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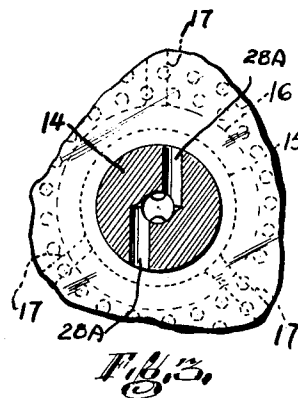
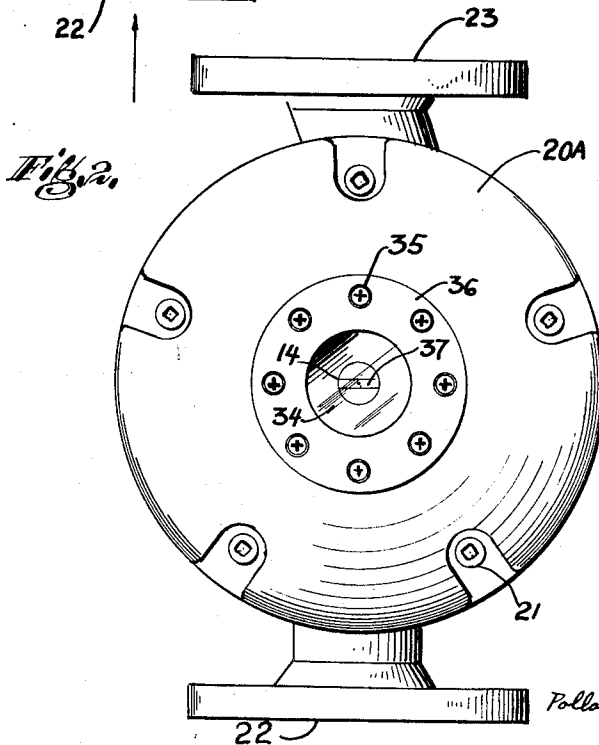
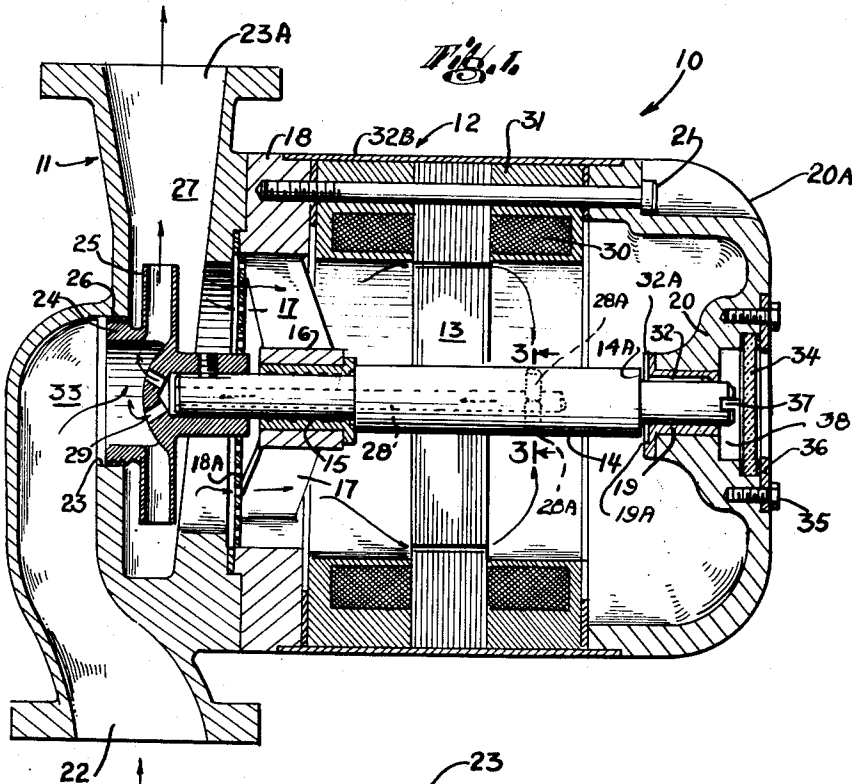
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PUMP

