PITOT PUMP WITH MEANS FOR EXCLUDING LEAKAGE FROM BEARINGS

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ABSTRACT

A pitot pump having registering axial inlets in adjacent end walls of its outer housing and inner, rotary casing, a bearing between such end walls, and a seal axially outwardly of the bearing for minimizing fluid leakage into the outer housing externally of the rotary casing. The latter is provided thereon with radial vanes for creating a positive pressure in the housing and at the bearing to prevent any leakage through the seal from entering the bearing, thereby causing such leakage to escape through a drain in the housing.

4 Claims, 3 Drawing Figures
PITOT PUMP WITH MEANS FOR EXCLUDING LEAKAGE FROM BEARINGS

BACKGROUND OF INVENTION

The present invention relates in general to centrifugal pumps and, more particularly, to a centrifugal pump of the pitot type, such a pump comprising, as its general elements, a rotary casing, inlet means for delivering a fluid to be pumped to the rotary casing, a discharge duct coaxial with the rotary casing, and a pitot tube in the rotary casing for picking up fluid adjacent the inner periphery of the casing with a ram effect and for delivering the fluid to the discharge duct. More particularly, the pitot tube extends radially of the rotary casing and is provided adjacent its outer end with an inlet adjacent the inner periphery of the rotary casing and facing in the direction opposite to the direction of rotation of the rotary casing, the pitot tube having adjacent its outer end an outlet communicating with the discharge duct. The fluid inlet means comprises registering axial inlets in adjacent end walls of the rotary casing and an outer housing enclosing the rotary casing, there being a bearing between such end walls for supporting the rotary casing. A seal means axially outwardly of the bearing minimizes leakage into the housing of fluid flowing through the axial inlet in the end wall of the housing into the axial inlet in the end wall of the rotary casing. Any leakage which does occur escapes through a drain in the outer housing. The discharge duct communicating with the pitot tube extends axially through the axial inlets in the adjacent end walls of the rotary casing and the outer housing, and through the bearing and the seal means, to the exterior of the housing, the axial inlets mentioned being annular inlets encircling the discharge duct.

Pitot pumps are well known and have the advantage of providing a very simple structure for pumping fluids at high pressures and in relatively large volumes. A pitot pump typical of the prior art is disclosed in U.S. Pat. No. 3,384,024, granted May 21, 1968 to William L. King. A serious disadvantage of pitot pumps having the structure hereinbefore outlined is that at least some of the leakage through the seal means enters the bearing, instead of flowing directly to the drain provided therefor. With many fluids, water being only one example, such leakage into the bearing causes severe bearing damage requiring frequent replacement.

The tendency of leakage through the seal means to enter the bearing, instead of exiting through the drain in the housing provided specifically for such leakage, is due to the fact that the pressure at the bearing between the rotary casing and the housing is normally slightly negative, e.g., 0.2 to 0.3 inches of water below atmospheric. Even such a relatively slight negative pressure can cause substantial leakage flow through the bearing, carrying away the bearing lubricant, and resulting in ultimate bearing failure.

SUMMARY AND OBJECTS OF INVENTION

With the foregoing background in mind, the primary object of the present invention is to provide a pump, and specifically a pitot pump, having means for creating a positive pressure between the housing and the rotary casing at the bearing to prevent any leakage through the seal means from entering the bearing, and causing such leakage to escape through the drain specifically provided therefor.

The invention may be summarized as including, and an important object of the invention is to provide a pump which includes: an outer housing having axially spaced ends and having an axial inlet in one end thereof for the fluid to be pumped; a rotary casing in the housing and having axially spaced ends one of which is adjacent the aforementioned end of the housing and is provided with an axial inlet communicating with the axial inlet in such one end of the housing; a bearing between the one end of the housing and the one end of the casing; seal means between the aforementioned end of the housing and the casing, and axially outwardly of the bearing, for minimizing fluid leakage into the housing as fluid flows through the inlet in the housing into the inlet in the casing; a drain in the housing for any leakage through the seal means; and means on the casing for creating a positive pressure in the housing at the bearing to prevent any leakage through the seal means from entering the bearing thereby causing the leakage to escape through the drain.

