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(54) Abstract Title
A fluid system and method of cooling bearings

(57) A fluid system includes a prime mover, such as a large pump or turbine (10), having a high pressure side and a low pressure side. Water is taken from the high pressure side of the pump (10) and is passed through the cooling coils (11) of the bearings for the pump (10). The water from the cooling coils (11) is then returned to the high pressure side of the pump (10) by means of an auxiliary pump (12).

The fluid system may be applied to a compressor unit or engine, such as an aeroplane engine, with air as the cooling fluid. A by-pass line (13) extends to the low pressure side of the prime mover so that cooling of the bearings will still be effected in the event of auxiliary pump failure.

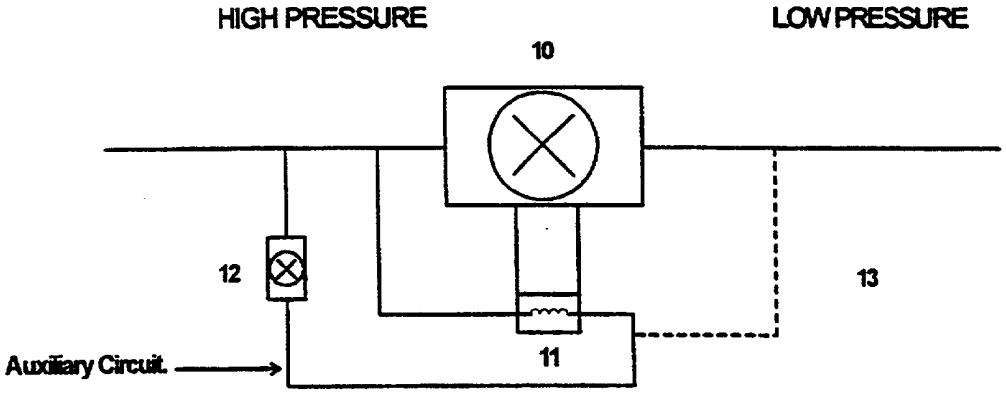

Fig. 3

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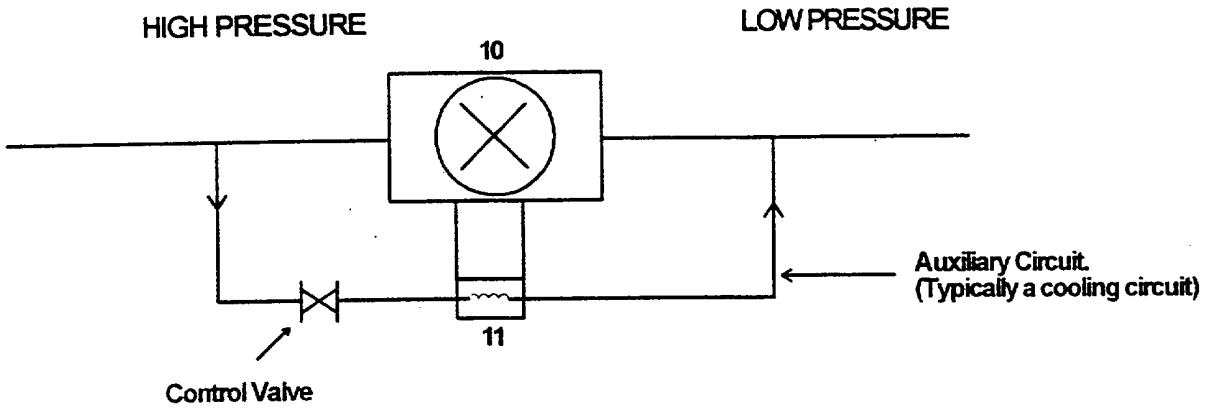

