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COMBINED PUMP MEANS AND MOTOR MEANS

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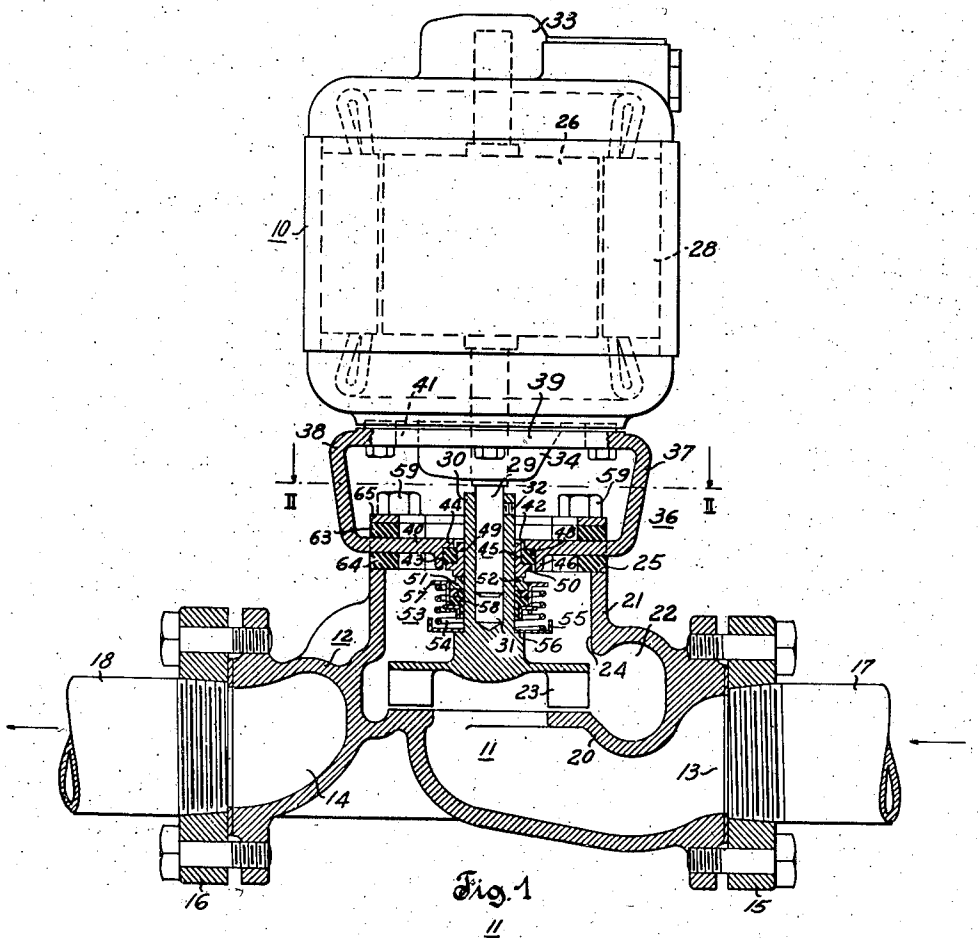

Fig. 1

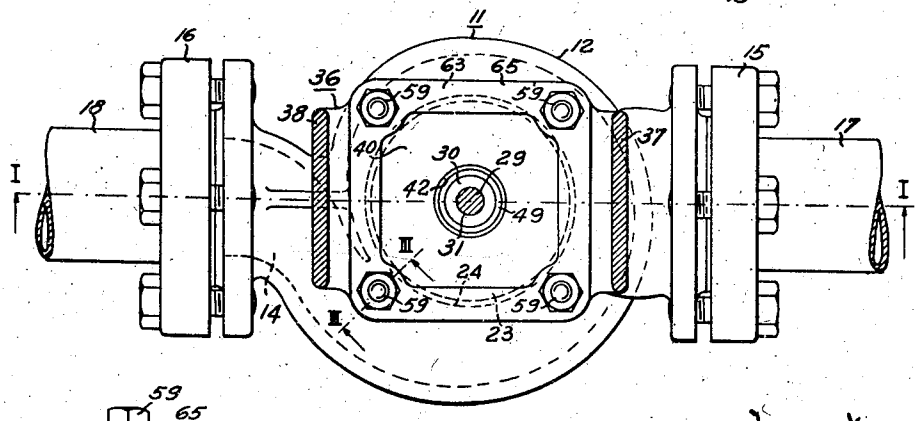

Fig. 2

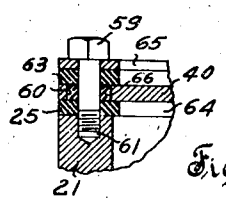

Fig. 3

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COMBINED PUMP MEANS AND MOTOR MEANS

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3 Claims. (Cl. 103—87)

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This invention relates to apparatus comprising rotary pump means and motor means for supplying power to the pump means, and the principal object is to provide a new and improved apparatus of this type.

