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Anderson

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[54] **FLUID MACHINES**

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[52] **U.S. Cl.** ..... **417/360,** 415/201, 248/2, 417/423 R

[51] **Int. Cl.** **F04b 17/00,** F04d 29/60

[58] **Field of Search** ..... 415/201, 108; 248/2, 14; 417/360, 423 R

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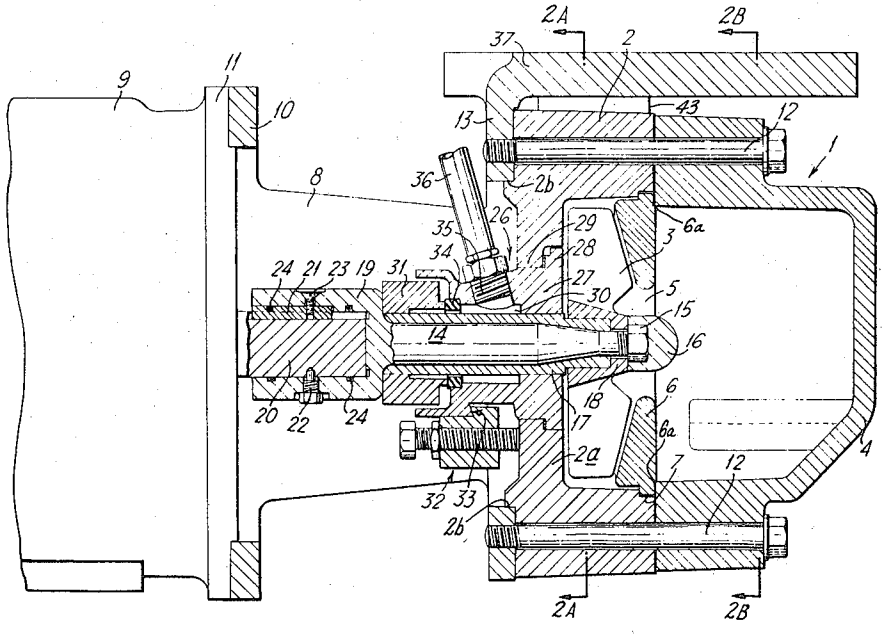
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[57] **ABSTRACT**

A rotodynamic pump includes a pump casing housing a shaft mounted impeller, which shaft is driven by a suitable drive motor, and suction and discharge ducts in the pump casing; and pipelines are provided for the supply and discharge of fluid to and from the suction and discharge ducts respectively. By the present invention, the pipelines are fixedly carried on a frame which is supported by any suitable base member for example, by the pump drive motor, such that load on the frame is not transmitted to the pump casing, and branch conduits connect the support member and the ducts for continuity of pipeline to the ducts. The arrangement enables the pump casing to be free of pipe load and the pump to be removable in toto or in part without disturbance to the pipelines; also thermal loads due to differential thermal expansion between the frame and pump casing are not transmitted to the pump casing.