Fig. 1

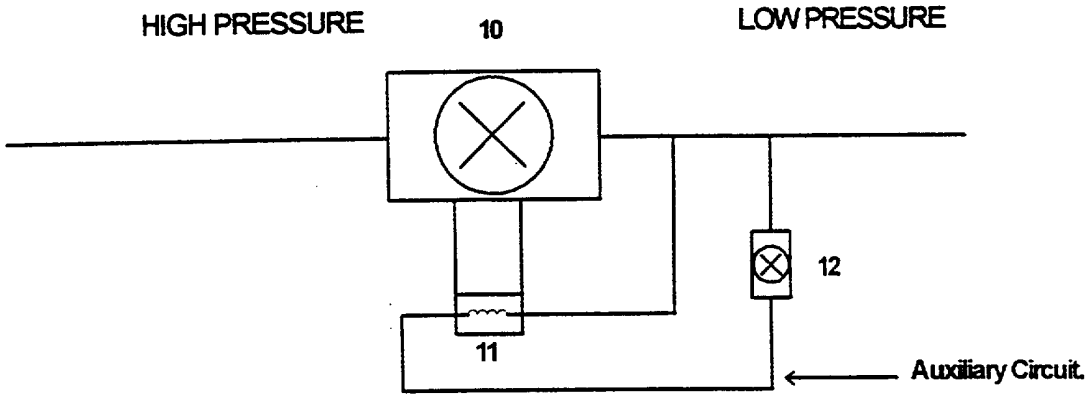

Fig. 2

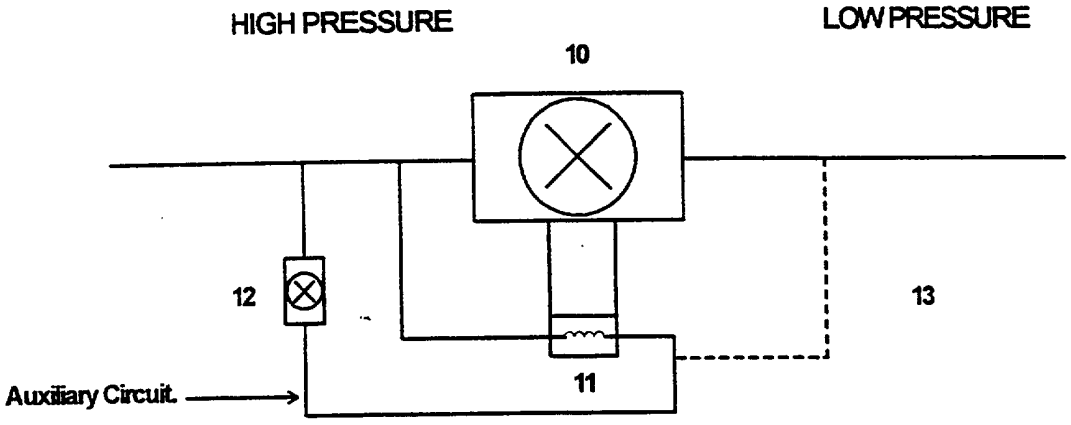

Fig. 3

FLUID SYSTEMS

Field of the Invention

This invention relates to fluid systems including a prime mover having a high pressure side and a low pressure side and, although it has been developed in relation to the cooling of the bearings of large pumps and turbines, it has a variety of applications as explained below.

One existing method of cooling the bearings of a large pump 10, such as a pump used for pumping water from a borehole or in a pumping station, is shown diagrammatically in Figure 1. The pump 10 has a high pressure side and a low pressure side and water is taken from the high pressure side and passed through the bearing cooling coils 11 before being returned to the low pressure side of the pump. This arrangement is reliable but is not energy efficient since the energy of the water at high pressure, for example, 10 bars, is effectively wasted.

Another existing method is shown in Figure 2. It includes the use of a small pump 12 to pump water from the low pressure side

of the large pump 11 through the cooling coils 11 and to return the water to the low pressure side of the pump. This arrangement is energy efficient as compared to the arrangement shown in Figure 1, but is not fail safe, i.e. if there is any failure of the small pump 12, cooling water will not be caused to flow through the cooling coils 11 and the bearings of the large pump 10 could become overheated with catastrophic results.

It is accordingly an object of the present invention to provide an improved fluid system which, in the particular application described above, overcomes the disadvantages of the arrangements shown in Figures 1 and 2.

Summary of the Invention

According to a first aspect of the present invention there is provided a fluid system which includes a prime mover having a high pressure side and a low pressure side, means for withdrawing fluid from the high pressure side of the prime mover and supplying it to a facility, and means for returning the fluid supplied to the facility to the high pressure side of the prime mover.

The means for returning the fluid to the high pressure side of the prime mover is preferably a pump and by-pass means are preferably provided, operable in the event of failure of said pump, to deliver the fluid from the facility either to the low pressure side of the prime mover or to exhaust.

The prime mover may, as mentioned above, be a large pump or turbine and the fluid may be water. Alternatively the prime mover may be a compressor or engine, for example, an aircraft engine, and the fluid may be air.

As applied to the use of the system in relation to the cooling of the bearings of a large pump or turbine, the facility will be the bearing cooling coils. The facility may, however, take many other forms and may comprise operating elements operated by means of the high pressure fluid obtained from the high pressure side of the prime mover.

