Aug. 9, 1966 F. E. LA FLAME 3,265,311

DOMESTIC APPLIANCE

Filed Jan. 30, 1964 4 Sheets-Sheet 1

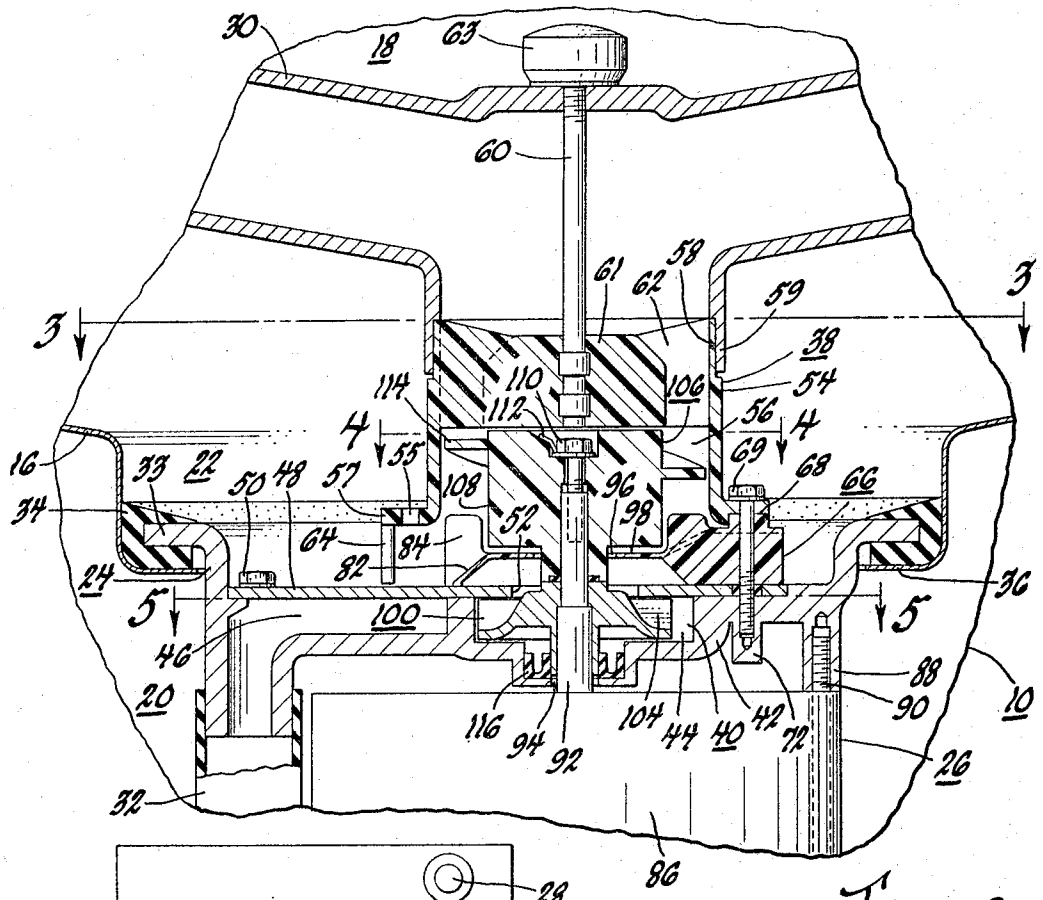


Fig. 2

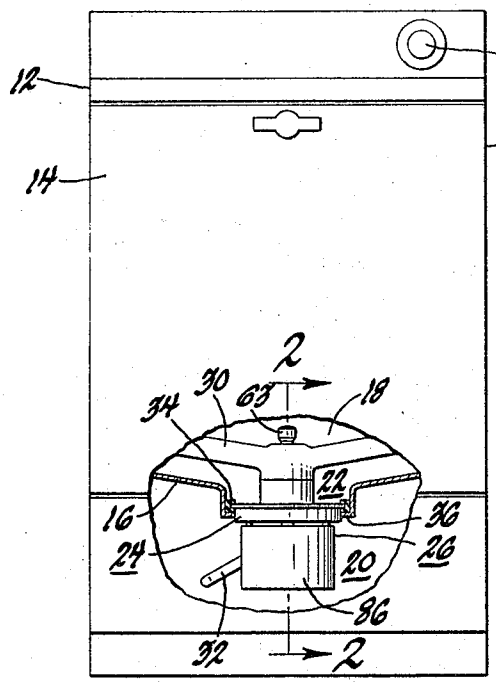


Fig. 1

INVENTOR.
Frank E. LaFlame
BY
J. C. Evans
HIS ATTORNEY

Aug. 9, 1966 F. E. LA FLAME 3,265,311

DOMESTIC APPLIANCE

Filed Jan. 30, 1964 4 Sheets-Sheet 2

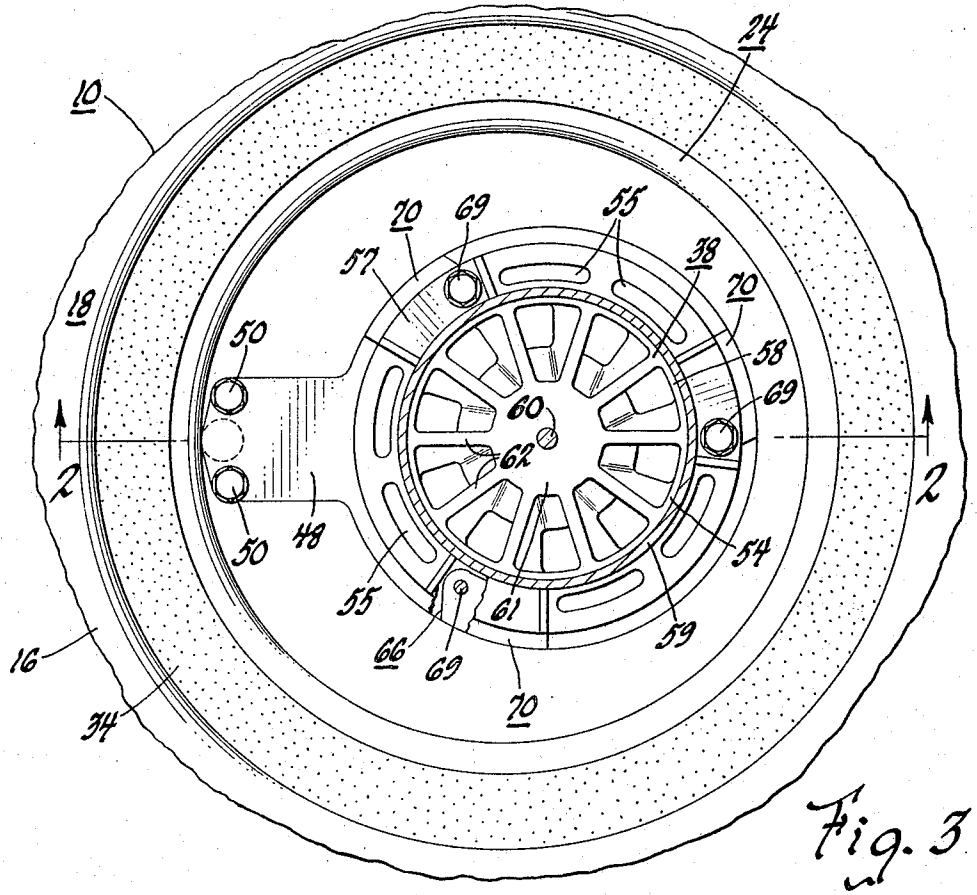


Fig. 3

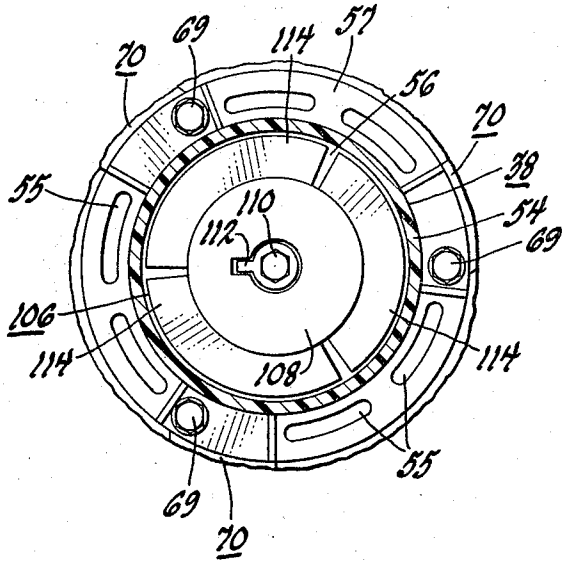


Fig. 4

INVENTOR.
Frank E. LaFlame
BY
J. C. Evans
HIS ATTORNEY

Aug. 9, 1966 F. E. LA FLAME 3,265,311

DOMESTIC APPLIANCE

Filed Jan. 30, 1964 4 Sheets-Sheet 3

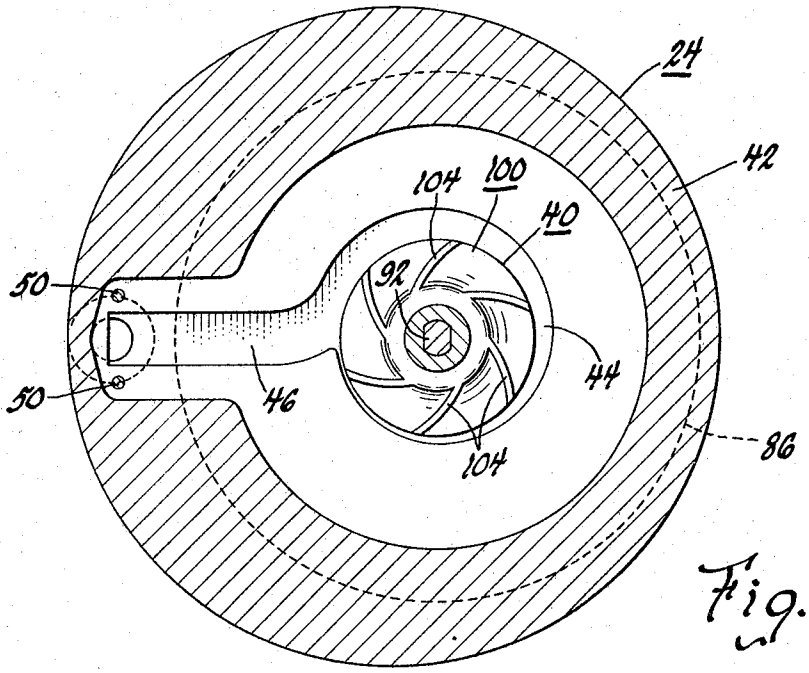


Fig. 5

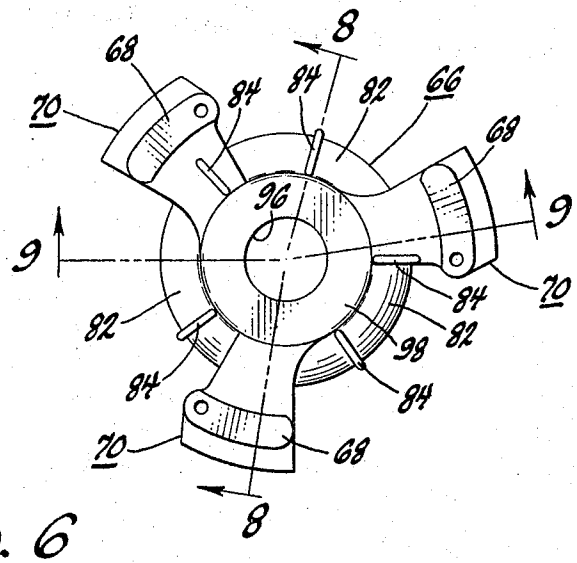


Fig. 6

INVENTOR.
Frank E. LaFlame
BY
J. C. Evans
HIS ATTORNEY

Aug. 9, 1966 F. E. LA FLAME 3,265,311

DOMESTIC APPLIANCE

Filed Jan. 30, 1964 4 Sheets-Sheet 4

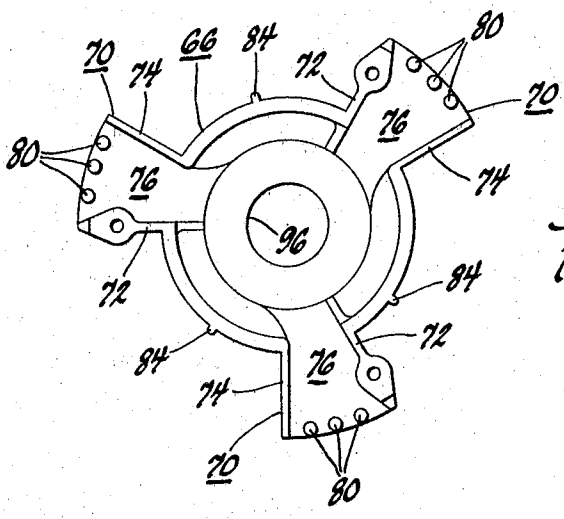


Fig. 7

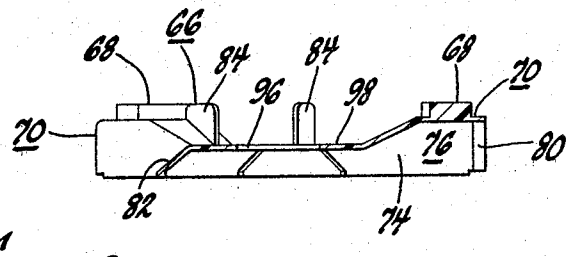


Fig. 9

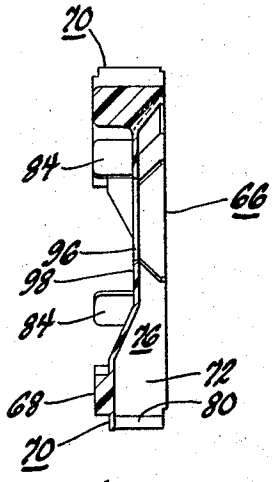


Fig. 8

INVENTOR.
Frank E. LaFlame
BY
J. C. Evans
HIS ATTORNEY

United States Patent Office 3,265,311 Patented August 9, 1966

3,265,311

DOMESTIC APPLIANCE

