United States Patent

Barnard

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[45] **Dec. 26, 1972**

[54] **WATER PUMP**

[72] Inventor: **Walter C. Barnard,** White Bear Lake, Minn.

[73] Assignee: **Whirlpool Corporation**

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[21] Appl. No.: **109,687**

Related U.S. Application Data

[63] Continuation of Ser. No. 813,536, April 4, 1969, abandoned.

[52] **U.S. Cl.** .....**415/170 A,** 415/214, 415/219 C, 277/174

[51] **Int. Cl.**.....**F01d 11/08,** F16k 41/00, F04d 3/00

[58] **Field of Search**..415/170 A, 196, 197, 200, 214, 415/219; 277/163, 174

[56] **References Cited**

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3,236,532	2/1960	Sale et al.	277/174
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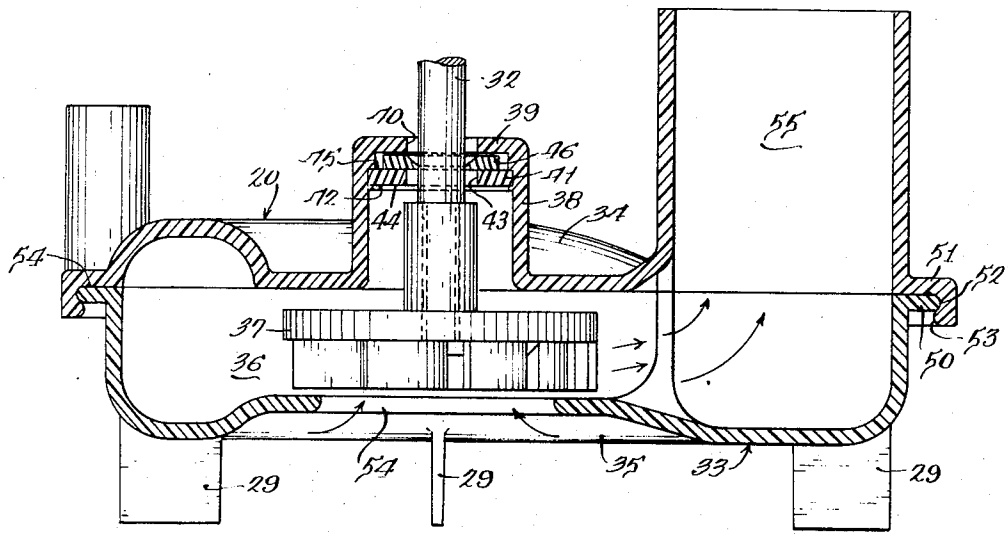
Primary Examiner—Henry F. Raduazo

Attorney—Hofgren, Wegner, Allen, Stellman & McCord

[57] **ABSTRACT**

A water pump for a commercial ice maker comprising a high capacity pump with a relatively large water flow rate and having an improved seal for sealing a motor shaft where it enters the pump chamber to avoid substantial leakage and resulting loss in pumping pressure.

