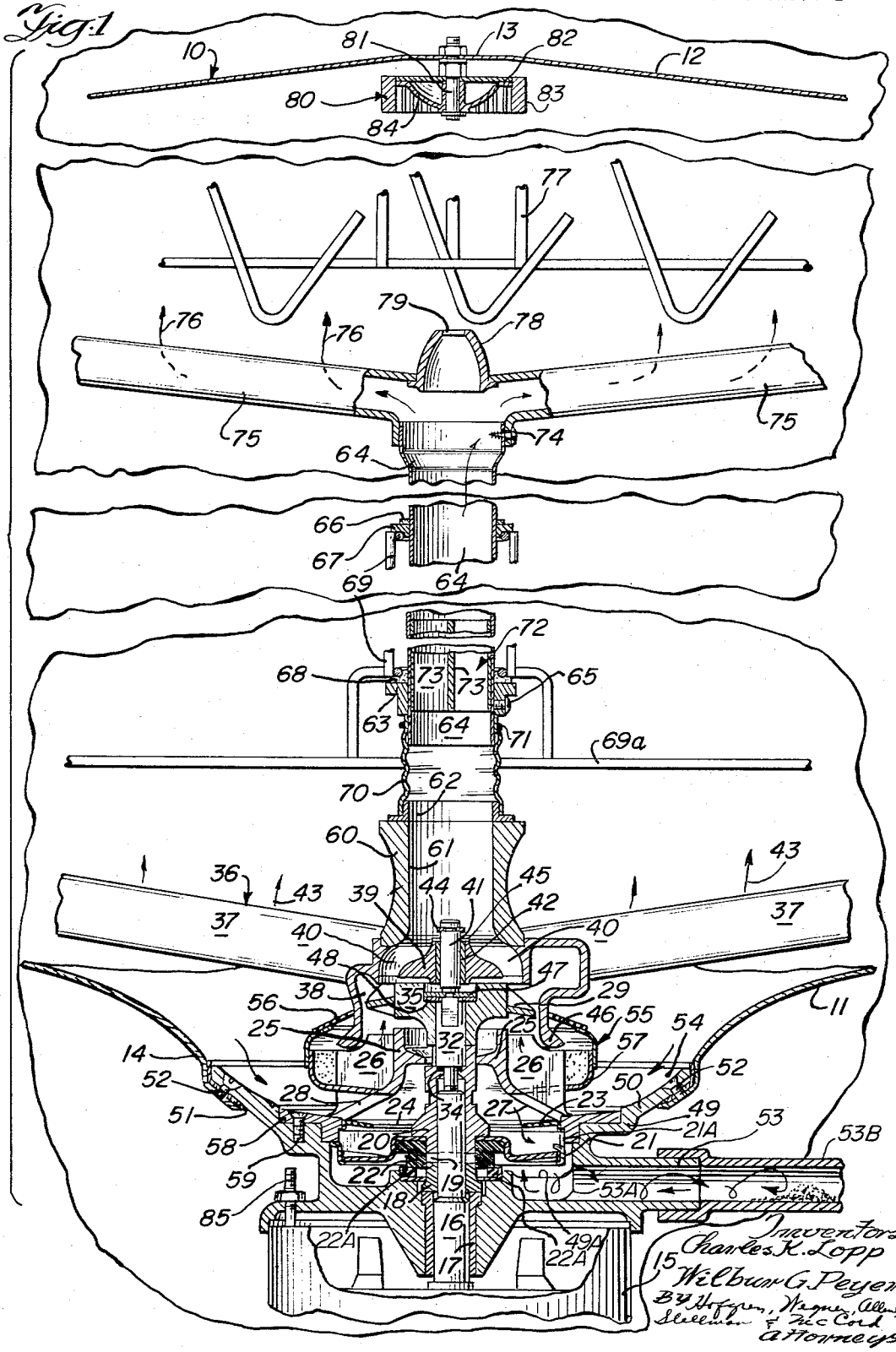
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DISHWASHER

