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ROTARY COMPRESSOR ARRANGEMENT

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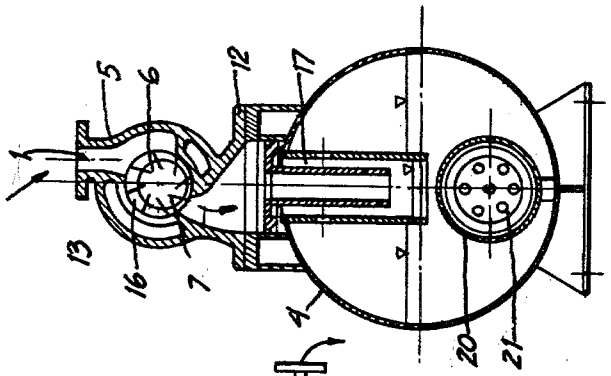


Fig. 2

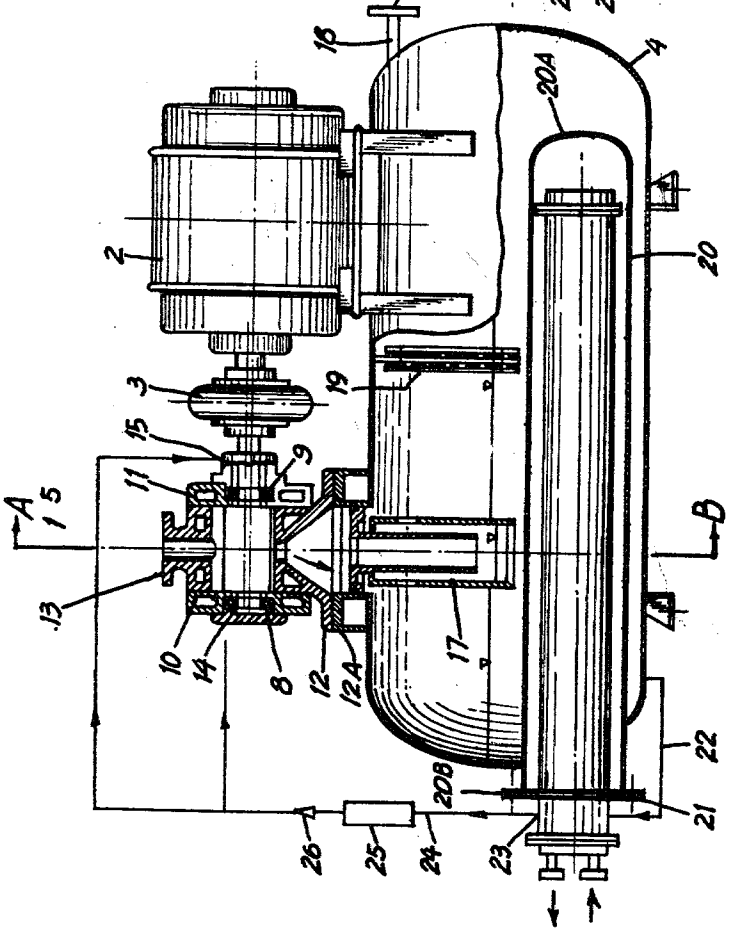


Fig. 1


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# ROTARY COMPRESSOR ARRANGEMENT

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The present invention relates to a rotary compressor arrangement, more particularly, to such an arrangement comprising an oil cooler, oil separator, and oil reservoir arranged as a unit with a compressor being mounted on the top of the reservoir and there being an oil return line between said oil cooler and said compressor.

In the operation of compressors the problem frequently arises as to the most effective manner for separating the lubricant for the compressor from the fluid which is being pumped by the compressor. This problem is of particular importance in compressors used for pumping a refrigerant wherein the refrigerant absorbs the lubricating oil while passing through the compressor. This separation problem is particularly great when rotary compressors having sliding vanes are used. In this type of a compressor a considerable quantity of lubricant oil is introduced into the working space of the compressor both to cool the compressor and to seal the clearances between the edges of the vanes and the compressor chamber.

In one known arrangement of a sliding vane rotary compressor having internal cooling the pumped fluid is separated from the lubricating oil in a separator which is located outside of the compressor. The lubricating oil is then returned under the discharge pressure of the compressor to the compression chamber through bores in the front faces of the compressor casing. The lubricant passes through a suitable cooling device and a filter.

