United States Patent [19]

Grant

[11] **3,724,231**

[45] **Apr. 3, 1973**

[54] **SINGLE STAGE DRY CYLINDER COMPRESSOR HAVING AUTOMATIC OIL DRAIN FROM SUCTION CHAMBER TO CRANKCASE**

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[22] Filed: **Oct. 8, 1971**

[21] Appl. No.: **187,801**

[52] **U.S. Cl.** **62/157,** 62/174, 62/193, 62/470

[51] **Int. Cl.**.....**F25b 31/00**

[58] **Field of Search**.....62/468–473, 192, 62/193, 157, 174

[56] **References Cited**

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2,978,877	4/1961	Long	62/174
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3,500,962	3/1970	Kocher	62/193
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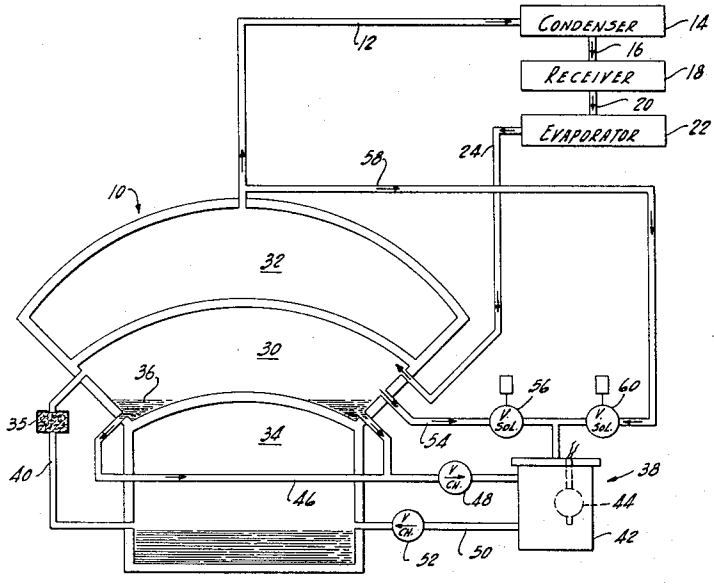
[57] **ABSTRACT**

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



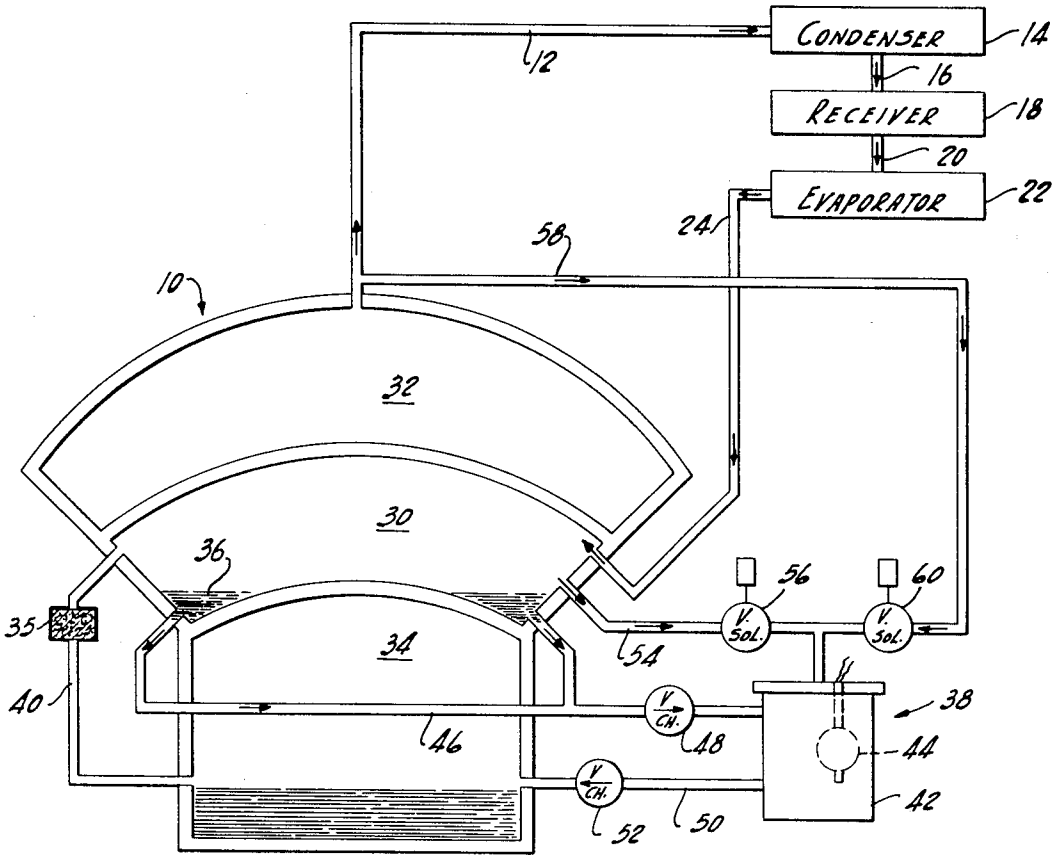


Fig. 1

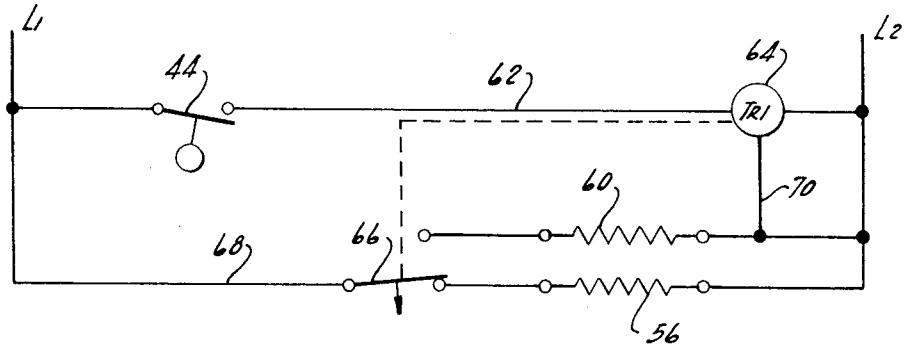


Fig. 2

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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 mans 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 **60** 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 aid 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 flow relation to the crankcase,

a one-way check valve in said second conduit to allow fluid flow from aid 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 **3** 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 condensor, 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.

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