Another object of the invention is the provision of new and improved apparatus of this type in which transmission of vibrations from the motor means to the fluid acted on by the pump means is minimized.

Another object of the invention is the provision of a new and improved apparatus of this type in which vibration absorbing means adapted to prevent the transfer of mechanical vibrations between the motor means and the rotary pump means is interposed therebetween, and a more specific object is the provision of static coupling means for preventing the said transfer of mechanical vibrations between the motor means and the housing of the rotary pump means.

Another object of the invention is the provision of a new and improved static coupling means whereby the interposition of such coupling means between the motor means and the rotary pump means provides a fluid seal between the motor means and rotary pump means.

Another object of the invention is the provision of a new and improved apparatus of the type hereinbefore referred to in which no bearings are required for the rotary pump means.

Another object of the invention is the provision of a new and improved apparatus of the type hereinbefore referred to in which the moving parts of the rotary pump means are closely coupled to the motor means, and a more specific object is the provision of rotary pump means in which the moving parts are free to vibrate independently of the stationary parts thereof.

Apparatus comprising a rotary pump and motor for driving the pump, has been frequently employed with hot water circulating systems in buildings so as to effect a more rapid circulation of water in the system. When so used, the apparatus must be quiet in operation and free from objectionable vibrations with reference to the circulating system.

Therefore, it is a further object of the invention to provide an apparatus of the type hereinbefore referred to which will transmit the minimum of vibrations to associated fluid circulating systems with which it is associated.

The novel features of the invention and how the objects are obtained will appear from this specification and the accompanying drawings

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showing one embodiment of the invention and forming part of this specification and all the novel feaures are intended to be pointed out in the claims.

In the drawings:

Fig. 1 is a partial vertical section view of an apparatus embodying the invention, taken on the line I—I of Fig. 2;

Fig. 2 is a horizontal section view, taken on the line II—II of Fig 1;

Fig. 3 is a fragmentary detail section view, taken on the line III—III of Fig. 2.

Referring to Fig. 1 of the drawings, the apparatus here shown comprises a rotary electric motor 10 of conventional construction mounted in vertical combination with a centrifugal pump 11. The pump 11, which is located beneath the motor, comprises a conventional volute housing 12 having respective inlet and discharge openings 13 and 14 located 180 degrees apart. Connected respectively to the inlet and discharge openings 13 and 14 in the housing 12 by any suitable means, here shown as threaded flanged connections 15 and 16, are conduits 17 and 18 which may form part of a fluid circulating system.

The pump housing 12 contains an inner wall 20 which may be integrally formed with the housing and external walls 21 thereof, as here shown. The inner wall 20 separates the inlet 13 from the discharge opening 14 and forms the base of a chamber 22 within which an impeller 23 is free to rotate. Extending vertically upward, the chamber 22 terminates in a circular opening 24 in the housing 12 at right angles to the inlet and discharge openings 13 and 14. The chamber opening 24 has a sufficiently large diameter so that upon assembly of the pump 11 the impeller 23 may be easily inserted into the housing 12.

Formed around the chamber opening 24 by a portion of the housing's external wall 21 is a rim, which has a suitably finished face 25 adapted to receive in liquid sealing engagement a motor mounting means hereinafter described.

The pump impeller 23 is driven directly by the rotary electric motor 10, the motor being located vertically over the chamber opening 24 in the pump housing 12. The motor comprises a stator 28, and a rotor 26 of conventional construction, having a vertically disposed shaft 29. Extending downward through the chamber opening 24, the shaft 29 connects with the impeller 23, preferably in the following manner.

The impeller 23 has an upward extending hub 30 provided with a circular bore 31 into which

the end of the shaft 29 is inserted a substantial distance, in relatively tight fit, the hub 30 and the shaft 29 being restrained against relative rotation by means of a set screw 32 in the hub firmly engaging the shaft 29.

The motor stator 28 is provided with the conventional bearings 33 and 34 mounted at each end thereof, in which the shaft 29 of the rotor is journalled. Supporting the stator 28 and rigidly connected to the base thereof, is the motor mounting means, a description of which follows.

