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REFRIGERATING APPARATUS OF THE COMPRESSION TYPE

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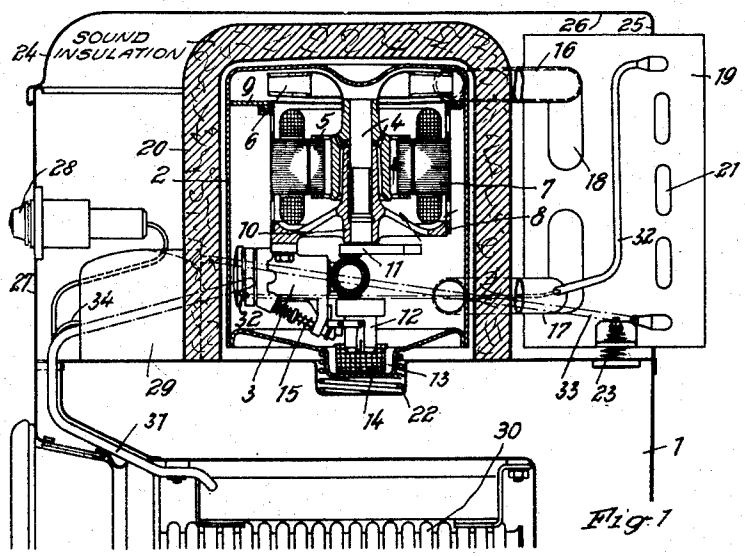


Fig. 1

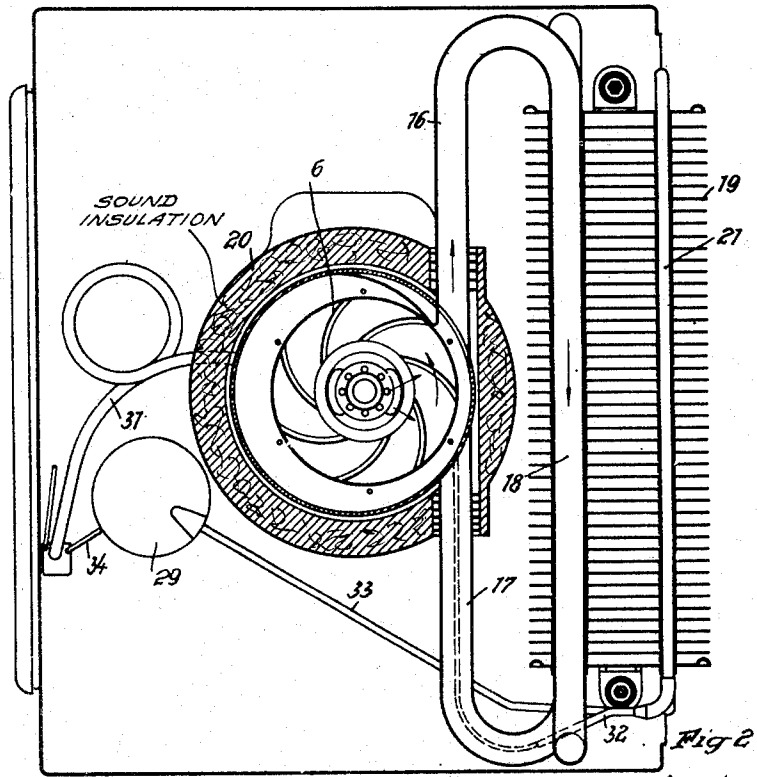


Fig. 2

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REFRIGERATING APPARATUS OF THE COMPRESSION TYPE

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The present invention relates to improvements in refrigerating apparatus of the compression type, and particularly to an improved cooling system therefor.

In the case of motor-driven compressors the waste heat from the compressor and electric motor must be as is well known carried off during the operation to the atmosphere. In air-cooled apparatus the heat has hitherto been carried off in different ways.

The motor and compressor are in part provided with cooling ribs and particularly with apparatus having an enclosed motor-compressor set the cooling is effected by the natural air draught. Since this cooling is impossible at high outside temperatures a ventilator is employed which requires a particular driving motor in the case of enclosed apparatus. Such a cooling set presents the drawback in that the ventilator produces an objectionable noise.

Attempts have therefore been made in dispensing with the ventilator to create other cooling systems for the motor-compressor. Thus, for instance, the gas compressed by the compressor takes up the waste heat of the apparatus and the waste heat is supplied to the condenser and is there carried off. It is evident that at the high temperature of the gases heated by the compression the temperature of the driving motor must be very high before the heat may be carried off.