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2 Sheets-Sheet 1



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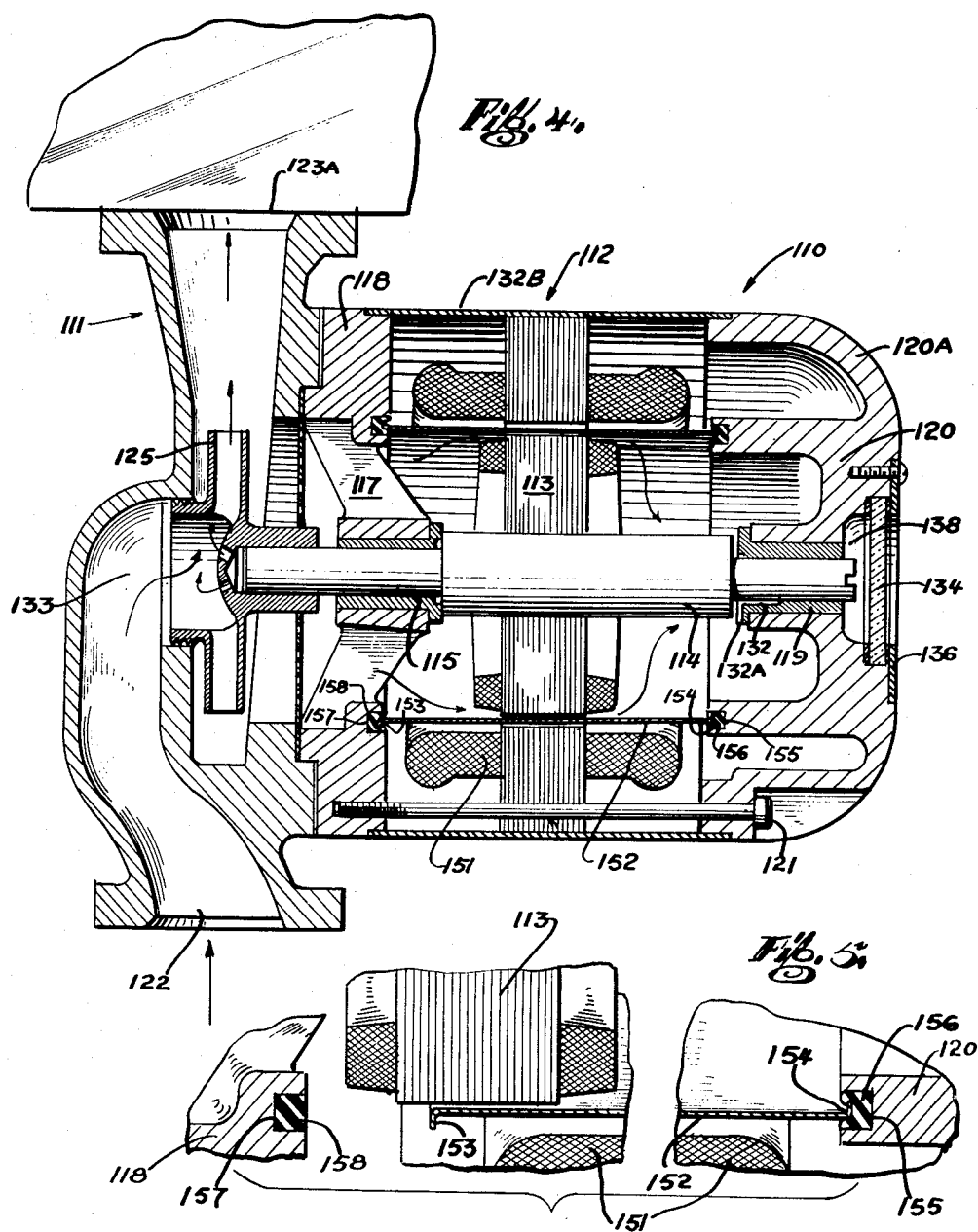
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2 Sheets-Sheet 2



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This invention relates to circulating pumps or the like, such as those adapted for use in hot water heating systems, and particularly to a totally enclosed unitary electric motor and pump combination.

One of the problems in circulating pumps having a shaft means connecting the pump with a driving motor has been that of leakage through the stuffing boxes or seals through which the shaft means normally must pass. A circulating pump used in a domestic heating system must be one which is quiet in operation and which will operate for long periods without attention, such requiring among other features means for lubricating the bearings. A pump of this type also is subject to failure because of being rotationally stopped by dirt in the system and thus it is desirable to provide simple means to overcome such a stoppage but wherein very little liquid will be lost.

