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3,208,667

COMPRESSOR

Filed July 19, 1963

2 Sheets-Sheet 1

FIG. 2

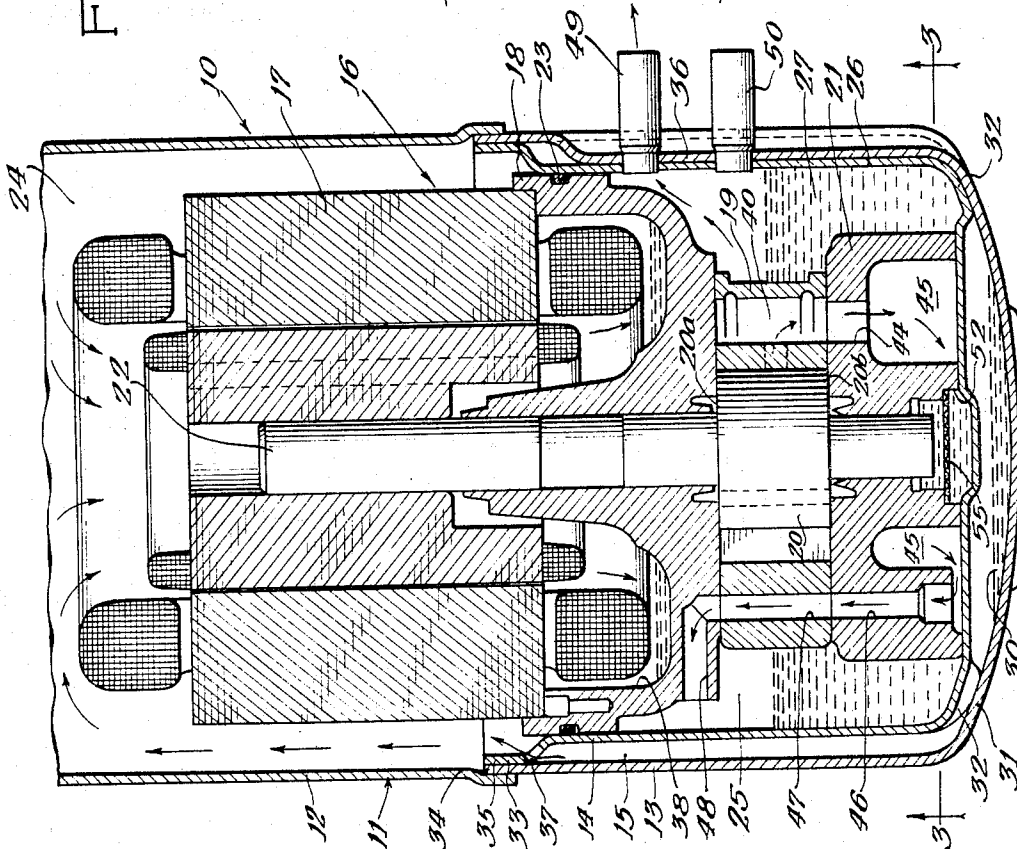
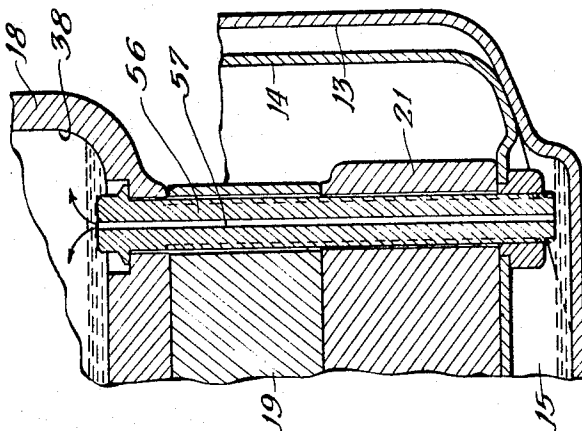