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Fig. 1



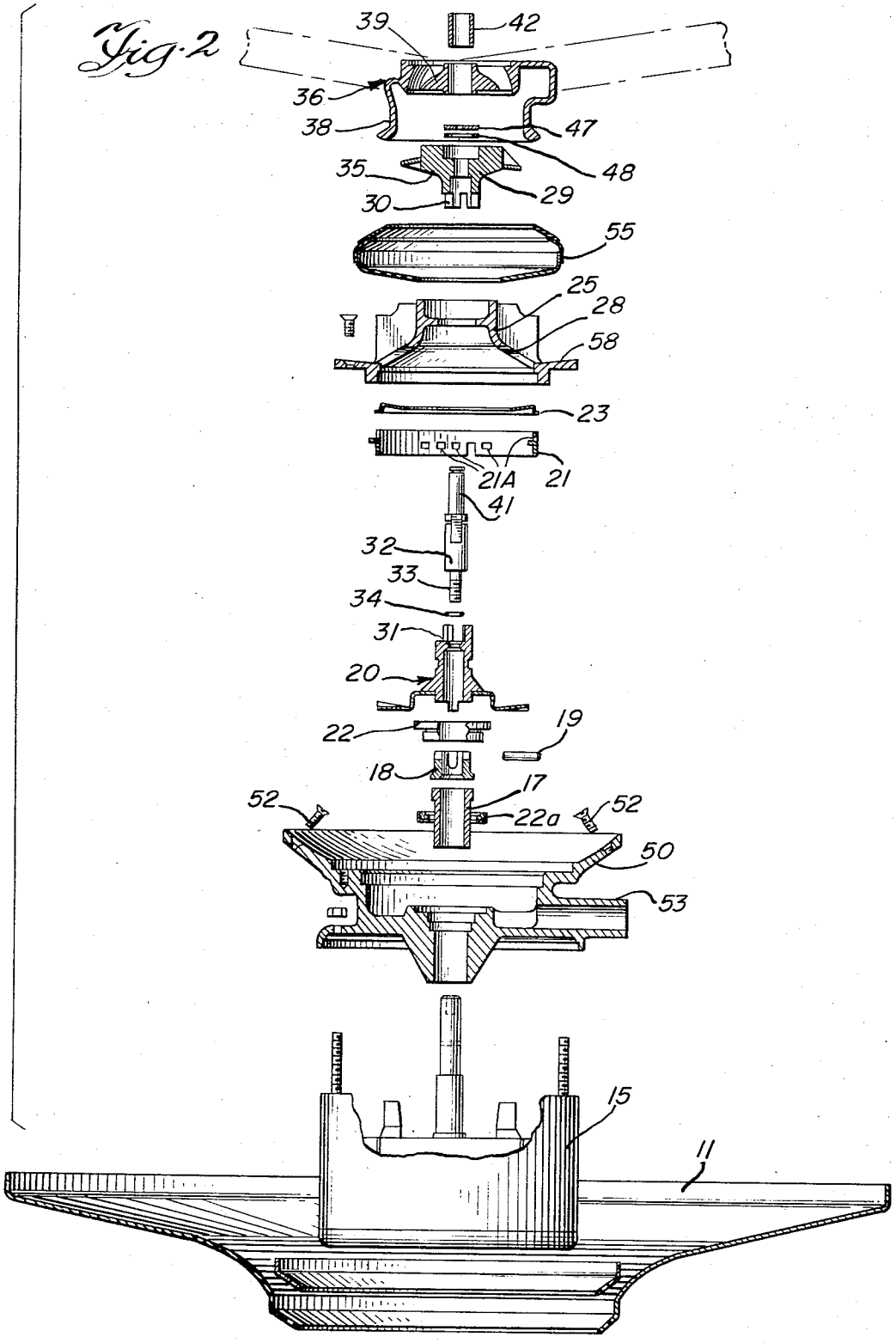
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Fig. 2



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DISHWASHER

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ABSTRACT OF THE DISCLOSURE

An article washing apparatus such as a dishwasher in which liquid is circulated over the articles being washed and in which at the conclusion of the washing operation the liquid is expelled from the apparatus, combined with a structure for separating solids from the liquid during the circulating of the liquid over the articles, and apparatus for transferring these separated solids to a grinder and grinding the solids during the draining of the liquid from the apparatus.

