Oct. 30, 1956 L. S. COOPER 2,768,708

OIL FAILURE SAFETY CONTROL

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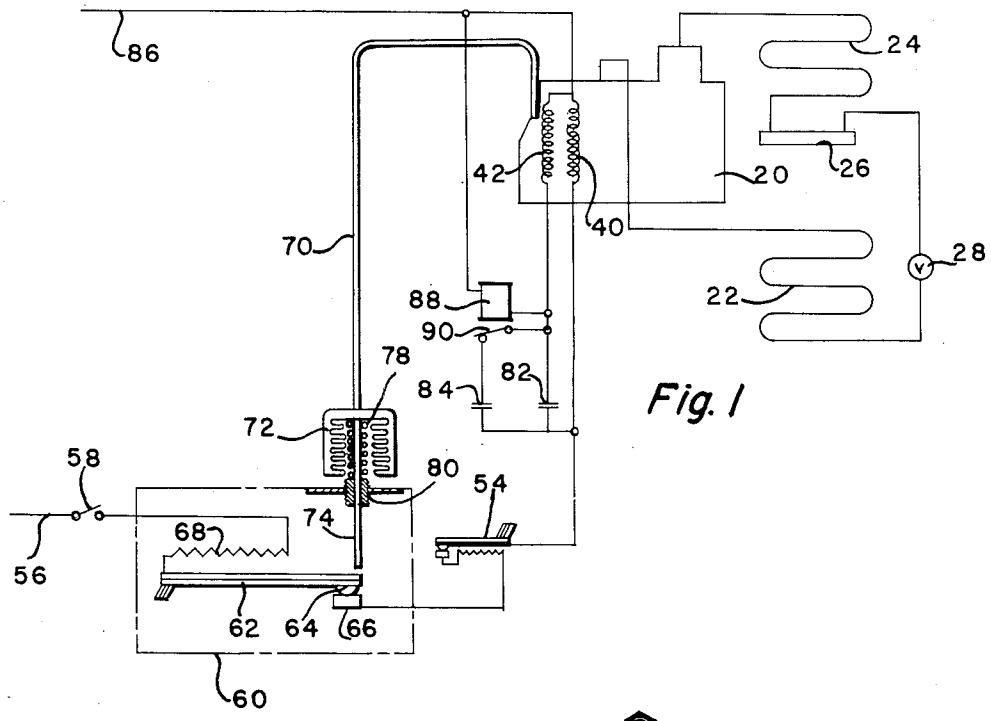


Fig. 1

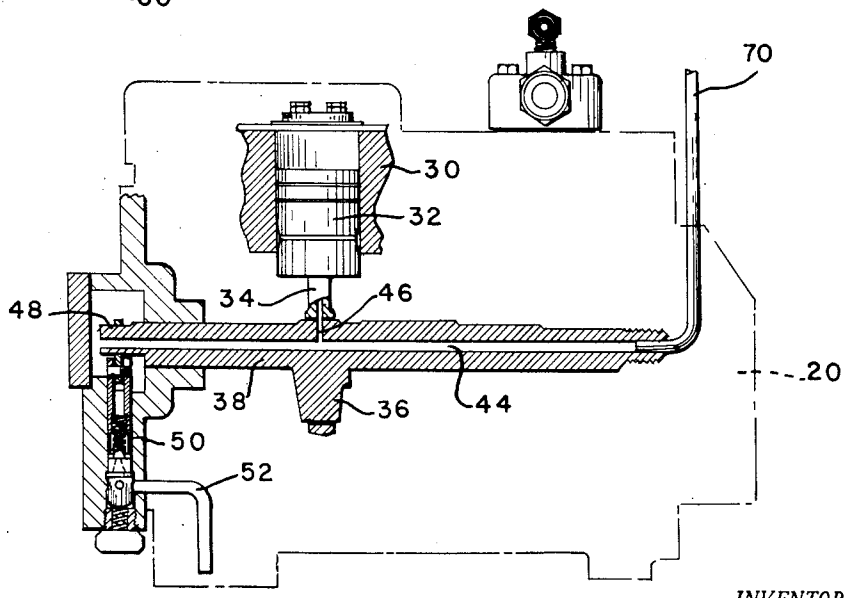


Fig. 2

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OIL FAILURE SAFETY CONTROL

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1 Claim. (Cl. 184—6)

This invention relates to refrigerating apparatus and more particularly to a control for preventing damage to pumps and compressors in the event of a failure of lubrication.