Another method consists in supplying already liquified refrigerant from the condenser back to the motor-compressor set, where it takes up heat, evaporates and gives up the heat in a condenser of larger dimensions where it is again liquified. This method is complicated and presents difficulties if pressure of evaporation prevails in the motor-compressor housing. In this case the condensate cannot be supplied to the motor-compressor parts so as to cause an effective cooling thereof. In order to enable an effective cooling of the driving parts the lubricant of the motor-compressor set is arranged in some types of sets to take up the waste heat and the heated lubricant is then again cooled down in a special cooler. This arrangement entails a particular design of the parts to be cooled besides an amply dimensioned oil pump in order to supply with certainty the oil to the points to be cooled. A remaining of the cooling oil at these points is, of course, undesirable, since the lubricant of the refrigerating apparatus is very sensitive to superheating. The rotor of the motor can be hardly cooled in this manner, since the presence of liquid in the air gap of the motor is not permissible.

The object of the present invention is to provide a motor-driven compressor in which the motor-compressor set is arranged in a completely closed housing which itself need not carry off any heat and in which the interior of the housing is connected through circulation conduits to the cooler, where the heat is carried off. In the case of air-cooling the cooler is provided with cooling ribs exposed directly to the outside atmosphere, by means of which the heat removed from the motor-compressor set is carried off to the atmosphere. The gaseous cooling medium contained in the motor-compressor housing is forced by a blower into a cooling system lying exteriorly of the housing, whence it returns again in a cooled state to the motor housing and is drawn back into the blower, thereby cooling all points of the motor-compressor to be cooled. The blower may be dimensioned in such a manner as to carry off the desired amount of heat. With this method of cooling all parts of the power unit come into contact with the gas owing to its high speed, whereby a very effective and uniform cooling of the motor-compressor parts as well as of the lubricant is attained which is also circulated in the motor housing.

The cooling of the motor-compressor set is preferably effected according to the invention in such a manner that the gaseous medium contained in the closed housing is set in motion by a centrifugal blower mounted on the motor shaft. According to the invention it is easily possible to combine the point where the waste heat of the motor-compressor is carried off with that where the heat liberated in the condenser for the refrigerating medium is carried off. To this end, the cooling ribs of the cooler serving to dissipate the heat produced by the power unit serve to dissipate also the heat of the condenser for the refrigerating medium. The housing of the motor-compressor set and its cooling devices are preferably rigidly connected with one another and this unit is resiliently supported with respect to the refrigerator cabinet.

In the accompanying drawing is shown an embodiment of the invention in diagrammatic form. Fig. 1 is a sectional elevation and Fig. 2 a top view, partly in section, of a motor-compressor set according to the invention. On top of the refrigerator cabinet 1 is mounted the refrigerating apparatus set. In a sheet metal casing 2 is

arranged the compressor 3 and the driving motor. The shaft 4 of the driving motor carries the rotor 5 and at the upper end a centrifugal blower 6. The stator 7 of the driving motor is rigidly connected to the casing 2 through a sheet metal cylinder 8 and an end plate 9. The sheet metal cylinder 8 carries at its lower end the shaft bearing 10. The shaft 4 drives the compressor piston (not shown) through a crank 11. 12 denotes an oil pump which delivers the lubricant from the sump 13 to the individual points to be lubricated. 14 is an oil filter. 15 denotes the regulating valve needle which operates in accordance with the oil pressure produced by the oil pump. The valve is opened when the motor-compressor set is at rest and also during the starting period of the motor-compressor set so as to facilitate the starting of the motor.

At the upper and lower end of the housing is connected a gaseous medium circulating conduit 16 and 17 respectively to which is connected a cooling conduit 18. The gaseous cooling medium for the motor and the compressor contained in the casing 2 is set into motion in the direction indicated by the arrow in Fig. 2 with the aid of the centrifugal blower 6 and is forced from the upper part of the casing 2 through the upper conduit 16 into the cooler 18 and leaves the latter by the lower conduit 17. By this circulation of this cooling medium the waste heat of the electric motor and of the compressor is carried off to the cooler 18. The latter is integral with the cooling ribs 19 which dissipate the heat taken up directly to the atmosphere. The casing 2 is surrounded by an insulating jacket 20 serving to dampen the noise. The circulation conduits 16 and 17 of the above-mentioned cooling system pass through the insulating jacket 20. The condenser 21 for the refrigerant of the refrigerating apparatus is heat conductively connected to the cooling ribs 19 of the cooler 18. In this manner the total waste heat of the refrigerating apparatus, that is to say, the heat of condensation of the refrigerant and the waste heat of the compressor and the driving motor is directly carried off to the cooling surfaces 19 in contact with the air. The casing 2 is rigidly connected to the cooling system 19 and the entire unit is resiliently supported by springs 22 and 23. The refrigerating apparatus is provided with a sheet metal cover 24 having openings for the passage of the air as indicated at 25 and 26. The front and the side sheet metal walls 27 of the refrigerator extend upwardly sufficiently to mount the control switch 28 thereon. 29 denotes the control device, such as, for instance, a float controlled valve firmly fixed on the top wall of the refrigerator cabinet. The refrigerant is drawn by the compressor 3 from the evaporator 30 mounted in the refrigerator chamber through a conduit 31 and forced by the compressor through a conduit 32 into the condenser 21. The liquified refrigerant passes from the condenser through a conduit 33 to the control device 29 and then to the evaporator through a conduit 34.

