United States Patent

Sieghartner

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[54] **COOLING AND LUBRICATING SYSTEM FOR BEARINGS**

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[52] **U.S. Cl.**.....**184/6.28,** 184/104 R, 415/112

[51] **Int. Cl.**.....**F16n 7/40,** F16n 39/02

[58] **Field of Search**.....184/104 B, 6.28, 6.22, 36, 184/6.18, 104 R; 415/112, 175

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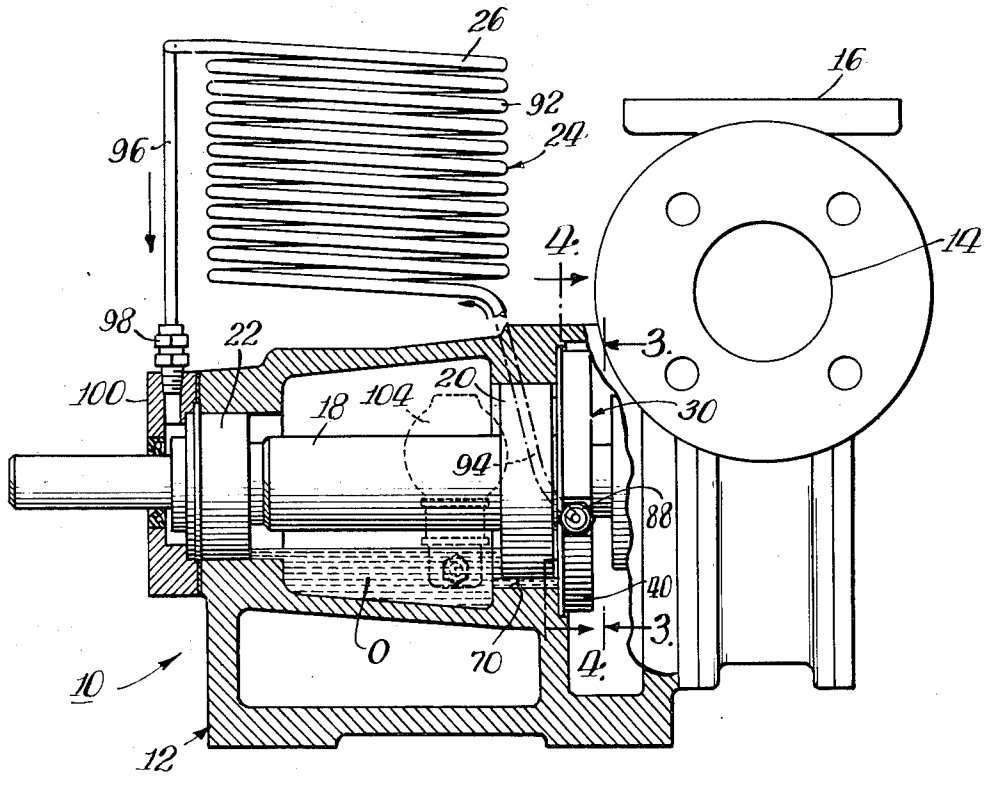
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[57] **ABSTRACT**

A cooling system for the bearings of a rotary machine designed to recirculate oil from the bearing housing through a heat exchanger unit and back through the bearings. A pumping unit contained in the housing provides sufficient pressure to recirculate the oil in a closed path. The pumping unit employs a turbine impeller fixed to the machine's shaft to develop the necessary pressure at standard motor speeds.

