SINGLE STAGE DRY CYLINDER COMPRESSOR HAVING AUTOMATIC OIL DRAIN FROM SUCTION CHAMBER TO CRANKCASE


[56] References Cited

UNITED STATES PATENTS

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[57] ABSTRACT

An automatic draining apparatus for draining the oil from a suction chamber to the crankcase of a single-stage refrigeration compressor. The apparatus includes a collecting tank having a float switch, a first conduit connecting the suction chamber in oil-draining relation with the collecting tank; a second conduit connecting the collecting tank in oil-draining relation with the crankcase; a third conduit having a first solenoid interposed therein connecting the collecting tank in equal pressure relation with the suction chamber; a fourth conduit having a second solenoid valve interposed therein connecting the collecting tank in equal pressure relation with the discharge chamber; and an electrical circuit operatively connecting the first and second solenoid valves to the float switch to automatically control the solenoid valves in response to the level of oil in the collecting tank.

8 Claims, 2 Drawing Figures
3,724,231

SINGLE STAGE DRY CYLINDER COMPRESSOR HAVING AUTOMATIC OIL DRAIN FROM SUCTION CHAMBER TO CRANKCASE

BACKGROUND OF THE INVENTION

In a two-stage compressor system having an automatic oil draining apparatus, the pressure in the crankcase is maintained at second stage suction pressure which is above first stage suction pressure in order to reduce the loading of the second stage parts. Such an arrangement is shown in U. S. Pat. No. 3,543,880 entitled "Two-Stage Refrigeration Compressor Having Automatic Oil Drain for the First Stage Suction Chamber." A batch-type system is employed wherein oil from the first stage suction chamber is collected in a collecting tank and then returned by pressurized flow into the crankcase.

SUMMARY OF THE INVENTION

In the present application, a dry cylinder compressor is contemplated wherein the crankcase pressure and the suction chamber pressure are normally the same. However, a simple drain arrangement cannot be used since the suction chamber must be isolated from the crankcase in order to prevent any possible oil vapors going from the crankcase into the suction chamber when system operating conditions change, i.e., whenever the crankcase pressure exceeds the suction chamber pressure. In order to maintain equal pressure, a separate equalizing connection is provided between the crankcase and the suction chamber which includes an oil vapor collecting device to prevent any oil vapors from going from the crankcase into the suction chamber of the compressor. However, there is a small amount of oil leakage past the internal rod seals which accumulates in the suction chamber and must be drained into the crankcase. This is accomplished in the present invention by connecting a collecting tank directly to the suction chamber and to the crankcase. One-way check valves are provided in each of these connections to prevent reverse flow of oil through either one of the connections. The collecting tank is also connected to the suction chamber and to the discharge chamber to selectively equalize pressure between the collecting tank and the suction chamber or discharge chamber. Solenoid valves are interposed in these connections which are controlled by an electric circuit to respond to the position of a float switch provided within the collecting tank. This arrangement provides gravity flow of oil from the suction chamber to the collecting tank and pressurized flow from the collecting tank to the crankcase.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of the automatic oil draining apparatus connected to a drywall cylinder type single-stage compressor; and

FIG. 2 is an electric diagram of the circuit used to control the automatic drain apparatus shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The refrigerating system of this invention generally includes a single-stage compressor 10 operatively connected in series circuit relation with a condenser 14, a receiver 18, and an evaporator 22 by means of conduits 12, 16, 20 and 24. The compressor 10 includes a suction chamber 30, a discharge chamber 32 and a crankcase 34. Oil 36, which accumulates in the suction chamber 30, is automatically returned to the crankcase 34 by means of an automatic draining apparatus 38 of this invention.

In a dry cylinder type single-stage compressor 10 of the type contemplated herein, it is essential to maintain the suction chamber 30 isolated from the crankcase 34 to prevent any possible oil vapors from passing from the crankcase 34 into the suction chamber 30. Means are, therefore, provided for equalizing the pressure between the suction chamber 30 and the crankcase 34 without allowing any oil vapor to flow into the suction chamber 30. Such means is in the form of an equalizing line 40 operatively connected between the suction chamber 30 and the crankcase 34. An oil vapor collecting device 35 is interposed in the equalizing line 40 to prevent any oil vapors from passing from the crankcase 34 into the suction chamber 30. This equalizing line provides the necessary control of the pressure without any excessive transfer of oil from the crankcase 34 to the suction chamber 30.

In accordance with the invention, the automatic draining apparatus 38 is used to allow for the flow of oil from the suction chamber 30 back to the crankcase 34 whenever a predetermined amount of oil has been collected. In this regard, the drain apparatus 38 includes a collecting tank 42 having a float switch 44 positioned within the tank. The tank is connected to the suction chamber 30 by means of a first oil conduit 46 having a one-way check valve 48 interposed therein to prevent reverse flow of oil from the collecting tank 42 to the suction chamber 30. The collecting tank 42 is connected to the crankcase by means of a second oil conduit 50 having a one-way check valve 52 interposed therein to prevent reverse flow of oil from the crankcase 34 into the collecting tank 42.

Means are provided to maintain equal pressure between the suction chamber 30 and the collecting tank 42 to allow oil to flow by gravity from the suction chamber 30 into the collecting tank 42. Such means is in the form of a first pressure equalizing conduit 54 connected between the suction chamber 30 and the collecting tank 42. The pressure in conduit 54 is controlled by means of a first solenoid valve 56 interposed therein. When the solenoid valve 56 is open, the pressure in the suction chamber 30 and collecting tank 42 will equalize. Oil in the suction chamber 30 will be free to flow by gravity into the collecting tank 42 through conduit 46.