4 Claims, 3 Drawing Figures



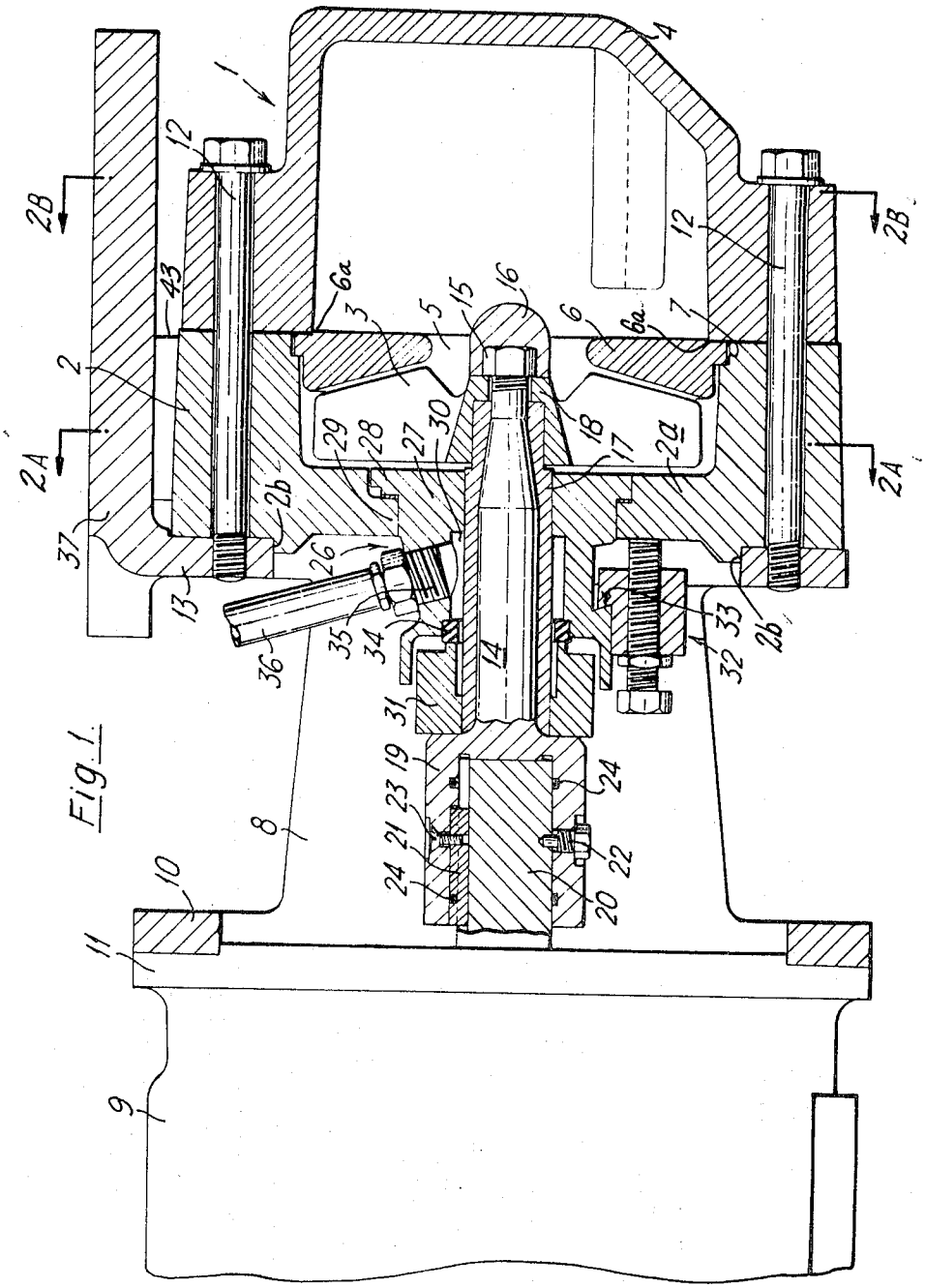

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Fig. 1.