This invention relates to an article washing apparatus such as a dishwasher.

Automatic dishwashers in which dishes or other articles being washed are placed in racks in a tub and sprayed with detergent solution and with rinse water have become quite common.

One feature of the invention is to provide an improved automatic dishwasher comprising means for circulating liquid in a tub over articles held in a holder therein, means for separating solids from the liquid during circulation thereof over the holder, means for grinding these solids to finer particle sizes, means for draining liquid from the tub and means for operating the grinding means during the draining.

Other features and advantages of the invention will be apparent from the following description of one embodiment thereof taken in conjunction with the accompanying drawings. Of the drawings:

FIGURE 1 is a fragmentary vertical sectional view through a combined dishwasher and solids grinder embodying the invention.

FIGURE 2 is a fragmentary vertical sectional view similar to the lower portion of FIGURE 1 but with the parts separated in an exploded view for clarity of illustration.

The dishwasher **10** disclosed in the accompanying drawings comprises a tub **11** having a top **12** that is provided with a raised peak **13** at approximately its center. The bottom of the tub **11** is provided with a sump **14** also at approximately the center.

Beneath the tub **11** the apparatus is provided with an electric motor **15** having a shaft **16** rotatable in a bearing **17**. The upper part of the vertical shaft **16** above the bearing **17** is attached to a drive sleeve **18** by a transverse pin **19**.

The drive sleeve **18** has attached thereto an impeller **20** for providing a drain pump. Surrounding this impeller **20** is a generally cylindrical shredder ring **21** of the usual type for grinding solids materials thrown thereagainst by the rotating impeller **20**. Thus, the impeller and shredder ring operate as the usual garbage disposer in grinding relatively large solid pieces into smaller particles which are flushed to the sewer with the drain water.

The bottom of the drain impeller is recessed and contains therein a seal assembly **22** and **22***a* that is located around the drive sleeve **18**.

Immediately above the shredder ring **21** that surrounds the drain pump impeller **20** is a drain filter **23** having an open center **24**. Above this drain filter **23** is an inlet diffuser **25** having radial vanes **26** integral with a bottom outwardly flaring skirt **27** provided with spaced inlet openings **28**. The inlet diffuser, as stated, is positioned above the drain impeller and beneath a pump impeller **29**. The pump impeller, as is shown in FIGURE 2, is provided with spaced splines **30** that are normally in driving engagement with similar splines **31** on the drain impeller **20**. As is also shown in FIGURE 2, the drive sleeve **18** and the bottom of the drain impeller **20** also have splined connections.

The pump impeller **29** is mounted on an impeller shaft **32** which as is shown in FIGURE 2 is attached to the top of the drain impeller **20** by means of a threaded lower post **33** on the impeller shaft and is sealed thereto by an O-ring **34**.

The hub **35** of the impeller **29** that surrounds the shaft **32** is used to mount the lower spray arm **36** which includes the usual pair of laterally extending arms **37** and a hollow hub **38**.

The hollow hub **38**, as is shown most clearly in FIGURE 2, has a top mounting part **39** with spaced liquid flow openings **40** therearound with this top part serving to mount the unit on the upper end **41** of the impeller shaft **32**. The spray arm assembly of arms **37** and hub **38** is thus suspended from the top end **41** of the impeller shaft and the spray arm assembly **36** is rotatable about a bearing **42** on this upper end **41** by the usual reactive force of the outwardly sprayed liquid as indicated by the arrows **43**. The assembly is locked in position on this upper end **41** of the shaft **32** by a retaining ring **44** attached to the upper end of this shaft. Between the retaining ring **44** and the upper end of the mounting part **39** there is provided a thrust washer **45**.

