

Aug. 13, 1957

J. GRAY
HEAT PUMPS

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2 Sheets-Sheet 1

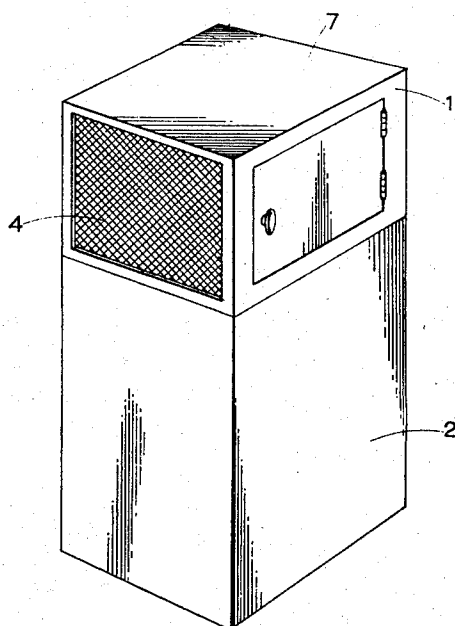


FIG. 1.

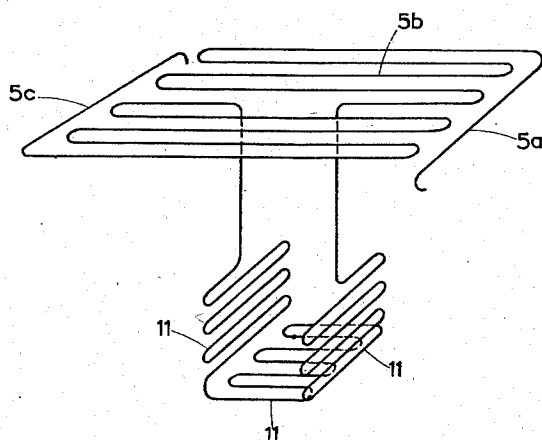


FIG. 4.

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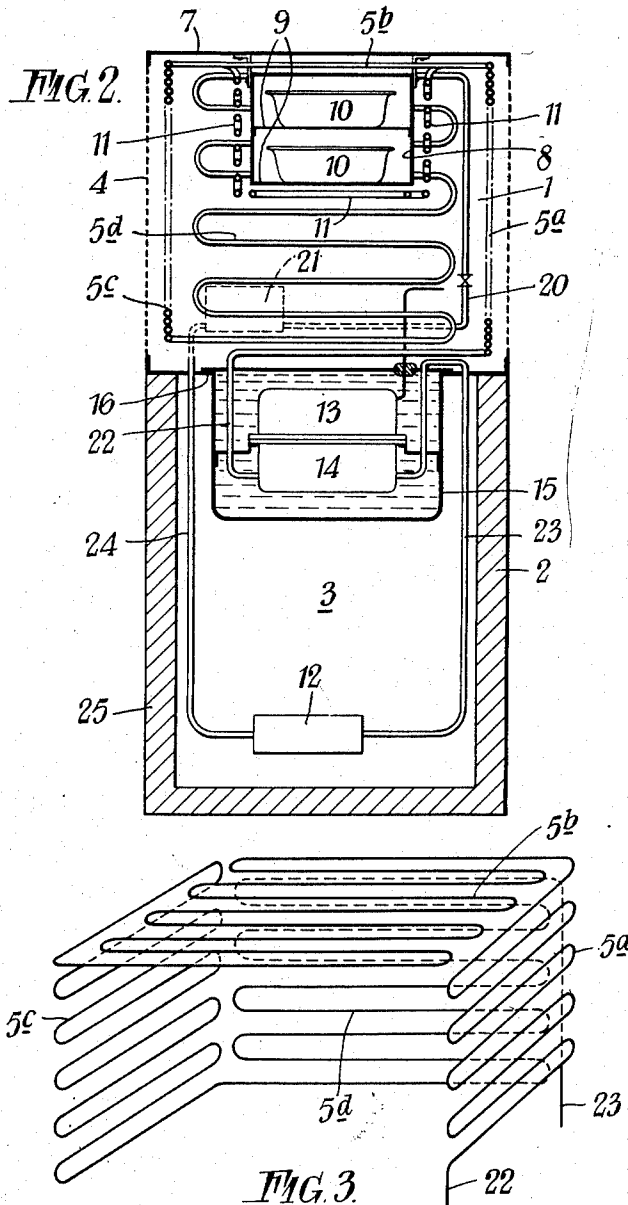
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HEAT PUMPS

