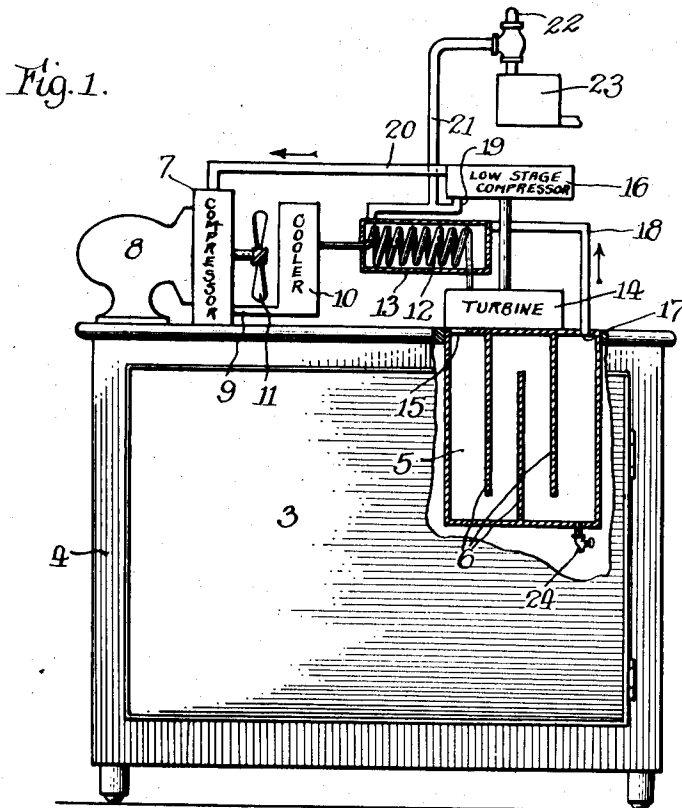
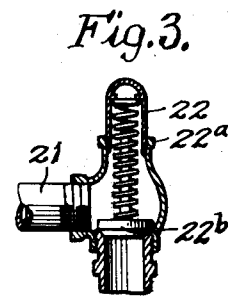
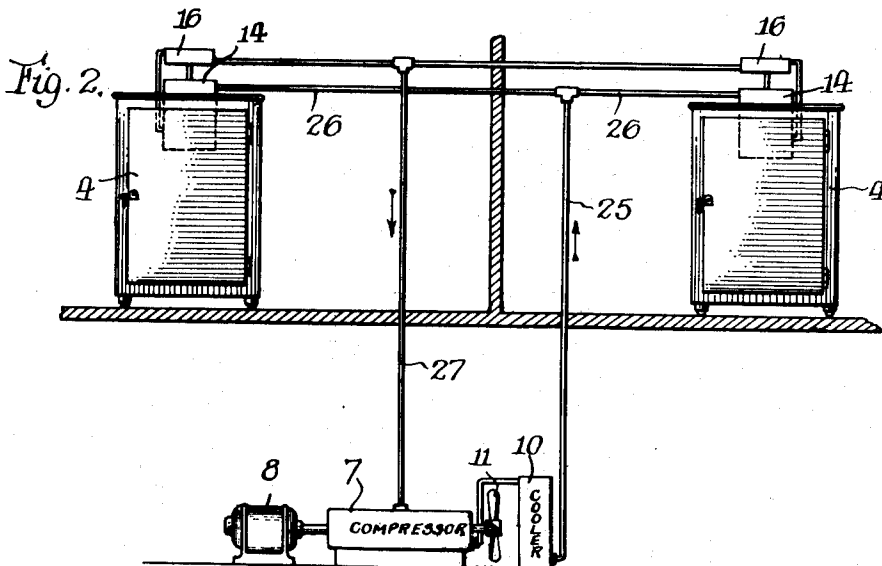


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REFRIGERATION SYSTEM
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REFRIGERATION SYSTEM

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4 Claims. (Cl. 62—98)

This invention relates to a refrigeration system of the compression type and more particularly to a system employing as the refrigerant air or other gas which does not liquefy at the temperatures existing within the system.

The general object of this invention is to provide a novel refrigerating system of the above general character which is particularly adapted for household use by reason of the safe and inexpensive character of the refrigerant employed, the simplicity and compactness of the operating parts required, and the efficient manner in which the compressed refrigerant is utilized.

In carrying out this object compression of the refrigerant is effected in two successive steps or stages by two interconnected but mechanically independent compressor units, one of which is driven from a primary or external source of power to place the refrigerant under high pressure, while the other or low-stage unit is driven by mechanical power derived by a machine in which the highly compressed refrigerant is expanded to effect final cooling thereof.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawing, in which:

Figure 1 is a diagrammatic view of a single-unit refrigerating system embodying the features of my invention.

Fig. 2 is a diagrammatic view of a multiple-unit refrigerating system in a form suitable for apartment buildings.

Fig. 3 is a sectional view of a valve employed in the present system.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawing and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

In the exemplary form shown in Fig. 1 of the drawing, the invention is embodied in a self-contained refrigerator unit for household use including a cooling compartment 3 defined by a cabinet 4 upon which the operating parts of the system may be compactly arranged in any preferred manner. Herein the air in the compartment 3 is exposed to and cooled by a coil or circulating passageway defined by a box-like structure 5 in which partitions 6 are arranged in stag-

gered relation to increase the length of the passageway.

