United States Patent

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[31] **P 17 63 554.0**

[54] **MOTOR-DRIVEN PUMP**
4 Claims, 3 Drawing Figs.

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[51] Int. Cl. F04b 17/00, H02k 5/00
[50] Field of Search ..... 103/87, 87 D, 87 E, 111 C, 111.1, 218; 310/91; 417/363, 423, 424

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ABSTRACT: A power pump including a dry-operating drive motor mounted on the pump housing and connected to a pump impeller, wherein the output shaft includes a seal consisting of a slipring and a contrarotating ring which is coupled to an elastic noise damper on the pump housing.

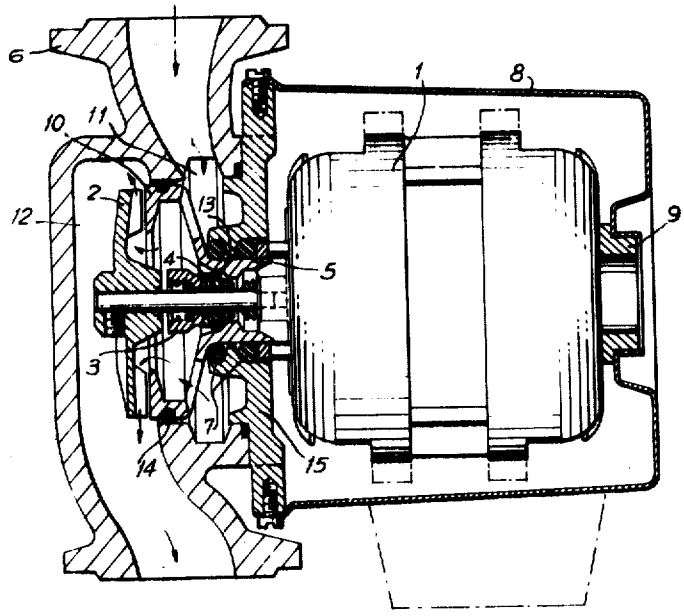


FIG. 2

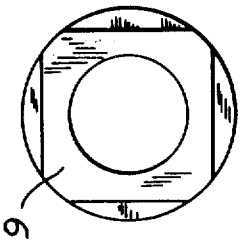
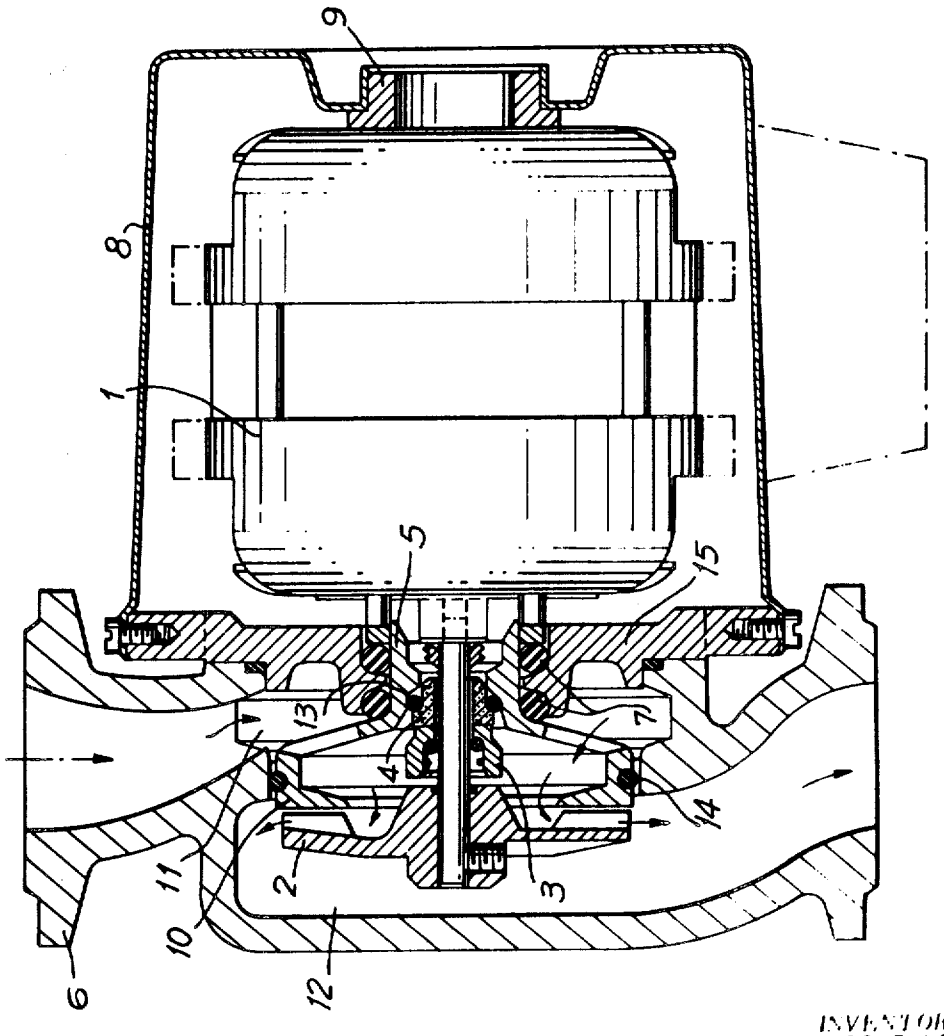