2 Claims, 5 Drawing Figures



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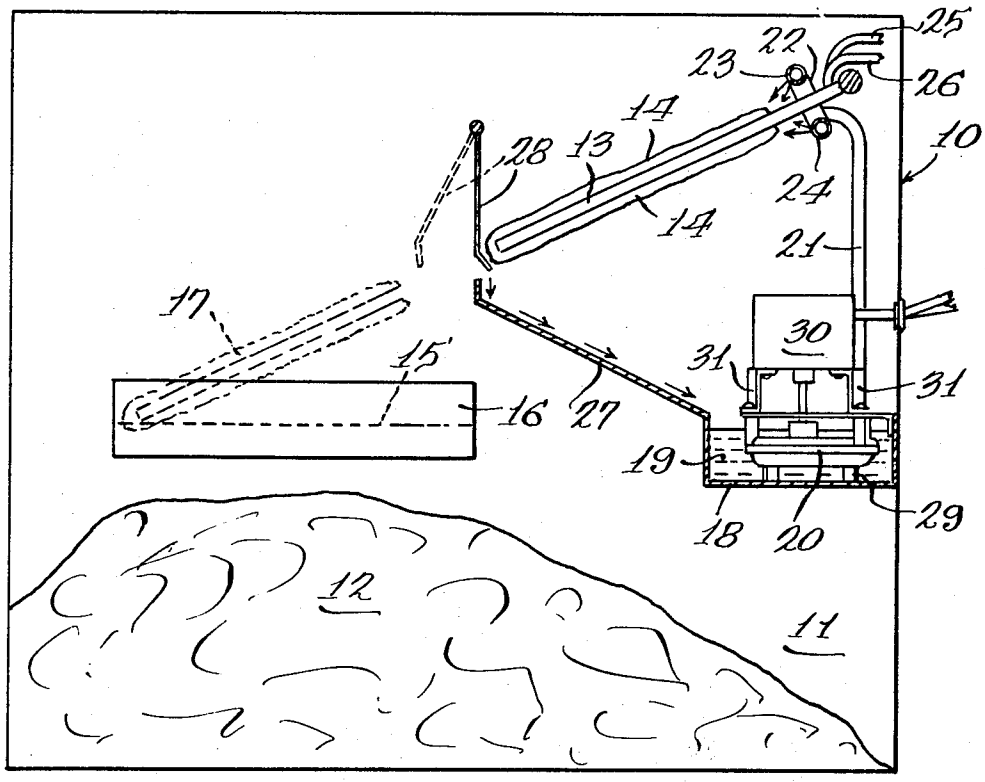


Fig. 1.

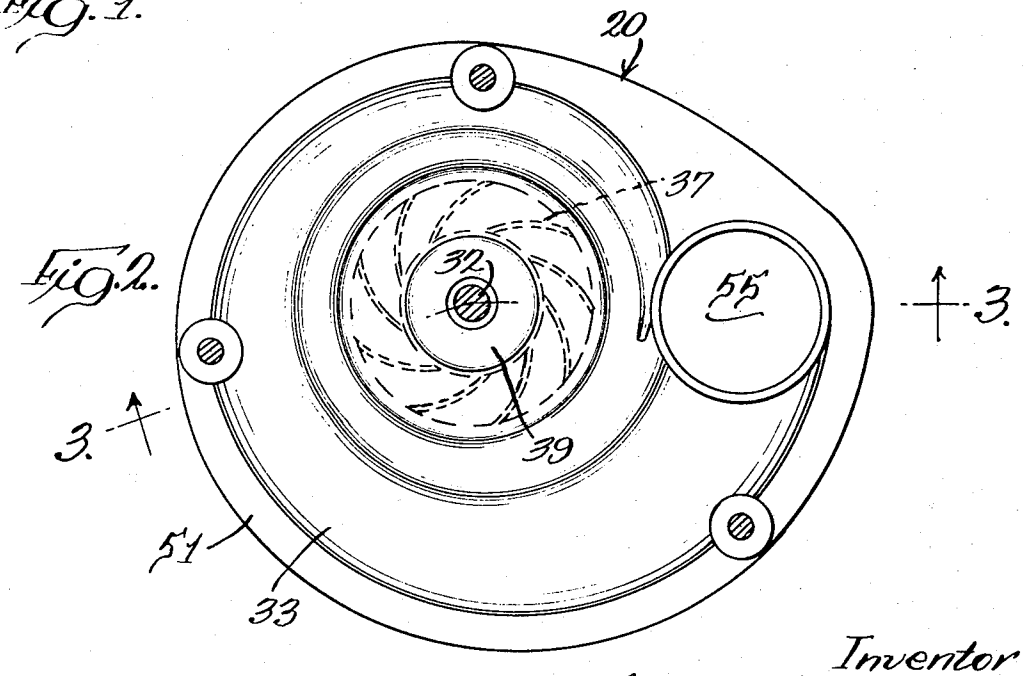


Fig. 2.