One of the objects of the invention is to provide an improved enclosed pump and electric motor combination arranged to operate without external lubrication.

A further object of the invention is to provide a pump and motor combination wherein the pump can be freed in a simple manner in case it should be stopped without loss of substantial amounts of liquid.

In one aspect of the invention, a fluid tight housing means can be provided having an access aperture therein and fluid inlet and outlet fluid connections to the pump impeller which preferably is of the centrifugal type. An electric motor and a rotary type centrifugal pump operated thereby is enclosed in said housing, there being no stuffing boxes, glands or seals employed. The combination is arranged so that fluid being pumped will be free to pass at least over the rotor of the motor. The fluid being pumped also is arranged so that it will suitably lubricate the bearings supporting the shaft means joining the motor and pump. In order to provide for easy access to the end of the shaft so as to turn it or "deblock" it in case of stoppage of the rotor due to dirt or foreign matter in the system, a removable fluid tight cover plate is provided for said aperture, such as described in U.S. Patent No. 2,756,680, dated July 31, 1956. In order to inhibit loss of liquid when it is necessary to remove said cover, the housing of the present invention has a partition means adjacent the end having said access aperture, the partition wall carrying one end of said shaft and defining a chamber into which said access aperture opens. A bearing for the shaft can be carried by said partition, said bearing being arranged so that liquid in the housing will lubricate the bearing. In one form, this may be a lubricating groove or slot for receiving fluid from the interior of the pump, the bearing and groove being arranged so that flow of liquid from the interior of the pump into said chamber will be substantially prevented or restricted. In a preferred aspect, the groove extends only part way through the bearing. The closure plate in one form may be transparent so that the end of the shaft is viewable therethrough and the shaft end may be suitably marked so that its operation can be viewed. If it is necessary to turn the shaft to free or deblock the

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pump, the closure plate can be removed exposing the shaft end and the chamber, the invention herein preventing an undesirable flow of liquid therefrom.

There may be a central passage part way through the shaft, the outlet therefrom being connected to the inlet of the pump. Transverse connecting passage means may lead from the exterior part of the shaft to said central passage in the zone adjacent the motor to enhance circulation. In one aspect, the transverse passage means may be arranged to provide a pumping action from the interior of the casing into said shaft such as by locating the transverse passage means eccentrically relative to the axis of the shaft.

The pump impeller and the electric motor rotor are submerged in the liquid being pumped in a fluid tight enclosure means. In one form, the stator of the motor may be enclosed in a waterproof plastic which is part of the fluid tight enclosure means. In another form, a tube may be used to separate the rotor and stator, the tube having flanged ends cooperating with gaskets or sealing members on the housing, said flanged ends being arranged so that the motor and pump can be assembled and disassembled from one end.

At the inlet end of the pump, a central portion of the rotor may extend into the inlet aperture of the pump casing aperture, said central portion being arranged relative to the margins of the aperture so that there is a tortuous passage to reduce flow of fluid passing from the pressure side of the rotor back to the inlet side.

These and other objects, advantages and features of the invention will become apparent from the following description and drawings, which are merely exemplary.

In the drawings:

Fig. 1 is a sectional elevation view.

Fig. 2 is an end view looking from the right of Fig. 1.

Fig. 3 is a fragmentary sectional view taken along the line 3—3 of Fig. 1.

Fig. 4 is a sectional view of a modified form.

Fig. 5 is an enlarged broken fragmentary view of the tubular means of Fig. 4.

Fluid tight housing 10 may include pump casing portion 11 and motor casing portion 12 (Fig. 1). Pump impeller 25 may be mounted on pump and motor shaft 14, shaft 14 being carried adjacent one end in bearing 15, said bearing being supported in hub 16. Motor rotor 13 is carried by shaft 14. Hub 16 may be connected by arms 17 with its flange 18 and there may be two or more arms 17 for supporting hub 16, said arms being arranged to provide passages for fluid from the pressure side of the pump to at least the rotor of the motor. If desired, a perforated plate 18A may be located in the path of fluid toward the rotor so as to prevent large foreign particles from reaching the same.