This arrangement, however, has the disadvantage of occupying a considerable amount of space because of the individual locations of the various components of this arrangement. Further, this arrangement is not comprised an integral unit since the various components are mounted as separate units which are connected to each other.

In another proposed arrangement an oil separator is mounted on the compressor so as to extend laterally therefrom. This separator is subjected to a flow of cooling water so that the oil can be cooled simultaneously with the separation thereof. An oil reservoir is mounted beneath the compressor.

However, this proposed arrangement has the disadvantage that it can be used only when the condensation temperature of the pumped fluid is lower than the temperature of the cooling water. Otherwise, the pumped fluid will condense and accumulate in the reservoir. Further if the specific weight of the pumped liquid is higher than that of the lubricant, the pumped liquid may enter into the lubricating surfaces of the compressor and hence cause damage. Accordingly, this arrangement is not suitable for the compression of refrigerants since even the temperature of the cooling water is generally lower than the condensation temperature of the refrigerant.

In addition, the mounting of the compressor on the oil reservoir has been of some importance since previously known mountings occupied a considerable amount of space and were rather complicated. In one such mounting the discharge of the compressor extended laterally of the compressor and was connected to the reservoir. In this arrangement, it was therefore necessary to provide the compressor with a supporting base. Accordingly this arrangement was not particularly useful because it was difficult to both mount the compressor on its supporting base and to connect the other side of

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the compressor to the oil reservoir by using a short rigid connecting tube. It was then proposed to extend the supporting base laterally from the compressor and to make the connection between the discharge of the compressor and the oil reservoir by means of a corrugated tube. This proposed solution was an improvement but still contained many disadvantages and drawbacks.

It is therefore the principal object of this invention to provide a novel and improved rotary compressor arrangement which is particularly adapted for compressing refrigerants.

It is another object of this invention to provide a simplified arrangement of a compressor, oil separator, oil cooler, and oil reservoir which occupies a minimum of space and provides the best possible separation of the oil and the refrigerant.

It is an additional object of this invention to provide a simplified and effective mounting of a rotary compressor upon an oil reservoir so as to occupy a minimum of space and to permit a ready assembly and disassembly of the compressor from the reservoir.

The objects of the present invention are achieved by arranging the oil separator, oil cooler and oil reservoir as a single structural unit wherein the oil separator is built into the upper portion of the oil reservoir and the oil cooling unit is positioned in the lower half of the reservoir. The cooling unit is enclosed in a tube which is welded within the oil reservoir in such a manner that one end of the tube is open to the exterior of the reservoir and the inner end of the tube is closed.

As a result of this arrangement it is now possible to cool the lubricating oil in the reservoir in compressor installations for refrigerants. The refrigerant will not condense since the cooling water flowing through the oil cooler does not directly cool the refrigerant but cools through the medium of the protecting tube. The lubricating oil flows from the cooling unit back to the compressor where it serves to both lubricate and cool the compressor. It is thereby possible to obtain a very high pressure ratio in the compressor simultaneously with a good delivery rate.

In addition, the compressor and the drive motor are directly coupled and are mounted on the horizontally extending oil reservoir in such a way that the flange surrounding the discharge opening of the compressor is used as the supporting or mounting base of the compressor. This flange is mounted directly on the rservoir in such a manner that the pumped liquid is discharged directly from the compressor into the oil separator mounted in the top of the reservoir.

This mounting of the compressor directly on the reservoir is a considerable simplification since the discharge opening flange replaces the previously required mounting base. This flange is enlarged to such an extent so as to provide a stable mount for the compressor.

The cooling and lubricating liquid is introduced into the compressor through its bearings which are mounted in the side cover plates thereof. As a result, the compressor and the reservoir form a single structural unit.

Other objects and advantages of this invention will be readily apparent upon reference to the accompanying description when taken in conjunction with the following drawings wherein;

FIGURE 1 is a longitudinal sectional view of the rotary compressor installation of the present invention; and

FIGURE 2 is a transverse sectional view of the installation illustrated in FIGURE 1 and taken along the line A–B thereof.