The invention may be further summarized as including a pitot tube in the casing and having a circumferentially oriented inlet facing in a direction opposite to the direction of rotation of the casing, a passage in the pitot tube extending radially inwardly from the circumferentially oriented inlet, and means for providing an axial discharge passage communicating with the passage in the pitot tube and extending through the casing and the housing, the axial inlets in the housing and the casing being annular and the discharge passage extending axially through such axial inlets, the bearing and the seal means, to the exterior of the housing.

A more specific object of the invention is to provide a pitot pump of the foregoing construction wherein the means for creating positive pressure within the housing at the bearing comprises circumferentially spaced radial vanes on the rotary casing.

Still another object is to provide a pitot pump wherein the radial vanes mentioned are on the end of the rotary casing opposite the end thereof having the axial inlet therein.

The foregoing objects, advantages, features and results of the present invention, together with various other objects, advantages, features, and results thereof which will be evident to those skilled in the centrifugal pump art, and particularly the pitot pump art, may be achieved with the exemplary embodiment of the invention illustrated in the accompanying drawings and described in detail hereinafter.

DESCRIPTION OF DRAWINGS

In the drawings:

FIG. 1 is a longitudinal sectional view of a pitot pump which embodies the invention;

FIG. 2 is a fragmentary sectional view taken as indicated by the arrowed line 2—2 of FIG. 1; and

FIG. 3 is a fragmentary view duplicating a portion of FIG. 1 on a larger scale, and showing in longitudinal sections various parts which are shown in elevation of FIG. 1 of the drawing.

DESCRIPTION OF EXEMPLARY EMBODIMENT OF THE INVENTION

In the drawing, the numeral 10 designates generally
a pitot pump which includes an outer housing 12 having axially spaced ends 14 and 16 and containing a rotary casing 18 having axially spaced ends 20 and 22 respectively adjacent the housing ends 14 and 16. In the particular construction illustrated, the rotary casing 18 is supported for rotation within the housing 12 by bearings 24 and 26, the bearing 24 being interposed between and engaging the housing and casing ends 14 and 20, and the bearing 26 being interposed between and engaging the housing and bearing ends 16 and 22. A drive shaft 28 is connected to the casing end 22 and projects through the housing end 16 in the particular construction shown.

The housing end 14, as best shown in FIG. 3, includes an inlet port 30 for the fluid to be pumped, such inlet communicating with an inlet chamber 32 which, in turn, communicates with an annular axial inlet 34 in the housing end 14. Aligned with the axial inlet 34 is an axial inlet 36 in the casing end 20. The fluid to be pumped flows radially outwardly from the axial inlet 36 in the rotary casing 18 through passages 38 in the casing end 20, such fluid entering the interior of the rotary casing adjacent the periphery thereof.

Within the rotary casing 18 is a pitot tube 40 having adjacent the inner periphery of the rotary casing a circumferentially oriented inlet 42 facing in a direction opposite to the direction of rotation of the casing. The pitot tube inlet 42 communicates through a radial passage 44 in the pitot tube with an axial pitot tube outlet 46 leading to an axial discharge duct 48 which extends through the housing and casing ends 14 and 20 and the bearing 24 to the exterior of the housing 12, terminating in a discharge port 50. The discharge duct 48 is encircled by the axial inlets 34 and 36 in the housing and casing ends 14 and 20.

