May 18, 1965 W. C. GAYNOR 3,183,841

PUMP AND SEALING UNIT THEREFOR

Filed Sept. 12, 1963 2 Sheets-Sheet 1

FIG. 1

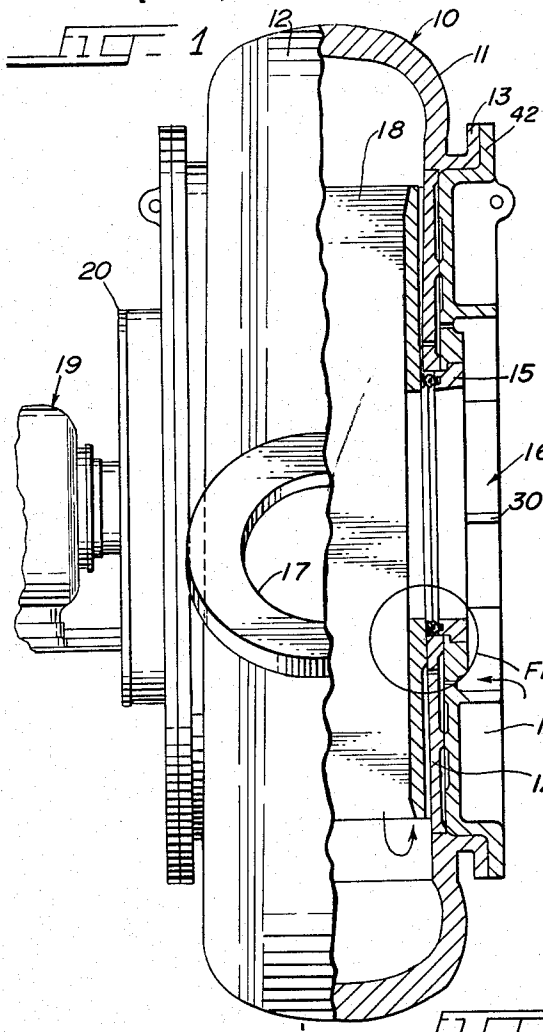

FIG. 2

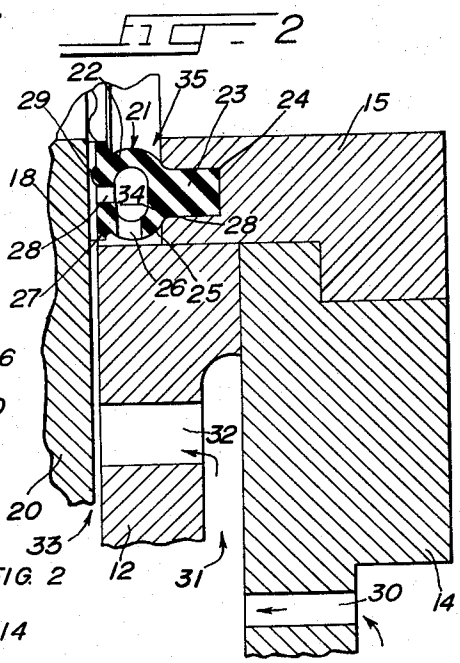

FIG. 3

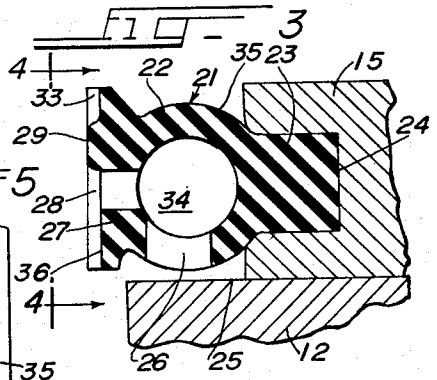

FIG. 4

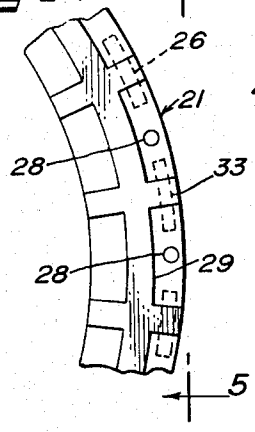

FIG. 5

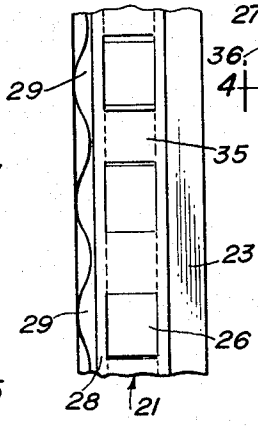

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Fig - 6

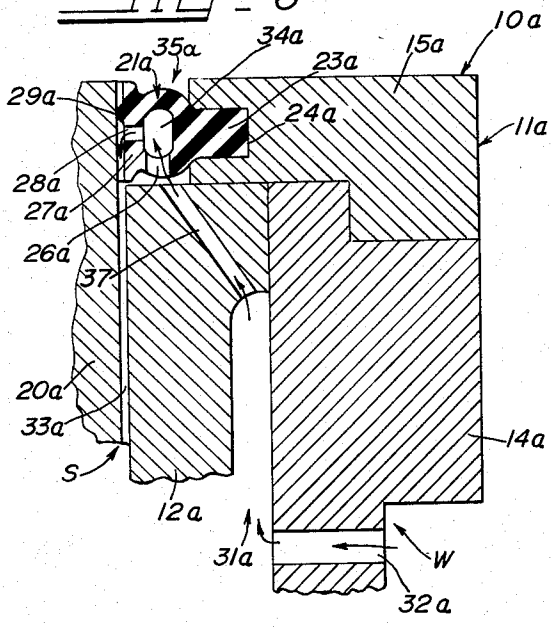


