

3,241,746

2 Sheets-Sheet 1

Technical drawing of a mechanical device, showing two views: a side elevation (top) and a cross-sectional view (bottom).

Side Elevation (Top View):

- 2: Main body or housing.
- 4: Top flange or connection point.
- 12: Vertical pipe or rod.
- 13: Vertical pipe or rod.
- 19: Horizontal pipe or rod.
- 20: Side flange or connection point.
- 22: Small component or fitting.
- 24: Horizontal pipe or rod.
- 25: Small component or fitting.
- 29: Small component or fitting.

Cross-sectional View (Bottom View):

- 1: Central shaft or rod.
- 7: Seal or gasket.
- 8: Piston or plunger.
- 8': Piston or plunger (dashed line).
- 9: Conical component or valve.
- 10: Central shaft or rod.
- 11: Internal component or seal.
- 16: Piston or plunger.
- 17: Seal or gasket.
- 22: Small component or fitting.
- 23: Valve or control component.
- 24: Horizontal pipe or rod.
- 25: Small component or fitting.
- 29: Small component or fitting.

ATTORNEY.

March 22, 1966

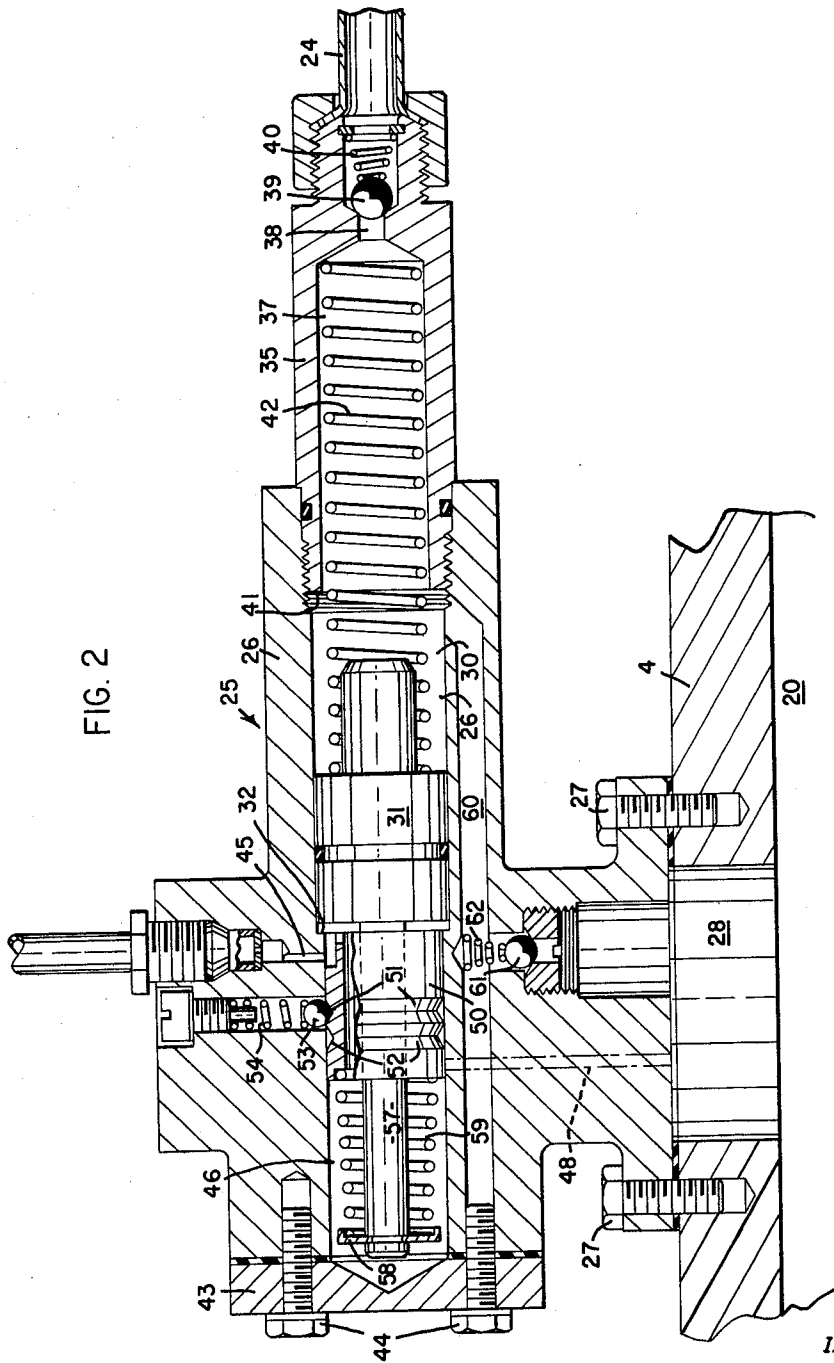
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3,241,746