Proceeding next to the drawings wherein like reference symbols indicate the same parts throughout the various views a specific embodiment of this invention will be described. In FIGURE 1 the compressor installation com-

prises a sliding vane rotary compressor 1 which is driven by a drive motor 2 through a clutch 3. The compressor and the motor are mounted on a horizontally positioned substantially cylindrical shaped oil reservoir 4. The reservoir is of the conventional shape employed in pressure vessels wherein the ends thereof are convex.

The rotary compressor 1 comprises a compressor casing 5 and a rotor 6 eccentrically mounted therein. The rotor 6 is provided with a plurality of slots in which are slidably mounted vanes 7. The rotor 6 is journalled in friction bearings 8 and 9 which are mounted in compressor side cover plates 10 and 11.

The compressor has a discharge opening flange 12 which is positioned on the bottom of the compressor casing 5 and an inlet opening flange 13 which is positioned on the upper side of the compressor casing. The flange 12 is bolted or screwed to a corresponding flange 12A formed on the upper surface of the reservoir 4.

The lubricating and cooling oil is forced out of the oil reservoir 4 by the discharge pressure of the compressor to enter the compressor through the connections 14 and 15 in the side plates 10 and 11 respectively. The oil enters the friction bearings 8 and 9 to lubricate the same and then passes through slots between the rotor and the side cover plates into the crescent shaped chamber 16 of the compressor. Not only does this oil lubricate the moving components of the compressor but also serves to seal clearances between the rotor vanes and the compression chamber walls. Further, this oil cools the interior of the compressor.

As the oil flows into the compression chamber of the compressor it is conveyed together with the pumped fluid through the discharge outlet flange 12 into the reservoir 4.

The reservoir flange 12A surrounds an opening to which is connected a first oil separator device 17. This device is for the purpose of separating the mixture of the pumped fluid and the lubricating oil. The separating device 17 can be constructed of the form to take advantage of the kinetic energy of the entering pumped fluids.

The reservoir 4 is provided with an outlet pipe 18. In addition, there is a filter 19 of the lattice type as second oil separating device which separates fine drops of lubricating oil or oil spray from the refrigerant or pumped fluid. Thus, elements 17 and 19 define a two-stage oil separator.

A tubular shell 20 having an inner closed end 20A and an outer open end 20B is welded within the lower half of the reservoir 4. An oil cooling unit 21 is mounted within the tubular shell 20. A conduit 22 connects the bottom of the reservoir 4 with the cooling unit 21 to convey the oil to be cooled into the cooling unit. Cooling water is circulated through the cooling unit to remove heat from the lubricating oil. The cooled oil leaves the cooler at 23 and flows through a conduit 24 through an oil filter 25 and a control valve 26 which controls the circulation of the lubricating oil to the compressor. The oil then enters the compressor through the connections 14 and 15 previously described.

It is apparent that the above described compressor installation results in an integral and compact arrangement which comprises a compressor, a reservoir, an oil separator, and an oil cooler. In addition, the mounting of the compressor by means of a discharge outlet flange eliminates the need for a special base plate. Thereby a considerable reduction in the cost of this installation is effected. Further, the construction of the arrangement is particularly simple since the discharge opening flange of the compressor is directly connected to the oil separator. This eliminates a second set of flanges or a resilient connection between the discharge opening of the compressor and the reservoir.

Since the oil cooling unit is built into the lower half of the reservoir the supply of oil can be restricted only to the needed quantity and the oil cooler is integrated into the installation so as to save a considerable amount of space.



The above installation is particularly valuable in those locations where space is at a premium since the reservoir contains the oil separator and oil cooler therein. Further, the compressor and its driving motor are mounted on the upper surface of the reservoir.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions, and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

What is claimed as this invention is:

1. A rotary compressor arrangement particularly adapted for pumping and compressing a refrigerant and comprising a horizontally positioned cylindrical reservoir for containing lubricant oil, a tubular shell mounted in the lower half of said reservoir with one end thereof opening to the exterior of said reservoir, a cooling unit mounted in said tubular shell for cooling said oil, a multiple stage oil separator mounted in the upper half of said reservoir, an opening in the reservoir receiving the upper open end of the oil separator, a rotary compressor having inlet and discharge openings, with said discharge opening connected to the open end of the oil separator, the lower end of the oil separator being in open communication with the oil reservoir, a first oil line connected to said lower half of said reservoir for collecting oil therefrom and feeding it to said oil cooler, and a second oil line connecting said oil cooling unit and said compressor so that cooled oil is conveyed under the discharge pressure of said compressor to said compressor to lubricate and cool the same.