5 Claims, 6 Drawing Figures



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Fig. 1

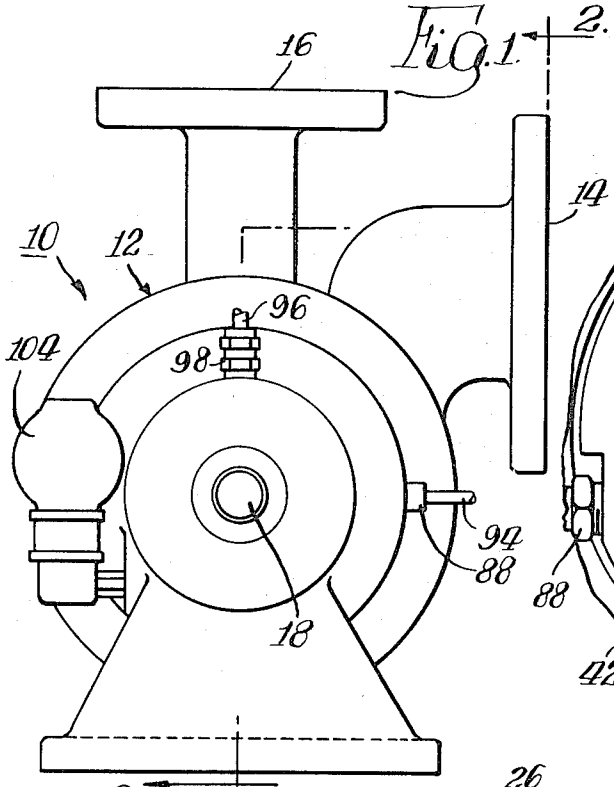


Fig. 3

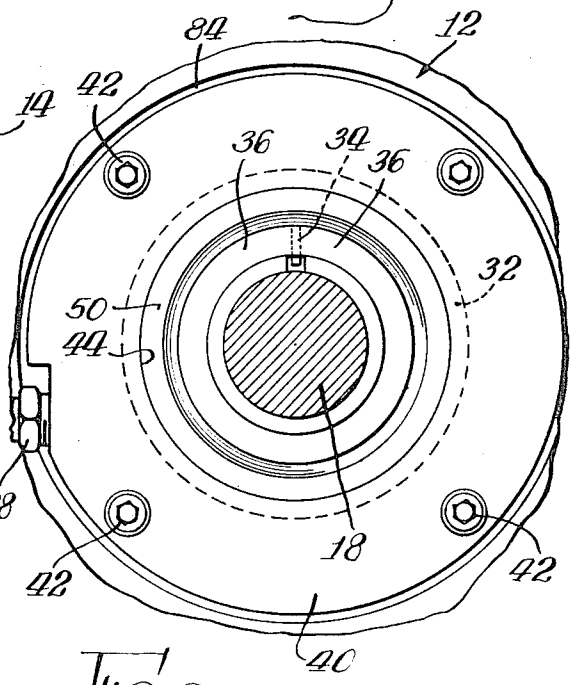
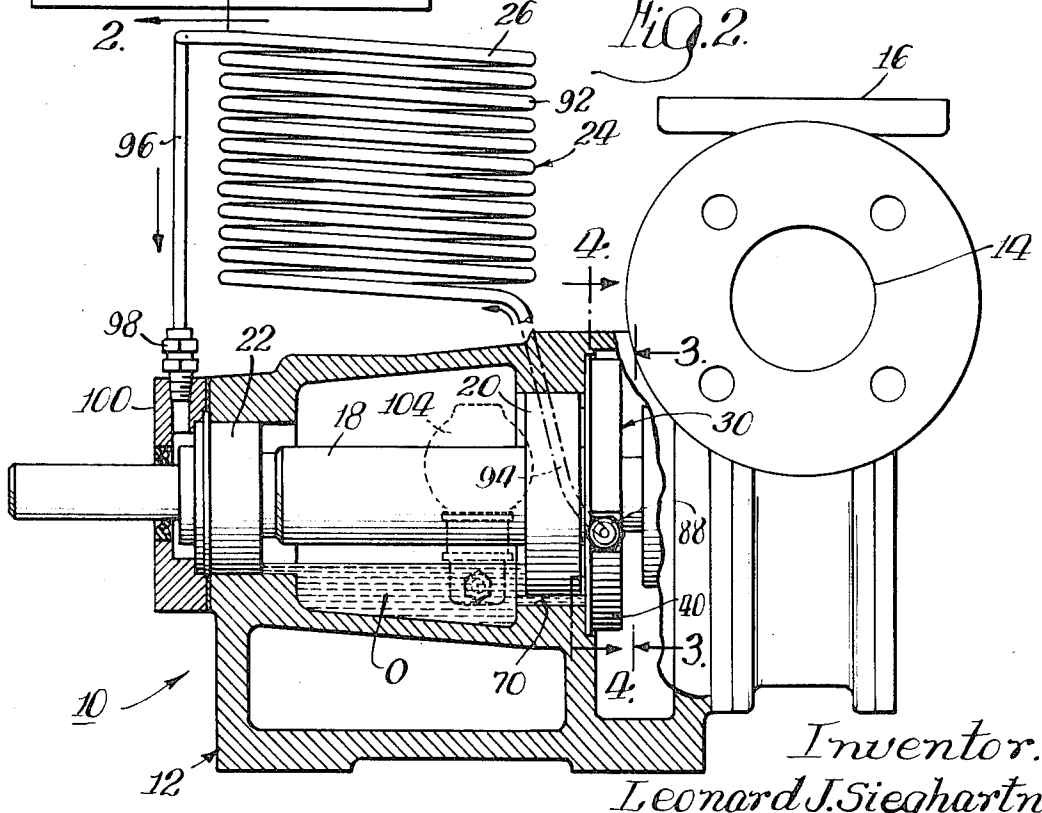