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3 Claims. (Cl. 62—116)

This invention relates to heat pumps, that is to say, apparatus for utilising the heat extracted from the atmosphere by a refrigerating system, and of the type in which the condenser of the system is disposed within the storage tank of a hot water heating system.

The main object of the invention is not only to utilise the heat extracted from the atmosphere to heat the water in the hot water system, but also to utilise for this purpose the heat produced by the motor and the compressor of the refrigerating system.

To this end the motor and compressor are mounted in an oil-filled casing which is made of metal or other good thermal conductor, and said casing is disposed in the hot water tank, the electrical leads to the motor being brought out of the casing without passing through the water tank.

It is a further object of the invention to provide a refrigerator cooled by the evaporator of the refrigerating system in which at least the side walls are constituted by evaporator pipes protected by external grilles which permit free access of atmospheric air to said evaporator pipes.

In order that the invention may be more completely understood one embodiment thereof will now be described with reference to the accompanying drawings in which—

Figure 1 shows the apparatus externally in perspective,

Figure 2 shows the apparatus in vertical section,

Figure 3 shows the general arrangement of the evaporator pipes diagrammatically in perspective, and

Figure 4 shows also diagrammatically in perspective, one way in which evaporator pipes for refrigerating ice trays may be incorporated in the general evaporator pipe system.

In the embodiment illustrated in the drawings the apparatus comprises a sheet metal cabinet having an upper part 1 forming a refrigerator chamber and a lower part 2 containing a hot water tank 3.

The sides 4 of the upper part 1 of the cabinet are perforated for example they may be grilles, or of lattice form sheet metal, as indicated diagrammatically in Figures 1 and 2.

The evaporator coils of the refrigerating system extend up both sides of the refrigerator chamber 1, across the back thereof and also under the roof of said chamber. The arrangement of these evaporator coils may be as shown diagrammatically in Figure 3, in which the coils at the sides are indicated at 5a and 5c respectively while those which extend under the roof of the chamber are indicated at 5b and the coils at the back are indicated at 5d.

Preferably, the individual turns of the evaporator coils, at least those of the side coils 5a and 5c are in contact with one another so that the coils 5a and 5c literally form side walls for the refrigerator chamber 1, and are thus directly exposed to the atmosphere, the grilles 4 serving merely as a protection.

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Depending from the roof 7 of the chamber 1 is a frame 8 carrying shelves 9 for ice trays 10 of conventional form, and these ice trays are provided with their own evaporator coils 11. The latter may be in series with the roof coil 5b as shown diagrammatically in Figure 4.

The condenser 12 of the refrigerating system is located within the hot water tank 3 so that the heat given off during the condensation of the refrigerant is utilised to heat the water in the tank 3.

According to a main feature of the invention the heat produced by the electric motor which drives the compressor, as well as the heat produced by the adiabatic compression of the refrigerant, is also used to heat the water in tank 3.

To this end, the motor 13 and compressor 14 are mounted within a casing 15 containing oil, and said casing 15 is immersed in the water in the tank 3, the casing being made of metal so that it conducts heat from the oil to the water.

The casing 15 passes through a hole in the bottom of the refrigerator chamber 1 and the top of the casing is provided with a peripheral flange (Figure 2) whereby it is attached to the bottom of chamber 1, the joint being sealed by means of a sealing ring 16.

The compressor 14 and its motor 13 may be mounted in the casing 15 by any convenient means, for example by brackets 17.

The electrical leads 18 to the motor 13 pass out of the top of the casing 15 through a sealing bush 19 and thence to a supply terminal (not shown).