The opposite end of shaft 14 may be journaled in bearing 19 carried in partition 20 of end casing 20A. End casing 20A may be fastened by means of bolts 21 to flange 18, intermediate motor casing 32B covering stator 30. Flange 18 may be suitably fastened by screws (not shown) to pump casing 11, pump casing 11 having an inlet pipe connection 22 and outlet pipe connection 23A.

Inlet aperture margins 23 in pump casing 11 may have inlet impeller portion 24 of the pump impeller extending therein. The periphery of said extending inlet portion 24 of the rotor may be grooved as at 26 to provide a tortuous liquid passage relative to the margin 23 of the inlet aperture. When the pump is operated, liquid will enter inlet passage 33 and the impeller will force it into pressure chamber 27. The small portion of liquid leaking back through the tortuous passage into the inlet side will have its pressure, and therefore flow, reduced because of the irregular passage. Also, if dirt becomes lodged in the passage, it can move easily into the grooves in the

turbulent flow and thereby reduce the friction or drag created by the dirt contacting the impeller and housing. Further, by grooving, the closely fitting portion surface area will be reduced or the clearance may be increased.

A portion of fluid from pressure chamber 27 will flow into the motor compartment and thence through central passageway 28 in the motor shaft to ports 29 in the pump body and back into the inlet passage of the impeller. In one form of the invention, transverse passages 28A are formed with their axes eccentric or offset relative to the shaft center, preferably in the direction of rotation, so as to assist flow from the motor zone back through the shaft to the inlet so as to enhance fluid circulation. The axis of the transverse port means 28A does not coincide with a longitudinal plane through the axis of the shaft.

In one aspect of the invention, stator windings 30 of the motor may be mounted, for example, in a suitable waterproof insulating resin 31, one such resin which has been found to be of advantage being an epoxy resin. Shell 32B can have the stator mounted therein and the resin placed therein, the insulating resin thus being in effect part of the fluid tight enclosure means enclosing the impeller, shaft and stator.

The pumped fluid circulating in and around the motor will lubricate bearing 15 and thrust surface 19A. Groove 32A in bearing 19 will facilitate fluid finding its way to the bearing surfaces of 19 for lubrication purposes. In the form shown, groove 32 does not extend to the outboard end of the bearing so that fluid will be permitted to flow only slightly into chamber 38. Groove 32 also may be extended the length of the bearing but be made sufficiently small or of such shape so that any leakage there-through will not be objectionable. Furthermore, the bearing and journal can be dimensioned in various manners to carry out the aforementioned operating condition of a lubricating passage with or without the groove.

When the motor is at rest and increased pressure is introduced on the liquid in the pump, pressure from the left toward end partition 29 (Fig. 1) may cause shoulder 14A to tightly engage the left face 19A of bearing 19 so as to create high frictional forces therebetween. Further, if oil, for example, is present between said shoulder and left face 19A of bearing 19, fluid pressure may not have access to chamber 38 so as to balance the force from the left end of the shaft. In order to overcome this problem, groove 32A also will serve to feed fluid to this face and into compartment 38 when the motor is started, thereby balancing pressures and eliminating the thrust caused by this pressure differential.

Compartment or chamber 38 in end 20A may have a fluid tight closure member which can include transparent plate 34 held in place by screws 35 and retaining ring 36. The end of shaft 14 in the form shown has a slot 37 therein for receiving a screw driver or other shaft turning implement after removal of closure plate 34. In the event that the motor or pump becomes locked by dirt or the like, cover plate 34 can be removed and a screw driver or suitable shaft turning means inserted in slot 37 to turn the shaft and thus free the pump. It should be evident that the end of the shaft may have any suitable shape for receiving a complementary shaft turning means and that the shaft does not necessarily extend all of the way through the bearing.

Figs. 4 and 5 illustrate another form of the invention wherein the rotor is separated from the stator by means of a tube. The parts of the structure of Figs. 4 and 5 which correspond to those of Figs. 1 to 3 are given the same reference numerals with the addition of 100 thereto.

Rotor 113 is separated from the stator 151 by means of tube 152, said tube being of stainless steel or other nonmagnetic material. Tube 152 has an outwardly turned flange 153 at one end and an inwardly turned flange 154 at the other end. End wall 120A may have an annular groove 155 therein, said groove receiving a suitable seal ring or means 156. Flange 118 may have

annular groove 157 receiving a suitable seal ring or means 158.