Fig - 7

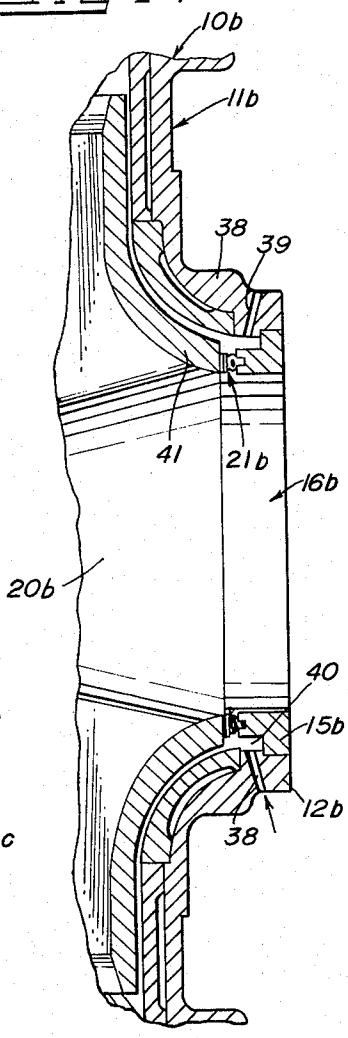
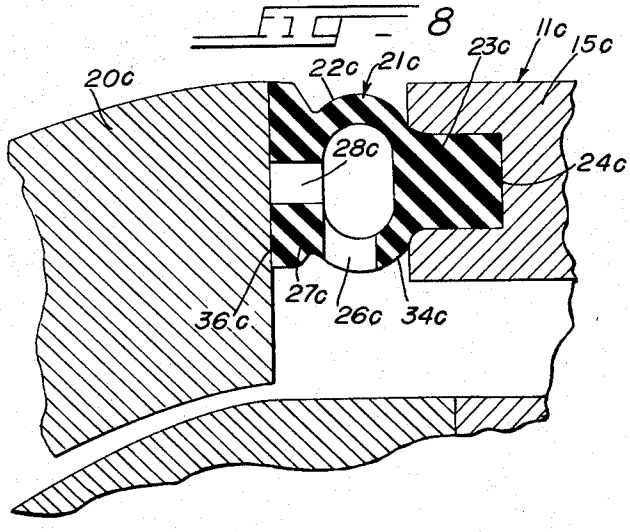


Fig - 8



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PUMP AND SEALING UNIT THEREFOR

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4 Claims. (Cl. 103—111)

This invention relates to pumps and sealing units therefor. More particularly, this invention relates to centrifugal suction pumps used in hydraulic dredging operations, and sealing units therefor.