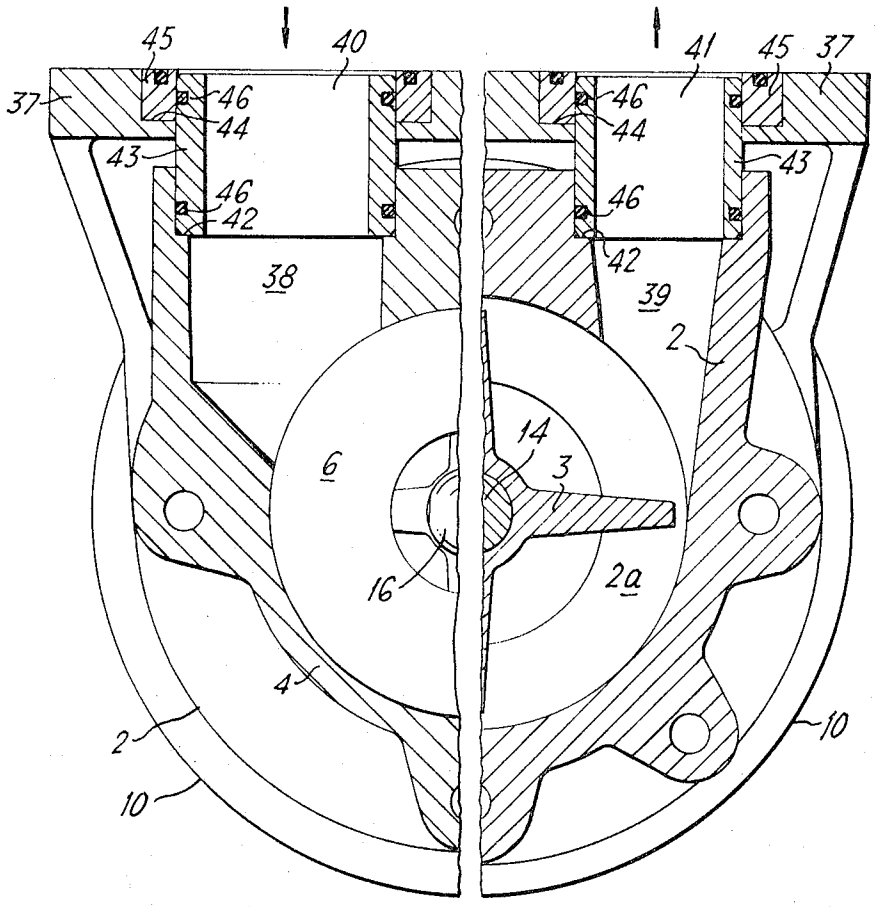

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Fig. 2B

Fig. 2A

FLUID MACHINES

The present invention relates to a fluid machine of the type including a casing and a fluid duct in the casing for the inflow or discharge of fluid from the casing, and particularly to a fluid pump. Such a machine is hereinafter referred to as a fluid machine of the type aforesaid.

In previous fluid pumps the pipework for the inflow and discharge of fluid from the pump casing was directly coupled to the casing at pump suction and discharge ducts so that the casing had to withstand the pipe load arising for example from pipework distortion, thermal loading and flange tightening. Aggressive materials attack pump components by corrosion and/or abrasion, and pump casings for such duties may require to be of expensive metal, plastics or ceramics. It has been a disadvantage that to cater for the pipe loads, the pump casing had to be of an unnecessarily greater thickness of expensive metal, plastic or ceramic or there had to be provided an outer sheath of cast iron moulded onto the casing which arrangement was expensive. Further, in previous pumps loads due to differential thermal expansion has been transmitted to the pump casing.

It is an object of the present invention to obviate or mitigate the above disadvantages.

According to the present invention there is provided a pump installation including: a pump comprising a casing having a removable front cover and a back wall, an impeller shaft penetrating the back wall of the casing, sealing means sealing said penetration of said back wall, a rotary impeller mounted on said impeller shaft inside the casing, a fluid suction duct in the casing for delivery of fluid to said impeller, an inlet to said fluid suction duct located in a lateral wall of the casing, a fluid discharge duct in the casing for discharge of fluid from the impeller, and an outlet from said fluid discharge duct located in said lateral wall of the casing; a motor having a casing and being connected to the impeller shaft for driving the pump; bracket means rigidly interconnecting the motor and pump casings; a support member formed by an extension of said bracket means and adapted to fixedly carry pipes such that the pump casing is substantially free from pipe loads and thermal loads due to differential thermal expansion between the pump casing and the support member; and conduit means interconnecting the support member and said inlet and outlet; whereby on removal of said front cover said pump can be disassembled without disturbance to the pipes.

A embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 shows a cross-sectional elevation of an electric-motor driven pump installation according to one embodiment of the present invention:

FIG. 2A is a sectional end view of the pump of FIG. 1 taken along the line 2A—2A in FIG. 1 looking in the direction of the arrows; and FIG. 2B is a sectional end view of the pump of FIG. 1 taken along the line 2B—2B in FIG. 1 looking in the direction of the arrows.