COMPRESSOR LUBRICANT EQUALIZING PUMP

Filed Feb. 8, 1965

2 Sheets-Sheet 2



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1

2

3,241,746

COMPRESSOR LUBRICANT EQUALIZING PUMP
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Filed Feb. 8, 1965, Ser. No. 431,115
6 Claims. (Cl. 230—206)

This invention relates to compressors, and more particularly, to a lubrication arrangement for compressors adapted for use in multiple compressor systems.

In systems employing multiple compressors, excess lubricant may accumulate in one or more of the compressors at the expense of the remaining compressor or compressors. This occurrence is particularly in evidence where one of the compressors has, or by means of an unloader mechanism is, operated at a capacity different from that of the remaining compressor or compressors, or where one or more of the compressors is shutdown while the remaining compressor or compressors is used to sustain system operation at reduced capacity. Variations in pressure conditions within the crankcase compartments of the several compressors may override the lubricant balancing function of equalizing lines interconnecting the crankcase compartments of the several compressors resulting in excess lubricant in the crankcase compartment of one compressor to the detriment of the remaining compressor or compressors.

It is a principal object of the present invention to provide a new and improved arrangement for insuring adequate quantities of lubricant in each compressor of a multiple compressor system.

It is a further object of the present invention to provide an oil equalizing arrangement which prevents lubricant starvation of one compressor in multiple compressor installations.

It is an object of the present invention to provide pumping apparatus for withdrawing excess lubricant from one compressor for transfer to another compressor of a multiple compressor installation.

It is an object of the present invention to provide an auxiliary pump for use with compressors adapted for multiple compressor installations, the auxiliary pump being driven from the compressor and being operable to remove excess oil from the sump of the compressor.

This invention relates to a system having at least two compressors, each compressor including a sump for the storage of lubricant comprising in combination means for withdrawing excess lubricant from the sump of a first of the compressors including a member having a chamber therein; a piston-like operator movably disposed in the chamber, the operator separating the chamber into first and second compartments; the member having first and second passages therein opening into the first compartment, the first passage being connected to the first compressor sump at a predetermined lubricant level; means regulating that first passage to prevent outflow of lubricant from the first compartment through the first passage into the first compressor sump; control means adapted to communicate the second compartment with a source of pressurized fluid to move the operator to force lubricant in the first compartment through the second passage; and means connecting the second passage with the sump of a second of the compressors.

This invention further relates to a lubricant transfer means for use with a compressor of the type having a sump for storage of lubricant and means for distributing the lubricant to the working parts thereof, the compressor being adapted for use in multiple compressor installations, the lubricant transfer means comprising in combination a member having a cavity therein; a piston movably disposed in the member cavity, the piston separating the cavity into motor and pumping compartments; the mem-

ber having suction and discharge passageways opening into the pumping compartment, the suction passageway being connectable to the compressor sump at a selected lubricant level; means for closing the suction passageway to the discharge of lubricant; a first passage connecting the drive compartment to the discharge side of the compressor lubricant distributing means to move the piston and drive lubricant through the pumping compartment discharge passageway; bias means for retracting the piston; a second passage adapted to connect the drive compartment with the compressor sump; and control means for interrupting the first passage while opening the second passage in response to predetermined movement of the piston whereby the bias means retracts the piston.

Other objects will be apparent from the ensuing description and drawings in which:

FIGURE 1 is a view partly in section and partly in elevation of a multiple compressor arrangement incorporating the improved lubrication system; and

FIGURE 2 is an enlarged view in section showing the equalizing pump apparatus of the present invention.

Referring to FIGURE 1 of the drawings, there is shown a multiple compressor installation incorporating my improved lubrication system and having parallel connected compressors 2. According to a preferred construction, each compressor 2 includes a shell or housing 4 partitioned into a motor compartment 7 having drive motor 8 therein and crankcase compartment 9 having compression means 10 therein. Crankshaft 11 operably interconnects rotor 8' of motor 8 with compression means 10.

Compressors 2 are shown as hermetic type compressors wherein gas from suction header 19 passes through conduits 13 into the motor compartment 7 of each compressor and into heat exchange relation with the drive motor 8 thereof to cool the motor, the suction gas thereafter passing through the intake manifold 16 to compression means 10. Compression means 10 discharges relatively high pressure gas through the discharge manifold 17 of each compressor 2 into conduits 12 and discharge header 18. Headers 18, 19 connect compressors 2 with the high and low pressure sides of a closed refrigeration system.

