

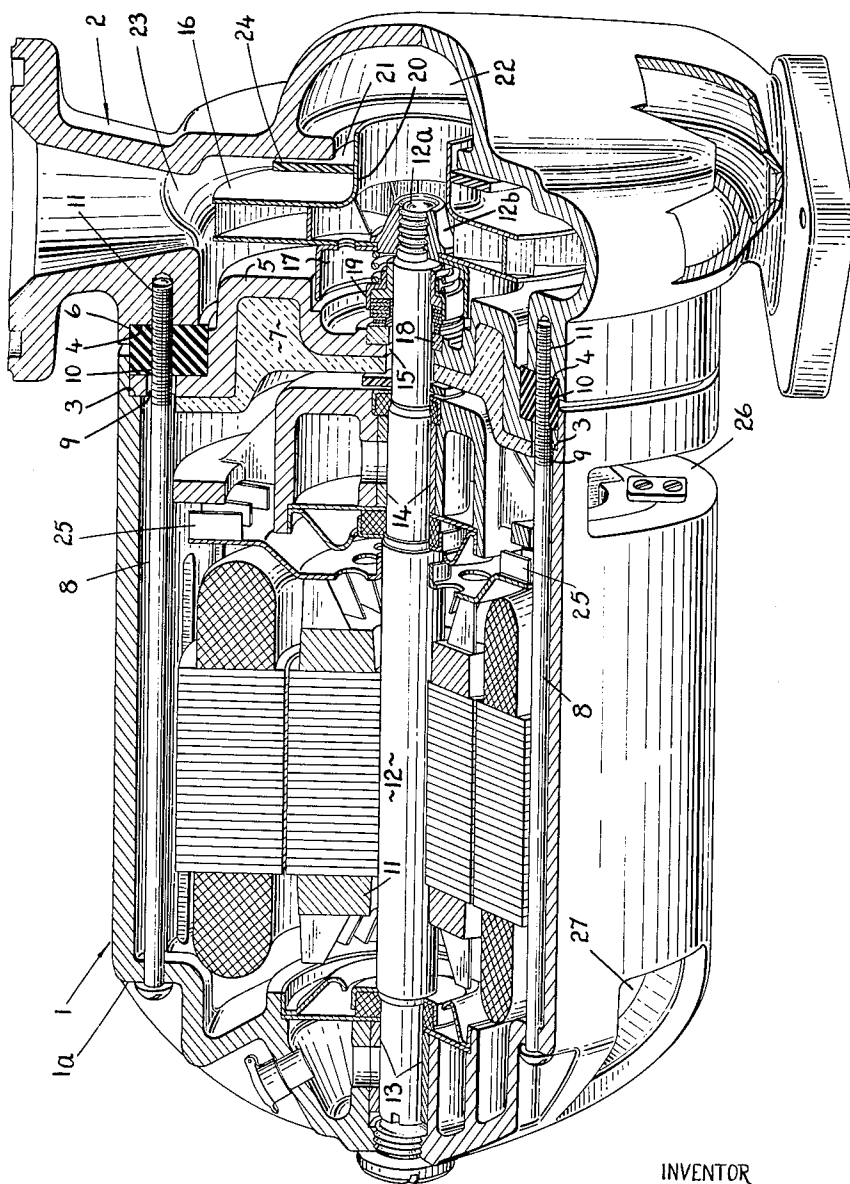
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MOTOR PUMP UNIT

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MOTOR PUMP UNIT

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This invention relates to fractional horsepower direct-coupled motor-pump units, of the type used primarily for circulating water through closed circuit hydronic systems.

An inherent problem in known motor-pump units of this type is the excessive amounts of vibration and noise that they transmit throughout the hydronic system. The unwanted vibration and noise are generated by the motor, and due to the close coupling of the motor to the pump the vibration and noise are transmitted through the pump and into the system.

Some motor-pump units make use of a flexible coupling to connect the driving shaft of the motor to the pump impeller shaft in order to reduce the transmission of vibration and of noise from the motor to the pump. This arrangement in practice has given only limited satisfaction; the flexible coupling is susceptible to failure, resulting in high maintenance costs and lack of reliability. Other known motor-pump units avoid the use of a flexible coupling; in these units a resilient gasket is positioned between the motor and the pump housing, and the pump impeller is fastened directly to the end of the motor shaft, sufficient clearance being left between the pump impeller and the pump housing so that there will be no obstruction to impeller movement despite any relative movement of the pump housing and of the motor housing and the motor shaft. Due to the ineffectiveness of known resilient gasket arrangements the degree of suppression of vibration transmission through the coupling has been unsatisfactory. Furthermore, the very wide clearances required between the pump housing and the pump impeller have caused high rates of leakage from the output side of the pump to the input side, resulting in extremely low pump efficiency.