FIG. 1

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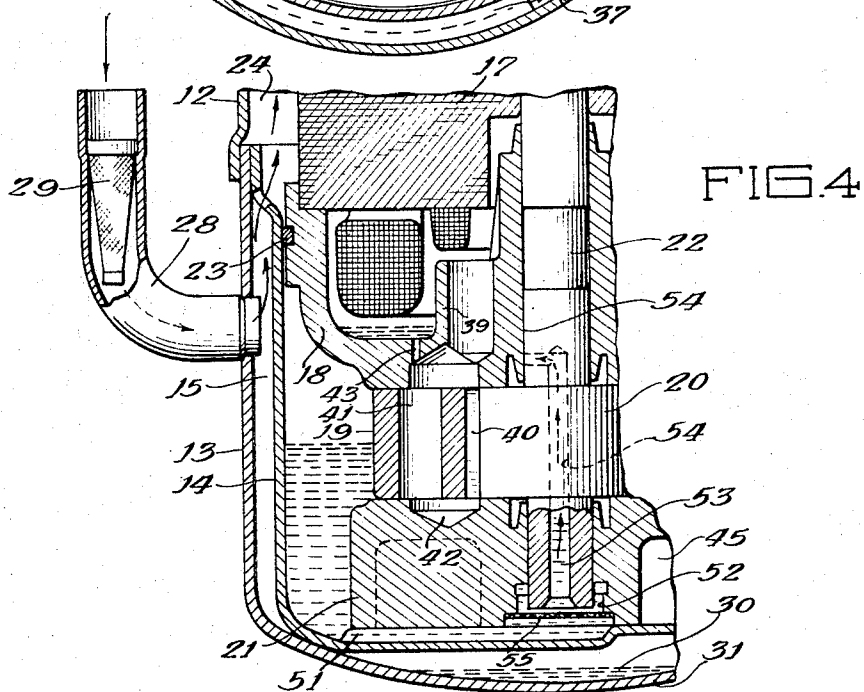
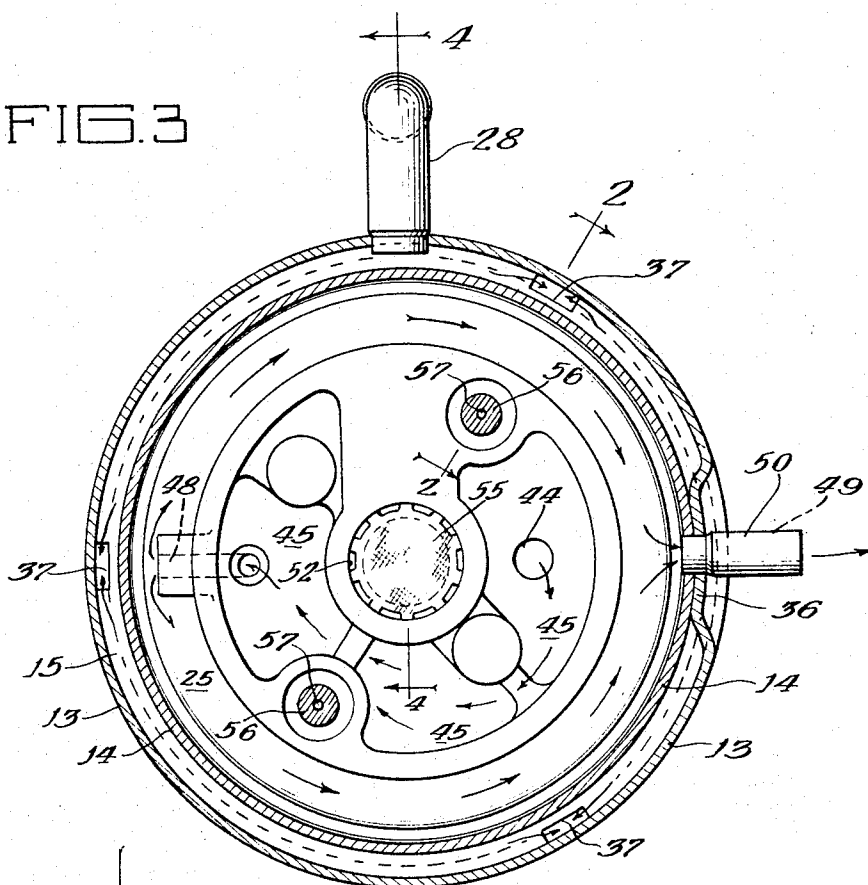
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COMPRESSOR

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FIG. 3



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COMPRESSOR

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Filed July 19, 1963, Ser. No. 296,301
11 Claims. (Cl. 230-207)

This invention relates to compressors and in particular to compressors for refrigeration systems.

In one form of conventional refrigeration system, refrigerant vapor is delivered from an evaporator to a compressor which compresses the vapor for delivery to a condenser. Thus, the inlet to the compressor is at a relatively low pressure and the outlet from the compressor is at a relatively high pressure. One form consists of a compressor with a high pressure crankcase in which the space within the housing surrounding the working parts is carried at substantially condenser pressure. Usually suction vapor entering the compressor passes directly into the compression chamber.