An object of the present invention is to provide a new and improved centrifugal suction pump and a new and improved sealing unit therefor.

One of the problems encountered in centrifugal suction pumps of the type used in hydraulic dredging operations is the fact that the water drawn through the pump contains finely divided clay, sand, and other abrasive materials which tend to wear away the sealing means or units arranged between the front head of the pump housing or casing and the rotary impeller of the pump with the result that a portion of the water and entrained material flowing through the pump leaks between the front head of the pump casing and the rotary impeller with the result that the pump loses part of its operating efficiency.

An object of the present invention is to provide a new and improved centrifugal suction pump which is particularly adapted for use with hydraulic dredging equipment and a new and improved sealing unit therefor which, in use, overcome the foregoing and other difficulties experienced in those prior centrifugal suction pumps and sealing units therefor.

An additional object of the invention is to provide a new and improved sealing unit for providing a water-tight seal between the front head liner of a centrifugal hydraulic pump and the rotary impeller unit embodied therein.

An additional object of the invention is to provide a new and improved centrifugal hydraulic pump embodying a new and improved flexible and resilient and compressible annular sealing unit for providing an effective water-tight seal between the front head line of the pump and the adjacent lateral wall surface of the rotary impeller unit of the pump, and to provide a novel construction and arrangement for supporting and retaining the flexible and resilient and compressible annular sealing unit under compression so as to urge the sealing surface thereof into sealing engagement with the adjacent lateral surface of the rotary impeller unit of the pump.

Another object of the invention is to provide a new and improved centrifugal pump and a new and improved sealing unit therefor which embodies means for utilizing a stream of clean water supplied from an outside source thereof, which is independent of the stream of water and entrained sand, clay, etc., entering the pump through the suction inlet, for the purpose of lubricating the area of surface contact between the rotary impeller of the pump and the sealing unit embodied therein, and between the rotary impeller and the stationary front head of the pump housing.

A further object of the invention is to provide a new and improved sealing unit for use in connection with centrifugal hydraulic suction pumps.

Other objects will appear hereinafter.

In the drawings:

FIG. 1 is a fragmentary view, partly in section and partly in elevation, of a centrifugal pump embodying the present invention;

FIG. 2 is an enlarged fragmentary sectional detail view of the area indicated by the legend "FIG. 2" in FIG. 1

and showing the construction of one form of the invention.

FIG. 3 is an enlarged sectional detail view of the sealing unit shown in FIGS. 1 and 2;

FIG. 4 is a fragmentary elevational view of the new sealing unit, on line 4—4 of FIG. 3;

FIG. 5 is a fragmentary sectional view on line 5—5 of FIG. 4;

FIG. 6 is a fragmentary sectional detail view similar to FIG. 2 but illustrating a modification of the invention;

FIG. 7 is a fragmentary sectional view of another modification of the invention; and

FIG. 8 is an enlarged sectional view illustrating a modification of the sealing unit embodied in the invention.

A centrifugal pump embodying a preferred form of the invention is illustrated in FIGS. 1 to 5, inclusive, of the drawings, where it is generally indicated at **10**, and includes a pump housing or casing **11** which includes a front head liner **12** having a flanged portion **13** to which there is detachably attached a flange **42** on the front head **14** of the pump housing **10**. The new centrifugal pump includes a suction mouth liner **15** which provides a supporting member for supporting the new flexible, resilient and compressible annular sealing unit and for retaining the same under compression, as will be described hereinafter.

The front head **14** of the pump housing **11** has a suction water inlet opening **16** therein through which water and entrained material flows into the pump housing **11**. The pump housing **11** has a water outlet opening **17** and arranged within the pump housing is a rotor or rotary impeller **18**, of conventional design, which is adapted to be rotated within the pump housing **11** by means of a suitable motor unit **19** and driving mechanism **20**, as is well understood in the art.

A preferred form of the new sealing unit is shown in FIGS. 1 to 5, inclusive, of the drawings, where it is generally indicated at **21**, and is preferably made of any suitable synthetic oil and grease-resistant resinous elastomer polymer such, for example, as Buna S or Buna N, and includes an annular hollow resilient body portion **22** with which there is integrally formed an outwardly or laterally extending annular shank attaching portion **23** which is adapted to be adhesively or otherwise suitably secured or anchored in an annular groove or channel **24**, which is formed in the suction mouth liner **15** of the new pump.

