United States Patent

Buse

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[54] **CENTRIFUGAL PUMP HAVING LEAKAGE COLLECTION AND DRAINING MEANS**

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[52] **U.S. Cl.**.....**415/110,** 415/170 A, 415/219

[51] **Int. Cl.**.....**F01d 11/00**

[58] **Field of Search**.....415/109, 110, 170 A, 219

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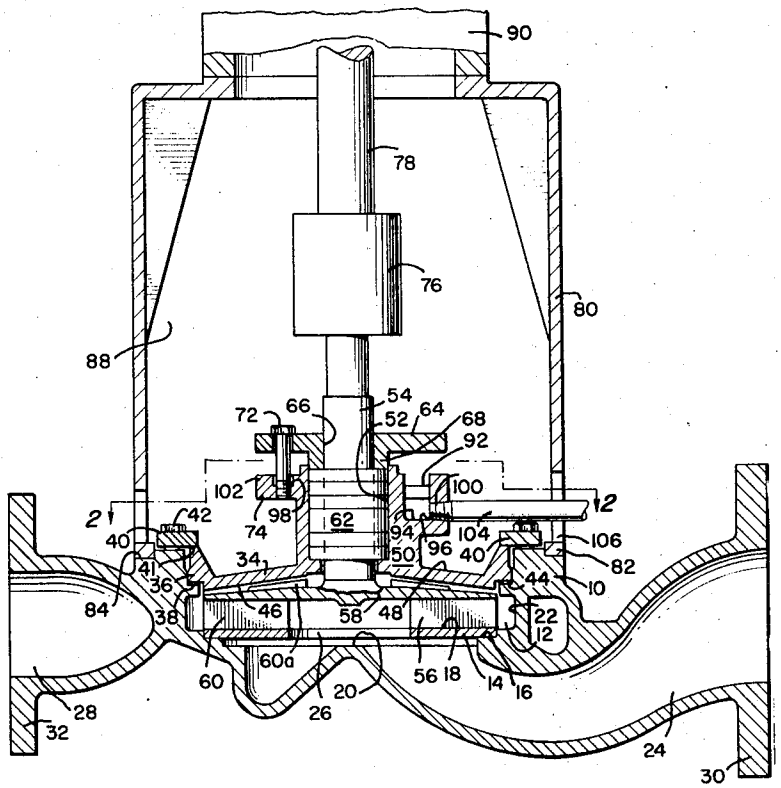
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[57] **ABSTRACT**

A centrifugal pump in which the hub portion of the casing cover is provided with a liquid leakage collecting channel having a recessed portion communicating through a drainage outlet with a conduit discharging liquid collected in the channnel. Also, the side face of the casing cover external to the pumping chamber slopes downwardly towards its periphery for facilitating collection of liquid at the periphery; and a drainage conduit communicates with such periphery for removing the collected liquid.