According to the present invention, the foregoing difficulties can be reduced by providing a motor-pump unit in which the pump impeller is fastened directly to the end of the motor shaft, and the motor housing and the pump housing are coupled to each other through a resilient gasket by means of flexible tension rods, this coupling arrangement effectively suppressing the transmission of vibration from the motor housing to the pump housing. Another feature is the provision of a novel device to control leakage from the output side of the pump to the intake side, the said device comprising a disc rotatably fitted on a hub of the impeller and having sliding freedom of movement thereon in the gap between a face of the impeller and an opposed face of the pump housing, the said disc being urged against the said opposed face of the pump housing by the forces resulting from the differences of pressure applied to the two sides of the disc.

A further feature of the invention is the provision of a common wall between the pump housing and the motor housing and which embodies a heat shield for the motor from the pump.

The invention will now be described by way of example with reference to the accompanying drawing, which is a broken-away perspective view of a motor pump unit embodying the invention.

The motor and pump unit comprises a motor housing generally indicated at 1, and a pump housing generally indicated at 2 and which is in alignment with the motor housing. Annular recesses 3 and 4 are provided in the abutting parts of the motor housing and of the pump housing, and interposed between the two housings is a com-

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mon wall 5 of the motor housing and of the pump housing, and a resilient gasket 6. It will be observed that one side of the gasket 6 bears against one face of the wall 5 while its other side bears against the pump housing on a surface which is defined by the recess 4; a peripheral portion of the other face of the common wall bears against the motor housing 1 at the recess 3.

Heat insulation 7, which may be of polyurethane, is adhered to the motor side of the wall 5. Thus the wall 5, in addition to providing a seal plate between the motor housing and the pump housing, also has the function of providing a heat shield for the motor from the pump.

The motor housing 1, the pump housing 2, and the interposed common wall 5 and the gasket 6 are coupled by means of several tension rods 8 which extend from the outer end 1a of the motor housing, pass through aligned holes 9 and 10 provided in the wall 5 and in the gasket 6, respectively, and engage tapped holes 11 in the pump housing 2. The holes 9 in the wall 5 are appreciably larger in diameter than the diameters of the tension rods 8, so that the tension rods do not contact the edges of the holes; preferably, the holes 10 in the gasket 6 also are larger in diameter than the diameters of the tension rods. The flexural quality of the tension rods and the resilience of the gasket ensure a coupling of the motor housing 1 to the pump housing 2 which suppresses the transmission of vibration and of noise from the motor through the pump and into the system in which the pump ultimately is inserted.

Within the motor housing 1 is a rotor 11 which is mounted on a shaft 12 journaled in bearings 13 and 14. A threaded end 12a of the shaft extends beyond the bearing 14 and through an opening 15 in the wall 5 and into the pump housing 2. An impeller 16 having a balancing ring 17 is fastened to the threaded end of the shaft by means of a nut 12b.

A seal is provided to prevent leakage of water through the annular gap between the shaft 12 and the periphery of the opening 15; the seal includes a ring 18 fast on the pump side of the wall 5 and which is in rubbing contact with a spring-actuated seal assembly 19 of known construction that is fixed to and rotates with the shaft.

Because of the resilient coupling of the pump housing to the motor housing, there is some freedom of movement of the pump housing 2 relative to the impeller 16 and to its shaft 12. Since this freedom of movement is necessary, there must be a relatively large clearance between the impeller 16 and the adjacent surface of the pump housing 2. Therefore a special seal is provided to control the leakage through this clearance which otherwise would result from the output side of the pump to the intake or suction side.

On the impeller 16 is a hub 20 which extends through a wall opening 21 into a chamber 22 that forms the intake or suction side of the pump; a cavity 23 provides the output or pressure side of the pump. Between the outer surface of the hub 20 and the periphery of the opening 21 through which the hub extends there is an annular gap which creates the aforementioned large clearance. To avoid the excessive leakage which otherwise would result, a disc 24 is rotatably fitted on the hub 20 between a face of the impeller and an opposed face of the pump housing, the disc being urged against the said opposed face by the forces resulting from the difference of pressures applied to the two sides of the disc, namely the relative high pressure on the output side and the relatively low pressure on the intake side. It is to be understood that the disc should have a face which is complementary to the pump housing surface which it contacts; in the embodiment which is illustrated, the pump housing

surface contacted by the disc 24 is flat, and consequently the disc has a complementary flat surface.