Fig. 2



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Fig. 4.

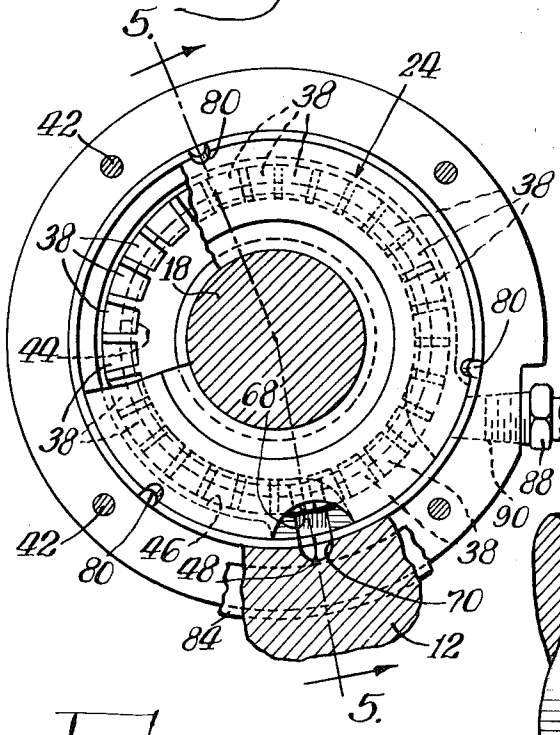


Fig. 5.

