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AXIAL RELIEVING ARRANGEMENT FOR IMPELLER-TYPE PUMPS

Filed Nov. 6, 1967 2 Sheets-Sheet 1

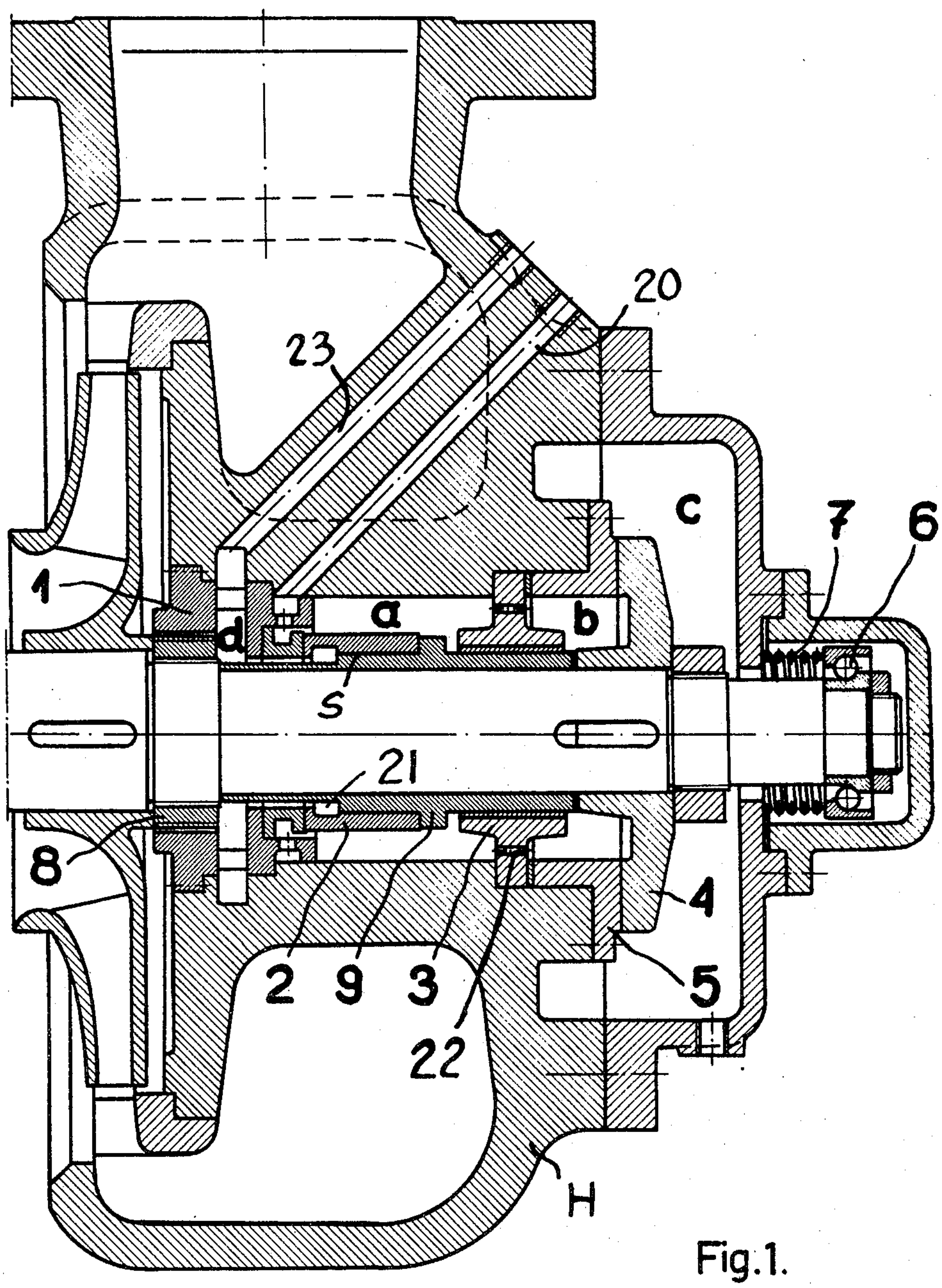

Fig.1.