The annular hollow body portion **22** of the sealing unit **21** includes a radially inner or bottom wall **25** which is provided with an annular row of spaced openings **26** therein arranged at spaced intervals radially therearound.

The annular hollow body **22** of the flexible and resilient sealing unit **21** includes a front sealing wall portion **27** and this front sealing wall portion **27** has an annular row of radially arranged outlet openings **28** formed therein and arranged at spaced intervals radially therearound.

The front sealing wall **27** of the annular hollow body **22** of the flexible and resilient sealing unit **21** has a radially arranged row of compressible and deformable undulated sealing portions or protuberances **29** formed thereon, it being noted that the openings **28** are spaced radially inwardly of the sealing protuberances **29**, for a purpose which will be described presently.

The annular hollow body **22** of the new flexible and resilient sealing unit **21** has an annular internal cavity **34** therein and the annular hollow body **22** of the sealing unit is disposed in an annular recess **35** which is provided between and by the inner wall of the suction mouth liner **15**, the radially outer wall of the front head liner **12**, and the adjacent outer wall of the body of the rotary impeller unit **20** (FIG. 2).

In the practice of the present invention, the front head

14 of the new centrifugal pump 10 has a series of radially arranged auxiliary water inlet openings 30 formed therein which communicate at their outer sides with an independent source or supply of clean water under pressure (not shown), as is customary in the art, and these auxiliary water inlets 30 communicate at their inner end with a passage 31 which is provided between the front head 14 and the front head liner 12 of the new pump 10. The passage 31 communicates with a row of radially arranged passages 32 which are formed in and are spaced at radial intervals around the front head liner 12 and these passages 32 communicate at their inner ends with a relatively narrow and restricted area 33 which is provided between the inner surface of the front head liner 12 and the body of the rotor or rotary impeller 20 (FIGS. 2 and 3).

The annular hollow body 22 of the new sealing unit 21 may be inserted into position of use in the annular passage 35 in the centrifugal pump 10 by inserting the rearwardly extending attaching shank portion 23 thereof into the mounting channel 24 of the suction mouth liner 15 and adhesively or otherwise securing it therein, and when the parts of the new pump are assembled in position of use the annular hollow body 22 of the flexible and resilient sealing unit 21 is placed under compression with the result that the forwardly projecting front wall 27 thereof and the sealing portions or protuberances 29 thereon bear laterally against and contact the adjacent lateral face or surface of the body of the rotary impeller unit 20.

In the use of the form of the invention illustrated in FIGS. 1 to 5, inclusive, of the drawings, the annular hollow body 22 of the flexible and resilient sealing unit 21 is supported and retained under compression by the suction mouth liner 15 of the pump housing 11 so as to force the undulated sealing protuberances 29 into sealing engagement with the adjacent outer lateral wall surface of the rotary impeller 20. Accordingly, when the rotor or rotary impeller unit 20 is rotated by the motor unit 19 and driving mechanism 20 water and entrained material enters the pump housing 11 through the suction water inlet 16 and flows therethrough into the pump housing 11 from which it is forced by the rotary impeller 20 out through the outlet opening 17 of the pump housing 11. At the same time clean water from an independent supply or source thereof (not shown) flows through the inlet openings 30 in the front head 14 of the new pump and thence by way of the passage 31 and the passage 32, in the front head liner 12, into the restricted area 33 and thence into the area 35 from which a portion of the water flows through the inlet openings 26 into the interior 34 of the annular hollow body of the flexible and resilient sealing unit 21. The clean water then flows by way of the outlet openings 28 from the interior of the annular hollow body 22 of the flexible and resilient sealing unit 21 into the restricted area 33 between the front head liner 12 and the body of the rotary impeller 20, thereby effectively lubricating the area of contact between the flexible and deformable undulated sealing protuberances 29 and the adjacent lateral surface of the rotary impeller 20 and preventing undue abrasion of the sealing unit 21 which would occur if water and entrained abrasive sand, and clay, etc., entering the suction inlet opening 16 were allowed to flow into the restricted area 33 between the front head liner 12 and the body of the rotary impeller 20.