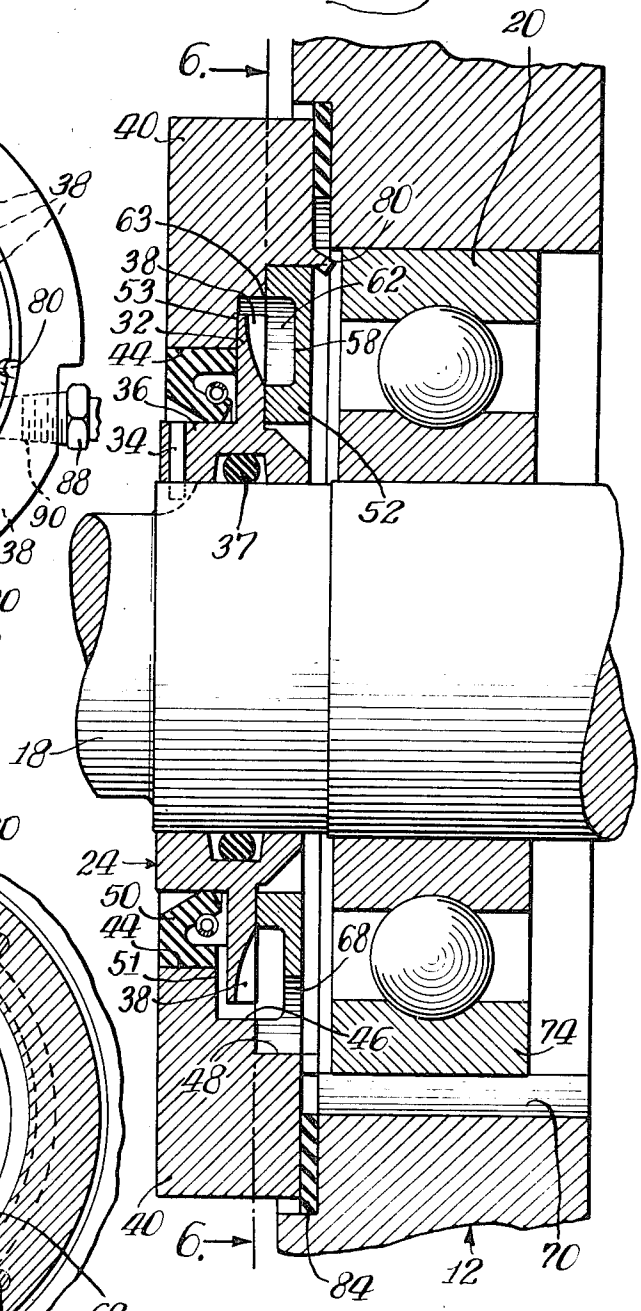
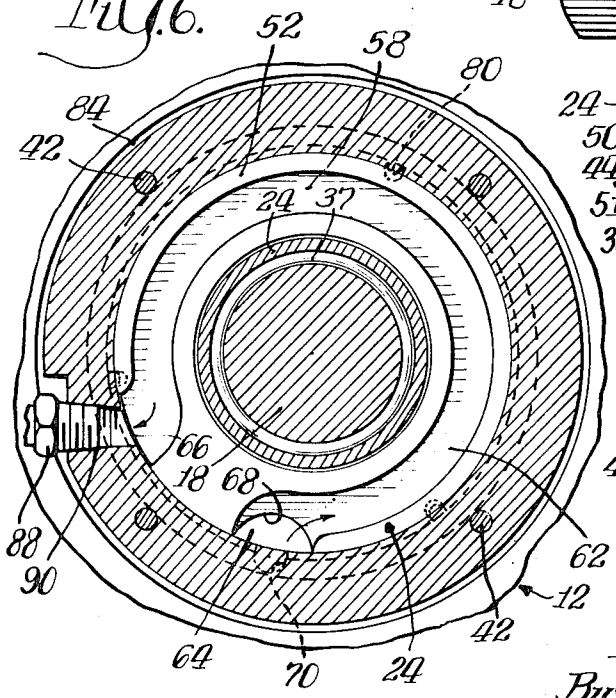


Fig. 6.



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COOLING AND LUBRICATING SYSTEM FOR BEARINGS

BACKGROUND OF THE INVENTION

This invention relates to a system for cooling and lubricating bearings used to support the shaft of a rotary machine.

In designing pumps for handling liquids at high temperatures or under high pressures, it is essential to provide means for cooling the bearings. One satisfactory method of cooling is to continuously circulate water under pressure through the portion of pump housing containing the bearing. To practice this method requires a water reservoir and a pumping device.

This invention is an improvement over prior art cooling systems by providing a self-contained cooling arrangement which continuously circulates a cooled lubricant through the bearings in response to the rotary movement of the machine's shaft.

