Aug. 5, 1947. C. R. PAPAY 2,425,119

COOLING UNIT

Filed March 24, 1944 2 Sheets-Sheet 1

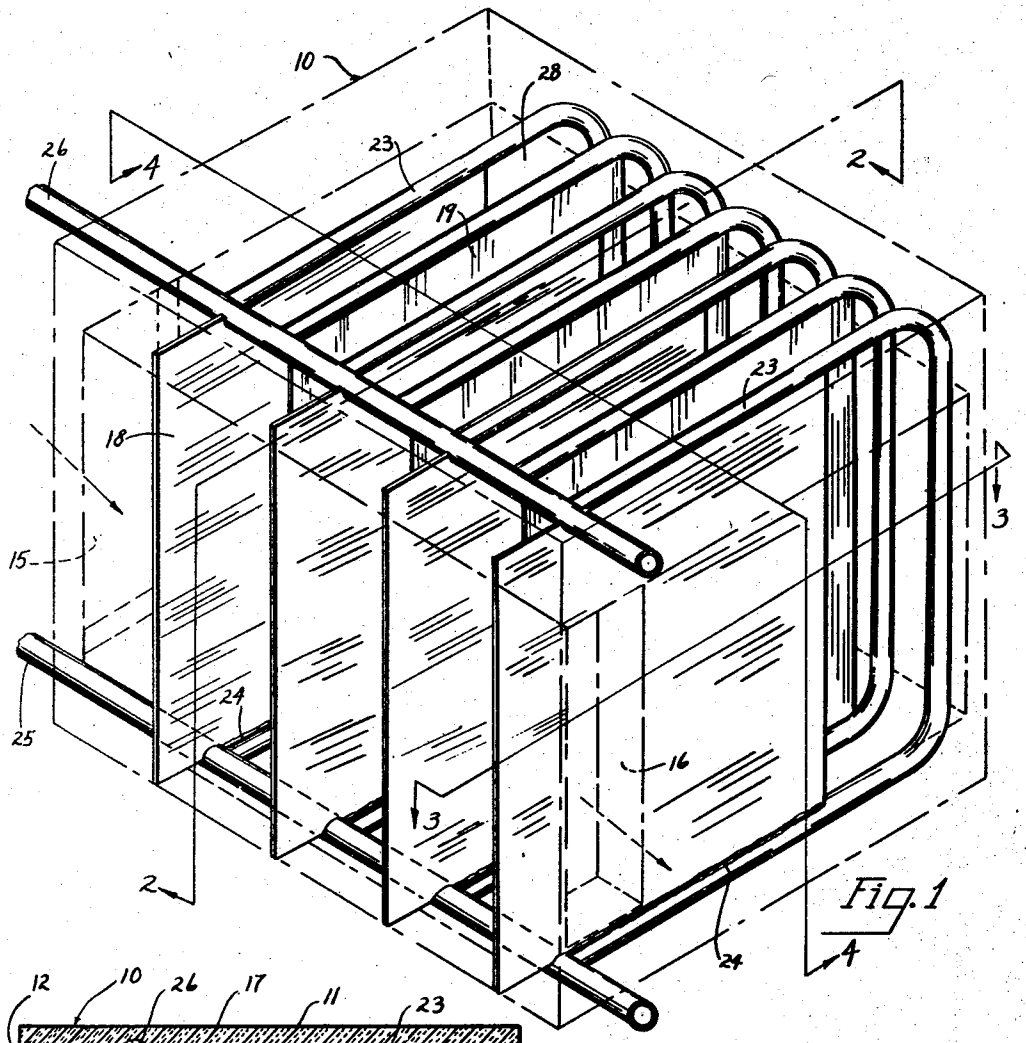

Fig. 1

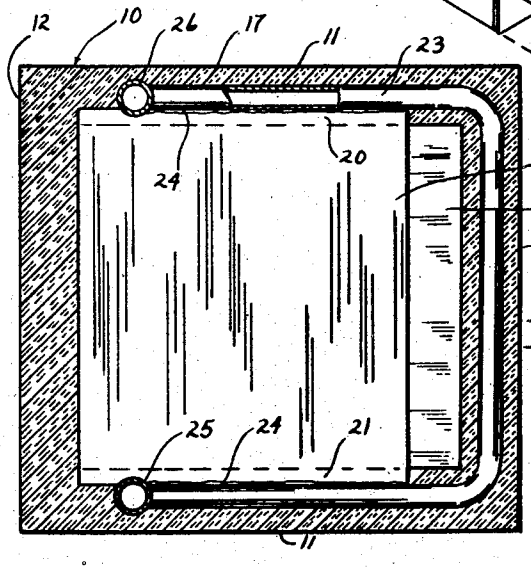

Fig. 2

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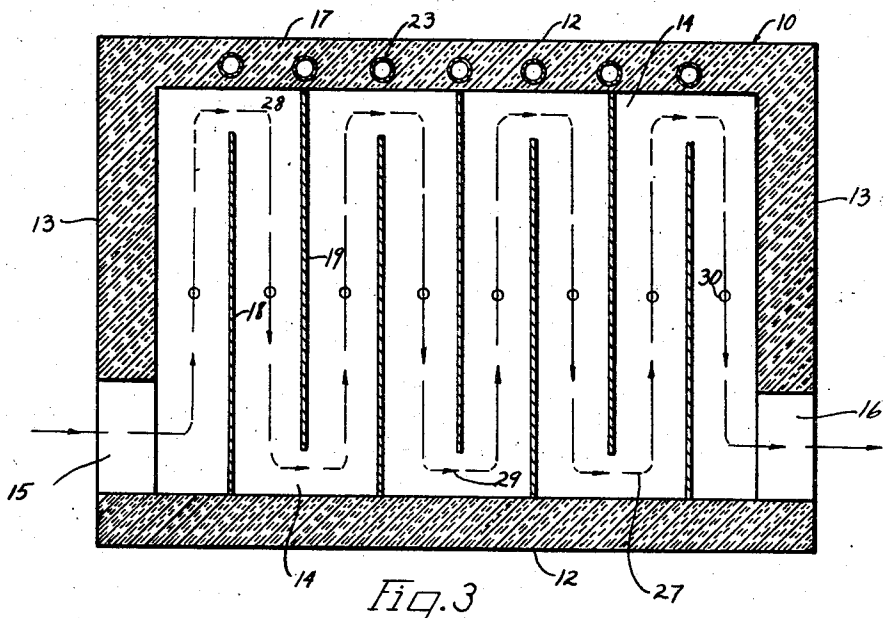

Fig. 3

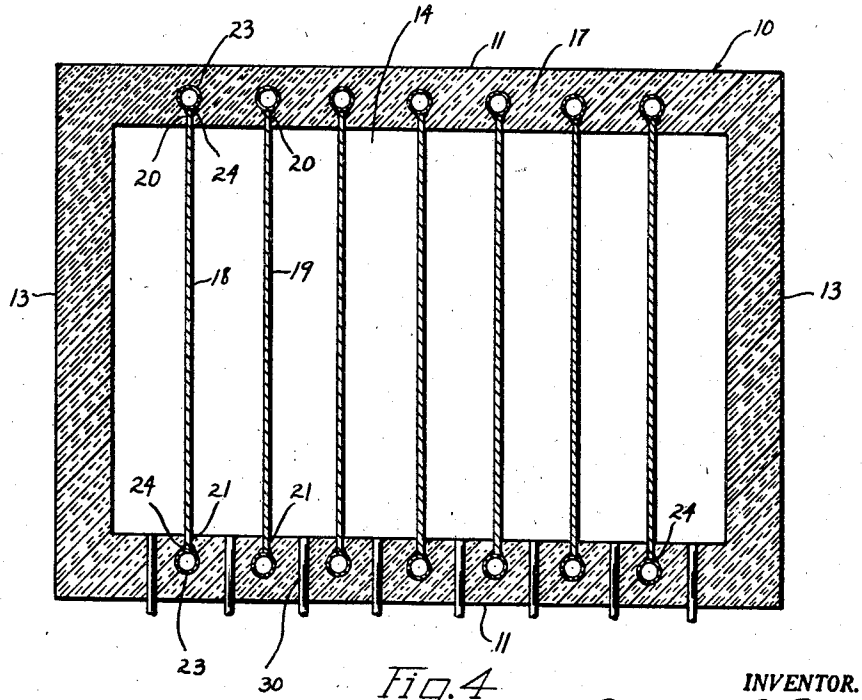

Fig. 4

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COOLING UNIT

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5 Claims. (Cl. 257—233)

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This invention relates to thermal-exchange apparatus and, as one of its objects, aims to provide a novel form of heat-exchange unit which is very compact and efficient and is well suited for use in air conditioning apparatus and the like.