FIG. 1



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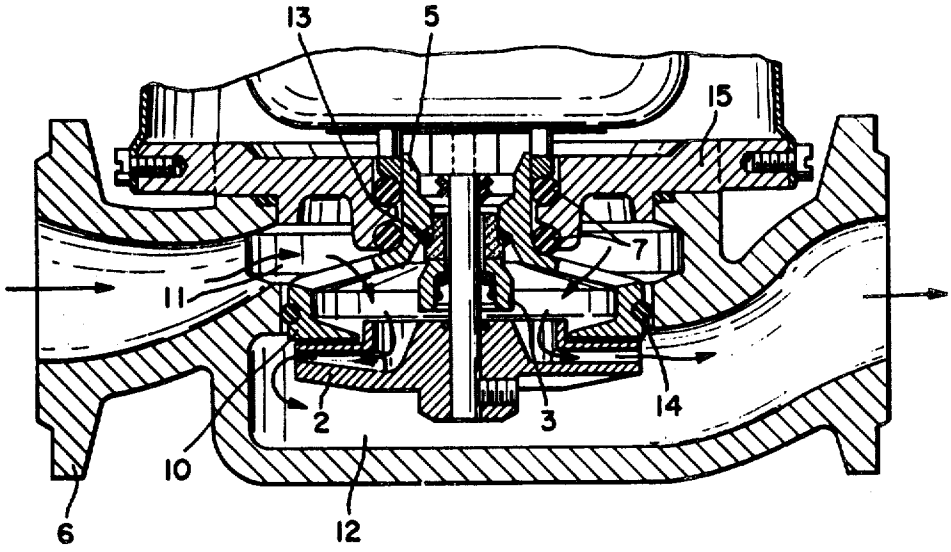


FIG. 3.

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MOTOR-DRIVEN PUMP

This invention relates to a power pump with dry-operating driving motor mounted on the pump housing, or a monoblock-type pump.

In applications where low-output pumps are required, monoblock type pumps have gained acceptance in recent times due to this low cost and space-saving advantages. Monoblock-type pumps, when used as heat-circulating pumps, have been widely employed in a great variety of designs. In widespread use are the conventional collimator-type power pumps with a rotor space, due to the fact that the hermetic conditions of the latter are particularly simple. However, the drawback to these pumps resides in their impaired electrical efficiency due to the collimator and the relatively high copper and iron constituents of this type of pump. Their relatively poor motor efficiency thus does not warrant this type of design for a pump. The collimator, however, frequently gives rise to problems, particularly for small motors. In restarting the pump after a prolonged period of rest, the narrow air gap between the rotor and collimator often becomes clogged owing to the accumulation of products of deposition and corrosive phenomena, thus blocking the pump.

Motorized or powered pumps with dry-operating blocked drive motors, or monoblock-type pumps are more advantageous, in view of the above-described drawbacks for wet-operating-type pumps. However, they are only suited, to a limited extent, where low-noise pumps are required, such as for circulating pumps for hot water heating units, since the magnetic and mechanical motor noises are transmitted through the rigid couplings, between the motor and the pump, and into the conduits of the system. To prevent these noises, low-saturation-type motors with ball bearings are used. However, these type of motors are considerably costly.