Lubricant failures in pumps and compressors are rare but extremely costly in large pumps and compressors.

It is an object of my invention to provide a control which will permit the starting of the pump or compressor but which will prevent continued operation in the event that the lubricant pressure does not attain or maintain the proper value within a predetermined length of time.

It is another object of my invention to provide a control for an electrically driven pump or compressor which will keep the circuit closed during the starting period but which will open the circuit within a short period of time in the event that the lubricant pressure fails to attain or maintain the proper value.

These and other objects are attained in the form disclosed by providing a normally closed bimetal switch in series with the electric driving motor. This bimetal switch is normally closed when cold, but is heated by the current flowing to the motor so that if not prevented it will open within a short period of time such as 30 seconds. A pressure operated detent responsive to the lubricant pressure of the pump or compressor is provided for preventing the opening of this bimetal switch whenever the lubricant pressure is above a predetermined pressure.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of the invention is clearly shown.

In the drawing:

Figure 1 is a diagrammatic view of a refrigerating system provided with a control embodying one form of my invention; and

Figure 2 is an enlarged view partly in section of the motor-compressor unit shown in Figure 1.

Referring now to the drawing there is shown a sealed reciprocating type of motor-compressor unit **20** which withdraws evaporated refrigerant from the evaporator **22** and compresses and pumps this refrigerant into a condenser **24** where it is liquefied and cooled in a receiver **26**. From the receiver **26** the liquid refrigerant is conducted under the control of a suitable control valve **28** such as an automatic expansion valve into the evaporator **22**. The motor-compressor unit **20** as shown in Figure 2 includes a cylinder **30** provided with a piston **32** connected by the eccentric rod **34** to an eccentric **36** upon the rotatable shaft **38**. The rotatable shaft **38** is driven by an electric motor shown diagrammatically as including a main winding **40** and a phase winding **42**.

The motor-compressor unit includes a lubricating system in which the eccentric shaft **38** is provided with a coaxial lubricant passage **44** having branch passages such as the branch passage **46** extending to the bearing surface of the eccentric **38** and to the passage in the eccentric rod **34** which extends to the piston pin bearings of the piston **32**. The end of the eccentric shaft **38** is

provided with another eccentric **48** operating a piston type lubricant pump **50** which through the pipe **52** draws lubricant from the lubricant sump and pumps it into the passages of the lubricating system such as the passages **44** and **46**. Upon rare occasions there may be a failure of lubrication due to leakage of oil or failure of the lubricant pump **50**. Under such circumstances the motor-compressor unit may be damaged in a very short time. In a comparatively large motor-compressor unit of this type, the cost of repair may be quite high and the cost of a complete replacement unit will also be very expensive. Consequently, it is desirable to provide some form of protection even for the remote possibility of a failure of lubrication.

The use of a simple oil pressure operated control to prevent the operation of the compressor upon failure of lubricant pressure is not sufficient. Since the lubricant pump **50** is driven directly from the eccentric shaft **38** there will be substantially no lubricant pressure in the lubricating system until after the compressor has been operated for a short period of time. Therefore, a simple pressure responsive device responsive to the lubricant pressure would prevent the starting of the compressor.