Inventor:
Walter C. Barnard
By Hofgren, Wegner,
Allen, Stellman & McCord
Attys

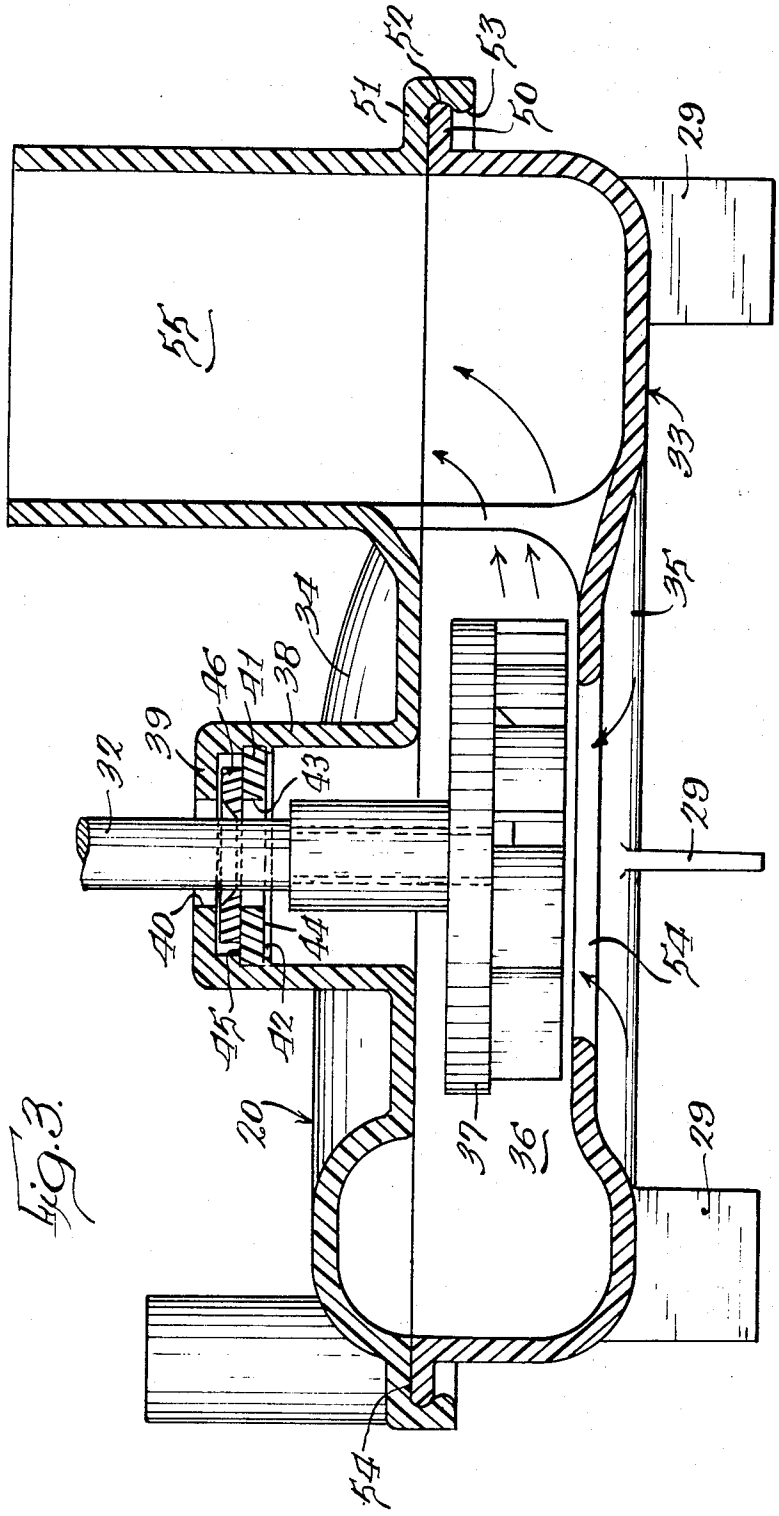


Fig. 3.

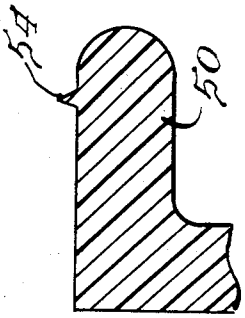


Fig. 4.



Fig. 5.

WATER PUMP

This application is a streamlined continuation of Ser. No. 813,536 filed Apr. 4, 1969, now abandoned.

Certain structure disclosed herein is also disclosed and claimed in the copending application of D. F. Swanson and W. G. Winkler Ser. No. 832,914, filed June 13, 1969 now issued as U.S. Pat. No. 3,625,023 that is assigned to the same assignee as is the present application.

One of the features of this invention is to provide an improved water pump for a commercial ice maker wherein the rate of flow of water from the pump is relatively great with resulting high pressure of the water and including an improved shaft seal adjacent the area where the motor shaft enters the pump in order to avoid substantial leakage and resulting drop in outlet water pressure.