The mounting means comprises a hollow pedestal 36 having the general outline of an inverted truncated rectangular pyramid, two sides being open, and the other two sides 37 and 38 forming the pyramidal support for a horizontally disposed upper mounting member 39 and being supported on a lower horizontally disposed base cover plate 40. As here shown, the sides 37 and 38 of the pedestal 36 are integrally formed with the cover plate 40. The mounting member 39, provides a base upon which the stator 28 is mounted, and has a large central aperture 41 through which the shaft 29 and the lower bearing 34 of the motor 10 depend. The cover plate 40 provides a cover for the pump chamber 22 and has a relatively small bore 42 suitably proportioned for passage of the shaft 29 and impeller hub 30 therethrough.

As will be apparent, the bore 42 in the cover plate is countersunk from the plate's underside, thereby forming a counterbore 43 terminating in a suitable shoulder 44 for reception and retention of a composite rotary fluid seal 45. The counterbore 43 is further extended by means of a downward depending lip 46 which surrounds the counterbore 43 at the underside of the cover plate 40. This further extension of the counterbore 43 provides the necessary axial wall support for the seal 45 without requiring an increase in the thickness of the cover plate.

The composite seal 45 comprises a resilient ring 48 of rectangular section engaging the wall of the counterbore 43, and a non-resilient first contact ring 49 engaging the impeller hub 30 in slidable relation thereto, both rings being concentric relative to the impeller hub. The two rings 48 and 49 are fastened together by any suitable means, as by bonding, and are non-rotatable relative to the cover plate 40. The contact ring 49 has a substantially L-shaped section including a circular radially extending flange 50, the upper side of which presses against the bottom radial face of the resilient ring 48, forcing the ring 48 against the shoulder 44 in the counterbore 43.

Although the shoulder 44 in the counterbore 43, as hereinbefore described, restrains the seal 45 against upward axial movement, it is necessary to provide a corresponding restraint against downward axial movement, and this is accomplished as follows:

A second contact ring 51 is mounted on the hub 30 in axially slidable non-rotatable concentric relation thereto. The ring 51 has an upward extending circular rib 52, the end face of which is in slidable contact with the opposed radial face of the first contact ring 49. The two rings 49 and 51 are relatively rotatable and are in slidable and sealing contact with one another.

Means 53 for biasing the second ring 51 against the first ring 49 and also serving as an auxiliary seal relative to the impeller hub 30 is mounted on the hub below the second ring 51. The biasing means 53 may be of any suitable form, as here shown, and comprises a compression coil spring 54 surrounding the impeller hub 30.

One end of the spring 54 is supported by a washer 55 abutting a shoulder 56 formed in the base of the impeller hub 30. The other end of the spring 54 acts against an inverted L-shaped collar 57 attached to the second contact ring 51.

It will be noted that the rotary seal 45 has two sets of relatively rotatable sealing surfaces, one between the contact rings 49 and 51 and the other between the first contact ring 49 and the impeller hub 30.

In order to prevent the passage of fluid between the second contact ring 51 and the impeller hub 30, a flexible seal 58 is inserted between the axially extending portion of the collar 57 and the impeller hub 30 in axially slidable contact therewith.

From the foregoing description of the rotary seal 45 and its component and associated parts, it will be apparent that the seal not only acts to prevent escape of fluid from the housing 12, but also acts as a vibration damper to minimize the transmission of lateral vibrations from the impeller 23 and shaft 29 to the cover plate 40. The resilient ring 48 of the composite seal 45 is the effective element in minimizing the transfer of lateral vibrations. Such vibrations may be caused in the shaft 29 by the rotor 26, or by a mechanically unbalanced impeller, or by air, or by fluid surges in the pump's associated circulating system.

Referring now to the means of assembling the motor pedestal 36 to the housing 12, the cover plate 40 is detachably secured to the face 25 of the housing by any suitable means, here shown as bolts 59; the bolts 59 passing through suitable holes 60, one of which is shown in Fig. 3, in the cover plate 40 and engaging recesses 61, one of which is shown in Fig. 3, in the face 25 of the housing 12. A pair of generally rectangular resilient gaskets 63 and 64 of rectangular section sandwich the cover plate 40 between them and are held against unlimited lateral movement by the bolts 59 passing therethrough. The lower gasket 64 of the pair is interposed in liquid sealing relation between the lower face of the cover plate 40 and the face 25 of the housing 12, thus comprising a relatively resilient static seal therebetween. The upper gasket 63 is mounted directly on the upper face of the cover plate 40. Referring to Fig. 2, interposed between the bolt heads 59 and the upper gasket 63, and in register therewith, is a washer 65 having a generally rectangular shape similar in shape to the gasket 63. The washer 65 functions to protect the gasket 63 from being cut by the angular corners of the heads of the bolts 59.