17 Claims, 3 Drawing Figures



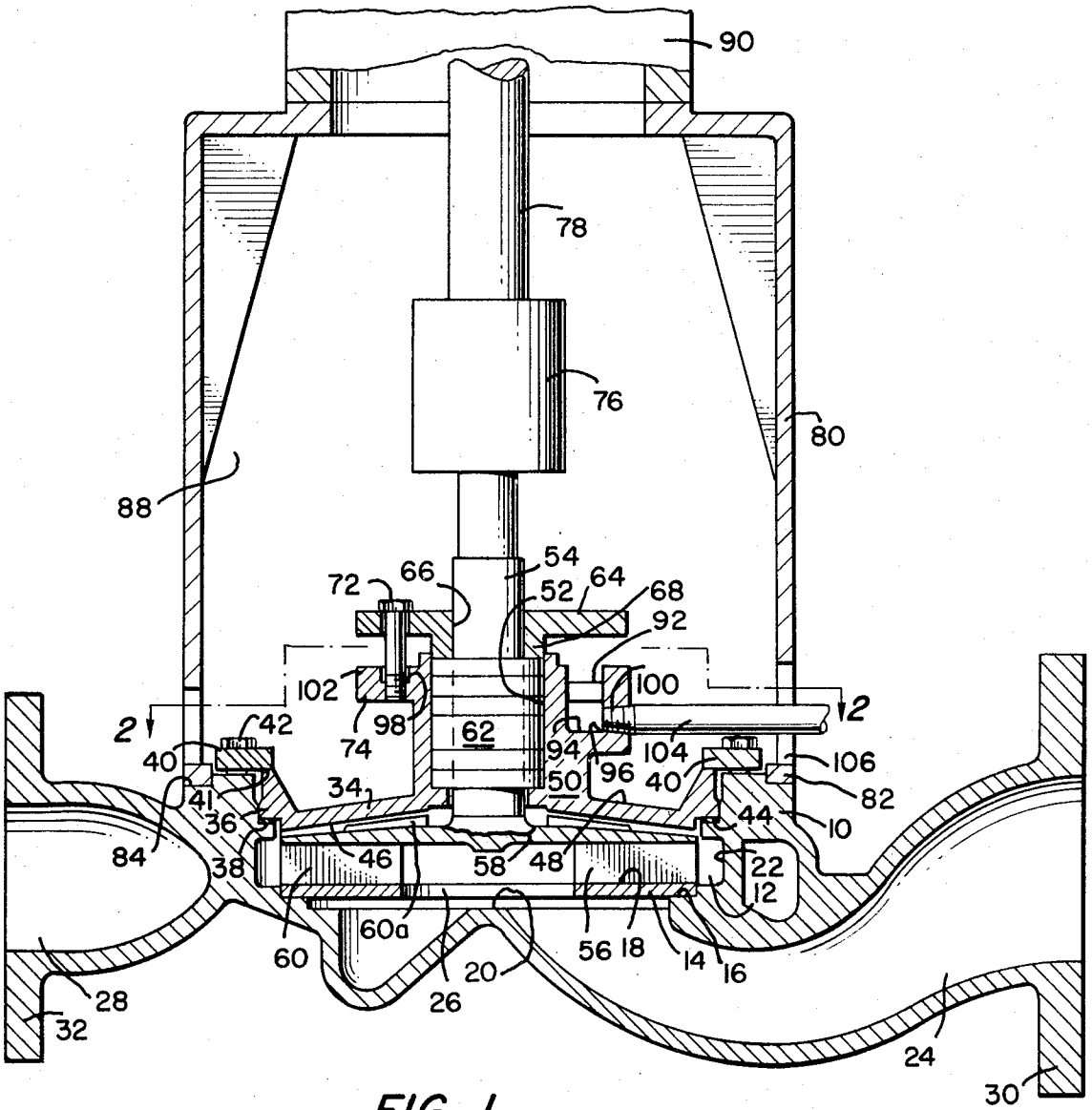


FIG. 1

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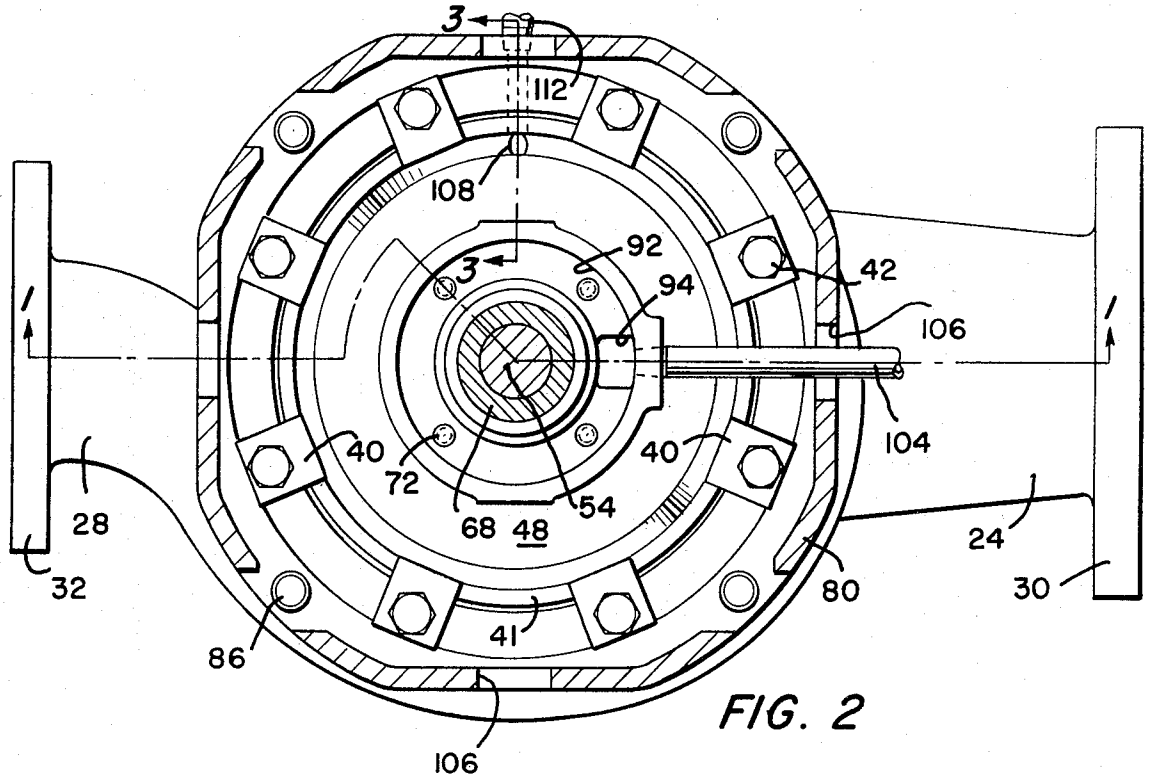