Referring to FIGS. 1 and 2, a rotodynamic fluid pump 1 which is driven by an electric motor 9 includes a cylindrical casing 2 housing the pump impeller 3 and having a back wall 2*a*, and a suction casing part 4 abutting an outer end of the cylindrical casing 2 and aligned

with the impeller eye 5. An annular suction plate 6 located at the eye of the impeller 3 is carried in an annular shoulder 7 of the casing 2 and is held in position by means of the suction casing part 4, preferably cooperating with a slight recess or shoulder area 6*a* on the suction plate 6. The pump casing parts 2, 4 are carried by a cylindrical bracket 8 supported by the motor 9, one flanged end wall 10 of the bracket being bolted to a flanged wall 11 of the motor. The casing parts 2, 4 are held in abutting relationship by means of long tie bolts 12 fixed to a flanged end wall 13 of the bracket 8.

The impeller 3 is secured to one end of the impeller stub shaft 14 by means of a nut 15 which is covered by a domed cover 16 assisting the smooth inflow of fluid to the impeller eye 5 and the shaft 14 which extends into the bracket 8 includes a sleeve part 17 against an end wall of which an internal flange part 18 of the impeller is held by the nut 15. The other end of the stub shaft 14 is in the form of a large diameter cylindrical socket portion 19 receiving the motor drive shaft 20, and the shafts 14, 20 are drivingly coupled by means of key 21, a set pin 22 and countersunk screw 23 being provided to set the shaft 20 in the socket portion 19. Sealing rings 24 seal the shaft 20 and socket portion 19 interfaces.

The penetration of the radial back wall 2*a* casing 2 by the shaft 14 is sealed by means of a sealing gland 26 including a gland housing 27 housing chamber 30 for sealing medium, a sealing ring 34 for the chamber 30 located by gland nut 31, and a chamber inlet 35 in the housing 27 to which sealing medium is supplied via pipeline 36. The gland 26 is held securely in position by means of puller block 32 which serves to urge a radial flange 28 of the housing 27 into abutment with an internal flange 29 of the back wall 2*a*, the block 32 including an inclined shoulder 33 engaging a corresponding shoulder on the gland housing 27.

The pump 1 is particularly intended for pumping liquids of an aggressive nature which liquids attack the pump parts by corrosion and/or abrasion, and consequently the pump parts are made of a suitable material for example a metal, plastics or ceramic material capable of withstanding such liquids. Since a suitable metal may be expensive, the casing parts if made of metal would be made as thin as possible commensurate with withstanding the required pump pressures, and such a casing would not be suited for carrying the pipe loads, as would one made from plastics or ceramic materials. Consequently in the present arrangement a separate pipe support member is provided to withstand the pipe thrusts or loads, while it is arranged that the pump casing need only withstand the pump pressure.

The pipe support member is comprised by a flanged extension 37 of the bracket 8, the extension 37 lying adjacent the pump suction and discharge ducts 38, 39 with the axes of the ducts 38, 39 normal to the flange (see FIG. 2). In this pump embodiment, the inlet and discharge ducts 38, 39 extend substantially radially relative to the pump casing 2 and parallel to each other, the inlet duct 38 being included in the suction casing 4 while the pump casing 2 houses the discharge duct 39. Through bores 40, 41 in the flange 37 align with the ducts 38, 39, and flanged parts of the inlet and discharge pipes (not shown) for the pump are bolted to the extension 37 in alignment with the through bores 40, 41. Each duct 38, 39 includes an outer stepped part 42 housing a cylindrical branch conduit 43 which ex-

tends into a respective through bore **40, 41** to provide for continuity of the pipeline to the duct **38, 39,** and preferably each through bore has an outer recess **44** housing a sealing ring **45** engaging the flange of the respective pipe for sealing of the pipe/extension interface. Further, each cylindrical branch conduit **43** includes a pair of O-seal rings **46** engaging the duct wall and the sealing ring respectively. The flanged extension **37** (bracket **8**) may be made of cast iron or other suitable material. It will be clearly seen therefore that flanged extension **37** carries the pipeline load while the pump casing need only withstand pump pressure. Further the motor and pump (unit) can be mounted on a common support, for example with the pump **1** extending in cantilever manner, and this conveniences alignment of parts during assembly work: the bracket **8** however provides a rigid connection between the motor **9** and the pump **1.**

