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REFRIGERATION SYSTEM WITH MULTI-STAGE THROTTLING

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Fig. 1

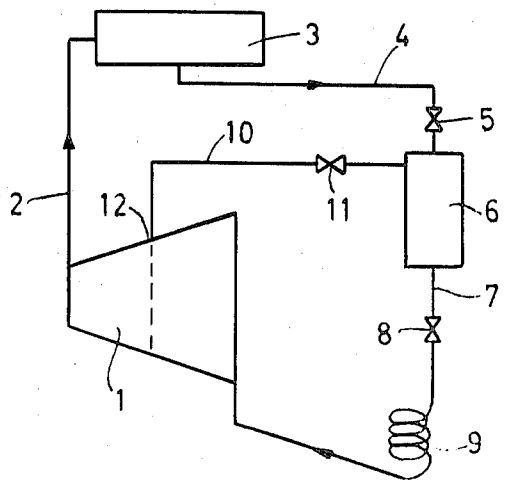
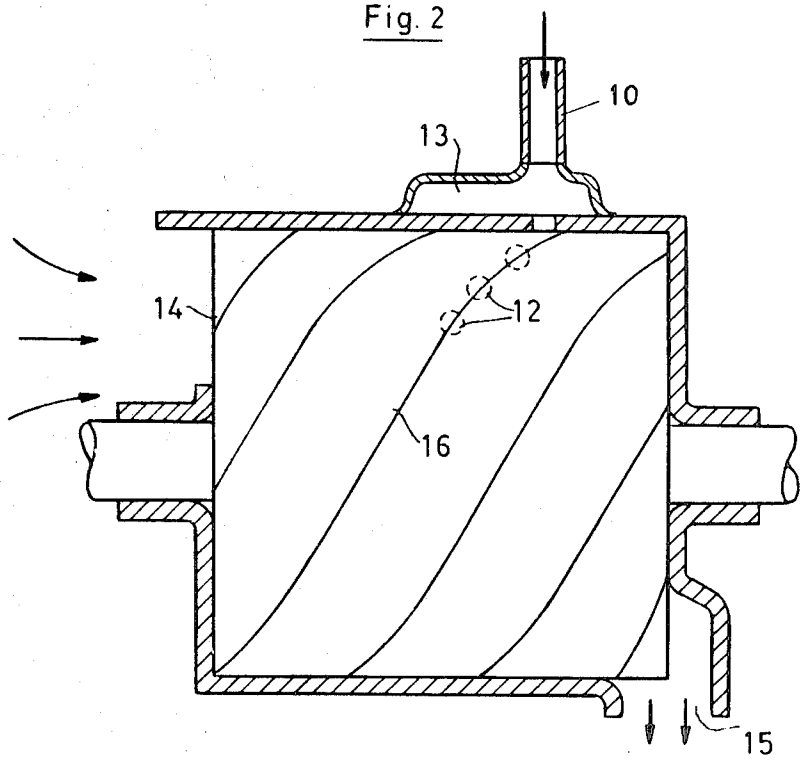


Fig. 2



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REFRIGERATION SYSTEM WITH MULTI-STAGE THROTTLING

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U.S. Cl. 62—510 2 Claims

ABSTRACT OF THE DISCLOSURE

A refrigerating system provided with multi-stage throttling and with a positive displacement compressor of the rotary type, the casing of the compressor being provided between its low pressure and high pressure ports with one or more admission ports for intermediate pressure gas from liquid separators located between throttling points. The gas formed during throttling is supplied through these admission ports to the working compartment of the compressor. The opening and closing of the admission ports is achieved by the action of the compressor which has its rotor lobes operative as valves for the admission ports.

In refrigerating systems multi-stage throttling is used in conjunction with multi-stage compression and with or without intercooling. The advantage of this arrangement is that, for a given swept volume, a greater refrigerating effect is obtained, since a larger enthalpy difference is obtained on the low pressure side. Multi-stage compression provides an even lower pressure rise per stage which gives even higher volumetric and total efficiencies. It is usual to employ more than one compressor or one compressor with more than one working compartment, this is, high pressure and low pressure cylinders in piston compressors or several wheels operating at different pressure levels in centrifugal compressors.

The present invention relates to a refrigeration system provided with multi-stage throttling and with a positive displacement compressor of the rotary type and is principally characterized by the fact that there is provided between the low pressure and high pressure ports in the compressor, one or several admission ports in the casing of the compressor, for the admission of intermediate pressure gas from liquid separators located between the throttling points. The gas formed during throttling is supplied through these admission ports to the working compartment of the compressor. The opening and closing of the admission ports is achieved by the compressor and in a screw compressor this is carried out by the rotor lobes. The ports are located in the wall of the working compartment to obtain the necessary intermediate pressure.

The intermediate pressure of the refrigeration system is determined by the mean pressure in that part of the working compartment in which the port is located.

Reference is to be had to the accompanying drawing wherein an illustrative embodiment of the invention is disclosed and in which

FIG. 1 shows the diagrammatic arrangement of a refrigeration system in accordance with the present invention and

FIG. 2 is a longitudinal sectional view through a screw compressor in which the improvements are embodied.

The compressor is designated at **1**. The gas compressed by the compressor is discharged through a pipe **2** to a condenser **3** from which the refrigerant liquid flows through pipe **4** and through a throttling device **5** to a liquid separator **6**. From the separator **6** the refrigerant liquid at intermediate pressure flows through another throttling device **8** to an evaporator **9** from which the gas is drawn back into the compressor.

The gas formed during throttling through the throttling device **5** is drawn through a pipe **10**, provided with a control valve **11**, to the compressor through one of several ports **12** in the wall of the compressor casing. As illustrated on the screw compressor in FIG. 2, the ports **12** consist of several small holes located along a spiral line which has the same pitch angle as the rotor lobes **16** and grooves between the same. This arrangement decreases the amount of leakage across the periphery of the rotor lobes from one working compartment which is at a higher pressure, to the succeeding compartment which is at a lower pressure. In addition, the positions at which the ports open and close are more readily defined.

The port **12** for the intermediate pressure gas is connected to a distribution chamber **13** integrally formed on the compressor casing.

Compared with a refrigeration system with single stage throttling, the advantage of a system made in accordance with the present invention is that for a given compressor size, the refrigerating effect increases roughly proportionately with the enthalpy difference. In addition, the specific power consumption of the compressor is improved since the power consumption due to the altered shape of the PV diagram after filling does not increase by the same amount as the enthalpy difference.

The port or ports **12** should preferably be located at a point where gas is supplied to the low pressure gas when the volume of the latter has decreased by 30% or more.

The low pressure port is designated at **14** and the high pressure port at **15**.

What is claimed is:

1. A refrigeration system with multi-stage throttling and with a positive displacement compressor of the rotary type, the compressor having a casing provided with high pressure and low pressure ports, said casing having at least one admission port, a liquid separator providing intermediate pressure gas to the compressor through the admission port in its casing, the liquid separator being located between throttling devices, the compressor being of the screw type and the admission port consisting of several holes disposed along a spiral line having the same pitch angle as lobes and grooves of a rotor of the compressor.

2. A refrigeration system according to claim **1**, wherein the admission ports in the casing for the gas of intermediate pressure, are connected to a collecting chamber provided on the casing and in communication with the liquid separator.

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