FIG. 2

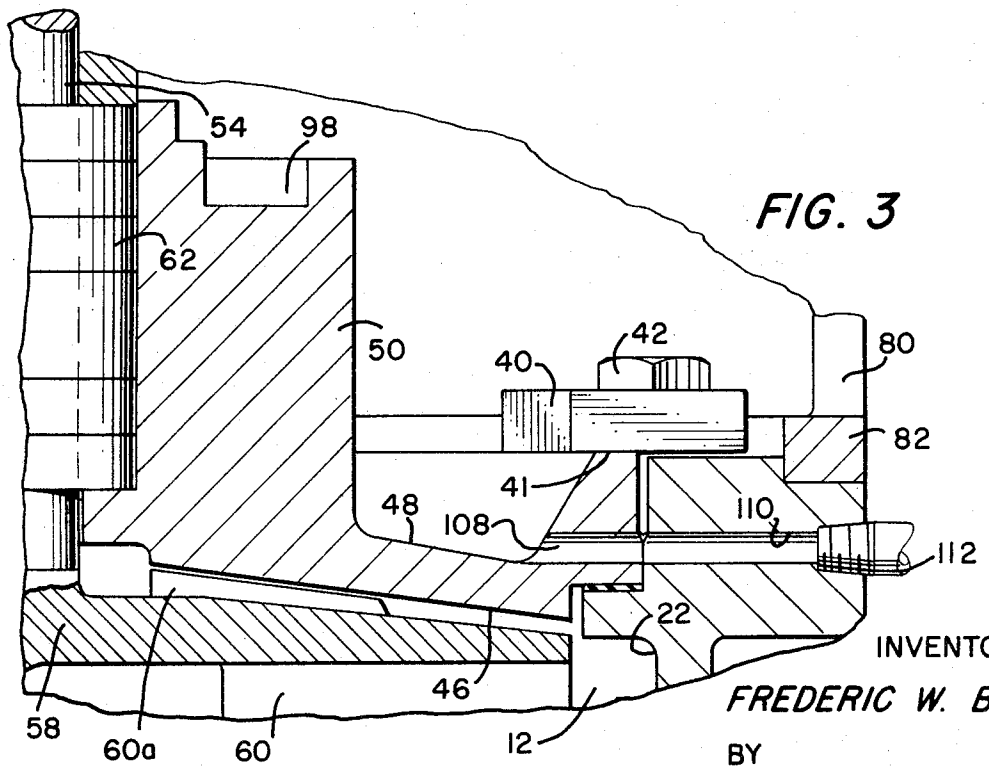


FIG. 3

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CENTRIFUGAL PUMP HAVING LEAKAGE COLLECTION AND DRAINING MEANS

The present invention relates to centrifugal pumps and more particularly to the collection and drainage of liquid leakage and other liquid external to the pumping chambers of such pumps.