SUMMARY OF THE INVENTION

The cooling system of this invention circulates a lubricating oil in a closed path and includes a heat exchanger coil located outside the bearing's housing to cool the lubricating oil after it is passed through the bearings. A pumping unit contained with the pump's casing is provided to develop sufficient pressure to recirculate the oil through the heat exchanger and back through the bearings. To take advantage of the superior pressure developing characteristics of a regenerative turbine pump, the pumping unit uses a turbine impeller affixed to the machine's shaft to provide the required pressure at standard motor speeds.

DESCRIPTION OF DRAWINGS

For a better understanding of this invention reference may be made to accompanying drawings, in which:

FIG. 1 is an elevational end view of a pump embodying the present invention, without the heat exchanger coil;

FIG. 2 is an elevational side view of the pump illustrated in FIG. 1 with the heat exchanger coil;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 2;

FIG. 5 is an enlarged cross sectional view taken along the line 5—5 of FIG. 4; and

FIG. 6 is a sectional view taken along the line 6—6 of FIG. 5.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, there is depicted a conventional turbine pump 10 designed to handle hot liquids. The pump 10 has a casing designated in its entirety by the reference numeral 12 which includes an inlet 14 and an outlet 16. A shaft 18 extends through the casing 12 and is rotatably supported by inboard and outboard bearings 20 and 22.

This invention resides in a cooling system 24 which continuously circulates oil through the pair of bearings 20, 22 as the shaft 18 rotates. The cooling system 24 utilizes a heat exchanger coil 26 supported outside the casing 12 to cool the oil 0 after it passes through the pair of bearings 20, 22.

The heart of this invention is the pumping unit 30 which develops sufficient pressure at standard motor speeds to recirculate the oil 0 through the heat exchanger coil 26 and through the outboard and inboard bearings 22 and 20. This pressure is provided by using a regenerative turbine impeller 32 which is keyed to the pump shaft 18 by one or more pins 34 (FIGS. 3 and 5) or other means extending from its hub 36 into the shaft 18. The impeller hub 36 is sealed to shaft 18 by means of 0-ring 37. The impeller has a set of vanes 38 which open from one or both sides of the outer marginal portion of the impeller.

The pumping unit 30 is contained in a circular-shaped cartridge 40 which is fastened to the pump casing 12 adjacent to the inboard bearing 20 by means of four radially spaced bolts 42 (FIG. 3). The center portion of cartridge 40 has an inner circular opening 44, an intermediate annular shoulder 46 and an outer annular shoulder 48. A lip-type oil seal 50 is placed in the inner opening 44 to prevent leakage along the impeller hub 36. A liner 52 is seated in the outer annular shoulder 48. The cartridge 40 and the liner 52 cooperate to form sealing surfaces for the opposite surfaces of impeller 32. A radial notch 51 (FIG. 5) and communicating with notch 48 (FIG. 4) is formed in the inner wall 53 of cartridge 40 to relieve pressure on the oil seal 50. An arcuate groove 58 is formed on the inside surface 60 of liner 52 and extends in a circular path through an angle less than 360° and cooperates with the annular shoulder 46 of cartridge 40 to define a pumping chamber 62 with a housing 63 for pumping unit 30, where housing 63 has an inlet 64 and an outlet 66. The inlet 64 is formed by an arcuate cut-out 68 through the liner 52. An oil return drain is provided by notch 70 formed in the casing 12 below the inlet 64 and extending underneath and beyond the length of the outer race 74 of the inboard bearing 20.

To assemble the pumping unit 30, the oil seal 50 is pressed into the inner opening 44, and the impeller 32 is then put in place. Next the liner 52 is pressed into place in the cartridge 40 and a number of points 80 located about periphery of the outer annular shoulder 48 are staked in to hold the liner 52 in place. The impeller 32 is then slid onto the shaft 18 and fixed thereto rotatably by means of pin 34. The cartridge 40 is mounted to the pump casing 12 by means of the four bolts 42. An annular gasket 84 is sandwiched between the cartridge 40 and the casing 12 for sealing purposes.