A fundamentally different solution to the problems of noise particularly in connection with the use of the pumps for hot water heating installations resides in the disassembly or the power motor and the pump. In this example, the pump impeller is secured not on the extended motor shaft, but on an additional pump shaft which runs in low-noise journal bearings. Moreover, in order to couple the motor shaft and the pump shaft, an elastic coupling is required, as well as other structural units to provide a noise-insulating anchorage of the motor in relation to the pump.

Accordingly, the present invention provides a monoblock-type pump with a dry-operating motor, and a seal or packing disposed between the pump and the motor, wherein the impeller is secured to an extended motor shaft, and wherein the motor is lodged opposite the pump with the aid of elastic intermediate member, in such a manner that noises, or vibrations caused by the motor cannot be transmitted to the pump and the connecting pipe lines. Thus, the advantages of the collimator-type power pump, including hermetical seals against leakage losses, are combined with the advantages of the monoblock pump with dry-operating motor without having to put up with the above-described drawbacks.

These improvements are due to the fact that the aforementioned hermetic seal between the pump and the motor must provide the maximum of safety of operating or performance, since owing to its low noise incidence and its compact design, the pump is best suited for utilization in warm water heating units so that a defect packing or seal is apt to lead to hard to detect damages. In order to provide for a flawless, long-enduring seal, the sealing surfaces of the slipring packings which glide over each other do not exercise any other relative movements with respect to each other, except the rotary movement. In other words, all vibrations of the sealing halves, with respect to each other, must be eliminated by structural means.

In order to solve this problem pursuant to the present invention the motor is combined with the pump impeller and the shaft seal, including the part of the housing containing the stationary seal of the shaft packing, in the case of the dry-operated motor pump, and mounted on the pump housing to form a single structural part which is connected, with the aid of elastic and noise-damping means, with the pump housing. Due to the design of the pump and specifically the packing portion of the shaft seal, a hermetic seal is provided against the shaft, as well as the sealing site of the shaft seal which seals against the housing and is contained in a single structural unit, so that relative and vibratory movements occur inside the packing. These vibrations cause a leak of fluid in the shaft seal.

In the case of conventional devices, wherein noise- and vibration-damping means have been employed for the purpose of anchoring the motor, and in the case in which the impeller is secured to the extended motor shaft, leaks in the area of the shaft guide are unavoidable since the shaft, being a part of the motor, is undergoing vibrations, and thus vibrates against the stationary sealing surface which is mounted in the pumping housing.

It has been found expedient to design the shaft seal as a slipring seal with a contrarotating ring, whereby the contrarotating ring is mounted in the part of the housing relating to the structural unit or rests as a stationary sealing against the said part of the housing.

The means which serve for both the elastic coupling and for the sealing of the structural unit against the pump housing, should be mounted against the pump housing on a smaller diameter than is consistent with the stator diameter of the power motor. It is then possible to achieve particularly advantageous conditions with respect to the seal and the vibrations. Special means must be provided for the power pump for supporting the motor's moment of reaction. Pursuant to the invention, provision should be made between the pump housing and the power motor, preferably on the side of the motor which is averted from the pump housing, to provide a supporting or covering hood with an elastic supporting member which is not rotationally symmetrical. One also finds at this point, a noise-damping coupling between the motor and pump housing.

That part of the pump housing which along with the pump impeller constitutes the gap seal, between the suction and pressure chamber of the pump, should be included into the structural unit. This unit is connected via elastic and noise-damping means, and consists of the motor, impeller, shaft packing, as well as the seal housing. In the case of impellers which are laterally open on one side, the part in question can be devised as a grinding plate. In the case of impellers closed on both sides laterally, the part can be provided with a housing split ring.

In the invention, a monoblock pump is provided with a dry engine room which impedes the transmittal of engine vibrations on to the pump, by means of vibration-damping intermediate members, and which, by including the entire sealing system in the undamped part of the motor, thereby creating a nonvibrating, securely sealed and moderately priced pump, which eliminates the relative vibrations of the sealing elements which glide against each other. It is therefore an object according to the present invention to provide a motor-driven pump which impedes the transmittal of vibrations to the pipe connections on the pump.

It is another object according to the present invention to provide a motor-driven pump which includes vibration-damping elements while maintaining a fluidtight seal.

It is a further object according to the present invention to provide a motor-driven pump which is simple in design, easy to manufacture, and reliable in operation.