The lower part of each compressor crankcase compartment 9 serves as a sump or reservoir 20 for lubricant. Suitable pump mechanisms, designated generally by numeral 22, distribute lubricant drawn from sumps 20 to the various points of frictional wear throughout compressors 2 such as crankshaft bearing 23. Pump mechanisms 22 are drivably connected to crankshafts 11 in a manner known to those skilled in the art.

Compressors 2 are each provided with an auxiliary pump, designated generally by the numeral 25, which will be more particularly described hereinafter. Conduits 24 connect the crankcase compartment sump of each compressor 2 with the discharge side of the auxiliary pump associated with the other compressor. The suction sides of pump 25 are connected to their associated compressor sumps at a desired lubricant level. A small line 29 interconnects the sumps 20 of compressors 2. Line 29 is connected to the compressor sumps slightly above the normal lubricant level. Line 29 functions to prevent the accumulation of excess lubricant in the off compressor.

Referring to FIGURE 2 of the drawings, each auxiliary pump 25 comprises a pump body 26 suitably secured to compressor housing 4 as by bolts 27 opposite crankcase opening 28. Opening 30 in pump body 26 has movable piston 31 disposed therein. Opening 30 is reduced in diameter at 32 to define a generally cylindrical stop surface which limits movement of piston 31 in one direction.

A hollow generally cylindrical member 35 is sealingly secured within one end of opening 30. Opening 38 in member 35 communicates the pumping side, space 37,

with conduit 24. Ball-type check valve 39 biased toward closed position by spring 40 prevents reverse flow of lubricant from conduit 24 through opening 38 into space 37.

The leading edge of member 35 forms a stop surface 41 which limits movement of piston 31 in the opposite direction. Spring 42 biases piston 31 in the direction of stop surface 32.

The opposite end of pump body opening 30 is closed by end plate 43 sealingly attached to pump body 26 as by bolts 44. A passage 45 communicates the motor side of pump 25, space 46, with a source of pressurized fluid as for example the discharge side of compressor lubricant pump 22. Passage 48 communicates space 46 with a suitable low pressure area as for example compressor sump 20. A generally cylindrical movable valve member 50 controls communication of passages 45, 48 with space 46. The external surface of valve member 50 is recessed at 51, 52. Detent ball 53, biased into engagement with valve member 50 by spring 54, cooperates with recess 51 or 52 to releasably retain valve member 50 in a position where passage 45 communicates with space 46, as illustrated in FIGURE 2 of the drawings, or in a position where passage 48 communicates with space 46.

Piston 31 has a stem 57 protruding into space 46. Spring 59 is disposed between abutment 58 on stem 57 and valve member 50.

Passage 60 in valve body 26 communicates space 37 with sump 20 of the compressor to which equalizing pump 25 is appended. Ball-type check valve 61, biased toward closed position by spring 62, prevents reverse flow of lubricant from space 37 into the compressor sump.

With piston 31 and control valve 50 of the auxiliary pump in the position illustrated in FIGURE 2 of the drawings and excess lubricant from the compressor sump in space 37, the admission of relatively high pressure lubricant to space 46 forces piston 31 to the right as seen in FIGURE 2 against the bias of spring 42. Check valve 61 prevents outflow of lubricant through passage 60 from space 37. Lubricant trapped in space 37 is forced by piston 31 through conduit 24 into sump 20 of the other compressor.

As abutment 58 on stem 57 approaches valve member 50, the force necessary to move piston 31 increases. Pressure in space 46 correspondingly increases thereby sustaining movement of piston 31 and lifting detent ball 53 out of recess 51. As ball 53 rises, the force required to continue lifting movement of ball 53 decreases. The increased pressure in space 46 compounded by the energy accumulated in spring 59 snaps valve member 50 to the right as seen in FIGURE 2 interrupting passage 45 and uncovering vent passage 48. Detent ball 53 cooperates with recess 52 to hold valve member 50 in the vent position.

With space 46 vented to a low pressure source, such as compressor sump 20, spring 42 retracts piston 31. As piston 31 retracts, lubricant is drawn through passage 60 into space 37. Check valve 39 closes opening 38 to prevent inflow of lubricant from the other compressor sump into space 37. As piston 31, under the influence of spring 42 approaches stop 32, piston 31 moves valve member 50 to interrupt vent passage 48 and uncover pressure passage 45 to once again drive the piston 31 to the right as seen in FIGURE 2. It is understood that auxiliary pump 25 operates so long as the source of fluid pressure is available. Where the source of fluid pressure comprises the compressor oil pump 22, the operation of auxiliary pump 25 is contingent upon operation of the compressor.