A very advantageous feature of the above pump according to the present invention, is that the pump can be removed (either completely or in part), without disturbing external pipework, removal of the bolts **12,** front cover **4** pipeline **36,** and impeller nut **15** permitting the suction plate **6,** impeller **3,** stub shaft **14** and gland seal **26** to be removed by a "front pull out" while the pump casing **2** is held axially by branch conduit **43** and radially by a small locating spigot or shoulder **2***b* (exaggerated in FIG. 1) on the pump casing and the support frame wall **13.** The pump front cover or suction casing portion **4** may be removed by unscrewing the bolts **12** and then moving the cover axially so that it is free from engagement with the small spigots or shoulders **6***a* (FIG. 1) on the annular suction plate **6.** This also then enables the cover **4** to be pulled downwardly out of engagement with one of the two branch conduits **43.**

Due to the resilience of the sealing rings **45** and **46,** the conduit **43** does not prevent the cover **4** from being moved in an axial direction by the small amount required to achieve this. After the suction plate **6,** impeller **3,** stub shaft **14** and sealing gland **26** have been withdrawn the removal of the casing portion **2** is similarly effected by moving it out of engagement with the shoulder or spigot (exaggerated in size) so that the casing **2** can be dropped down until it is disengaged from the other of the pipe conduits **43.**

The foregoing construction and ease of disassembly is particularly advantageous in large pumps where the pump casing **2** is of such a mass as to be only practicably removable by means of a crane, and where the only maintenance required is say gland maintenance. Also, the branch conduits **43** "float" in their housings, so enabling differential thermal expension between the pump casing **2** and the pipework (and extension **37**) when the pump is handling hot liquids. Since access to the pump is achieved by a rightward movement (as seen in FIG. 1) of the suction casing **4,** corrosive liquid spillage onto the motor/pump support on disassembly of the pump can be conveniently minimised by suitable location of the support e.g. by locating the support beneath the motor.

It will be understood that modifications are possible in the above described motor/pump installation according to the present invention without falling out with the scope of the present invention as defined by the appended claims, and particularly as regards the arrangement of the fluid conduit to the suction and discharge ducts of the pump.

I claim:

1. A pump installation including:

a pump comprising a casing having a removable front cover and a back wall, an impeller shaft penetrating the back wall of the casing, sealing means sealing said penetration of said back wall, a rotary impeller mounted on said impeller shaft inside the casing, a fluid suction duct in the casing for delivery of fluid to said impeller, an inlet to said fluid suction duct located in a lateral wall of the casing, a fluid discharge duct in the casing for discharge of fluid from the impeller, and an outlet from said fluid discharge duct located in said lateral wall of the casing;

a motor having a casing and being connected to the impeller shaft for driving the pump;

bracket means rigidly interconnecting the motor and pump casings;

a support member formed by an extension of said bracket means and adapted to fixedly carry pipes such that the pump casing is substantially free from pipe loads and thermal loads due to differential thermal expansion between the pump casing and the support member;

and conduit means interconnecting the support member and said inlet and outlet;

whereby on removal of said front cover said pump can be disassembled without disturbance to the pipes.

2. A pump installation as claimed in claim **1,** wherein the support member has through bores to permit fluid communication between the pipes and said ducts, and the conduit means includes cylindrical branch elements each of which extends into a respective one of the through bores to form a continuous fluid conduit with one of the pipes.

3. A pump installation as claimed in claim **1,** wherein a socket is formed in said inlet and said outlet to receive said cylindrical branch elements.

4. A pump installation as claimed in claim **3,** wherein the through bores each have a stepped socket portion housing, a sealing ring for engagement with one of the pipes to seal it to the support member.

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