The invention will be described as shown in the embodiment illustrated in the drawings. Of the drawings:

FIG. 1 is a view partially in section and partially in side elevation of a commercial ice maker including a pump embodying the invention.

FIG. 2 is a plan view of the pump housing with portions thereof shown in horizontal section.

FIG. 3 is a vertical sectional view taken substantially along line 3—3 of FIG. 2.

FIG. 4 is an enlarged fragmentary detail in section of the edge flange of the lower portion of the pump housing.

FIG. 5 is an enlarged detail sectional view of the shaft seal of the pump.

The commercial ice maker illustrated in the accompanying drawings is of the general type shown in D. F. Swanson U.S. Pat. No. 3,164,972, issued Jan. 12, 1965 and assigned to the same assignee as the present application. That is, the commercial ice maker **10** comprises a bottom storage portion **11** for collecting the ice **12**, an inclined refrigerated plate **13** on which the water is frozen to provide slabs of ice **14** which are here illustrated as formed on opposite sides of the plate **13**, rather than on the one side illustrated in the above U.S. Pat. No. 3,164,972, and an electrically heated wire grid **15** in a support **16** on which the released slab of ice **17**, illustrated in dotted lines in FIG. **1**, drops to be subdivided into ice portions as it melts its way through the electric resistance grid **15**.

The ice maker of FIG. **1** also includes a sump **18** for holding a supply of water **19**, a water pump **20** in the sump **18** to receive water therefrom and force the water under pressure up a pipe **21** and a spray head **22** having a top outlet **23** and a bottom outlet **24** for spraying water onto the top and bottom surfaces of the refrigerated plate **13** for forming the ice slab **14**.

The apparatus also includes refrigerant supply lines **25** and **26** for supplying liquid refrigerant to the interior of the plate **13** to produce the freezing effect and also to supply hot refrigerant to the interior of the plate **13** to melt the ice slab **14** from the plate where it slides by gravity to the position shown at **17** in dotted lines in FIG. **1** preparatory to being cut into smaller blocks or cubes.

The apparatus also includes an inclined surface conduit **27** for directing excess water that flows from the plate **13** back to the sump **18**. In order to direct this water onto the surface conduit **27** there is provided a hinged deflector **28** that is pushed out of the way to the

position illustrated by the dotted lines in FIG. **1** by the descent of the released ice slab **17**.

The pump **20** is retained above the bottom of the sump **18** by a plurality of supporting legs **29** as is illustrated most clearly in FIG. **3**. Above the pump **20** there is supported an electric motor **30** that is itself supported above the pump **20** by supporting legs **31**.

As shown most clearly in FIGS. **2–4**, the motor **30** has a downwardly extending drive shaft **32** that extends into the pump **10**. This pump includes a housing **33** that has an upper part **34** and a lower part **35** that are joined together to form a coplanar chamber **36**. In the chamber **36** there is positioned a usual pump impeller **37** that is mounted on the lower end of the motor shaft **32** which extends into the impeller chamber **36**.

Above the impeller **37** the pump housing is formed to provide a shaft seal chamber **38** which is integral with the upper part **34** of the pump housing **33**. This shaft seal chamber **38** has an upper wall **39** through which the motor shaft **32** extends. As can be seen in FIG. **3**, the opening **40** in this upper wall **39** is considerably larger than the diameter of the shaft **32**.

Positioned within the seal chamber **38** is an annular seal retainer **41** that is held in position by an annular bead **42** on the inner surface of the chamber **38**. This seal retainer **41** has a central opening **43** of larger diameter than the shaft **32** and through which this shaft extends. The retainer **41** has an inner surface **44** adjacent the impeller **37** and an outer surface **45** spaced from the seal chamber upper wall **39**.

Located between this outer surface **45** of the seal retainer **41** and the upper wall **39** is an annular shaft seal **46** that has a thickness slightly less than the vertical distance between the top surface **45** and the upper wall **39**. This seal **46** has a central opening defined by an annular shaft engaging surface **47** that is of an axial length (vertical width) that is considerably less than the maximum thickness of the seal **46** itself. Thus, preferably, this axial length of the surface **47** is less than one-half the maximum thickness of the seal.

