

[54] **REFRIGERATION COMPRESSOR**
DEFINING OIL SUMP CONTAINING AN
ELECTRIC LUBRICANT PUMP
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[22] Filed: **Mar. 25, 1974**
[21] Appl. No.: **454,304**

Primary Examiner—C. J. Husar

Related U.S. Application Data

[63] Continuation of Ser. No. 286,806, Sept. 6, 1972,
abandoned.
[52] U.S. Cl..... **417/423, 62/469, 184/6**
[51] Int. Cl..... **F04b 17/00**
[58] Field of Search..... **417/423; 184/6 C, 6 L;**
62/469

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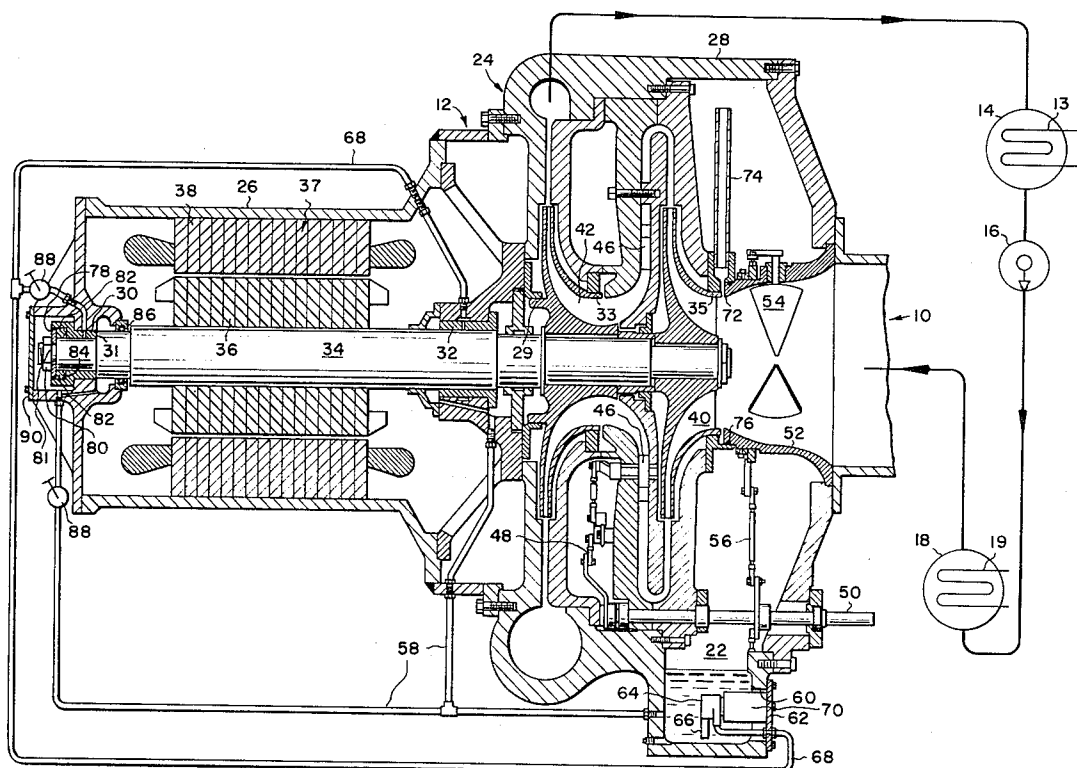
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[57]

