, jets extending from said tube at opposite sides of its axis of rotation, said jets being directed toward said basket and forming divergent planes with said tube, and means for rocking said supporting member about a substantially horizontal axis so that the streams from said jets act against the basket when said supporting member is inclined in one direction to exert a force against dishes in the basket and thereby cause rotation of the basket in one direction, and said streams from said jets act when said supporting member is inclined in the opposite direction to thereby cause rotation of said basket in the opposite direction, a hydraulic device for operating said rocking means, a valve controlling delivery of fluid to said hydraulic device, said valve being mechanically connected by gearing to said basket, whereby said rocking means is actuated in fixed relation to a predetermined number of revolutions of said basket.

4. A machine as characterized in claim 1, wherein said rocking means is mechanically connected by gearing to said basket, whereby said means is actuated in fixed relation to a predetermined number of revolutions of said basket.

5. A machine as defined in claim 1, further characterized by a hydraulic device for operating said rocking means, a valve controlling delivery of fluid to said hydraulic device, said valve being mechanically connected by gearing to said basket, whereby said rocking means is actuated in fixed

relation to a predetermined number of revolutions of said basket.

6. In a washing machine, a frame structure, a basket rotatably mounted therein to turn on a vertical axis, a rockable supporting member spaced laterally from the axis of rotation of said basket and having an appreciable dimension in the general direction of said axis, a reaction tube rotatably carried by said member on an axis of rotation substantially parallel to the first named axis of rotation, jets extending from said tube at opposite sides of its axis of rotation, said jets being directed toward said basket and forming divergent planes with said tube, and means for rocking said supporting member about a substantially horizontal axis so that the streams from said jets act against the basket when said supporting member is inclined in one direction to exert a force against dishes in the basket and thereby cause rotation of the basket in one direction, and said streams from said jets act when said supporting member is inclined in the opposite direction to thereby cause rotation of said basket in the opposite direction, a conduit for supplying fluid to said reaction tube, a valve in said conduit, and means operable by said rocking means and connected to said valve for causing movement of said valve.

7. In a washing machine, a frame structure, a basket rotatably mounted therein to turn on a vertical axis, a rockable supporting member spaced laterally from the axis of rotation of said basket and having an appreciable dimension in the general direction of said axis, a reaction tube rotatably carried by said member on an axis of rotation substantially parallel to the first named axis of rotation, jets extending from said tube at opposite sides of its axis of rotation, said jets being directed toward said basket and forming divergent planes with said tube, and means for rocking said supporting member about a substantially horizontal axis so that the streams from said jets act against the basket when said supporting member is inclined in one direction to exert a force against dishes in the basket and thereby cause rotation of the basket in one direction, and said streams from said jets act when said supporting member is inclined in the opposite direction to thereby cause rotation of said basket in the opposite direction, a conduit for supplying fluid to said reaction tube, a valve in said conduit, linkage for opening said valve, spring means acting on said linkage to close said valve, and an escapement mechanism operable by said rocking means and operable on said linkage to control the movement thereof under the action of said spring means.

8. A dishwashing machine having, in combination, a dish container, a reaction type nozzle mounted for rotation about a substantially vertically disposed axis and further mounted for rocking about a substantially horizontal axis, the nozzle and the dish container being supported in such relative relation that when the nozzle is inclined in one direction its stream delivery will have a component of motion in one direction across the dishes in the container and when inclined in the opposite direction said stream delivery will have a component of motion in the opposite direction across said dishes, the nozzle and the dish container being further supported so as to be relatively movable about a vertical axis of revolution one with respect to the other to cause horizontal travel between the dishes and the nozzle stream whereby the stream will exert

a force to cause said relative movement between the dishes and the nozzle in one direction about said vertical axis when the nozzle is inclined in one direction and to cause said relative movement in the opposite direction when the nozzle is inclined in the opposite direction, the rocking of the nozzle about a substantially horizontal axis being automatically effected by means operating in response to said relative movement between the dish container and the nozzle.

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