Frank E. La Flame, Dayton, Ohio, assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Filed Jan. 30, 1964, Ser. No. 341,209
4 Claims. (Cl. 239—251)

This invention relates to domestic appliances and more particularly to dishwashing apparatus.

In many dishwasher arrangements it is desirable to use a plural pump arrangement wherein each of the pumps is concurrently driven by a reversible motor to alternately circulate fluid within a washing container and drain fluid therefrom upon opposite rotation of the motor to thereby effect a desired cleaning of articles supported within the washing compartment.

One problem in dishwashers having such a pump arrangement is that of smoothly directing fluid flow into the inlets of the pumps and, furthermore, of preventing the pumps from interfering with the operation of one another where they are operatively arranged to alternately withdraw fluid from a sump portion of the washing compartment while being continuously driven by the motor means.

Accordingly, an object of the present invention is to improve a plural unit pump arrangement for a dishwasher or the like by the provision of a fluid flow diverter for directing fluid from a common level in a sump as a smooth stream into the inlets of each of the plurality of pumps.

A further object of the invention is to improve dishwashing apparatus including a plurality of pumps for effecting fluid distribution therein during different phases of the operation thereof by the provision of a common unitary fluid flow diverter for smoothly directing fluid to the inlets of each of the plurality of pump means with the unitary diverter serving to substantially prevent each of the pumps from being affected by the operational characteristics of the other pumps.

A still further object of the invention is to improve a plural pump mechanism for association with a dishwashing apparatus or the like including a reversible motor means, a first continuously driven pump for pumping fluid from a sump portion of the apparatus to a washing fluid distributing portion thereof on one direction of motor rotation and a second continuously driven pump for pumping fluid from the sump to a drain located exteriorly of the apparatus upon another direction of motor rotation, by the provision of a diverter element located intermediate the first and second pumps to direct fluid into the inlet of each of the pumps from a common level in the sump with the diverter element including means thereon for straightening flow into the inlets of the pump and means for isolating reverse fluid flow through the first pump from the inlet to the second pump during periods in which the second pump is drawing fluid from the sump.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a front elevational view partially broken away of a dishwashing arrangement including the present invention;

FIGURE 2 is an enlarged view in vertical section taken substantially along the line 2—2 of FIGURE 1;

FIGURE 3 is a view in horizontal section taken along the line 3—3 of FIGURE 2;

FIGURE 4 is a view in horizontal section taken along the line 4—4 of FIGURE 2;

FIGURE 5 is a view in horizontal section taken along the line 5—5 of FIGURE 2;

FIGURE 6 is a top elevational view of the fluid diverter of the present invention;

FIGURE 7 is a bottom elevational view of the diverter of FIGURE 6;

FIGURE 8 is a view in vertical section taken along the line 8—8 of FIGURE 6; and

FIGURE 9 is a view in vertical section taken along the line 9—9 of FIGURE 6.