In conventional vertical centrifugal pumps, liquid leakage from the pumping chamber along the impeller shaft generally has been allowed to collect on the side face of the casing cover external to the pumping chamber where, in combination with cleaning water and other liquid entering the pump housing from outside sources, it remained in a stagnant pool until subsequent dismantling of the pump. This accumulation of the leakage and other liquid in a stagnant pool on the casing cover is highly objectionable and, depending on the nature of the leakage, can result in external corrosion of the pump components and/or present a potential hazard due to its fumes or toxicity. Also, due to this pool, the dismantling of these conventional pumps must proceed with extreme care lest the pool be spilled on adjacent surfaces and/or attending personnel; and the outside liquid component of the pool presents the danger of possible contamination of the liquid being pumped.

An object of the present invention is to provide a new and improved centrifugal pump which is particularly constructed and arranged to prevent the formation of the aforedescribed stagnant pool of liquid.

Another object of the invention is to provide a new and improved centrifugal pump which is particularly constructed and arranged to permit the collection and drainage of leakage and other liquid from the pump.

In accordance with the present invention, a centrifugal pump may comprise a casing containing a pumping chamber and having inlet and discharge ports connected to the pumping chamber, a casing cover mounted on the casing and having a side face bounding one side of the pumping chamber and an opposite side face external to the pumping chamber, the casing cover including a central hub portion projecting from its said opposite side face, a rotatable shaft extending through the hub portion of the casing cover, an impeller in the pumping chamber mounted on the shaft, sealing means in the hub portion around the shaft for restricting leakage from the pumping chamber through said hub portion, the hub portion having a collar therearound and the collar including a collecting channel extending around the shaft, such collecting channel including a portion recessed from another portion thereof, outlet means communicating with the recessed portion of the collecting channel for draining liquid therefrom, said opposite side face of the casing cover sloping downwardly from the hub portion towards its outer periphery to facilitate drainage theretowards and outlet means communicating with the outer periphery of said opposite side face of the casing cover for draining liquid there from. Referring to the drawings:

FIG. 1 is an elevational sectional view of a vertical in-line centrifugal pump embodying the invention taken on Line 1—1 of FIG. 2, looking in the direction of the arrows;

FIG. 2 is a sectional view of the pump shown in FIG. 1 taken on Line 2—2 of FIG. 1, looking in the direction of the arrows; and

FIG. 3 is an enlarged fragmentary elevational sectional view of such pump taken on Line 3—3 of FIG. 2, looking in the direction of the arrows.

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout the several views, the illustrated vertical in-line centrifugal pump comprises a casing **10** containing a pumping chamber **12** and provided with a flat annular plate shroud **14** which is detachably mounted in an annular recess **16** in the casing **10** such that its flat upper surface **18** bounds the lower or forward side of the pumping chamber **12**. The casing **10** includes the usual centrifugal pump surface **20** below the plate shroud **14** and has an annular wall **22** peripherally bounding the pumping chamber **12**. The casing **10** comprises an inlet **24** communicating with the pumping chamber **12** through the opening **26** in the plate shroud **14** and an outlet **28** connected to the pumping chamber **12** through the annular wall **22**, the inlet **24** and outlet **28** being in the conventional manner provided with integral flanges **30, 32**, respectively, for connecting the pump in the pipeline through which the liquid is to be pumped.

A casing cover **34**, having an annular flange **36** supported on an annular ledge **38** of the casing **10**, is detachably clamped to the latter by eccentric washers **40** mounted to the casing **10** by mounting bolts **42** and engaging an annular upright peripheral rim or flange **41** on the casing cover **34**. Leakage between the flange **36** and the ledge **38** is the usual manner prevented by a therebetween annular sealing gasket **44**. The casing cover **34** includes an annular flat lower surface or side face **46** sloping downwardly towards the outer periphery of the casing cover **34** and bounding the upper or rearward side of the pumping chamber **12**; and the casing cover **34** also includes an annular flat upper surface or side face **48** external to the pumping chamber **12**. The casing cover **34** includes an integral central hub portion **50** which extends upwardly from its upper side face **48** and contains a vertical bore **52** extending through the casing cover **34**.