The seal **46** has a flat surface **48** facing the impeller **37** and a tapered surface **49** extending upwardly and outwardly from the shaft engaging surface **47**. As can be seen in FIG. **3** this tapered surface is on the side of the seal adjacent the upper wall **39** of the chamber **38**.

In a typical embodiment of the invention the shaft seal **46** has a thickness of 0.065 inch, a taper **49** of 45°, a vertical spacing when at rest from its top surface to the upper wall **39** of 0.015 inch (depending on the shaft diameter this could vary between 0.010 inch and 0.020 inch), a lateral clearance between its outer periphery and the inner surface opposite this periphery of 0.09 inch and an axial length at the surface **47** of 0.01 inch.

The upper **34** and lower **35** parts of the pump housing are snapped together to form the assembled housing. In order to provide this the peripheries of these housing parts are provided with outwardly extending flanges **50** and **51**. The outer rounded edge of the lower flange **50** is received in an undercut groove **52** and is received therein by being snapped past an inwardly projecting ridge **53** on an annular portion of the flange **51** which surrounds the flange **50**.

In order to provide an effective seal between the two flanges **50** and **51** the flange **50** (FIG. **4**) is provided with a continuous V-shaped ridge **54** on its surface that

bears against the other flange **51** and the corresponding surface of this other flange **51** is provided with a similarly shaped groove to receive the ridge **53**.

The seal of this invention not only provides a very effective shaft seal which prevents loss of water pressure and thus loss of water flow rate but is also quite easy to make and assemble. Thus the pump housing **33** parts are preferably made of a rigid plastic material that is molded in a forming operation and during this molding all of the plastic parts including the seal retainer and seal **46** may be made in a one-shot process. In addition, the seal can be inserted during the molding cycle which is a considerable saving on labor.

Because of the small shaft engaging surface **47** of the seal there is very little interference with the rotation of the shaft **32**. The seal also is provided with the above-mentioned vertical clearance as well as lateral clearance so that it can adapt itself to the position or misalignment of the motor **30**.

During the operation of the pump the water pressure within the housing **33** will of course also be applied within the seal chamber **38** and this forces the seal **46** up against the upper wall **39** to form a very tight seal not only with the shaft **32** but also with this upper wall **39**.

The pump **20** is provided with the usual water inlet opening **54** leading from the sump **18** into the impeller chamber **36** and a water outlet **55** from the chamber **36** and emptying into the previously described water outlet pipe **21**. These are, of course, customary structures in a pump of this type.

Having described my invention as related to the embodiment shown in the accompanying drawings, it is my intention that the invention be not limited by any of the details of description, unless otherwise specified.

I claim:

1. A water pump for a commercial ice maker, comprising: a rigid plastic pump housing having a water inlet, a water outlet and an impeller chamber; a rotatable shaft extending into said chamber; an impeller in said chamber for rotation by said shaft to develop a water pressure in said chamber; means forming a shaft seal chamber adjacent said pump chamber integral with said housing having a radial outer wall through which said shaft extends, an annular seal retainer of rigid plastic fixed against rotation in said seal chamber having an opening of limited larger diameter than said shaft through which said shaft extends, said retainer having an inner surface adjacent said impeller and an outer surface spaced axially inwardly from said seal chamber outer wall; and a one-piece annular floating shaft seal of rigid plastic located between said retainer outer surface and said seal chamber outer wall and having a radial inner surface subjected to water pressure from said impeller and an axial opening through which said shaft extends, said shaft seal defining a frustoconical, axially outwardly widening, axially outer surface about said opening, said opening being defined by a cylindrical shaft engaging surface extending axially outwardly from said inner surface of the seal less than one-half the axial thickness of said seal, said shaft seal having a thickness less than the distance between said retainer outer surface and said seal chamber wall and said seal chamber being defined radially outwardly by an annular surface, said shaft seal having an outer periphery spaced radially inwardly from said annular surface so as to float with respect to said seal chamber outer wall, said retainer outer surface and said annular surface of said seal chamber, and said pump housing, retainer, and seal being formed of the same plastic material.

2. The pump of claim 1 wherein said rigid shaft seal has an axial thickness less than one-half the radial thickness thereof and is tapered inwardly to said shaft engaging surface thereof.

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