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REFRIGERATION MACHINE WITH LUBRICANT COOLING

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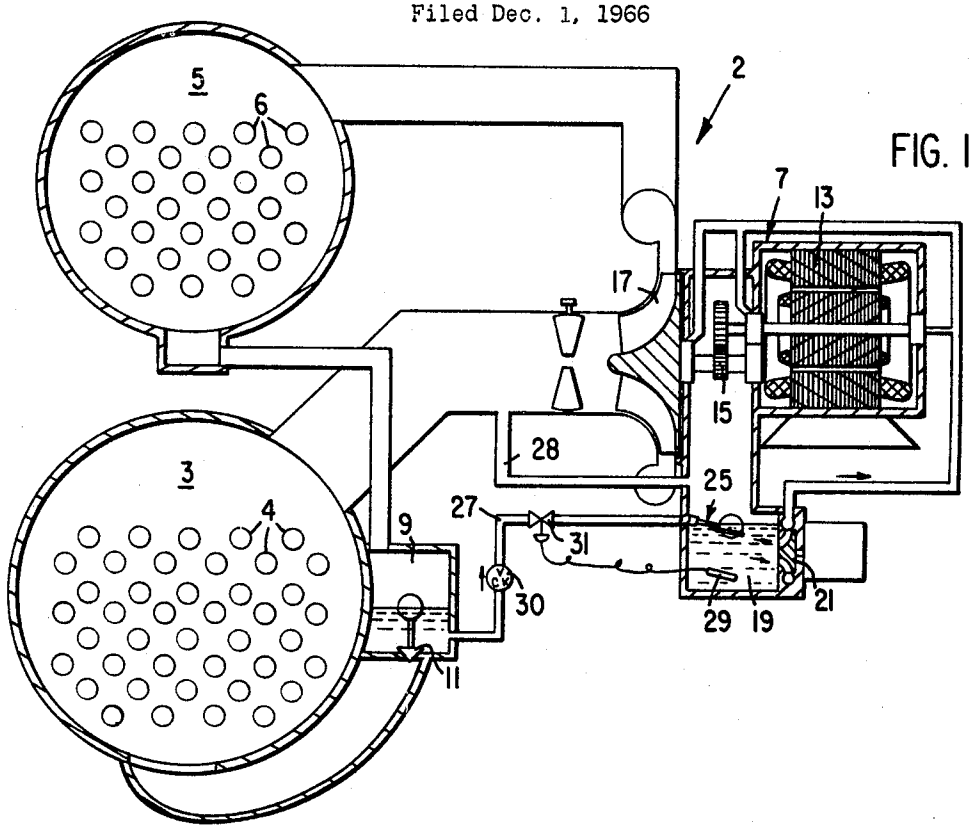


FIG. 1

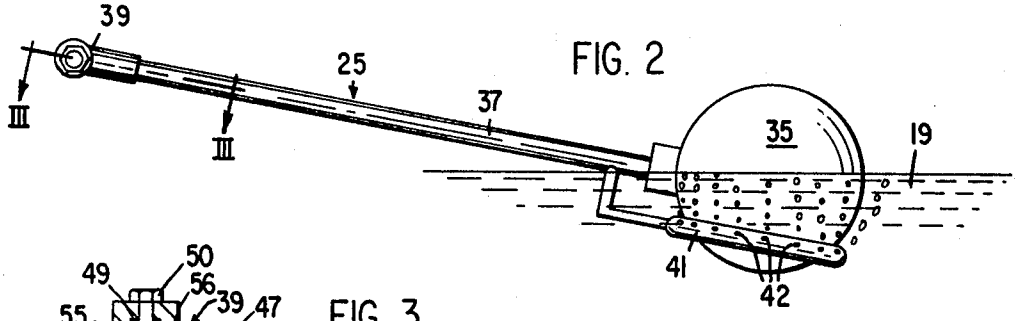


FIG. 2

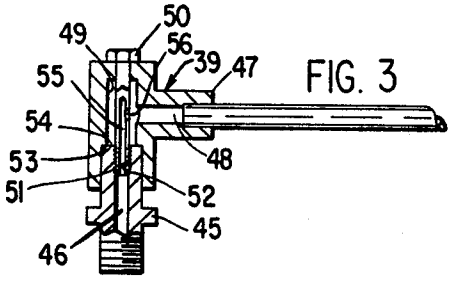


FIG. 3

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REFRIGERATION MACHINE WITH LUBRICANT COOLING

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ABSTRACT OF THE DISCLOSURE

A refrigeration machine provided with means for injecting refrigerant directly into the collected lubricant in the sump for cooling the lubricant without excessive lubricant foaming.

This invention relates to a refrigeration machine. More particularly, this invention relates to a refrigeration machine having provision for cooling the lubricating oil associated therewith. Still more particularly, this invention relates to a refrigeration machine for direct injection of liquid refrigerant into the relatively warm body of oil in the lubricant sump of the machine to cool the oil by direct contact heat exchange causing vaporization of refrigerant therein.

In large refrigeration machines, it is common to provide a cooling water coil in the oil sump of the machine to prevent overheating of the lubricating oil. The water coil and the various water connections and water flow rate controls necessary to maintain a constant oil temperature unduly complicate the refrigeration machine and add to the expense thereof.

It is, therefore, the chief object of this invention to provide an improved means for cooling the oil in a refrigeration machine. It is a further object to provide an improved method for cooling the oil in a refrigeration machine. Still another object of this invention is to provide a means for directly injecting refrigerant in the oil of a refrigeration machine for cooling thereof.