Referring to Fig. 3, it will be noted that each of the bolt holes 60 in the cover plate 40 has a diameter substantially larger than the diameter of the bolt shank 59 passing therethrough, which, in effect creates an annular space around each bolt in the plane of the plate. Into this space is inserted a resilient bushing 66, which effectively insulates the bolt shank 59 mechanically from the plate 40 and prevents the transmission of lateral vibrations therebetween. The gaskets 63 and 64 restrain the bushing 66 from upward or downward movement about the shank of the bolt 59.

Upon assembly of the motor pedestal 36 to the housing 12, the bolts 59 are engaged and tightened, thus firmly securing the pedestal 36 to the housing 12 and sealing the chamber opening 24 therein. While the pedestal 36 is thus secured, it is still free to vibrate laterally, and longitu-

dinally relative to the housing 12, by virtue of the construction and arrangement of the parts of the combined apparatus as hereinbefore described. Vibrations of the motor stator 28 are effectively absorbed by the gaskets 63 and 64 and bushing 66 and prevented from passing to the housing 12 and the associated circulatory system and the fluid therein. Vibrations of the rotor 26 are similarly prevented from passing to the housing 12.

It will be noted that the structure shown and described herein eliminates the requirement for a pump bearing, the lower bearing 34 of the motor 10 performing that function. The design also permits close coupling of the impeller 23 to the motor 10 as hereinbefore described.

From the foregoing it will be apparent to those skilled in the art that the illustrated embodiment of the invention provides a new and improved combined apparatus for accomplishing the objects of the invention. And it will also be obvious to those skilled in the art that the illustrated embodiment of the invention may be variously changed and modified, or, the features thereof, singly or collectively, may be embodied in combinations other than that illustrated, without departing from the spirit of the invention, or sacrificing all of the advantages thereof, and that accordingly the disclosure herein is illustrative only, and the invention is not limited thereto.

It is claimed and desired to secure by Letters Patent:

1. Pumping apparatus, comprising: a motor having a stator, a rotor, and a bearing mounted on said stator for supporting said rotor; pumping means comprising a housing having an opening in a side thereof and an impeller within said housing; means for connecting said impeller to said rotor, said connecting means extending through said opening to said impeller; means for supporting said stator on said opening side of said housing comprising a pedestal interposed between said housing and said stator; retaining means cooperating with said housing for fastening said pedestal to said housing; resilient means interposed between said pedestal and said housing and between said pedestal and said retaining means whereby said stator and said pedestal and said impeller may vibrate laterally and longitudinally relative to said housing and independently thereof, said resilient means including sealing means cooperating in liquid sealing relation with said pedestal and with said housing for closing said opening in said housing, and further sealing means cooperating in liquid sealing relation with said connecting means and said pedestal at a place between said bearing and said impeller, while leaving said impeller free to vibrate laterally relative to said pedestal.

2. Pumping apparatus, comprising: a motor having a stator, a rotor, and a bearing mounted on said stator for supporting said rotor; pumping means comprising a housing having a rim defining an opening, and an impeller within said housing; means for connecting said impeller to said rotor, said connecting means extending through said opening to said impeller; means for supporting said stator on said housing, said supporting means comprising a pedestal interposed between said housing and said stator; retaining means cooperating with said housing for fastening said pedestal to said housing; a resilient member axially interposed between said pedestal and said rim for sealing said pedestal to said housing in liquid sealing relation, another resilient member axially interposed between said pedestal and said retaining means and cooperating with said first member to permit the longitudinal vibration of said stator and said pedestal and said impeller relative to said housing and independently thereof, means including a third resilient member laterally interposed between said pedestal and said retaining means to permit lateral vibration of said stator and said pedestal relative to said housing and independently thereof, and sealing means cooperating in liquid sealing relation with said connecting means and said pedestal at a place between said bearing and said impeller, while leaving said impeller free to vibrate laterally relative to said pedestal.

3. Pumping apparatus, comprising: a motor having a stator, a rotor, and a plurality of bearings mounted on said stator for supporting said rotor, said stator having a base end and a free end; pumping means comprising a housing having an opening in a side thereof and an impeller within said housing; means for connecting said impeller to said rotor; said connecting means extending through said opening to said impeller; means for supporting said base end of said stator on said opening side of said housing comprising a pedestal abutting said base end and remote from said free end of said stator, retaining means cooperating with said housing for fastening said pedestal to said housing; resilient means interposed between said pedestal and said housing and between said pedestal and said retaining means to permit longitudinal and lateral vibrations of said stator and said pedestal and said impeller relative to said housing and independently thereof, said resilient means including sealing means cooperating in liquid sealing relation with said peedstal and with said housing for closing said opening in said housing, and further sealing means cooperating in liquid sealing relation with said connecting means and said pedestal at a place between said bearing and said impeller, while leaving said impeller free to vibrate laterally relative to said pedestal.

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