Referring now to the drawings, in FIGURE 1 a dishwashing apparatus **10** is illustrated including an outer cabinet **12** having a front opening therein closed by a downwardly swinging door **14** for providing access into the interior thereof. The cabinet **12** has a bulkhead **16** located therein for separating it into an upper washing compartment **18** and a lower machinery compartment **20**. The central portion of the bulkhead **16** is recessed to form a sump **22** for collecting fluid from the washing compartment **18**. In the illustrated arrangement, the bottom-most portion of the sump **22** is formed by a support plate **24** for locating a plural pump apparatus **26** within the washing compartment **18** and the lower machinery compartment **20**. The plural pump assembly **26** is conditioned by means of a timer mechanism **28** on a top control panel across the rear of the cabinet **12** to circulate fluid from the sump **22** through a rotary fluid distributing arm **30** or other suitable distributing means against articles supported on suitable racks (not shown) within the washing compartment **18** during a predetermined washing cycle and is also conditioned thereby during a desired operative cycle to drain the sump **22** exteriorly of the washing compartment **18** and cabinet **12** through a drain conduit **32**.

Referring now to FIGURE 2, a peripheral flange **33** on the supporting plate **24** is supported within a continuous channel-shaped annular seal element **34** supported in turn on a radially inwardly turned edge **36** of the bulkhead **16**. A first pump **38** of the plural pumping assembly **26** is located within sump **22** above the plate **24** and a second pump **40** of the assembly **26** is located at a point below the supporting plate **24** within the machinery compartment **20**. The pump **40** more particularly includes an outer casing formed by a downwardly bulged portion **42** in the support plate **24** which in turn defines a convolutely-shaped pumping chamber **44** opened to the washing compartment side of the support plate **24**. A passageway **46** formed radially outwardly through the support plate **24** communicates the pumping chamber **44** within the looped drain conduit **32** and serves as an outlet from pump **40**. The pumping chamber **44** and passageway **46** are closed by a cover plate **48** supported on the upper surface of the support plate **24** and secured thereto by suitable means including screws **50**. An opening **52** located centrally of plate **48** is aligned with the convolute pumping chamber **44** to serve as the inlet opening thereto.

Above the cover plate **48** is located a tubular housing **54** of the pump **38** having a lower open end and an upper open end serving as the inlet and outlet, respectively, to an axially elongated cylindrical pumping chamber formed therethrough. On the bottom edge of the tubular housing **54** a flange **57** extends in a radially outward direction with the flange including groups of circumferentially spaced fingers **64** depending therefrom to a point adjacent the lower surface of the sump **22** which is defined in part by the cover plate **48** and in part by plate **24**. Suitable weep holes **55** extend through flange **57** to drain the upper surface thereof.

In the illustrated embodiment the housing **54** further includes a small diameter extension **58** on the outlet end thereof supporting a depending central hub **59** of rotary fluid distributing arm **30** for rotation relative thereto. A stud element **60** fastened at one end thereof in a hub **61** located centrally of the cylindrical pumping chamber **56** by a plurality of flow straightening vanes **62** is directed through the arm **30** into threaded engagement with a nut **63** for holding the arm on housing **54**.

In accordance with certain of the principles of the present invention a novel flow diverter element **66** is supported within the washing compartment **18** above the upper surface of the supporting plate **24** intermediate the tubular housing **54** and the cover plate **48**. A plurality of circumferentially located upper bearing surfaces **68** on diverter **66** engage the underside of the flange **57** of the tubular housing **54** at circumferentially spaced points thereon for support thereof and it and diverter **66** are secured at these points to support plate **24** by means of elongated studs **69** directed through flange **57**, diverter **66** and cover plate **48** into threaded engagement with internally threaded hub portions **72** formed on the underside of support plate **24**.

The diverter element **66** is constructed and arranged to assure improved fluid flow patterns into the inlets of the pumps **38**, **40** and further acts to fluidly isolate the inlets of these pumps from one another during pumping. More particularly, in order to carry out these functions, diverter **66** includes a plurality of circumferentially located radially outwardly directed portions **70** each including spaced, radially inwardly converging side wall portions **72**, **74** forming an inverted channelway or tunnel **76** that communicates at one end thereof with a lower level of the sump **22** and at the opposite end thereof with the inlet opening **52** to the convolutely-shaped pumping chamber **44**. Each radially outwardly directed portion **70** at the inlet thereof also includes a plurality of pins **80** depending from the upper surface thereof between walls **72**, **74** into the vicinity of the upper surface of the support plate **24** for straining fluid flowing from the sump **22** to the inlet opening **52** to the drain pump **40**.