A vertical, rotatable impeller shaft **54** extends through the bore **52** and at its lower end carries an impeller **56** in the pumping chamber **12**. The impeller **56**, as illustrated, includes a rear shroud **58**, but no front shroud, and has a plurality of vanes **60** and radial blades **60*a***. Conventional packing or sealing rings **62**, intended for preventing liquid leakage from the pumping chamber **12** along the impeller shaft **54**, are provided in the bore **52** around the impeller shaft **54**. The packing **62** is detachably mounted in operative position by an annular clamping element **64** which contains a bore **66** rotatably receiving the impeller shaft **54** and has a depending portion **68** extending into the bore **52** in engagement with the uppermost of the packing **62**. The clamping element **64** is connected by mounting bolts **72** to an annular collar **74** formed integrally around the upper end of the hub portion **50**.

At its upper end, the impeller shaft **54** is connected by a coupling **76** to the lower end of a motor shaft **78** which is at its upper end connected to be rotatably driven by the pump motor **90**. The coupling **76** may, if desired, include conventional adjusting means operable for vertically moving the impeller shaft **54** to thereby adjust the clearance of the impeller **56**.

A housing **80**, surrounding the coupling **76** and adjacent portions of the pump, includes an annular flange **82** seating on an annular ledge **84** of the casing **10** to cause the casing **10** to support the housing **80**. The housing **80**, as shown in FIG. **2**, is detachably mounted to the casing **10** by four mounting bolts **86** at equally spaced locations therearound. The housing **80** contains a plurality of large side openings **88** adapted to permit ready access to its interior and at its upper end supports the pump motor **90**.

In the illustrated embodiment of the invention, the upper surface of the collar **74** of the casing cover hub portion **50** is provided with a relatively shallow, annular, liquid collecting channel or trough **92** encircling the impeller shaft **52**. A minor arcuate portion of this channel **92** is substantially deepened to form a deeper recess or pocket **94** in communication with the remainder of the channel **92** and having its bottom **96** substantially below the bottom **98** of such remainder. A drainage outlet **100** is formed through the outer wall **102** of the channel **92** in communication with the recess **94** immediately above the level of its bottom **96**; and a drainage conduit or pipe **104** is connected to the recess **94** at the drainage outlet **100** and projects through an opening **106** in the housing **80** to drain liquid externally of the latter. As illustrated in FIG. **2**, the housing **80** is preferably provided with a plurality of such openings **106**, adjacent openings **106** being at 90° intervals, to permit adjustment of the angular mounting of the housing **80** on the casing **10**.

Also, in the illustrated embodiment of the invention, the upper side face **48** of the casing cover **34** is flat and continuously slopes downwardly as it extends outwardly from the hub portion **50** to the peripheral flange **41**. A drainage outlet **108** is formed radially through the peripheral flange **41** to receive liquid on the outer periphery of the side face **48** immediately above the level of the latter; and an aligned drainage outlet **110** is formed through the casing **10**. A drainage conduit or pipe **112** is connected to the outlet **110** to receive liquid drained through the communicating outlets **108**, **110** and discharges the received liquid externally of the pump.

In the operation of the pump, the impeller **56** is continuously rotatably driven in the pumping chamber **12** to pump liquid from the inlet **24** through the outlet **26**. Liquid leakage along the impeller shaft **54** through the packing **62** passes into the channel **92** and thence into the recess **94** from whence it is discharged to a point of disposal external to the pump through the drainage conduit **104**. Liquid flowing onto the upper side face **48** of the casing cover **34**, whether entering the housing **80** through the side openings **88** or otherwise passing onto the upper side face **48**, flows outwardly to the periphery and is discharged therefrom through the drainage openings **108**, **110** and the drainage conduit **112**. Hence, the formation of the stagnant liquid pools normally present in conventional pumps of this general type is prevented; and the aforedescribed hazards and dangers of such pools are resultantly avoided.

Although only a single embodiment of the invention has been illustrated and hereinbefore specifically described, it will be understood that this illustrated embodiment has been given by way of example only; and the invention is not limited merely to this single embodiment, but rather comprises other embodiments and variations within the scope of the following claims.