AXIAL RELIEVING ARRANGEMENT FOR IMPELLER-TYPE PUMPS

Filed Nov. 6, 1967 2 Sheets-Sheet 2

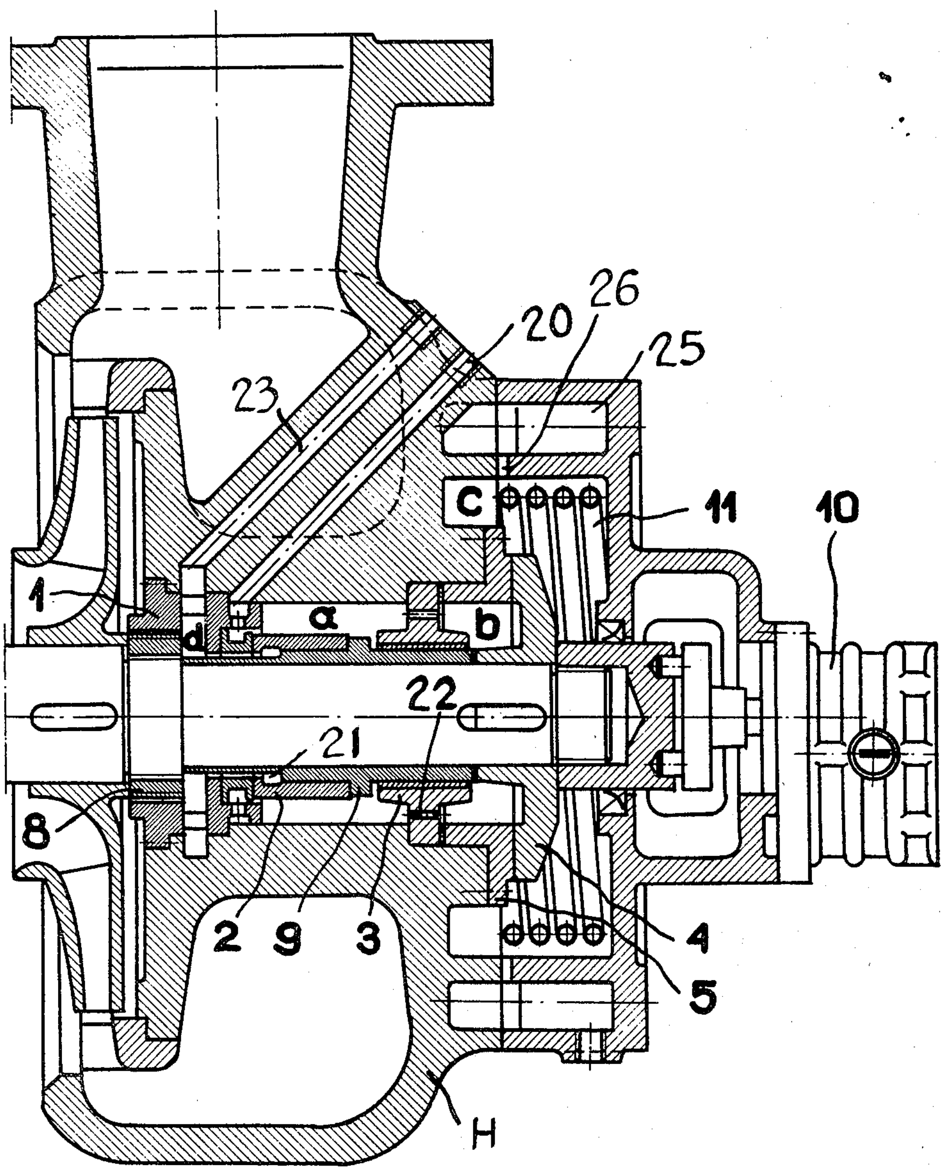

Fig. 2

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AXIAL RELIEVING ARRANGEMENT FOR IMPELLER-TYPE PUMPS

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ABSTRACT OF THE DISCLOSURE

An impeller-type pump equipped with an arrangement for axial relief consisting of a relieving disk operating under the pressure of oil or other working liquid fed at a suitable pressure, higher than that of the pumped liquid, from a separate oil system. An auxiliary oil pump of the relieving arrangement is driven directly from the pump shaft. The space, through which the oil flows in acting against the relieving disk, is separated from the flow space of the pump by means of a packing. The relieving arrangement is also equipped with a device furnishing protection against shifting of the shaft.

The invention relates to an arrangement for axial relief of impeller-type pumps, enabling equilibration of high axial forces, independently of the liquid being pumped.

For equilibration of the axial forces acting on impeller-type pumps, axial slide bearings known in pump constructions as so-called relieving disks are employed in structural cooperation with the flow system of the pump, in which the working medium is the liquid being pumped by the pump. However, using the pumped liquid as the working medium makes it impossible to employ pumps provided with relieving disks for liquids contaminated with mechanical impurities, as the sliding surfaces are then subjected to rapid wear. Thus for pumping mechanically polluted liquids there are constructed pumps of symmetrical hydraulically equilibrated flow systems, or pumps provided with axial bearings forming separate members of the structure. Pumps of such a design are heavy and have large overall dimensions.

The invention consists essentially in application of an axial bearing completely relieved, in which the working medium is machine oiled under a pressure higher than that of the pumped liquid. Such structure provides good operational conditions for the relieving system independently of the pumped liquid or its degree of contamination.