The lower end of the hub **38** is provided with an outwardly flaring skirt portion **46** surrounding the pump impeller **29** and extending therebelow. The skirt **46** is located immediately above the inlet diffuser vanes **26**.

As previously mentioned, the retaining ring **44** and thrust washer **45** are located on the upper end **41** of the impeller shaft **32**. The portion of this shaft **32** between the hub **35** and the top mounting part **39** is also provided with a retaining ring **47** and a thrust washer **48**.

The drain impeller **20** is surrounded by a lower pump casing **49** having an upwardly and outwardly flared flange **50** that is fastened to the bottom of the sump **14** to span an opening **51** therein and thus form a part of the bottom of the sump. This flange **50** and thus the lower pump casing is held in position by a series of circularly arranged screws **52** engaging the flange **50** in the adjacent annular part of the bottom of the casing **11**. As can be seen in FIGURE 1, this arrangement provides that the lower part of the unit which includes a drain tube **53** is beneath the tub **11** but above the motor **15**.

The outwardly and upwardly flared flange **50** on the lower pump casing **49** provides an annular opening to the inlet diffuser **25** and thus upwardly to the pump chamber containing the pump impeller **29** and defined by the depending skirt portion **46** of the spray arm assembly **36**. The spaced vanes **26** provide for even flow of liquid into the pump impeller **29**. Because the openings **28** in the skirt **27** of the diffuser **25** provide downward access to the drain impeller **20** the annular inlet openings **54** to the pump casing **49** provide for flow both upwardly into the pump impeller **29** and downwardly into the drain impeller **20**. As can be seen from FIGURE 1, the two impellers are vertically aligned with the pump impeller being above the drain impeller.

Surrounding the bottom of the inlet diffuser **25** in the region of the lower part of the vanes **26** is a recirculation filter **55**. This filter has a flexible rubber top **56** surrounding the depending skirt portion **46** of the spray arm assem-

bly **36** and a screen bottom **57** that extends across the inlet defined by the edges of vanes **26** to the inlet diffuser **25**.

The inlet diffuser **25** is provided with an annular mounting flange **58** that is attached to the upper surface of the lower pump casing **49** as by a plurality of attaching screws **59**.

The motor **15** is of the type that can be rotated in either of two directions. When rotated in one direction the recirculation pump impeller **29** recirculates liquid in the tub **12** in the manner to be described hereinafter. When rotated in the opposite direction the drain impeller **20** pumps liquid from the tub **11** through the drain tube **53**.

Mounted above the lower spray arm assembly **36** is a generally cylindrical flow nozzle **60** having a vertical central passage **61**. An annular center tube retainer **63** is attached to the bottom of a vertical tube **64** by means of a set screw **65**. This tube at an intermediate area thereon has an outwardly extending annular flange **66** which bears against a top bearing **67** around the tube **64**. A bottom bearing **68** similar to the top bearing **67** is held in position against the top of the center tube retainer **63**. These bearings **67** and **68** and thus the tube **64** are held in place by an upwardly extending wire framework **69** mounted on the bottom dish rack **69***a*. Extending between a bottom connector flange **62** and the center tube retainer **63** is an expendable and contractible bellows connector **70** preferably made of a flexible plastic material. The top of the connector **70** is held in position on the bottom of the tube **64** by means of a clamp ring **71**. The bottom of the connector **70** is held in position by frictional contact with the connector flange **62**. Positioned in the lower end of the center tube **64** is a flow straightener **72** that is provided with vertical internal vanes **73**. The flow straightener is intended to convert the rotational components of flow entering the bottom of the tube **64** to approximately axial flow.