What is claimed is:

1. A refrigerating apparatus of the compression type including a compressor, a condenser, an evaporator and connecting conduits between said three elements and an electric motor for driving said compressor, a pressure-tight casing containing said compressor and said motor, a cooler disposed exteriorly of said casing and circulating ducts for connecting said cooler with said casing to permit circulation of a gaseous cooling medium through said casing and said cooler and a circulating device for circulating said medium through said casing, said conduits and said cooler.

2. A refrigerating apparatus of the compression type including a compresor, a condenser, an evaporator and connecting conduits between said three elements and an electric motor for driving said compressor, a pressure-tight casing containing said compressor and said motor, a cooler disposed exteriorly of said casing and having cooling ribs exposed to the atmosphere, and circulating ducts for connecting said cooler with said casing to permit circulation of a gaseous cooling medium through said casing and said cooler and a circulating device for circulating said medium through said casing, said conduits and said cooler.

3. A refrigerating apparatus of the compression type including a compressor, a condenser, an evaporator and connecting conduits between said three elements and an electric motor for driving said compressor, a pressure-tight casing containing said compressor and said motor, a cooler disposed exteriorly of said casing and circulating ducts for connecting said cooler with said casing to permit circulation of a gaseous cooling medium through said casing and said cooler and a centrifugal blower mounted inside of said casing and directly driven by said motor for circulating said medium through said casing, said conduits and said cooler.

4. A refrigerating apparatus of the compression type including a compressor, a condenser, an evaporator and connecting conduits between said three elements and an electric motor for driving said compressor, a pressure-tight casing containing said compressor and said motor, a cooler disposed exteriorly of said casing and having cooling ribs exposed to the atmosphere, and circulating ducts for connecting said cooler with said casing to permit circulation of a gaseous cooling medium through said casing and said cooler and a circulating device for circulating said medium through said casing, said conduits and said cooler, said cooling ribs being heat-conductively connected with said condenser.

5. A refrigerating apparatus of the compression type including a compressor, a condenser, an evaporator and connecting conduits between said three elements and an electric motor for driving said compressor, a pressure-tight casing containing said compressor and said motor, a cooler disposed exteriorly of said casing and circulating ducts for connecting said cooler with said casing to permit circulation of a gaseous cooling medium through said casing and said cooler and a circulating device disposed within said casing for circulating said medium through said casing, said conduits and said cooler, said cooler and said conduits being rigidly connected with said casing to form a unit therewith, and springs for mounting and supporting said unit on the refrigerating apparatus.

6. A refrigerating apparatus of the compression type including a compressor, a condenser, an evaporator and connecting conduits between said three elements and an electric motor for driving said compressor, a pressure-tight casing containing said compressor and said motor, a cooler disposed exteriorly of said casing and circulating ducts for connecting said cooler with said casing to permit circulation of a gaseous cooling medium through said casing and said cooler and a circulating device disposed within said casing for cir-

culating said medium through said casing, said conduits and said cooler, said cooler and said conduits being rigidly connected with said casing to form a unit therewith, and springs for mounting and supporting said unit on the refrigerating apparatus, refrigeration control devices rigidly mounted on said refrigeration apparatus and flexible connection between said devices and the refrigeration elements contained in said casing.

7. A refrigerating apparatus of the compression type including a compressor, a condenser, an evaporator and connecting conduits between said three elements and an electric motor for driving said compressor, a pressure-tight casing containing said compressor and said motor, a cooler disposed exteriorly of said casing and circulating ducts for connecting said cooler with said casing to permit circulation of a gaseous cooling medium through said casing and said cooler and a circulating device for circulating said medium through said casing, said conduits and said cooler, and sound insulating means immediately surrounding said casing.

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