The invention is deescribed further with reference to the accompanying drawing, wherein:

FIG. 1 is a cross section of the delivery casing of the pump with members of the relieving arrangement,

FIG. 2 is a similar view which shows a modification of the arrangement.

An oil of constant pressure, higher than that of the pumped liquid, is fed through a port **20** in the delivery pump casing H to a collector **1**, wherefrom, through ports **21** in the collector, the oil flows out onto the sliding surfaces S of a packing **2** and further to the space *a*. The outlet ports of the collector **1** are situated tangentially to the inner diameter of the collector, to provide swirling of the oil flowing out, necessary for regular operation of the packing **2**. The pressure of the oil in the space *a* is higher than that of the pumped liquid, to include the penetration of the pumped liquid (together with impurities therein) into the relieving system. The packing **2** operates under a small pressure which is the difference between the pressure of the oil and the pressure of the pumped liquid.

Through ports **22** in the bushing of the radial bearing **3**, the oil flows to the space *b*. The decrease of the pressure, caused by the throttling of the oil through the ports **22** to the bushing **3**, causes the formation of a pressure difference between spaces *a* and *b*, necessary for self-controlling of the relieving system. Through the clearance between the relieving disk **4** and the sliding ring **5** the oil flows to chamber *c*, wherefrom it is drained to the oil reservoir.

Since the magnitude of the axial force is not constant, and since during the operation of the pump there occur notable fluctuations of the axial force, and also since the self-controlling of the pressure in the space *b* is performed with some delay, in order to avoid impacts of the relieving disk against the sliding ring **5** there is provided an auxiliary bearing **6**, which prevents excessive shifting of the pump shaft in the suction direction. The bearing **6** is able to shift freely together with the pump shaft in the axial direction, and is opposed in the delivery direction by means of the spring **7**.

In order to protect the sliding surfaces of the packing **2** from contamination with impurities contained in the pumped liquid, a chamber *d* is formed between the flow space of the pump and the packing, through which liquid free from mechanical impurities flows, which impurities could damage the sliding surfaces of the packing. The liquid flows to the chamber *d* through a port **23** in the delivery casing of the pump, parallel to the port **20** feeding the oil to the relieving system. The pressure in the chamber *d* is somewhat lower than the pressure of the pumped liquid, owing to application of a threaded thrower **8**.

The pump shaft is radially born in bushing **3** which is self-aligning on sleeve **9** on which is fitted the packing **2**. The difference of pressure in spaces *a* and *b* secures a suitable lubricating of the bearing.

There is provided also a modification of the specified system consisting in fitting the oil reservoir, the oil cooler and the oil pump **10** in a single structural unit together with the delivery casing of the pump (FIG. 2). In this arrangement, the space *c*, completely filled with oil, is used as the cooling chamber for the oil. In this chamber there is provided a coil **11** through which cooling water flows. The cooling coil **11** is fixed in a helical groove cut on the ribs of the cooling chamber and the diameter of the coil is greater than that of the helical groove so that the coil is secured in place by its own elasticity. The cooling performance is increased by swirling the oil caused by rotation of the relieving disk **4**. Outside the cooling chamber there is provided a ring-shaped oil tank **25** connected by means of ports **26** with the cooling chamber. In order to prevent the swirling of the oil in the tank there are provided longitudinal ribs.

The oil pump **10** is driven directly from the pump shaft by means of a flexible coupling.

We claim:

1. Axial relieving apparatus for an impeller-type pump having a shaft with a slidable sealing means thereon for sealing the liquid being pumped, said apparatus comprising means defining a first chamber around said sealing means, means for introducing a pressure fluid past said sealing means and into said first chamber, said pressure fluid being at a pressure higher than that of the liquid means for said shaft between said disc and said sealing being pumped to prevent the latter from impinging on said means, said bearing means and disc defining a second sealing means, a relieving disc on said shaft, and bearing chamber therebetween, said bearing means having at least one port providing communication between said chambers whereby the pressure fluid is throttled as it passes from said first to said second chambers to establish a pressure difference between said chambers which exerts an axial force on said shaft.

2. Apparatus as claimed in claim 1 wherein said means for introducing the pressure fluid into said space has tangential apertures to produce swirling of the pressure fluid.

3. Apparatus as claimed in claim 1 comprising means on said shaft for preventing major axial displacement thereof.

4. Apparatus as claimed in claim 3 wherein said means for preventing major axial displacement of the shaft comprises a bearing thereon and a spring biasing said bearing and thereby said shaft.

5. Apparatus as claimed in claim 1 wherein said pump comprises a housing having a cooling chamber and a reservoir for said pressure fluid, and an auxiliary pump driven by said shaft for circulating said pressure fluid.

6. Apparatus as claimed in claim 5 wherein said relieving disc is disposed within said cooling chamber for producing turbulence of the pressure fluid therein.

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277—74, 27; 103—112