ABSTRACT

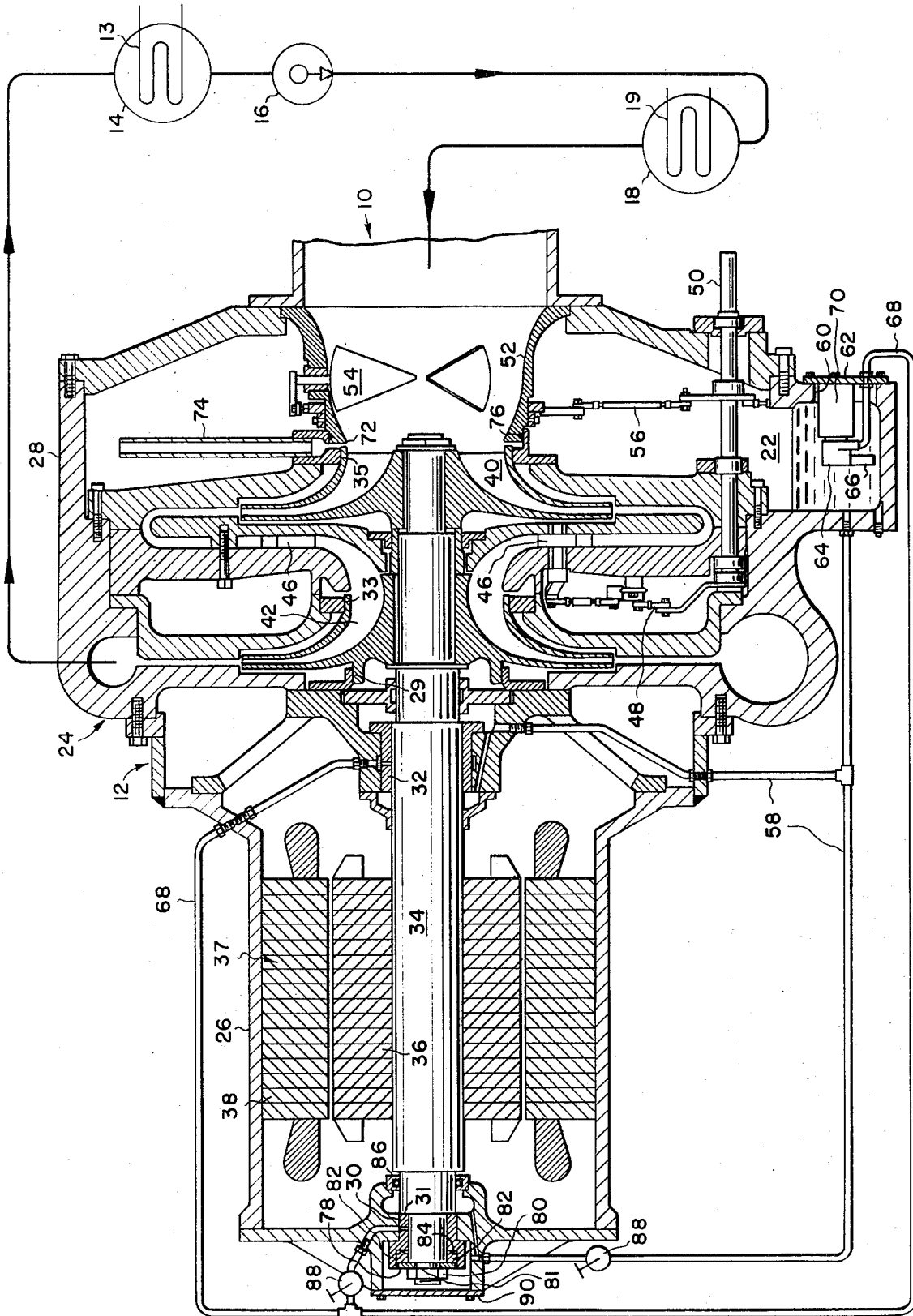
A compression cycle refrigeration system is shown having a two-stage direct-drive hermetic centrifugal compressor. The thrust bearing for the compressor impeller is mounted remote from the impeller for easy inspection and service. The centrifugal compressor housing defines a lubricant pump incorporating an electric motor driven lubricant pump.

4 Claims, 1 Drawing Figure



PATENTED DEC 10 1974

3,853,433



REFRIGERATION COMPRESSOR DEFINING OIL SUMP CONTAINING AN ELECTRIC LUBRICANT PUMP

This is a continuation of application Ser. No. 286,806, filed Sept. 6, 1972, now abandoned.

SUMMARY OF THE INVENTION

This invention relates to centrifugal compressors for a refrigeration machine. More particularly this invention relates to a lubrication system for such a compressor in which the eye of the compressor inlet and the compressor housing together define a substantially annular chamber containing housing an electric motor driven lubricant pump. The chamber functions as a lubricant sump from which the lubricant is withdrawn by the pump and delivered to the compressor bearings. The chamber is vented to compressor suction inlet for removal of refrigerant vapors from the lubricant sump.

Other aspects and advantages will be apparent as this specification describes the invention in detail with reference to the drawing in which the sole FIGURE shows a vertical section of a centrifugal refrigerant compressor incorporating the invention and schematically connected in a refrigeration system.

Now with reference to the drawing it will be seen that the refrigeration system 10 has a centrifugal refrigerant compressor 12 connected to discharge compressed refrigerant into a refrigerant condenser 14 which may be cooled by water as at 13. The condensed refrigerant then passes through a flow control 16 which may be in the form of a float or other device for regulating the flow of condensed refrigerant to a refrigerant evaporator 18, the heat for evaporation being provided by the refrigeration system load 19. The vaporized refrigerant is returned to the suction side of the compressor.

The compressor 12 has a compressor housing 24 including a motor portion 26 and a compressor portion 28. Motor portion 26 is provided with a pair of spaced bearings 30 and 32 which rotatably support a compressor drive shaft 34. Mounted for rotation with shaft 34 between bearings 30 and 32 is a motor rotor 36 operatively associated with motor stator 38 of compressor motor 37 supported within portion 26 of housing 24.