Intermediate each of the radially outwardly directed portions **70**, the flow diverter element **66** includes a surface or ramp **82** inclined upwardly from the support plate **24** radially inwardly from the outer periphery of the diverter element **66** for directing fluid from the lower level of the sump **22** into the lower inlet opening to the cylindrical pumping chamber **56** across flow straightener vanes **84** having one end thereof integrally formed with the inclined surface **82** and the opposite end thereof located within the lower opening in the tubular housing **54**.

The pumps **38**, **40** are driven by suitable drive means, for example, a reversible electric motor **86** secured to depending internally threaded bosses **88** on the supporting plate **24** by means of screw elements **90**. A rotatable shaft **92** from the motor **86** is directed upwardly through an opening **94** in housing **42**, inlet opening **52** to the convoluted pumping chamber **44**, and an opening **96** formed in a flat upper surface portion **98** of the flow diverter **66**. Within the convoluted pumping chamber **44** a centrifugal impeller **100** has a central hub portion thereof secured to the rotatable shaft **92** and a plurality of circumferentially located curved blades **104** thereon that extend generally radially outwardly across the upper surface of the hub **100** within the convolute pumping chamber **44** for effecting a desired pumping action therein upon rotation of impeller **100**.

Within chamber **56** an axial flow impeller **106** has its cylindrical central hub portion **108** secured to the upper end of the rotatable shaft **92** by suitable fastening means such as a screw element **110** threaded through an opening in the upper surface of the hub **108** into threaded engagement with internal threading in the upper end of the shaft **92** to force a small diameter lower end portion of the hub **108** against an upper bearing surface located centrally of the centrifugal impeller **100**. A suitable lock nut **112** preferably is interposed between impeller **106** and screw element **110**. The hub **108** has a plurality of axially extending helical or screw blades **114** secured on the outer periphery thereof so that the radially outer edges thereof are in close proximity to the inner surface of the tubular housing **54** for effecting a desired pumping action within pumping chamber **56**.

The illustrated embodiment of the pumping assembly **26** further includes a seal assembly **116** supported in the housing **42** of the drain pump **40** to sealingly engage the outer periphery of the rotatable shaft **92** below the centrifugal impeller **100** for preventing leakage of fluid exteriorly of the sump **22**.

In the operation of the improved plural pump assembly **26**, upon conditioning the electric motor **86** to rotate in a clockwise direction, the axial flow impeller **106** will displace fluid from the pumping chamber **56** so as to cause washing fluid in the sump **22** to be drawn from the lower level thereof through the fingers **64** that serve to prevent the ingress of large particles into the pump **38**. The fluid thence flows upwardly across the inclined surfaces **82** and between the flow straightener vanes **84** into the open end of the housing **54**, thence upwardly through the pumping chamber **56** through the outlet opening into the rotary fluid spray arm **30** that is driven by the pumped fluid to distribute spray against articles supported within the washing compartment **18**. During clockwise rotation of the motor **86**, the curved blades **104** on the centrifugal impeller **100** of drain pump **40** are arranged to idle within the convoluted pumping chamber **44** without producing any pumping effect therein.

Upon conditioning the motor **86** to drive the pumps **38**, **40** in a counterclockwise direction, the curved blades **104** on the centrifugal impeller **100** will draw fluid from the sump **22**, across the strainer pins **80**, through the tunnels **76**, the inlet opening **52**, the convoluted pumping chamber **54** and thence through the drain passageway **46** to be discharged through the drain conduit **32** exteriorly of the cabinet **12**. The counterclockise rotation of the axial flow impeller **106** will draw any washing fluid in the rotary spray arm **30** downwardly through the tubular housing **54** and discharge it through the lower open end thereof into the sump **22**. Following this, the impeller will displace air from the rotary spray tube and force it into the bottom of the sump **22** during the drain cycle of operation. One feature of the invention is that the radially outwardly directed portions **70** effectively locate the inlet to the drain pump **40** radially outwardly from the lower open end to the axial flow pumping chamber **56** and the flat surface **98** and inclined surfaces **82** of the flow diverter **66** will block communication between the inlet to the distributing pump **38** and the inlet to drain pump **40** whereby only fluid in the lower radially outermost part of the sump **22** is directed into the drain pump **40** during the drain cycle. Hence, any tendency for air from pump **38** to starve pump **40** is effectively negated.