Where the lubricant level in the sump of the compressor, during operation of the compressor, is below the level of opening 28, it is understood that the equalizing pump 25 associated therewith, although operational, does not effect transfer of lubricant into the sump of the other compressor. The operation of the equalizing pump associated with the other compressor is similar to that described herebefore.

Where one of the compressors 2 is idle, the equalizing pump 25 associated with that compressor is inoperative. During operation of the system with one compressor, lubricant may accumulate or trap in the sump of the idle compressor. Line 29 permits excess lubricant in the sump of the idle compressor to return to the sump of the other compressor. It is understood that pressure in the crankcase compartment of the idle compressor is normally greater than pressure in the crankcase compartment of the operating compressor. Thus, lubricant in the idle compressor at or above the level of line 29 is forced through line 29 into the sump of the other compressor. The size of line 29 is such that line 29 is normally incapable of equalizing pressures in the crankcase compartments of the compressor 2.

The relatively small sized line 29 between the sumps of the compressors 2, which prevents the accumulation of excess lubricant in the sump of one compressor when that compressor is idle, may be dispensed with if discharge and suction lines 12, 13 respectively are suitably designed to prevent trapping of lubricant in the off compressor during operation of the other compressor. Lubricant trapping may be obviated if the discharge and suction lines 12, 13 are arranged so that the juncture thereof with discharge and suction headers 18, 19 respectively is below the junction of discharge and suction lines 12, 13 with compressors 2. In effect this arrangement requires that suction gas flowing into the compressors flow upwardly while gas discharged from the compressors flow downwardly.

While I have described a preferred embodiment of my invention, it will be understood that my invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

I claim:

1. In a system having at least two compressors, each compressor including a sump for the storage of lubricant, the combination of means for withdrawing excess lubricant from the sump of a first of said compressors including a member having a chamber therein; a piston-like operator movably disposed in said chamber, said operator separating said chamber into first and second compartments; said member having first and second passages therein opening into said first compartment, said first passage being connected to said first compressor sump at a predetermined lubricant level; means regulating said first passage to prevent outflow of lubricant from said first compartment through said first passage into said first compressor sump; control means adapted to communicate said second compartment with a source of pressurized fluid to move said operator to force lubricant in said first compartment through said second passage; and means connecting said second passage with the sump of a second of said compressors.

2. The system according to claim 1 including bias means for retracting said piston-like operator, said control means being operable upon predetermined movement of said piston-like operator to reduce pressure in said second compartment to permit said bias means to retract said piston-like operator.

3. The system according to claim 2 in which said second passage connecting means includes means regulating said second passage to prevent inflow of lubricant from said second compressor sump through said second passage into said first compartment.

4. The system according to claim 3 in which said first compressor includes lubricant pumping means having suction and discharge sides, said control means communicating said second compartment with the discharge side of said pumping means to apply pressurized lubricant to said piston-like operator.

5. The system according to claim 3 including a second member having a chamber therein, a piston-like operator movably disposed in said second member chamber, said operator separating said second member cham-

5

ber into first and second compartments, said second member having first and second passages therein opening into said first compartment, said second member first passage being connected to said second compressor sump at a predetermined lubricant level, means regulating said second member first passage to prevent outflow of lubricant from said second member first compartment through said first passage thereof into said second compressor sump, control means adapted to communicate said second member second compartment with a source of pressurized fluid to move said operator to force lubricant in said second member first compartment through said second member second passage, and means connecting said second member second passage with said first compressor sump, said last-mentioned means including means regulating said second member second passage to prevent inflow of lubricant from said first compressor sump through said second member second passage into said second member first compartment.

6. Lubricant transfer means for use with a compressor of the type having a sump for storage of lubricant and means for distributing said lubricant to the working parts thereof, said compressor being adapted for use in multiple compressor installations, the combination of a member having a cavity therein; a piston movably disposed in

6

said member cavity, said piston separating said cavity into motor and pumping compartments; said member having suction and discharge passageways opening into said pumping compartment, said suction passageway being connectable to said compressor sump at a selected lubricant level; means for closing said suction passageway to the discharge of lubricant; a first passage connecting said drive compartment to the discharge side of said compressor lubricant distributing means to move said piston and drive lubricant through said pumping compartment discharge passageway; bias means for retracting said piston; a second passage adapted to connect said drive compartment with said compressor sump; and control means for interrupting said first passage while opening said second passage in response to predetermined movement of said piston whereby said bias means retracts said piston.

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