Mounted on the upper end of the center tube **64** as by screws **74** is a top spray arm **75** also designed to be rotated in the customary manner by the reactive force of liquid jets issuing from the spray arm **75** in the normal manner at an angle as indicated by the arrows **76**. The liquid spray is thereby projected toward and over articles such as dishes (not shown) held in a customary upper dish rack **77** similar in its function to the bottom rack **69***a*.

Centrally of the upper spray arm **75** and aligned with the vertical tube **64** is a nozzle **78** having an outlet opening **79** at the top thereof for projecting a jet of liquid (not shown) toward the tub top **12**.

Mounted on this top **12** at the raised peak **13** thereof which is directly above the nozzle opening **79** is a rotatably mounted spray device or spinner **80**. This receiver is rotatably mounted about a vertical axle **81** and is of generally inverted cup-shape with a flat bottom **82** and a generally cylindrical rim **83** in the form of spaced vertical vanes. The spray device **80** is provided with an upwardly and outwardly sloped false bottom **84** which slopes from the axle **81** toward the rim **83**. The axle **81** is located vertically approximately directly above the nozzle opening **79**.

The apparatus of this invention when used to wash dishes or similar articles operates in the following manner. The liquid, whether detergent solution or rinse water, gathers in the sump **14** at the entrance **54** to the pump impeller **29**. During the washing portion of the machine cycle the motor **15** rotates the shaft **16** in a direction such that the recirculating pump **29** draws the liquid from sump **14** through filter **55** and forces a portion of it out the hub **38** into the lower spray arms **37**. The reaction of the sprays **43** causes the spray arm assembly **36** to rotate and spray dishes and other articles in the lower rank **69***a*. The recirculation pump **29** forces another portion of the liquid up through the liquid flow openings **40** above the impeller **29** and through the flow nozzle passage **61** and the bellows connector **70** into the tube **64**. From the upper end of the tube **64** this portion of the liquid then has one part flowing outwardly through the top spray arm **75** to spray the bottoms of dishes and other articles in the rack **77** and another portion flowing vertically in a jet out the nozzle opening **79** to the spray device or spinner **80**. This jet strikes the spinner at about the center axle **81** and the liquid force is diverted by the inverted cup-shaped bottom **84** toward the annular rim spaced vanes **83**. The liquid issuing between vanes **83** causes the spray device **80** to spin about its axle **81** and spray the tops of articles within the rack **77** and spray the inner surface of the tub top **12** to prevent the accumulation of soil thereon.

During this washing operation of the apparatus large solid particels are gathered on the bottom **57** of the filter screen **55** that is beneath the recirculation impeller **29**. Because the rotation of the motor shaft **16** in the direction for washing, as previously described, has the effect of rotating the drain impeller **20** in an opposite direction from its normal pumping direction of rotation, the drain impeller blocks passage of the liquid from the sump **14** into the drain from tube **53**. Furthermore, this reverse rotation of the drain impeller **20** aids in depositing the large solids on the bottom **57** of filter screen **55**.

During the drain and garbage grinding operation the direction of rotation of the motor shaft **16** is reversed by reversing the direction of motor **15**. This causes the recirculation impeller **29** to rotate in an opposite from normal direction with the result that liquid from the impeller **29** is pumped downwardly to backwash the screen **55** and force the solids through the central opening **24** in the drain filter **23**. After being forced past the drain filter **23** the liquid is pumped out the drain tube **53** to the sewer or other place of disposal and at the same time the drain impeller **20** shreds the large pieces of solids to fine particles against the shredder ring **21**.

The drain filter **23** is used to block the passage of solids within the confines of the shredder ring **21** from being drawn back into the recirculation impeller **29** and thus the liquid recirculated thereby during rotation of the impeller **29** in its normal direction.