In a typical arrangement, the pressure on the high pressure side of the prime mover may be 10 bars and the pressure of the fluid issuing from the facility, after the required function, e.g. cooling, has been effected, may be 9 bars. The energy-saving benefits of returning this relatively high pressure fluid to the high pressure side of the prime mover will be apparent.

According to a more specific aspect of the present invention there is provided a method of cooling the bearings of a large pump or turbine having a high pressure side and a low pressure side, said method comprising taking fluid from the high pressure side of the large pump or turbine, passing it through cooling coils associated with or forming part of the bearings, and pumping the fluid which has passed through the cooling coils back to the high pressure side of the large pump or turbine.

Brief Description of the Drawings

Figures 1 and 2 show the two prior art arrangements described above, and

Figure 3 is a diagrammatic illustration of an arrangement in accordance with the present invention for cooling the bearings of a large pump or turbine.

Description of the Preferred Embodiment

As shown in Figure 3, a large pump or turbine 10 (hereinafter referred to for convenience as a pump) has a high pressure side and a low pressure side. The pump 10 may, for example, of the kind used by a Water Undertaking in a pumping station. Water is taken from the high pressure side of the pump 10 and is passed through the cooling coils 11 of the bearings for the pump 10. The water issuing from the cooling coils 11 is then returned to the high pressure side of the pump 10 by means of an auxiliary pump 12.

A by-pass line 13 extends between the outlet of the cooling coils 11 and the low pressure side of the pump 10 so that, in the event of failure of the auxiliary pump 12, the by-pass line 13 can be opened and cooling of the bearings of the pump 10 will still be effected.

Thus, during normal operation, i.e. while the auxiliary pump 12 is operating, the system will operate with high energy efficiency

whereas, if the auxiliary pump 12 should fail for any reason, a fail safe condition is provided by means of the by-pass line 13. It is thus envisaged that energy saving costs of the order of 1 or 2% at least may be obtained for a large pumping station.

As applied to an engine or compressor unit, with air as the fluid, the by-pass line 13 will normally be connected to exhaust so that, in the event of any failure of the auxiliary pump 12, the required function will still be performed, or the facility operated, and the air used in performing said function or operating said facility will then pass to exhaust.

It is envisaged that, as applied to aeroplane engine systems, use of the auxiliary pump 12 to return high pressure air back to the high pressure side will enable additional thrust to be obtained which will more than compensate for the effect of the additional weight of the auxiliary pump 12. Typically, the increase in thrust may be of the order of 2 or 3% of the original thrust.

Claims:-

1. A fluid system which includes a prime mover having a high pressure side and a low pressure side, means for withdrawing fluid from the high pressure side of the device and supplying it to a facility, and means for returning the fluid supplied to the facility to the high pressure side of the device.

2. A fluid system as claimed in Claim 1, in which the means for returning the fluid to the high pressure side of the prime mover is a pump.

3. A fluid system as claimed in Claim 2, in which by-pass means are provided, operable in the event of failure of said pump, to deliver the fluid from the facility either to the low pressure side of the prime mover or to exhaust.

4. A fluid system as claimed in any one of the preceding claims, in which the prime mover is a pump and the fluid is water.

5. A fluid system as claimed in Claim 4, in which the facility is the cooling coils of the bearings of the pump.

6. A fluid system as claimed in any one of Claims 1 to 3, in which the prime mover is an aircraft engine and the fluid is air.

7. A fluid system substantially as hereinbefore described with reference to and as shown in Figure 3 of the accompanying drawings.

8. A method of cooling the bearings of a large pump or turbine having a high pressure side and a low pressure side, said method comprising taking fluid from the high pressure side of the pump, passing it through cooling coils associated with or forming part of the bearings, and pumping the fluid which has passed through the cooling coils back to the high pressure side of the large pump or turbine.

9. A method as claimed in Claim 8, substantially as hereinbefore described with reference to and as shown in Figure 3 of the accompanying drawings.

Application No: GB 0011833.1
Claims searched: 1 and 8

Examiner: Robert Crowshaw
Date of search: 8 August 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): F1C (CFLB); F1P; F1T (TFEA); F1W (WDG, WDX); F2A (AD28)

Int Cl (Ed.7): F15B 21/04; F16C 37/00

Other: Online databases: EPODOC, JAPIO, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	WO 92/12022 A1	(UWEVERKEN) See in figure 2 the bypass line 11 which leads from the prime mover engine M supply line 10, through heat booster unit facility T and pump 12, and then back to supply line 10.	1, 2
X	US 4022021	(RUSSELL) Note for example in figure 1 the bypass lines 26,27 which lead from the prime mover pump 12 supply line 10c, through the motor facility 28, and then back to the supply line 10d.	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.