The outlet 66 of the pumping unit 30 is connected to the heat exchanger coil 26 by a fitting 88 which is mounted through an opening 90 in the cartridge 40, which extends through its sidewall and terminates in direct communication with the outlet 66 of passageway 62. The heat exchanger coil 26 comprises a continuous pipe or conduit 92 formed in a spiral and supported above the pump casing 12 by two generally vertically extending leg portions 94 and 196. Leg portion 94 is coupled at its lower end to fitting 88 and leg portion 96 is coupled to fitting 98.

Fitting 98 extends through the side wall of end cap 100 and introduces the cooled oil behind the outboard bearing 22. The cooled oil entering through fitting 98 flows forwardly through outboard and inboard bearings 22 and 20 as well as through notch 70 (FIG. 5) and into the inlet 68 of pumping unit 30. A conventional constant level oiler 104 is provided in the casing 12

between the bearings **20** and **22** for maintaining an adequate oil level therein.

What is claimed is:

1. In a rotary machine having a shaft rotatably supported in its casing by a pair of bearings, a cooling system for recirculating cooled oil through said bearings, comprising: a heat exchanger coil, regenerative turbine pumping means disposed in the interior of said casing adjacent to the inboard bearing on the side remotest from the outboard bearing and mounted on said shaft at one end of said casing for pumping the oil which has passed through said bearings into one end of said heat exchanger coil, said pumping means comprising a housing mounted within said casing and having an internal pumping chamber, a regenerative turbine impeller fixed for rotation with said shaft and having vanes at its outer periphery operable within said pumping chamber, said housing having an outlet connecting said pumping chamber to said one end of said heat exchanger coil and an inlet in communication with said interior of said casing, said housing being disposed within said casing adjacent to one of said bearings with said housing inlet in direct communication with an elongated groove formed in said casing beyond and along the length of the outer race of said one bearing to facilitate flow of liquid into said housing inlet, and means for directly connecting the other end of said heat exchanger coil to the interior of said casing at its opposite end so that the cooled oil will pass through said pair of bearings and return to said pumping means.

2. In a rotary machine having a shaft rotatably supported in its casing by a pair of bearings, a cooling system for recirculating cooled oil through said bearings, comprising a heat exchanger coil mounted outside of said casing, a regenerative turbine pumping unit disposed in the interior of said casing adjacent to the inboard bearing on the side remotest from the outside bearing, said pumping unit including a regenerative turbine impeller fixed for rotation with said shaft and a housing mounted within said casing, said housing having a pumping chamber and said impeller having vanes at its outer periphery operable within said pumping chamber, said housing including an outlet connecting said pumping chamber to one end of said heat exchanger coil and an inlet in communication with the interior of said casing, a circular-shaped cartridge having its outer peripheral portion mounted to the interior of said casing, a center opening of sufficient diameter to accommodate the hub of said impeller, a first annular shoulder formed in one side surface of said cartridge, and a second annular shoulder formed inward of said first annular shoulder and of a diameter less than the diameter of said first annular shoulder but greater than the diameter of said impeller, and an annular liner of a diameter equal to said first shoulder seated in said first shoulder, said liner having an arcuate groove facing inwardly with an outer diameter equal to said second annular shoulder to define said pumping chamber, and means for connecting the other end of said heat exchanger coil to the interior of said casing through an end cap for said casing.

3. The combination of claim **2**, further comprising an oil seal snugly fitted in said center opening of said cartridge to prevent leakage along the impeller hub and a radial notch formed in the surface of said cartridge between said central opening and said second shoulder to relieve the pressure on said oil seal.

4. The combination of claim **2**, wherein said arcuate groove extends in a circumferential path of less than 360°, where an opening is provided through said liner at one end of said groove to define said housing inlet and a fitting is inserted through the other side surface of said cartridge in direct communication with the other end of said arcuate groove to define said housing outlet.

5. The combination of claim **2**, further comprising an annular oil seal seated in said center opening and in frictional engagement with the hub of said impeller.

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