During the operation of the new centrifugal pump, with the water flowing as described above, the flexible and resilient sealing unit 21 effectively seals the area 33 between the front head liner 12 and adjacent lateral face of the body of the rotary impeller 20, due to the sealing engagement of the inwardly projecting undulated sealing protuberances 29 thereon with the laterally outer face of the body of the rotary impeller unit 20 and thus an effective seal is provided preventing the clean water from escaping out of the pump housing 11 between the laterally outer face of the rotary impeller 20 and the new sealing unit 21. At the same time, the laterally inner face 36 of the inner wall 27 of the annular body 22 of the flexible

and resilient unit 21, being spaced slightly outwardly of the laterally outer face or surface of the body of the rotary impeller 20, provides an extension of the restricted area 33 between the front head liner 12 and the laterally outer face of the rotary impeller 20 upwardly past the laterally inner surface 36 of the annular body 22 of the flexible and resilient sealing unit 21 and up to the undulated flexible sealing protuberances 29 (FIGS. 2 and 3).

A modification of one feature of the invention is illustrated in FIG. 6 of the drawings and in this form of the invention those parts thereof which are similar to or comparable to corresponding parts in the form of the invention illustrated in FIGS. 1 to 5, inclusive, have been giving similar reference numerals followed by the additional and distinguishing reference character "*a*."

The form of the invention illustrated in FIG. 6 of the drawings is substantially the same as that shown in FIGS. 1 to 5, inclusive, except that in this form of the invention a radially arranged row of angularly extending passages 37 is formed in the front head liner 12*a* of the pump housing 11*a* so that a supply of clean water from a source (not shown) may enter through the opening 32*a* in the front head 14*a* of the pump and flow up through the passage 31*a* and through the angular passages 37 in the front head liner 12*a* into the area 35*a* and thence by way of the inlet openings 26*a* into the interior of the annular hollow body 34*a* of the flexible and resilient sealing unit 21*a*, and thence into the restricted area 33*a* between the laterally outer face of the rotary impeller 20*a* and the front head 12*a*, so as to lubricate the area between the laterally outer surface of the rotary impeller 20*a* and the inner surface of the flexible and resilient sealing unit 21*a* while, at the same time, an effective seal is provided between the laterally outer surface of the rotary impeller 20 and the undulated sealing protuberances 29*a* on the annular body 22*a* of the flexible and resilient sealing unit 21*a*, with the same results and advantages as are described above in the form of the invention shown in FIGS. 1 to 5, inclusive.

A further modification of the invention is illustrated in FIG. 7 of the drawings and in this form of the invention those parts thereof which are similar or comparable to corresponding parts in the form of the invention shown in FIGS. 1 to 5, inclusive, have been given the same reference numerals followed by the additional and distinguishing reference character "*b*."

The centrifugal pump 10*b* illustrated in FIG. 7 is somewhat different in design and construction than the centrifugal pump 10 illustrated in FIGS. 1 to 5, inclusive, and from the form shown in FIG. 6, and in this form of the invention the annular side wall 38 of the pump housing 11*b*, which surrounds the suction inlet 16*b*, has a series of radially arranged and angularly extending passages 39 therein which extend inwardly from the outer surface of the wall 38 of the pump housing 11*b* so as to conduct a supply of clean water from a source thereof (not shown) into the space 40 provided between the suction mouth liner 15*b* and the hub 41 of the rotary impeller 20*b* and associated parts and thence into the body of the flexible and resilient sealing unit 21*b*, in the manner and for the purposes described in connection with the form of the invention illustrated in FIGS. 1 to 5, inclusive, and the form of the invention illustrated in FIG. 6.

A modification of the new sealing unit feature of the invention is illustrated in FIG. 8 of the drawings, and this form of the new sealing unit is substantially the same as that illustrated in FIGS. 1 to 5, inclusive, and hence those parts thereof which are similar to or comparable to the sealing unit embodied in the form of the invention illustrated in FIGS. 1 to 5, inclusive, and that embodied in the form of the invention illustrated in FIGS. 6 and 7, have been given the same reference numerals followed by the additional and distinguishing reference character "*c*."