Several problems arise in such compressor structures. Firstly, liquid in the refrigerant vapor delivered to the compressor causes shock loads on the bearings of the compressor and undesirable noise particularly at start up. Further, such compressors require the use of precoolers for motor cooling. Still further, in such compressors, entrainment of lubricating oil in the refrigerant vapor passing through the precooler and in turn passing against the motor of the compressor has a deleterious effect on some motor insulation materials. Additionally, more efficient performance is obtained if a means is provided for removing a portion of the heat of compression.

The present invention comprehends an improved rotary compressor which effectively eliminates the above-discussed problems in a novel and simple manner. Thus, a principal feature of the present invention is the provision of a new and improved rotary compressor.

Another feature of the invention is the provision of such a rotary compressor having new and improved means for separating liquid such as lubricating oil from the incoming refrigerant vapor.

A further feature of the invention is the provision of such a rotary compressor having new and improved means for cooling the lubricating oil thereof.

A yet further feature of the invention is the provision of such a rotary compressor having a simplified construction wherein an inlet chamber is provided surrounding the oil sump of the compressor thereby placing the incoming refrigerant vapor in heat transfer association with the oil.

Another feature of the invention is the provision of such a rotary compressor including a housing defining a chamber including a portion defining a pressure space including a lubricating oil sump, means in the chamber for compressing refrigerant gas, wall means adjacent the sump portion of the housing defining a flow passage between the wall means and the housing, means for conducting refrigerant gas to the flow passage for cooling the sump, and means for conducting the refrigerant gas from the flow passage to the chamber for compression therein by the compressing means.

A further feature of the invention is the provision of such a rotary compressor having improved means for delivering to the compressor chamber oil removed from the refrigerant vapor at the inlet, thereby effectively bypassing the motor chamber portion of the compressor.

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

FIGURE 1 is a fragmentary diametric section of a compressor embodying the invention;

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FIGURE 2 is a fragmentary enlarged vertical section thereof taken substantially along the line 2-2 of FIGURE 3;

FIGURE 3 is a transverse section taken substantially along the line 3-3 of FIGURE 1; and

FIGURE 4 is a fragmentary vertical section taken substantially along the line 4-4 of FIGURE 3.

In the exemplary embodiment of the invention as disclosed in the drawing, a compressor generally designated 10 is shown to comprise a housing generally designated 11 including an upper, downwardly opening cup-shaped member 12, a first lower, upwardly opening cup-shaped member 13, and a second lower, upwardly opening cup-shaped member 14 nested within member 13 to define therebetween an inlet chamber 15. A compressor apparatus generally designated 16 is disposed within the housing 11 and includes a motor 17, a front head 18, a cylinder 19 in which is disposed a rotor 20, and a rear head 21, the motor and rotor being mounted on a common shaft 22 coaxially vertically disposed within the housing 11. The front head 18 carries an annular sealing ring 23 which seals the front head to the housing member 14, thereby dividing the interior of the housing into an upper suction chamber 24 and a lower pressure chamber 25. The lower portion 26 of the housing member 14 defines a sump for holding a body of lubricating oil 27.

As shown in FIGURE 4, refrigerant vapor is delivered from the refrigerant system evaporator (not shown) to the chamber 15 through an inlet fitting 28 having a suitable filter screen 29 installed therein. Liquid, such as lubricating oil, entrained in the refrigerant vapor drops therefrom in chamber 15 and is collected at the bottom of the chamber as a body of liquid 30, as shown in FIGURES 1 and 4. As best shown in FIGURE 1, the inner housing member 14 is spaced upwardly from the bottom wall 31 of the outer housing member 13 by means of a plurality of depending lugs 32 to permit the passage of the collected liquid downwardly to the bottom of the chamber 15.

The refrigerant vapor in chamber 15 is in effective thermal transfer association through housing portion 26 with the lubricating oil 27 in the sump, thereby effectively cooling the oil. Conversely, heat transfer from the oil to the vapor in the chamber 15 tends to vaporize any remaining liquid particles therein, thereby further precluding delivery of liquid droplets to the compressor.

As best seen in FIGURE 1, the housing members 12, 13 and 14 are joined to each other, as by welding, at the lower end 33 of the member 12 and upper ends 34 and 35 of the lower members 13 and 14, respectively. Additionally, the outer lower member 13 is provided with a vertically extending inwardly depressed portion 36 which is welded to the member 14 to provide additional rigidity to the structure.