Having thus described my invention, I claim:

1. In a centrifugal pump adapted to be generally vertically mounted, a casing containing a pumping chamber and having inlet and discharge ports connected to said pumping chamber, a casing cover mounted on said casing and having a side face bounding one side of the pumping chamber and an opposite side face external to said pumping chamber, said casing cover including a central hub portion projecting from its said opposite side face, a rotatable shaft extending through said hub portion of said casing cover, an said pumping chamber mounted on said shaft, sealing means in said hub portion around said shaft for restricting leakage from said pumping chamber through said hub portion, said hub portion having a collar therearound and said collar including a collecting channel extending around said shaft, said collecting channel including a portion recessed from another portion thereof, outlet means communicating with said recessed portion of said collecting channel for draining liquid therefrom, said opposite side face of said casing cover sloping downwardly from said hub portion towards its outer periphery to facilitate liquid drainage theretowards, and outlet means communicating with the outer periphery of said opposite side face of said casing cover for draining liquid therefrom.

2. A centrifugal pump according to claim **1**, wherein said periphery of said opposite side face of said casing cover is provided with a generally upstanding rim.

3. A centrifugal pump according to claim **1**, further comprising a plate detachably mounted to said casing bounding the side of said pumping chamber opposite to said one side thereof.

4. A centrifugal pump according to claim **3**, wherein said plate is generally annular and said inlet port communicates with said pumping chamber through the opening in said plate.

5. A centrifugal pump according to claim **1**, wherein said side face of said casing cover bounding one side of the pumping chamber slopes downwardly from said hub portion of said casing cover towards its periphery.

6. In a centrifugal pump adapted to be generally vertically mounted, a casing containing a pumping chamber and having inlet and discharge ports connected to said pumping chamber, a casing cover mounted on said casing and having a side face bounding one side of the pumping chamber and an opposite side face external to said pumping chamber, said casing cover being provided with a central hub external to said pumping chamber, a rotatable shaft extending through said central hub, an impeller in said pumping chamber mounted on said shaft, sealing means contained in said central hub around said shaft to restrict fluid flow from said pumping chamber through said central hub, said central hub being provided with a recessed collecting channel for receiving and collecting liquid passing from said pumping chamber through said central hub, and means communicating with said collecting channel for draining liquid therefrom.

7. A centrifugal pump according to claim **6**, wherein said collecting channel surrounds said central hub.

8. A centrifugal pump according to claim **6**, wherein said collecting channel includes a portion deeper

recessed than another portion thereof, said draining means being connected to said deeper recessed portion.

9. In a centrifugal pump adapted to be generally vertically mounted, a casing containing a pumping chamber and having inlet and discharge ports connected to said pumping chamber, a casing cover mounted on said casing and having a side face bounding one side of the pumping chamber and an opposite side face external to said pumping chamber, said casing cover having a central hub portion external to said pumping chamber, a rotatable shaft projecting through said hub portion of said casing cover, an impeller in said pumping chamber mounted on said shaft, sealing means in said hub portion around said shaft for restricting liquid flow from said pumping chamber through said hub portion, said opposite side face of said casing cover sloping downwardly towards its periphery, and drainage means communicating with the periphery of said opposite side face for draining liquid therefrom.

10. A centrifugal pump according to claim 9, further comprising a plate detachably mounted to said casing bounding the side of said pumping chamber opposite to said one side thereof.

11. A centrifugal pump according to claim 9, wherein said plate is generally annular and said inlet port communicates with said pumping chamber through the opening in said plate.

12. A centrifugal pump according to claim 1, wherein said outlet means in communication with said recessed portion of said collecting channel comprises an outlet through a wall of said collecting channel and a drainage conduit connected at said outlet.

13. A centrifugal pump according to claim 6, wherein said liquid draining means comprises an outlet through a wall of said channel and a drainage conduit connected at said outlet.

14. A centrifugal pump according to claim 6, wherein said collecting channel includes a portion deeper recessed than another portion thereof, said liquid drainage means is connected to said collecting channel at said deeper recessed portion thereof, and said liquid draining means comprises an outlet through a wall of said channel and a drainage conduit connected at said outlet.

15. A centrifugal pump according to claim 14, wherein said outlet communicates with said deeper recessed portion adjacent the bottom of said deeper recessed portion.

16. A centrifugal pump according to claim 9, wherein said periphery of said opposite side face of said casing cover is provided with a generally upstanding rim.

17. A centrifugal pump according to claim 16, wherein said drainage means comprises a drainage outlet through said rim.

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