In accordance with certain other of the principles of the present invention, the radially outwardly directed portions **70** of the flow diverter **66**, in addition to isolating the drain pump **40** from the downward rush of air produced by the pump **38** during counterclockwise rotation, also serves to straighten the turbulent fluid flow patterns present in the lower level of the sump volume during both the washing and drain cycles of operation of the dishwashing apparatus so that fluid flow is directed from a common lower level in the bottom of the sump **22** along substantialy radially inwardly directed fluid flow paths into the inlet of the wash pump **38** or the inlet to the drain pump **40** depending upon the direction of rotation of the impeller portions thereof. While the radially outwardly directed portions **70** serve as primary fluid flow straighteners, in some cases secondary flow director vanes such as those illustrated at **84** may be required to assure that

the flow into the axial flow wash pump **38** will have substantially all swirl removed therefrom with the fluid flow passing along smooth radially inwardly directed paths into the lower inlet end of the tubular housing **54** to maintain a desired maximum efficiency of operation of the pump **38**.

While the improved plural pump assembly is illustrated in combination with a dishwashing apparatus, it will be appreciated that the improved flow directing aspects of the invention and the arrangement of a fluid flow diverter element in combination with plural pumps to isolate the operation of each of the pumps one from the other, while drawing fluid from a common sump level, may have utility in other types of cleaning devices or the like.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. In a dishwashing apparatus the combination of, washing fluid distributing means, means including a bottom member forming a fluid containing sump volume for receiving fluid from said distributing means, first pump means for supplying fluid to said distributing means, second pump means for draining fluid from said sump volume, motor means reversible to drive said pump means in opposite directions of rotation for causing them to alternately pump fluid from said sump volume, diverter means for directing fluid from the lowest level in said sump volume across said bottom member to an inlet to each of said pump means, said diverter means including a plurality of circumferentially located radially outwardly directed conduit portions each having spaced apart side walls supported on said bottom member, said first pump means including a tubular pump housing supported by said conduit portions, means interconnecting said pump housing to said conduit portions and said conduit means to said bottom member, said conduit portions extending radially outwardly of said pump housing and including inlet means formed in part by said side walls directly communicating with the sump volume at said bottom member and outlet means located radially inwardly of said inlet means communicating with the inlet to said second pump means, said diverter means further including an upwardly inclined ramp intermediate spaced apart ones of said side walls of said tubular portions, said side walls of said conduit means defining with said bottom member an inlet passageway across said bottom member to said ramp, said ramp having a radially outer edge portion engaging said bottom member for directing fluid from said inlet passageway across said bottom member at the lowest

level of said sump volume into the inlet of said first pump means whereby said first pump means during a washing cycle of operation serves to comminute particles collected on said bottom member prior to the washing cycle of operation.

2. In the combination of claim **1**, said first pump means being operative upon a predetermined rotation thereof to draw air from the fluid distributing means and discharge air through the first pump means inlet, means interconnecting the radial inner edges of said upwardly inclined ramps and said circumferentially located conduit means for blocking the inlet end of said first pump means from the inlet of said second pump means to prevent the air flow through said first pump means inlet from blocking fluid flow into said second pump means inlet during a predetermined drain cycle of operation.

3. In the combination of claim **1**, said pump housing being a generally cylindrical member supported by said plurality of conduit means and including an upper open end and a lower open end, an axial flow impeller supported within said cylindrical housing for pumping fluid from said lower open end upwardly thereof through said upper open end into said washing fluid distributing means, said conduit means having a radially outwardly located end spaced radially outwardly of said pump housing constituting the sole means at this radially outermost location for straightening fluid flow adjacent and across said bottom member to cause it to flow radially inwardly both to said first pump means inlet and to said second pump means inlet.

4. In the combination of claim **3**, said cylindrical pump housing having flange portions on the lower end thereof directed radially outwardly of said cylindrical housing, each of said flange portions having a plurality of depending fingers thereon with an end portion thereof supported immediately adjacent said bottom member, said plurality of fingers cooperating with one another to strain fluid passing across said bottom member thence to and upwardly across said upwardly inclined ramps for straining predetermined large particles from the pumped fluid prior to the passage thereof into the lower open end of said cylindrical housing.

References Cited by the Examiner

UNITED STATES PATENTS

2,916,997	12/1959	Terrie.	
3,084,701	4/1963	Hardy et al.	103—3

EVERETT W. KIRBY, *Primary Examiner.*