In operation the gaseous refrigerant from the compressor 14 passes through pipe 23 to the condenser 12, where it gives up its heat to the water in tank 3, and then flows via pipe 24 to the liquid receiver 21 from which it passes through pipe 20 (containing a pressure reducing device) and through the evaporator coils 5a, 5b, 5c, 5d, and 11 in which it becomes vaporised and cools the chamber 1. The refrigerant gas or vapour is then returned to the compressor 14 through pipe 22.

The oil in the casing 15 should be of a type which readily transmits heat. An oil of the kind used for cooling electrical transformers is very suitable.

By thus immersing the motor and compressor in the casing 15 which is itself immersed in the water in the tank 3 the heat produced in the motor and compressor can be transferred to the water, while avoiding the difficulty and expense which would arise in maintaining the motor and its leads 18 watertight if the motor is directly immersed in the water.

A further advantage of the invention is the arrangement of the evaporator coils 5a and 5c with their individual turns close together so that said coils form sides to the refrigerator chamber 1 and are exposed directly to the outside atmosphere, whereby the maximum quantity of heat can be extracted from the atmosphere and is available for heating the water in tank 3.

The tank 3 is provided with heat insulation 25 and similar insulation (not shown) is provided between the tank 3 and the refrigerator chamber 1.

Although oil is given as the fluid in which the motor and compressor are immersed it will be understood that there are available other hydraulic fluids which can be used as a substitute for oil without harmful effects on the motor and compressor and also having a good thermal conductivity characteristic, and oil or such hydraulic fluids are contemplated under the term hydraulic fluid in the following claims.

I claim:

1. In a heat pump a refrigerator chamber, a hot water container upon which the refrigerator chamber is located, a condenser for the refrigerant within the hot water con-

tainer, a casing disposed within the hot water container, a motor, a compressor driven by the motor, both said motor and compressor being disposed in said casing, the walls of said casing being of good thermal conducting material and the casing being charged with hydraulic fluid so that the motor and compressor are immersed in the hydraulic fluid, electrical leads for the motor insulated from the water container, and evaporator piping within the refrigerator chamber and arranged for part of its length as contiguous tubes to form part of the wall of the refrigerator chamber and including as a closed refrigerating circuit the compressor and condenser.

2. In a heat pump a refrigerator chamber, a hot water container upon which the refrigerator chamber is located, a condenser for the refrigerant located in the hot water container, a casing disposed within the hot water container, a motor, a compressor driven by the motor, both said motor and compressor being disposed in said casing, the walls of said casing being of good thermal conducting material and the casing being charged with hydraulic fluid so that the motor and compressor are immersed in the hydraulic fluid, a wall part common to said hot water container and casing, electrical leads for the motor passing from said casing through said common wall part whereby they are insulated from the water container, conduiting passing from the compressor through the hot water container to said condenser, thence of a receiver for the refrigerant, and to evaporator pipes arranged along the rear and sides of the refrigerator chamber and including a plurality of series connected lengths arranged very closely together to form at least one wall of the refrigerator chamber and from the refrigerator chamber

back to the compressor, and grilles disposed externally of and close to said latter mentioned lengths of the evaporator pipes to afford access of atmospheric air to the evaporator pipes.

3. In a heat pump; a refrigerator chamber; a hot water container upon which the refrigerator chamber is located; a container for the refrigerant isolated from the hot water container; a casing disposed within the hot water container; a motor; a compressor driven by the motor, both said motor and compressor being disposed in said casing, the walls of said casing being of good thermal conducting material and the casing being charged with a hydraulic fluid so that the motor and compressor are immersed in the hydraulic fluid; a wall part common to said hot water container and said casing; electrical leads for the motor passing directly through said common wall part, whereby they do not pass through the water container; conduiting passing from the compressor through the hot water container to said refrigerant container, thence to evaporator pipes in the refrigerator chamber and from the refrigerator chamber back to the compressor, such evaporator pipes being arranged in a plurality of series connected lengths with adjacent lengths in contact to define at least two side walls of the refrigerator chamber; and grilles protecting externally such refrigerator chamber side walls.

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