Spanning an axial space between the axial housing inlet 34 and the axial casing inlet 36 is a seal means or seal assembly 52 which is conventional and which includes as its basic parts a stationary sealing ring 54 carried by the housing end 14 and a rotating sealing ring 56 carried by the casing end 20 and engaging the sealing ring 54. As will be apparent, the function of the seal means 52 is to minimize fluid leakage as the fluid to be pumped flows from the housing inlet 34 into the casing inlet 36, any leakage between the sealing rings 54 and 56 escaping into a drain chamber 58 which is located in the housing end 14 and which is provided with a drain port 60. The housing 12 is also provided in its lower side with a drain port 62 for any leakage through the seal means 52 which does not escape through the drain chamber 58 and the drain port 60.

The pitot pump 10 as thus far described is more or less conventional and suffers from the disadvantages that not all of the leakage through the seal means 52 escapes through the drain chamber 58 and the drain port 60 as intended. More particularly, some of the leakage through the seal means 52 flows inwardly through the bearing 24 and tends to erode away the bearing lubricant, the ultimate result being eventual bearing failure.

The reason for this phenomenon in the pitot pump 10 as thus far described is that there is a slight negative pressure between the housing and casing ends 14 and 20 adjacent the bearings 24, such negative pressure being of the order of 0.2 to 0.3 inches of water below atmospheric. This negative pressure, even though small, is sufficient to cause enough fluid flow through the bearing 24 to cause eventual failure, particularly if the fluid is of low lubricity, such as water, or corrosive.

The present invention solves the foregoing problem by providing means on the rotary casing 18 for creating a positive pressure in the housing 12 at the bearing 24 to prevent any leakage through the seal means 52 from entering the bearing, such leakage thus being forced to escape through the drain chamber 58 and the drain port 60 as intended.

The foregoing means for creating a positive pressure within the housing 12 at the bearing 24 is designated generally by the numeral 66 and, as best shown in FIGS. 1 and 2, may comprise simply a plurality of circumferentially spaced, radial vanes 68 on the exterior surface of the casing end 22. Thus, the casing 18 acts as a blower to create the desired positive pressure at the axially inner end of the bearing 24, and provides a very simple solution to the bearing failure problem hereinbefore discussed, which is an important feature of the invention. The blower formed by the vanes 68 receives atmospheric air through an inlet port 70 and discharges same through a small annular clearance between the rotating seal 56 and the housing wall 14, any excess escaping through the drain port 62.

Although an exemplary embodiment of the invention has been disclosed for illustrative purposes, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiment without departing from the invention as hereinafter claimed.

I claim:
1. In a pump having means for preventing bearing damage from fluid leakage, the combination of:
   a. an outer housing having axially spaced ends and having an axial inlet in one end thereof for a liquid to be pumped;
   b. a rotary casing in said housing and having axially spaced ends one of which is adjacent said one end of said housing and is provided with an axial inlet communicating with said axial inlet in said one end of said housing;
   c. a bearing between said one end of said housing and said one end of said casing;
   d. seal means between said one end of said housing and said casing, and axially outwardly of said bearing, for minimizing liquid leakage into said housing as liquid flows through said inlet in said one end of said housing into said inlet in said one end of said casing;
   e. a drain in said housing for any leakage through said seal means; and
   f. means communicating with a gas source outside said housing for creating a positive gas pressure in the space between said housing and said rotary casing and at said bearing to prevent any leakage through said seal means from entering said bearing, thereby causing such leakage to escape through said drain, said means for creating positive pressure comprising circumferentially spaced radial vanes on the outer surface of said casing.

2. A pump as defined in claim 1 which is a pitot pump, and which includes:
   a. a pitot tube in said casing and having a circumferentially oriented inlet facing in a direction opposite to the direction of rotation of said casing, said pitot tube having a passage therein extending radially in-
wardly from said circumferentially oriented inlet; and
b. means providing an axial discharge passage communicating with said passage in said pitot tube and extending through said casing and said housing.

3. A pitot pump according to claim 2 wherein said axial inlets in said one end of said housing and said casing are annular and wherein said discharge passage extends axially through said axial inlets, said bearing and said seal means to the exterior of said housing.

4. A pitot pump as defined in claim 1 wherein said vanes are on the other of said ends of said casing.

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