Means are provided for connecting the collecting tank 42 to the discharge chamber 32 to pressurize the collecting tank 42 and force oil from the collecting tank 42 into the crankcase 34. Such means is in the form of a second pressure conduit 58 having a second solenoid valve 60 interposed therein. When the second solenoid 60 is open, the pressure of the refrigerant in the discharge chamber 34 will pressurize the tank, forcing any oil therein into the crankcase 34 through the oil line 50. The solenoid valves 56 and 60 are controlled by means of the electric circuit shown in FIG. 2. This circuit includes the float switch 44 which is connected across the power source L1, L2 by an electric line 62.
which includes a timer 64 having a timer switch 66. The timer switch 66 is shown in its normally-closed position to connect the solenoid valve 56 across the power source L1, L2 by a line 68. The solenoid valve 56 will be normally open and the solenoid valve 60 will be normally closed.

When the float switch 44 closes, the timer 64 is actuated to move the switch 66 to a closed position with solenoid 60 and to open and deenergize solenoid 56. The solenoid valve 56 will close and the solenoid valve 60 will open to pressurize the collecting tank 42.

Since the float switch 44 will open immediately after the oil level in tank 42 starts to drop, means are provided to set up a holding circuit for the timer 64. Such means is in the form of a jumper 70 connected between timer 64 and line 68. After the timer 64 has run through its preset time interval, the switch 66 will open the line to the solenoid 60 and jumper 70 to deenergize both the solenoid valve 56 and the timer 64. The solenoid 56 will be reenergized by the closing of the switch 66 to open the solenoid 56 and again equalize pressure between the suction chamber 30 and the collecting tank 42.

Resume

The present invention provides an automatic oil return system for a dry cylinder type single-stage compressor having equalized pressures between the suction chamber and crankcase. The transfer of oil from the suction chamber to the collecting tank is provided by means of an oil conduit and a pressure equalizing conduit connected to allow for the gravity flow of oil from the suction chamber to the collecting tank. When the collecting tank is filled, the oil in the collecting tank is automatically pressurized by equalizing pressure between the collecting tank and the discharge chamber through a solenoid valve to force the oil therein into the crankcase. Check valves are provided to prevent reverse flow through the oil conduits. The solenoid valves are controlled by an electric circuit which includes a timer switch for holding the pressurizing solenoid valve open to assure flow of oil from the collecting tank to the crankcase.

I claim:

1. An apparatus for automatically draining oil from the suction chamber to the crankcase of a single-stage compressor having a discharge chamber, said apparatus comprising:
   a collecting tank,
   a first fluid conduit for connection said suction chamber in flow relation to said collecting tank,
   a one-way check valve in said first conduit to allow fluid flow from said suction chamber to aid collecting tank,
   a second fluid conduit for connecting said collecting tank in oil fluid relation to the crankcase,
   a one-way check valve in said second conduit to allow fluid flow from said collecting tank to said crankcase,
   a first pressure conduit for equalizing pressure between said suction chamber and said collecting tank,
   a second pressure conduit for equalizing pressure between said collecting tank and said discharge chamber,
   means for selectively connecting one or the other of said first and second pressure conduit to said collecting tank,
   and means responsive to the level of oil in said collecting tank for controlling said selective connecting means.

2. The apparatus according to claim 1 wherein said controlling means includes a float switch, and said connecting means includes a first normally-open solenoid valve interposed in said first pressure conduit means and a second normally-closed solenoid valve interposed in said second pressure conduit means.

3. The apparatus according to claim 2 including electrical circuit means for operatively connecting said float switch to said first and second solenoid valves.

4. The apparatus according to claim 3 wherein said circuit means includes a timer switch operatively connected to open said second solenoid valve and to close said first solenoid valve for a predetermined period of time.

5. The apparatus according to claim 1 including means for equalizing pressure between said suction chamber and said crankcase.

6. In a refrigerating system having a condenser, an evaporator, and a dry cylinder single-stage compressor, said compressor including a suction chamber, a discharge chamber and a crankcase, an automatic oil drain apparatus for draining oil from said suction chamber to said crankcase said apparatus comprising, a collecting tank, a float switch in said collecting tank, a first oil line connecting said suction chamber in oil delivering communication with said collecting tank, a first check valve in said first oil line, a second oil line connecting said collecting tank in oil delivering communication with said crankcase, a second check valve in said second oil line, a first pressure conduit connecting said collecting tank in equal pressure relation with said suction chamber, a first normally-open solenoid valve interposed in said first pressure conduit, a second pressure conduit connecting said collecting tank in equal pressure relation with said discharge chamber, a second normally-closed solenoid valve in said second conduit, and electric circuit means responsive to the position of said float switch for automatically closing said first solenoid valve and opening said second solenoid valve whereby oil in said collecting tank is pressurized by the refrigerant pressure in said discharge chamber to force the oil from said collecting tank into the crankcase.

7. The apparatus according to claim 6 wherein said electric circuit means includes a timer switch to control the time of opening of said second solenoid valve.

8. The system according to claim 6 including pressure equalizing means connected between said suction chamber and said crankcase.