In assembling the pump, stator 151 and shell 132B can be placed in assembled relation to end housing 120A. Tube 152 then is moved inside of the stator assembly and centered in position on its seal ring 156 on end wall 120A. Shaft 114 and rotor 113 mounted thereon can be positioned within tube 152, one end being slipped into its bearing 119. Flange 118 then is assembled relative to tube 152 so that seal ring 157 will engage the outwardly turned flanges 153 thereof. The remaining parts of the pump then can be assembled and the various bolts fastening the parts together suitably tightened. It can be seen that tube 152 with its inturned and outturned flanges 157 will facilitate assembly and disassembly of the pump.

It is to be understood that details of construction can be varied without departing from the spirit of the invention except as defined in the appended claims.

What is claimed is:

1. In a unitary liquid pump and motor device of the type adapted to operate in the atmosphere and having a motor rotor and stator wherein the motor rotor is at least partially submerged in the liquid being pumped, the combination including a housing means having pipe inlet and outlet connections adjacent one end thereof opening into a pump cavity, the inlet connection including a wall with an aperture, an electric motor in said housing means, a pump rotor in said pump cavity, said pump rotor having an annulus extending into the aperture in said wall, one of the margins of said annulus and aperture being grooved to provide a tortuous passage for liquid returning from the pressure side of said pump to the inlet side, a solid partition means adjacent the electric motor end of said housing means and defining a chamber with an access opening from the exterior of said housing means, shaft means joining said motor and pump, bearing means in said partition for said shaft means, said shaft means having an end extending into said bearing means and accessible from said opening, axially extending lubricating groove means in said bearing means opening into the interior of said housing means providing for liquid flow thereto but not freely passing liquid to said chamber, means on said shaft end for receiving shaft turning means, and liquid tight closure member removably mounted over said access opening.

2. In a unitary liquid pump and electric motor combination having a motor rotor and stator wherein the motor rotor is submerged in the liquid being pumped, the combination including housing means with pump inlet and outlet connections, an electric motor in said housing means, a pump in said housing means, shaft means joining said motor rotor and pump, one end of said shaft means being in communication with the inlet to said pump, said shaft means having passage means extending at least part way therethrough, said passage means communicating with said pump inlet, and transverse port means connected to said passage means adjacent said motor rotor for receiving liquid from the space adjacent said motor rotor, the axis of said port means at the surface of the shaft not coinciding with a plane passing through the axis of the shaft to enhance flow through said passage means.

3. In a unitary liquid pump and motor device of the type adapted to operate in the atmosphere, the combination including housing means with pump inlet and outlet pipe connections, said housing means including a motor stator and having a cavity therein, solid partition means adjacent one end of the housing means and defining a chamber with an access opening from the exterior of said housing means, said motor having an armature in said cavity, an impeller in said housing means between said inlet and outlet pipe connections, bearing means in said partition means, shaft means joining said armature and impeller, said armature and bearing means being in liquid communication with said impeller, said shaft means hav-

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ing an end extending into said bearing means and accessible from said access opening, said motor stator having means for water sealing it from said cavity, lubricating groove means in said bearing means extending axially only part way through said bearing means from the interior of said cavity through which fluid from the pump can enter but not freely pass fluid to said chamber, and a liquid tight closure member removably mounted over said access opening, said closure member being removable to gain access to said shaft end without substantial leakage of fluid from said housing means. 10

4. A device as set forth in claim 3 including means on the shaft having a first radial face adjacent said bearing means, and a second radial face in said housing adjacent said first radial face, said second radial face having a liquid passage groove communicating with said lubricating groove means. 15

5. In a unitary liquid pump and electric motor combination having a motor rotor and stator wherein the motor rotor is submerged in the liquid being pumped, the combination including housing means with pump inlet and outlet connections, an electric motor in said housing means, a pump in said housing means, shaft means joining said motor rotor and pump, one end of said shaft means being in communication with the inlet 20 25

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to said pump, said shaft means having passage means extending at least part way therethrough, said passage means communicating with said pump inlet, and transverse port means connected to said passage means adjacent said motor rotor for receiving liquid from the space adjacent said motor rotor, said port means being formed to enhance the flow of fluid to said passage means.

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