Other objects and features of the present invention will become more apparent from the following detailed description considered in connection with the accompanying drawing which discloses one embodiment of the present invention. It is to be understood, however, that the drawing is designed for the purpose of illustration only, and not as a definition of the limits of the invention.

In the drawing, wherein similar reference characters denote similar elements throughout the two views:

FIG. 1 is a cross-sectional view of the motor-driven pump according to the invention;

FIG. 2 is an end view of the motor; and

FIG. 3 is another cross-sectional view of a second embodiment of the motor-driven pump constructed in accordance with the present invention.

Referring to FIGS. 1, 2 and 3 a structural unit is lodged in a pump housing 6 with the aid of sealing elements 7, which also serve, at the same time the purpose of noise damping. The structural unit includes a power motor 1. On the extended shaft of motor 1 is secured a pump impeller 2, which may be laterally opened on one side as shown in FIG. 1 or laterally closed on both sides as shown in FIG. 2, and which also embraces the shaft seal, consisting of a slipring 3 and a contrarotating ring 4, and also includes a housing 5 wherein is mounted on the contrarotating ring 4 and a seal 13. In this embodiment, there is also shown connected with the housing 5, here, comprising a protruding cylindrical lip, and constituting an integral part therewith, a housing part 10 which is devised as a grinding plate at its anterior wall. The housing part, which consists of parts 5 and 10, is sealed by a seal 14 against the pump housing. In this embodiment, sealing elements 7 which are the elastic noise-damping means, are mounted in a special cover plate 15 so as to provide a more simplified design for the different parts of the pump. Mounted on cover plate 15 is a supporting or cover hood 8, which is secured to the motor bearing so as to provide a supporting member for the motor's reaction moment, since the plate 15 is firmly coupled to pump housing 6. The cover member is shown in detail in FIG. 2. This support or cover member is not rotationally symmetrical so that it is not capable of rotating in the cover hood. The moment of reaction of the motor is thus intercepted here. The supporting member can also be mounted, of course, at any other point on the monoblock pump.

In the pump apparatus, there is lodged in the pump housing 6, or in the cover plate 15, which is coupled watertight but rigidly with the pump housing, a structural unit which consists of the parts of the power motor, the shaft seal, and the pump impeller parts which have already been described above. This entire structural unit is now capable of pivoting around the seals and coupling elements 7, without any leak occurring in the pump housing 6 with respect to the dry space. Moreover, the shaft seal wherein both parts, namely the slipring 3, and contrarotating ring 4, vibrate, need only satisfy its own sealing object. The shaft seal is free of all incidental movements which are apt to come into evidence owing to vibration between the pump and the motor. Thus, practically no leak is capable of developing on the shaft seal. The stationary seals between the contrarotating ring and the intermediate housing, and between the cover plate 15, or pump housing 6, also does not provide any problems.

While only a single embodiment of the invention has been shown and described, it will be understood that many changes and modifications may be made thereunto without departing from the spirit and scope of the invention.

What is claimed is:

1. An apparatus for vibrationally isolating a motor from a pump, comprising:

a motor having an output shaft;

a pump impeller connected to said shaft;

a pump housing surrounding said impeller, and having a suction chamber and a pressure chamber;

at least one elastic noise-damping O-ring positioned within said pump housing for providing vibrational and structural isolation of said packing means from said motor; and

shaft-packing means disposed within said housing around said output shaft, said packing means including a stationary seal, wherein said motor, packing means and impeller form a single structural unit, including a cover plate having at least one seat concentric with said output shaft, an internal housing having a grinding plate at its anterior wall adjacent to said impeller and protruding cylindrical lip concentrically disposed in said noise-damping O-ring, a contrarotating ring concentrically disposed in said housing while disposed on said shaft, a seal communicatively positioned between said contrarotating ring and said housing so as to be fluid tight, and at least one elastic-type O-ring positioned so as to be communicative while concentric with said protruding lip of said housing and said seat of said cover plate providing a complete structural unit of said packing means for vibrational isolation.

2. The pump according to claim 1 additionally comprising a gap seal disposed between the suction and pressure chambers of said pump housing, said gap seal being included in said structural unit and coupled to said housing through said damping means.

3. The apparatus as recited in claim 1 additionally comprising a cover hood surrounding said motor and disposed over said cover plate, including at its opposite end a supporting member mounted at the end of said motor.

4. The apparatus as recited in claim 3, wherein said impeller is laterally closed on both sides, and said unit is provided with a splitring housing.