The objects of this invention are attained by providing a plurality of outlets for liquid refrigerant in the oil sump of a refrigeration machine below the lubricant level thereof for injection of refrigerant therein. The evaporation of refrigerant from the sump absorbs heat from the lubricant and thereby provides lubricant cooling.

Other objects and features of my invention will be apparent upon a consideration of the ensuing specification and drawing in which:

FIGURE 1 is a schematic view of a refrigeration machine;

FIGURE 2 is an elevational view of the novel refrigerant injector of my invention; and

FIGURE 3 is a sectional view taken along lines III—III of FIGURE 2 showing the refrigerant injector pivot connector.

Referring more particularly to the drawings, there is shown a refrigeration machine **2** having an evaporator **3**, a condenser **5** and a motor-compressor **7**. A tube bundle **4** in evaporator **3** is provided for passing the medium to be cooled therethrough while tube bundle **6** in condenser **5** is provided for passing cooling water from a suitable source such as a water tower (not shown) through the condenser to cool the compressed refrigerant and cause it to condense therein. The condensed refrigerant is collected in a float box **9**. A float valve **11** regulates the flow of refrigerant from float box **9** to evaporator **3**. The motor-compressor unit **7** is provided with a drive motor **13**, suitable drive gearing **15**, and compressor **17**. A lubricant sump **19** is provided in motor-compressor unit **7**. A lubricant pump **21**, associated with sump **19**, provides lubricant to the bearings in compressor **17**, drive

motor **13** and to gearing **15** in the well-known manner through a lubricant flow circuit.

The direct contact lubricant cooler is comprised of an injector assembly **25** supplied with liquid refrigerant from float box **9** through line **27**. A check valve **30** in line **27** is provided to prevent reverse flow of fluid therethrough. A thermal sensor **29** in sump **19** is operably associated with valve **31** in line **27** to regulate flow of liquid refrigerant to injector assembly **25** in response to lubricant temperature. A vent line **28** between sump **19** and the compressor inlet or any portion of the machine below condenser pressure is provided to vent gaseous refrigerant to the compressor. The injector assembly **25** is comprised of a float **35**, float arm **37**, pivot connector **39** and injector manifold **41**. Refrigerant from line **27** passes through pivot connector **39**, float arm **37**, injector manifold **41** and out the orifices **42** therein.

As can be seen from FIGURE 3, pivot connector **39** is made up of post **45** having a passageway **46** therein, float arm pivot **47** having passage **48** and differential bore **49** therein, and bolt **50**. The bolt **50** has threads **51** thereon for mating engagement with threads **52** in post **45**, a shoulder **53** for abutting engagement with surface **54** of post **45**, a longitudinal passageway **55** therein communicating with passageway **46** in post **45** and a lateral passageway **56** communicating with passageway **55** and cylindrical recess **49**.

Sufficient clearance between the head of bolt **50** and post **45** is provided so that float arm pivot **47** is free to rotate about bolt **50**.

The oil cooling system described above operates in the following manner:

Liquid refrigerant from boat box **9** is piped through line **27**, check valve **30** and temperature controlled valve **31** to sump **19**. An increase in temperature of the oil in sump **19** will cause valve **31** to open and provide additional refrigerant to the sump. The liquid refrigerant is sprayed directly into the oil and its pressure reduced to approximately that of the compressor suction pressure by vent line **28** connecting sump **19** with the compressor inlet passage. The liquid refrigerant injected into the lubricant will result in a mixture which is oversaturated with refrigerant. The excess refrigerant will flash from the lubricant, and because of its high latent heat content, will cool the lubricant. Flashing of the refrigerant will continue until the refrigerant and lubricant mixture is in equilibrium. Since injection of liquid refrigerant directly into the lubricant and vaporization thereof will cause foaming of the lubricant, the refrigerant should be sprayed into the lubricant near the top surface thereof to minimize foaming. For this reason, the injector manifold **41** is mounted on float **35** in a manner to maintain the manifold orifices **42** in the upper zone of the collected lubricant.

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

I claim:

1. A method for cooling lubricant in a refrigeration machine having a sump for collection of the lubricant comprising the steps of:

maintaining the sump at substantially the pressure of the low side of the machine, passing liquid refrigerant in direct contact into the upper zone of the collected lubricant in the sump;

utilizing the heat of the lubricant to vaporize refrigerant passed therein, thereby cooling the lubricant; and

passing the vaporzied refrigerant to a portion of the machine having a pressure lower than the high pressure side of the machine.

2. A lubricant cooler for a refrigeration machine comprising:

a sump for collection of lubricant;

a vent for connecting the sump with the low pressure side of the machine; and

means for supplying liquid refrigerant from the high pressure side of the machine into direct contact with and in the upper zone of the lubricant so that the lubricant is cooled by vaporization of the refrigerant, said means including a connection from the low pressure side to the sump.

3. A lubricant cooler for a refrigeration machine according to claim 2 wherein said means for supplying refrigerant into the lubricant includes a manifold having a plurality of orifices therein.

4. A lubricant cooler according to claim 3 wherein said means for supplying refrigerant into the lubricant further includes a float operably associated with said manifold to maintain the orifices in said manifold below

the surface of the lubricant but near the top thereof to prevent agitation or foaming of the lubricant;

a float arm connected to said float having a passageway therethrough communicating with said manifold; and

means for pivotally supporting said float arm and supplying liquid refrigerant thereto.

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