In the form of the invention illustrated in FIG. 8 of the drawings the undulated sealing protuberances **29** formed on the laterally inner surface of the annular hollow body **22** of the sealing unit **21** have been eliminated and in place thereof the entire lateral surface **36***c* of the body **22***c* of the sealing unit **21***c* serves as a sealing surface and contacts the adjacent outer lateral wall surface of the rotary impeller **20***c* to provide the desired sealing engagement between these parts.

It will thus be seen from the foregoing description, considered in conjunction with the accompanying drawings, that the present invention provides a new and improved centrifugal pump and sealing unit therefor having the desirable advantages and characteristics, and accomplishing its intended objects, including those hereinbefore pointed out and others which are inherent in the invention.

I claim:

1. A pump comprising a pump housing having a suction water inlet and a water outlet, a rotary impeller in the said pump housing and including a lateral wall surface facing toward the said water inlet opening, a flexible and resilient annular sealing unit including an annular hollow body having a lateral sealing surface facing toward and engaging the said lateral wall surface of the said rotary impeller, and means carried by the said housing for supporting the said flexible annular sealing unit and retaining the said annular hollow body thereof under compression and for urging the said lateral sealing surface thereof into sealing engagement with the said lateral surface of the said rotary impeller, the said means for supporting the said flexible and resilient sealing unit including a suction mouth liner arranged about the said inlet opening of the said pump, the said suction mouth liner having an annular groove formed therein, and the said flexible and resilient sealing unit including an annular anchoring flange mounted under compression in the said annular groove in the said suction mouth liner.

2. A pump comprising a pump housing having a suction water inlet and a water outlet, a rotary impeller in the said pump housing and including a lateral wall surface facing toward the said water inlet opening, a flexible and resilient annular sealing unit including an annular hollow body having a lateral sealing surface facing toward and engaging the said lateral wall surface of the said rotary impeller, means carried by the said housing for supporting the said flexible annular sealing unit and retaining the said annular hollow body thereof under compression and for urging the said lateral sealing surface thereof into sealing engagement with the said lateral surface of the said rotary impeller, the said annular body of the said flexible and resilient sealing unit being hollow and compressible and having an annular anchoring flange portion formed integrally therewith and projecting laterally therefrom at the side of the said body of the said flexible and resilient sealing unit which is opposite the side thereof at which the said lateral sealing surface thereof is arranged, the said means for supporting the said flexible and resilient sealing unit including a supporting member having an annular groove formed therein, the said annular anchoring flange of the said flexible and resilient sealing unit being mounted in the said annular groove in the said supporting member, the said annular hollow body of the said flexible and resilient sealing unit having a series of sealing protuberances formed integrally therein in the said lateral sealing surface thereof and arranged radially therearound, the said sealing protuberances being mounted under compression and being urged into sealing engagement with the said lateral surface of the said rotary impeller by the mounting of the said annular anchoring flange portion of the said annular body of the said flexible and resilient sealing unit in the said annular groove in the said supporting member, the said annular hollow body of the said flexible and resilient sealing unit including a bottom wall having an annular row of water inlet openings therein communicating with the interior of the said annular hollow body of the said sealing unit, the said lateral sealing surface of the said annular hollow body of the said flexible and resilient sealing unit having an annular row of spaced water outlet openings formed therein radially inwardly of the said sealing protuberances and communicating with the interior of the said annular hollow body of the said sealing unit, and the said pump including passageway means for conducting a stream of clean water into the said water inlet openings in the said annular hollow body of the said flexible and resilient sealing unit whereby the said stream of clean water will flow through the said annular hollow body of the said sealing unit and out of the latter through the said water outlet openings therein against the said lateral surface of the said rotary impeller radially inwardly of the said sealing protuberances on the said sealing surface of the said annular hollow body of the said flexible and resilient sealing unit.

3. A pump as defined in claim 1 in which the said annular hollow body of said sealing unit has an annular row of radially arranged circumferentially spaced compressible sealing protuberances thereon having sealing engagement with the said lateral wall surface of said rotary impeller.

4. A pump as defined in claim 1 in which the said annular hollow body of the said sealing unit has a relatively flat, smooth uninterrupted surface facing toward and having sealing engagement with the said lateral wall surface of said rotary impeller.

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