Upper end 35 of inner housing member 14 is provided with a plurality of small openings 37 (herein three openings) providing restricted communication between inlet chamber 15 and suction chamber 24. The refrigerant vapor passes from chamber 15 through openings 37 to flow over the motor 17, as shown in FIGURE 1, thereby cooling the motor and providing improved efficiency of operation thereof. The heat of the motor additionally serves to vaporize remaining liquid entrained in the vapor. Also, the rotating armature tends to provide further separation of remaining liquid for complete vaporization.

As best seen in FIGURE 1, front head 18 defines an annular, upwardly opening trough 38 in which any remaining liquid in the refrigerant vapor collects prior to the flow of the vapor to the compressor apparatus. Also, oil collects in this trough, as will be explained subsequently. As shown in FIGURE 4, the front head 18

is provided with an inlet passage 39 opening downwardly to the compressor chamber 40 in cylinder 19. Cylinder 19 is provided with a vertical passage 41 which communicates with the inlet passage 39 in front head 18 and with a recess 42 in the rear head 21. As shown in FIGURE 4, the recess communicates also with the compressor chamber 40 and thus refrigerant vapor is delivered from its inlet passage 39 concurrently into the top and bottom of the chamber 40.

Front head 18 is further provided with a small passage 43 which meters a small quantity of the oil collected in trough 38 into the refrigerant vapor being delivered to the compressor chamber 40. Lubricating oil liquid delivered into the refrigerant vapor in this manner serves to lubricate the compressor during the operation thereof.

As best seen in FIGURES 1 and 3, the compressed vapor is delivered from chamber 40 through an outlet passage 44 in rear head 21 which opens into a muffler chamber 45. The compressed vapor passes from chamber 45 to a delivery passage 46 in the rear head 21 opening upwardly into a delivery passage 47 in the cylinder 19 which, in turn, opens through a delivery passage 48 in the front head 18 communicating with the high pressure chamber 25. The high pressure chamber 25 thusly serves as a second muffler chamber cooperating with chamber 45 to effectively minimize the sounds produced by the compression of the vapor in the chamber 40.

As shown in FIGURES 1 and 3, the high pressure compressed refrigerant is delivered from chamber 25 through an outlet 49 which is connected by suitable conduit means (not shown) to the condenser of the compression system (not shown). A normally closed fitting 50 may be provided communicating with chamber 25 for introducing lubricating oil and for charging the compressor when desired.

The oil 27 in the sump portion 26 of the housing member 14 is under the relatively high pressure of the compressed gas in chamber 25 and is forced thereby through a suitable downwardly opening channel 51, as best seen in FIGURE 4, in rear head 21 to a central recess 52 in the rear head into which the lower end of the shaft 22 extends. As shown in FIGURE 4, the shaft is provided with a bore 53 opening at its lower end into recess 52 and at its upper end radially through the shaft to the annular space 54 between the shaft and the bearing surface of the front head 18. A suitable filter screen 55 may be disposed across the recess 52 to filter the lubricating oil as it passes upwardly under the compressed gas pressure through the recess to lubricate the shaft 22 and the rotor 20 at its upper and lower surfaces 20a and 20b.

As indicated briefly above, the openings 37 between inlet chamber 15 and suction chamber 24 are restricted, thus, a pressure differential (e.g. approximately 1 pound per square inch) is produced between these chambers. As shown in FIGURE 2, one of the screws 56 provided to maintain the rear head cylinder and front head of the compressor apparatus 16 in assembled relationship may be provided with an axial bore which opens at its lower end into the chamber 15 and its upper end into the trough 38 of the upper head 18. Thus, the collected lubricating oil in the lower portion of chamber 15 is forced, by the pressure differential existing between chamber 15 and chamber 24 into which trough 38 opens, upwardly through the bore 57 and into the trough. This oil is delivered through the passage 43 into the refrigerant vapor being delivered to the compressor chamber 40 as discussed above, thereby further assisting in the lubrication of the compressor.

Thus, compressor 10 provides a simple improved structural arrangement whereby improved cooling of the lubricating oil, removal of entrained material from the incoming refrigerant vapor, and improved lubrication of the rotating parts of the compressor are provided. The

operation of the compressor is substantially improved as shock loads on the bearings resulting from liquid in the vapor are effectively eliminated and the noise normally encountered in such compressors on start up is effectively eliminated.

While I have shown and described one embodiment of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Apparatus for compressing refrigerant gas, comprising: first housing means defining a pressure space; compressor means in said first housing means for compressing said refrigerant gas; second housing means spaced from said first housing means to define a passage therebetween; means defining a lubricating oil sump in said pressure space; third housing means closing said first and second housing means and including a chamber in communication with said compressor means; conduit means for conducting said refrigerant gas to said passage; and means for conducting said refrigerant gas from said passage to said chamber for compression of said gas by said compressor means.