When the pump is installed in a typical hydronic system, the temperature on the pump side of the wall 5 may reach 225° F. The heat insulation 7 impedes the flow of heat from the pump side of the wall to the motor side, and thus protects the motor and its bearings 13 and 14. To assist in maintaining the bearings at suitable operating temperatures, there also is provided a fan 25 fast on the shaft 12 and which induces cooling air through ports 26; this air scrubs the bearings and the adjacent motor structure, and finally it escapes through ports 27 at the outer end of the motor housing.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

What I claim as my invention is:

1. A motor and pump unit comprising, a motor housing containing a stator, a pump housing in alignment with the motor housing, a shaft in the motor housing having an end that protrudes into the pump housing, a motor rotor mounted on the shaft, bearing means to support the shaft, said bearing means being within and fixed to the motor housing, an impeller within the pump housing and fast on the protruding end of the shaft, a common wall for the motor housing and for the pump housing, a resilient gasket interposed between the pump housing and the motor housing and having one side which bears against one face of the common wall and another side which bears against one of the housings, the other face of the common wall bearing against the other housing, and tension rods extending from one housing to the other to couple them and the common wall and the gasket together, the tension rods passing through openings in the common wall which are of appreciably greater diameter than the diameter of the rods so that there is no contact between the rods and the edges of the openings.

2. A motor and pump unit comprising a motor housing having an outer end and another end, a pump housing in alignment with the motor housing and bearing against it at the said other end, a shaft in the motor housing having an end that protrudes into the pump housing, a motor rotor mounted on the shaft, bearing means to support the shaft, said bearing means being within and fixed to the motor housing, an impeller within the pump housing and fast on the protruding end of the shaft, a common wall for the motor housing and for the pump housing, a resilient gasket interposed between the pump housing and the aforesaid other end of the motor housing and having one side which bears against one face of the common wall and another side which bears against one of the housings, the other face of the common wall bearing against the other housing, and tension rods extending from the pump housing to the outer end of the motor housing to couple the housings and the common wall and the gasket together, the tension rods passing through openings in the common wall which are of appreciably greater diameter than the diameter of the rods so that there is no contact between the rods and the edges of the openings.

3. A motor and pump unit comprising, a motor housing containing a stator, a pump housing in alignment with

the motor housing, a shaft in the motor housing having an end that protrudes into the pump housing, a motor rotor mounted on the shaft, bearing means to support the shaft, said bearing means being within and fixed to the motor housing, an impeller within the pump housing and fast on the protruding end of the shaft, a hub forming part of the impeller, a common wall for the motor housing and for the pump housing, a resilient gasket interposed between the pump housing and the motor housing and having one side which bears against one face of the common wall and another side which bears against one of the housings, the other face of the common wall bearing against the other housing, tension rods extending from one housing to the other to couple them and the common wall and the gasket together, the tension rods passing through openings in the common wall which are of appreciably greater diameter than the diameter of the rods so that there is no contact between the rods and the edges of the openings, and a disc rotatably fitted on the impeller hub and having sliding freedom of movement thereon in the gap between a face of the impeller and an opposed face of the pump housing, the said disc being urged against the said opposed face of the pump housing by the forces resulting from the differences of pressure applied to the two sides of the disc thus to control leakage from the output side of the pump to the intake side.

4. A motor and pump unit comprising a motor housing having an outer end and another end, a pump housing in alignment with the motor housing and bearing against it at the said other end, a shaft in the motor housing having an end that protrudes into the pump housing, a motor rotor mounted on the shaft, bearing means to support the shaft, said bearing means being within and fixed to the motor housing, an impeller within the pump housing and fast on the protruding end of the shaft, a common wall for the motor housing and for the pump housing, a resilient gasket interposed between the pump housing and the aforesaid other end of the motor housing and having one side which bears against one face of the common wall and another side which bears against one of the housings, the other face of the common wall bearing against the other housing, tension rods extending from the pump housing to the outer end of the motor housing to couple the housings and the common wall and the gasket together, the tension rods passing through openings in the common wall which are of appreciably greater diameter than the diameter of the rods so that there is no contact between the rods and the edges of the openings, and a disc rotatably fitted on the impeller hub and having sliding freedom of movement thereon in the gap between a face of the impeller and an opposed face of the pump housing, the said disc being urged against the said opposed face of the pump housing by the forces resulting from the differences of pressure applied to the two sides of the disc thus to control leakage from the output side of the pump to the intake side.

5. A motor and pump unit as claimed in claim 1, in which the common wall includes a layer of insulating material to provide a heat shield for the motor from the pump.

No references cited.

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