One end of drive shaft 34 extends beyond bearing 32 into the compressor portion 28 of housing 24. First and second stage centrifugal fluid impellers 40 and 42 respectively are mounted at this end of shaft 34 which is cantilevered beyond bearing 32. Impellers 40 and 42 are appropriately rigidly secured to shaft 34 for rotation therewith. The impellers 40 and 42 are surrounded by the compressor stator members 44 fixedly secured within portion 28 of housing 24 which defines diffuser passages for receiving fluid from each of the impellers and an interstage passage for conveying fluid from the first stage diffuser to the inlet of the second stage impeller. This interstage passage has a plurality of circumferentially spaced second stage inlet guide vanes 46 which are adjustable through a linkage 48 and guide vane control shaft 50. An annular inlet member 52 is disposed within housing 24 for conducting fluid from the suction line to the inlet of the first stage impeller 40. Annular inlet member 52 contains a plurality of circumferentially spaced first stage inlet guide vanes 54 which are adjustable through linkage 56 and guide vane control shaft 50.

The annular cavity defined between housing portion 28 and inlet member 52 serves as a lubrication system sump 22 in addition to providing space for linkage 56. Oil return lines 58 are connected to drain lubricating oil from bearings 30 and 32 to sump 22.

The lower portion of housing portion 28 is provided with an aperture 60 which is closed by a removable cover plate 62. Connected at the inner side of plate 62 is a lubricant pump 64 positioned to receive lubricant from the lower portion of sump 22 through an inlet 66 and from whence lubricant is discharged under pressure to bearings 30 and 32 through lubricant supply lines 68. Pump 64 is driven by an electric motor 70 also supported on the inner side of plate 62 within the annular cavity between housing 24 and inlet member 52. This cavity is further provided with a vent 72 to the first stage impeller inlet downstream of inlet control vanes 54 through a standpipe 74. Standpipe 74 effectively places the vent for sump 22 at the upper most location so that even if there be foaming of lubricant within sump 22, such foam is unlikely to reach an elevation sufficient to allow oil to enter the top of standpipe 74. Oil is also prevented from passing through the annular space between impeller 40 and inlet guide member 52 by reason of an O-ring seal 76.

During operation of the system, the impellers 40 and 42 exert a net axial force on shaft 34 due to the unbalance of pressures on opposite sides of the impellers as dictated by the location of seals associated therewith as at 29, 33, and 35. In the particular impeller arrangement shown, this force would be to the right. To oppose this force shaft 34 is provided with an annular thrust plate 78 which is secured to shaft 34 for rotation therewith as by thrust plate retainer nut 80. Thus during operation of the compressor thrust plate 78 is caused to bear against a plurality of circumferentially spaced thrust pads 82 pivotly supported on a flat annular face 84 within the member defining bearing 30 adjacent the other end of shaft 34 opposite from the end supporting impellers 40 and 42. The thrust bearing 81 formed by plate 78 and pads 82 is lubricated by lubricant overflow from bearing 30. A shoulder on shaft 34 in abutment with the end of bearing 30 as at 31 limits movement of the shaft to the left such as may occur during shipment. The compressor motor is provided with a seal 86 between bearing 30 and motor 37, to maintain the bearing lubricant separate from the cooling medium (usually refrigerant) within the motor. The lubricant supply and drain lines 68 and 58 are provided with shutoff valves 88. By closing valves 88 and removing bearing cover plate 90, thrust bearing 81 may be inspected and replaced if necessary. During this period when plate 90 is removed seal 86 will minimize leakage between the compressor motor and the atmosphere.

Having now described the preferred embodiment of the invention, it is contemplated that many changes may be made without departing from the scope or spirit of the invention as limited only by the claims.

We claim:

1. A refrigerant centrifugal compressor comprising: a compressor housing; a shaft disposed within said housing; bearing means for rotatably supporting said shaft in said housing; a centrifugal type fluid impeller disposed within said housing and mounted for rotation with said shaft; an annular inlet member disposed within said housing to conduct fluid to the inlet of said impeller and coaxially arranged with respect to said

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shaft; a plurality of inlet control vanes disposed in said inlet member; portions of said inlet member being radially inwardly spaced from said housing thereby defining a substantially annular cavity between and axially coextensive with said compressor housing and said inlet member; a lubrication system for said compressor including first conduit means for conducting lubricant to said bearing means; and second conduit means for draining lubricant from said bearing means to said annular cavity whereby said annular cavity defines a lubricant sump; means for mechanically adjusting said control vanes disposed within said cavity; passage means for venting the upper portion of said cavity to the inlet of said compressor; and pressurizing means for

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pressurizing lubricant from said sump and returning pressurized lubricant to said bearing means via said first conduit means.

2. The apparatus as defined in claim 1 wherein said pressurizing means is a lubricant pump disposed within said annular cavity.

3. The apparatus defined by claim 2 including a first electric motor drivingly connect to said shaft.

4. The apparatus as defined by claim 3 including a second electric motor drivingly connected to said pump; said second electric motor being disposed within said annular cavity.

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