2. A rotary compressor arrangement particularly adapted for pumping and compressing a refrigerant and comprising a horizontally positioned cylindrical reservoir for containing lubricant oil, a tubular shell mounted in the lower half of said reservoir with one end thereof opening to the exterior of said reservoir, an oil cooling unit mounted in said tubular shell for cooling said oil, a multiple stage oil separator mounted in the upper half of said reservoir, an opening in the reservoir receiving the upper open end of the oil separator, a rotary compressor having inlet and discharge openings, with said discharge opening connected to the open end of the oil separator, the lower end of the oil separator being in open communication with the oil reservoir, a first oil line connected to said lower half of said reservoir for collecting oil therefrom and feeding it to said oil cooler, and a second oil line connecting said oil cooling unit and said compressor so that cooled oil is conveyed under the discharge pressure of said compressor to lubricate and cool the same, and a drive motor directly coupled to said compressor, said drive motor and said compressor being both mounted on said oil reservoir.

3. A rotary compressor arrangement particularly adapted for pumping and compressing a refrigerant and comprising a horizontally positioned cylindrical reservoir for containing lubricant oil, a tubular shell secured in the lower half of said reservoir with one end thereof opening to the exterior of said reservoir, an oil cooling unit mounted in said tubular shell for cooling said oil, a multiple stage oil separator mounted in the upper half of said reservoir, an opening in the reservoir receiving the upper open end of the oil separator, a rotary compressor having inlet and discharge openings, with said discharge opening connected to the open end of the oil separator, the lower end of the oil separator being in open communication with the oil reservoir, a first oil line connected to said lower half of said reservoir for collecting oil therefrom and feeding it to said oil cooler, and a second oil line connecting said oil cooling unit and said compressor so that cooled oil is conveyed under the discharge pressure of said compressor to said compressor to lubricate and cool the same.

4. A rotary compressor arrangement particularly adapted for pumping and compressing a refrigerant and comprising a horizontally positioned cylindrical reservoir for containing lubricant oil, a tubular shell mounted in the lower half of said reservoir with one end thereof opening to the exterior of said reservoir, an oil cooling unit mounted in said tubular shell for cooling said oil, a multiple stage oil separator mounted in the upper half of said reservoir, an opening in the reservoir receiving the upper open end of the oil separator, a rotary compressor having inlet and discharge openings, with said discharge opening connected to the open end of the oil separator, the lower end of the oil separator being in open communication with the oil reservoir, a first oil line connected to said lower half of said reservoir for collecting oil therefrom and feeding it to said oil cooler, and a second oil line connecting said oil cooling unit with said compressor bearing housing so that cooled oil is conveyed under the discharge pressure of said compressor to said bearing housing to lubricate the same and into the compression chamber of said compressor to cool the compressor.

5. A rotary compressor arrangement particularly adapted for pumping and compressing a refrigerant and comprising a horizontally positioned cylindrical reservoir for containing lubricant oil, a tubular shell secured in the lower half of said reservoir with one end thereof opening to the exterior of said reservoir, an oil cooling unit mounted in said tubular shell for cooling said oil, an oil separator mounted in the upper half of said reservoir, an opening in the reservoir receiving the upper open end of the oil separator, a rotary compressor having inlet and discharge openings, with said discharge opening connected to the open end of the oil separator, the lower end of the oil separator being in open communication with



the oil reservoir, a first oil line connected to said lower half of said reservoir for collecting oil therefrom and feeding it to said oil cooler, and a second oil line connecting said oil cooling unit and said compressor so that cooled oil is conveyed under the discharge pressure of said compressor to said compressor to lubricate and cool the same.

6. In a rotary compressor arrangement particularly for the compression of a refrigerant, an oil reservoir comprising a hoizontal, cylindrical vessel with an opening in the top thereof, a rotary compressor and motor for driving the compressor mounted on the vessel with the discharge opening in the compressor being in direct communication with the opening in the vessel, an oil separator mounted in the reservoir at said vessel opening and receiving through its upper end discharge from the compressor, the lower end of the oil separator being in communication with the oil reservoir and placing the oil therein under compression, an oil cooler in said reservoir and receiving oil therefrom under compression, and means for circulating oil from the oil cooler to the compressor for lubricating and cooling the compressor.

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