In the present instance, the final compression of the air refrigerant is accomplished in a compressor 7 preferably of the rotary type so that it may be driven efficiently by an electric motor 8. From the outlet side of the compressor the air is led through a conduit 9 to a cooler 10 from which dissipation of the heat may be hastened by air circulation induced by a fan 11 driven from the motor 8. To further cool the compressed air, the outlet side of the cooler 10 communicates with a coiled conduit 12 surrounded by a casing 13 and forming therewith a heat exchanger.

Since the refrigerant thus compressed and cooled is still in the gaseous state, expansion thereof to effect final cooling may take place in an expansion engine capable of deriving mechanical power as an incident to such expansion. Preferably this machine is of the rotary type, such as a turbine 14, which may be designed to operate at a speed greatly in excess of the speed of the motor 8. Such a high speed turbine operates with optimum efficiency and is of minimum size. For this reason it may be mounted directly upon the cooling coil 5 whose inlet 15 communicates with the low pressure side of the turbine. The air is delivered to the turbine from the outlet end of the heat exchanger coil 12.

The rotary power thus rendered available is utilized in the present system to drive a compressor 16 and thereby assist in expansion of the spent refrigerant. For this purpose the air flowing from the outlet 17 of the cooling coil 5 is led through a conduit 18 and the casing 13 of the heat exchanger to the inlet 19 of the compressor 16.

Preferably the compressor 16 is also of the rotary type and designed to operate efficiently at the speed of the turbine 14. The air is only compressed to a relatively low temperature in the unit 16 whose outlet is connected by a conduit 20 to the suction side of the high-stage compressor 7, thereby completing the refrigerating cycle.

It will be observed that the compression of the air is effected in two successive stages by two machines which are mechanically distinct from each other. Because of this independence of operation, the two compressors and therefore their power driving means may operate at widely differing speeds. This enables an expansion engine to be selected for driving the low-stage compressor, which engine is of most efficient design and compact in structural arrangement inasmuch as there are no fixed limitations upon its oper-

ating speed. Similarly, the most efficient power driving means may be employed for operating the high-stage compressor 7.

In order to replenish the normal leakage in the system above described, means may be provided to allow for the ingress of air when the pressure on the suction side of the cycle is reduced below a predetermined point. This means may comprise a conduit 21 communicating with the inlet 19 of the compressor 16 and with the atmosphere through a spring closed poppet valve 22 and a chamber 23 containing a dehydrating chemical. The spring 22^a of the poppet valve maintains the valve member 22^b seated until the pressure in the conduit 21 is reduced to a predetermined value whereupon the valve opens automatically to permit air to be drawn into the system through the drying chamber. The moisture accumulating in the system and collecting in the cooling coil 5 may be drawn off through a valve 24.

The present invention is particularly adapted for embodiment in multiple-unit refrigeration systems such as are commonly employed in apartment buildings where the primary compressor is common to all of the units. Such a system is shown in Fig. 2, the reference numerals for the principal parts corresponding to those shown in Fig. 1. In this system the compressed refrigerant is conducted to the different apartment units through a common feed pipe 25 and branch pipes 26. A low-stage compressor driven by a turbine constitutes the refrigerating unit in each room. From such unit the partially compressed air is returned through a common conduit 27 to the suction side of the high-stage compressor.

I claim as my invention:

1. In a refrigerating system of the class described, the combination of two mechanically independent compression machines communicating with each other, primary power means for operating one of said machines, and a rotary machine operable to expand the refrigerant delivered by said last mentioned compression ma-

chine and to derive power which is applied to drive said other compression machine at a speed different than the speed of said power means.

2. In a refrigeration system of the class described, the combination of a high-stage compressor, a motor for driving said compressor, means providing a circulating passageway within the compartment to be cooled by the system, a turbine receiving refrigerant in gaseous form from said high-stage compressor and adapted to expand the refrigerant into said passageway and to derive rotary power through such expansion, and a low-stage compressor driven by said turbine and arranged to exhaust the spent refrigerant from said passageway and to deliver the refrigerant after partial compression thereof to said high-stage compressor.

3. In a refrigeration system utilizing air as the refrigerant, the combination of a high-stage compressor, a heat exchanger receiving the air from said compressor, a rotary expansion engine receiving the air from said heat exchanger to derive power from the expansion of the compressed air, said expanded air being discharged into a circulating passageway, and a low-stage compressor driven by said expansion engine returning the air from the passageway directly to said high-stage compressor, said air being withdrawn from the passageway through said heat exchanger thereby constituting the cooling medium thereof.

4. A refrigeration system for apartments or the like comprising, in combination, a common high-stage air compressor, individual refrigerators having an air circulating passageway located in the various apartments, a rotary expansion engine mounted on the individual refrigerators receiving the air from said compressor and discharging the expanded air into said passageway, and a low-stage compressor driven by said expansion engine drawing the air from said passageway and returning it directly to said common compressor.

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