Because rotation of the motor shaft **16** in the direction for washing, as previously described, has the effect of rotating the drain impeller **20** in an opposite direction from its normal pumping direction of rotation, the drain impeller sets up a vortex liquid flow path from inlet openings **28** downwardly through open center **24** of drain filter **23** and upwardly through filter **23** to pump impeller **29**. Since the openings of filter **23** are substantially smaller than those of filter **55**, filter **23** removes the small food and dirt particles from the liquid flowing therethrough.

A liquid flow path is simultaneously set up from impeller **20** through openings **21A** in shredder ring **21** to inlet **53A** of drain tube **53**. A vortex flow results at inlet **53A**, in drain tube **53** and in hose **53B**, as liquid is centrifugally ejected from pump casing ramp **49A**. The small particles in the liquid flowing to tube **53** and hose **53B** separate from the liquid and are deposited in hose **53B**. As the liquid loses its velocity, it is returned to pump impeller **20** through the low pressure area in the center of the vortex. Furthermore, the upward flow of liquid from drain impeller **20** aids in depositing the large solids on the filter screen **57**.

At the completion of the washing operation, the apparatus goes through a drain operation in which the liquid is drained from the tub and the large solids collected on the filter screen **57** and the small particles collected on filter screen **23** are directed to impeller **20** to be ground up as in an ordinary garbage disposer for passage into the sewer with the liquid. During this drain and garbage grinding portion of the machine cycle the apparatus operates as follows.

In the apparatus of this invention the recirculation pump **29** and the drain pump **20** and associated parts can be assembled as a package unit and installed in the tub **11** as a unit. These parts include all the elements from

the motor **15** up to and including the retaining ring **47**. As mentioned previously, the drain filter **23** provides a means for trapping and holding small solids during the wash operation in order to decrease the redeposit of these small particles on the articles being washed. During the pump-out operation in which the solids are ground to fine particles by the drain impeller **20** and the shredder ring **21**, any solids gathered on the filter **23** will be flushed therefrom. The result is that the filter is automatically cleaned during each pump-out and garbage grinding operation.

In the illustrated apparatus all of the parts from the connector flange **62** through the top spray arm **75** may be subassembled as a unit and mounted on the lower dish rack **69***a*. The connector flange **62** and the bellows connector **70** function to provide a flat, non-jamming contact seal surface between the bottom of the connector flange **62** and the top of the flow nozzle **60**. The bellows connector **70** being made of flexible material provides flexible compression contact between the flange **62** and the top of the flow nozzle. This seal is provided by the lower spray arm assembly **36** rising to meet the connector flange **62** when subjected to internal water pressure in the lower spray arm assembly.

The pump casing **49** also serves as the end bell for the motor **15** being held in place thereon by spaced bolts **85**. The force of the drive sleeve **18** contacts the face of the motor bearing as shown at the bottom of FIGURE 1 so as to provide a thrust bearing structure for this assembly.

Having described our invention as related to the embodiment shown in the accompanying drawings, it is our intention that the invention be not limited by any of the details of description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

1. Article washing apparatus, comprising: a tub; an article holder; rotatable pump means for circulating liquid in said tub over said article holder; means for draining liquid from said tub; a rotatable drain pump normally rotated in one direction during said draining and in a reverse direction during said circulating, said reverse direction rotation of the drain pump during said circulating tending to flow liquid inwardly to one portion of said drain pump and outwardly away from another portion of said drain pump in a vortex path; particle separating filter means in said vortex path for separating particles from said liquid during said reverse rotation; grinding means in said drain means on the side of said filter means opposite said circulating pump for grinding and reducing solids during said draining; and means for simultaneously operating said grinding means and said drain pump.

2. The apparatus of claim **1** wherein said one portion of said drain pump is adjacent the pump center and said other portion is adjacent the pump periphery, and said particle separating means is annular and is also adjacent said periphery.

3. The apparatus of claim **1** wherein said means for circulating liquid comprises a first pump means having a first inlet, said means for draining liquid comprises a second pump means having a second inlet, and said filter means is located between said first and second inlets to be contacted by liquid in both said first and second paths.

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