According to my invention in addition to the usual thermal overload switch **54** shown diagrammatically as connected in series with the supply conductor **56** and the control switch **58**, I provide an additional control **60** which may be connected in series with the conductor **56** and the switches **54** and **58**. This control **60**, however, may control the supply of energy through this circuit through the use of a pilot relay instead of being directly connected in the line. The control **60** includes a normally closed bimetal switch **62** which when cold keeps closed the contacts **64** and **66**. It is adapted to be opened by heating through the flow of electric energy through the circuit. It may receive some of the heat through the passage of current through the bimetal and it may receive additional heat from the electric heater **68** shown diagrammatically as being connected to the anchored end of the bimetal **62**. Thus when the switch **58** is open the bimetal **62** will keep the switch contacts **64** and **66** in the closed position. However, after current flows through the circuit for a short time, such as 30 seconds, the heat generated by this current in the bimetal **62** and the heater **68** will be sufficient to open the contacts **64** and **66**.

Connected to the passage **44** in the eccentric shaft **38** is a pipe **70** extending to a fluid motor **72** attached to the control **60**. This fluid motor **72** includes an outer casing containing a bellows having one closed end and having its open end sealed to the rim of the outer casing. The closed end of the bellows is connected directly to a rod **74** which when the pressure in the lubricant system is sufficiently high will be pressed into engagement with the bimetal **62** to hold the contacts **64** and **66** in the closed circuit position regardless of the heating effect of the current flowing through the control **60**. The fluid motor **72** includes a spring **78** for retracting the rod **74** when the lubricating pressure is below a satisfactory value. This spring **78** may be adjusted by a screw **80** threaded through a part of the housing of the control **60**. The pipe **70** connects to the chamber between the bellows and the housing of the fluid motor **72**. When the lubricating pressure is sufficient the lubricant will impose enough pressure upon the closed end and the outside of the bellows to move the rod **74** into engagement with the bimetal **62**. This will hold the contacts **64** and **66** in closed circuit position throughout the normal running of the motor compressor unit **20** as long as and whenever the lubricant pressure is at a safe value.

Whenever the motor-compressor unit **20** is stopped by the opening of the switches **54** or **58**, the lubricant pres-

sure will fall, thereby causing the fluid motor **72** to retract the rod **74**. The bimetal **62** may open the contacts **64** and **66** for a short time after the withdrawal of the rod **74** but as soon as the bimetal **62** is cooled the contacts **64** and **66** will be reclosed. The bimetal **62** will keep the contacts **64** and **66** in the closed position as long as it is cold. Not until after the circuit has been energized a short period of time will there be sufficient heat to tend to cause the bimetal **62** to reopen. Under normal conditions, however, the heating of the bimetal **62** is slower than the built-up lubricant pressure to operate the rod **74**. In this way the bimetal **62** will normally remain closed at all times other than the failure of lubricant pressure.

The phase winding **42** is connected to a running capacitor **82** and a starting capacitor **84**. These two capacitors **82** and **84** are connected in parallel with each other and in series with the phase winding **42**. They are connected also to one terminal of the main winding **40**. The other terminals of the main and phase windings **40** and **42** are connected to the second supply conductor **86**. The starting capacitors **84** are disconnected from the phase winding **42** by a normally closed voltage relay **88** having its magnetic coil connected in a shunt arrangement with the phase winding **42**. This relay **88** includes a normally closed contact **90** connected in series with the running capacitors **84**.

Thus by my control **60** there is provided a control for

preventing damage to the motor-compressor unit in the event that there is a failure of lubrication.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted as may come within the scope of the claim which follows.

What is claimed is as follows:

In combination, a pump having a lubricating system, a lubricant pumping means driven by said pump for building up and maintaining a lubricant pressure in said lubricating system during the operation of the pump, electrical means including an electrical circuit for effecting the operation of the pump, a normally closed switch means in said electrical circuit having means for holding said circuit normally closed, electrothermal means for lightly applying a physical opening force to said switch means after current has flowed through said switch means for a period of time, and a fluid motor responsive to the pressure within said lubricating system and a follower operated into switch closing engagement with said switch means for preventing the opening of said switch means.

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