2. Apparatus for compressing refrigerant gas, comprising: first housing means defining a pressure space; compressor means in said first housing means for compressing said refrigerant gas; second housing means spaced from said first housing means to define a passage therebetween; means defining a lubricating oil sump in said pressure space; third housing means closing said first and second housing means and including a chamber in communication with said compressor means; conduit means for conducting said refrigerant gas to said passage; and means for conducting said refrigerant gas from said passage to said chamber for compression of said gas by said compressor means, said lubricating oil sump being in thermal contact with said refrigerant gas flowing through said passage for cooling of said oil sump.

3. Apparatus for compressing refrigerant gas, comprising: a housing defining a chamber including a portion defining a pressure space including a lubricating oil sump; means in said chamber for compressing refrigerant gas; wall means adjacent said sump portion of the housing defining a passage between said housing portion and wall means; means for conducting refrigerant gas to said passage for cooling said sump; and means for conducting the refrigerant gas from said passage to said chamber for compression therein by said compressing means.

4. The apparatus of claim 3 wherein said wall means substantially surrounds said sump portion of the housing.

5. Apparatus for compressing refrigerant gas, comprising: a housing defining a chamber including a first portion defining a suction space and a second portion defining a pressure space including a lubricating oil sump; means in said chamber and communicating with said suction space for compressing refrigerant gas; wall means adjacent said sump portion of the housing defining a passage between said housing portion and wall means; means for conducting refrigerant gas to said passage for cooling said sump; and means for conducting the refrigerant gas from said passage to said suction space for compression by said compressing means, said last-named means being arranged to maintain the gas pressure in said passage substantially higher than in said suction space.

6. The apparatus of claim 5 wherein said last-named refrigerant gas conducting means comprises means defining a flow restricting orifice communicating with said passage and said suction space.

7. Apparatus for compressing refrigerant gas, comprising: a housing defining a chamber including a first

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portion defining a suction space and a second portion defining a pressure space including a first lubricating oil sump; means in said chamber and communicating with said suction space for compressing refrigerant gas; wall means adjacent said first sump portion of the housing defining a passage between said housing portion and wall means and defining a second lubricating oil sump; means for conducting refrigerant gas to said passage for cooling said first sump; and means for conducting the refrigerant gas from said passage to said suction space for compression by said compressing means, said last-named means being arranged to maintain the gas pressure in said passage substantially higher than in said suction space, said housing second portion and said wall means being arranged to provide a baffle effect whereby lubricating oil entrained in the refrigerant gas is caused to drop therefrom in said passage and collect in said second sump.

8. Apparatus for compressing refrigerant gas, comprising: a housing defining a chamber including a first portion defining a suction space and a second portion defining a pressure space including a first lubricating oil sump; means in said chamber and communicating with said suction space for compressing refrigerant gas; wall means adjacent said first sump portion of the housing defining a passage between said housing portion and wall means and a second lubricating oil sump; means for conducting refrigerant gas to said passage for cooling said first sump; means for conducting the refrigerant gas from said passage to said suction space for compression by said compressing means, said last-named means being arranged to maintain the gas pressure in said flow passage substantially higher than in said suction space; and passage means for conducting lubricating oil from said second sump to said suction space as a result of the pressure differential therebetween.

9. Apparatus for compressing refrigerant gas, comprising: a housing defining a chamber including a first portion defining a suction space and a second portion

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defining a pressure space including a first lubricating oil sump; compressor means in said chamber for compressing refrigerant gas including a front head extending across the chamber and defining an inlet, a cylinder defining a compression chamber communicating with said inlet, a rotor in said chamber, and a rear head disposed in said first sump, and means for conducting compressed gas from said compression chamber to said pressure space; means sealing said front head to said housing to seal said suction space from said pressure space; wall means adjacent said first sump portion of the housing defining a passage between said housing portion and wall means, and a second lubricating oil sump; means for conducting refrigerant gas to said passage for cooling said sump; and means for conducting the refrigerant gas from said passage to said suction space for compression by said compressing means, said last-named means being arranged to maintain the gas pressure in said passage substantially higher than in said suction space.

10. The apparatus of claim 9 including means defining a passage between said second sump and said inlet.

11. The apparatus of claim 9 wherein said compressor means includes a bolt extending through said front head, cylinder, and rear head and having an axial bore providing a passage for oil from said second sump to said suction space adjacent said inlet.

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