Another object of this invention is to provide a novel form of cooling and dehumidifying unit embodying a group of heat-conducting plates which afford an extensive contact area for the air or other medium being conditioned, and wherein the conditioning is carried out substantially without the formation of frost.

A further object of the present invention is to provide a novel cooling and dehumidifying unit, of the character mentioned, in which the plates are exposed in a chamber having walls containing thermal-insulating material and which plates have edge portions thereof joined to fluid conducting pipes embedded in such insulating material.

Still another object of this invention is to provide a novel heat-exchange unit, of the character referred to, wherein the heat-conducting plates are disposed so as to cause a circuitous flow of the air through the conditioning chamber.

Other objects and advantages of the invention will be apparent from the following description when taken in conjunction with the accompanying sheets of drawings, in which

Fig. 1 is a perspective view showing a thermal-exchange unit constructed according to the present invention, the housing of the unit being shown in construction lines only;

Fig. 2 is a transverse sectional view taken through the unit as indicated by line 2—2 of Fig. 1 and with the housing shown in full lines;

Fig. 3 is a sectional plan view taken on line 3—3 of Fig. 1; and

Fig. 4 is a longitudinal sectional view taken through the unit on line 4—4 of Fig. 1.

As above indicated in a general way, my thermal-exchange unit 10 embodies a novel construction which can be used for various purposes and in various heat-exchange systems and apparatus, but which is especially suitable for use as a cooling unit in refrigerating or air conditioning apparatus. For that reason the unit 10 is hereinafter described as a cooling unit but it will be understood, of course, that this is done without intention of limiting the invention to such use.

As will become more apparent hereinafter, the unit 10 provides a cooling surface of relatively large area for contact with the air to be cooled and dehumidified. This is an important feature

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and advantage because the desired conditioning of the air can be obtained without using the relatively lower temperatures which would be required for conditioning the same volume of air with a smaller cooling area. Moreover, the conditioning of the air by the use of a large cooling area and a more moderate temperature has the advantage that the conditioning is accomplished substantially without formation of frost on the cooling surfaces. This is very desirable because frost adhering to cooling surfaces acts as an insulating medium which retards the transfer of heat and decreases the efficiency of the cooling surfaces and apparatus.

As shown in the drawings, the cooling unit 10 comprises a housing having top and bottom walls 11, side walls 12 and end walls 13, such walls defining a cooling chamber 14. Certain of the walls of the housing, in this instance the end walls 13, have inlet and delivery openings 15 and 16 for the air or other medium being conditioned. The walls of the housing contain a thermal-insulating material 17 which may be any substance suitable for this purpose and which will prevent the transfer of heat through such walls.

The cooling surface is provided by a group of plates 18 and 19 which are preferably of polygonal form, such as the quadrangular shape shown in the drawings, and which extend transversely of the cooling chamber 14 and are disposed in spaced substantially parallel relation to each other. Edge portions of the plates, in this instance the top and bottom edges 20 and 21, are connected therealong with pipes 23 which carry a thermal-exchange fluid or refrigerant, such as brine or the like. The edge portions 20 and 21 are in direct metallic contact with the pipes 23 and are joined to the latter as by means of silver solder 24 or other suitable medium affording a connection of good thermal-conductivity between the plates and pipes.

As shown in the drawings, the pipes 23 are completely embedded in the insulating material 17 contained in the walls of the chamber 14. The edge portions of the plates 18 and 19 which are connected with the pipes 23 extend partway into this insulating material but the major portion of the surface area of the plates remains exposed in the cooling chamber 14. The embedding of the pipes 23 in the insulating material 17 shields the same from contact with the air being conditioned and thus prevents the formation of frost on these pipes. Since the pipes 23 carry the thermal-exchange fluid, they are usually at a lower temperature than the cooling

plates 18 and 19 and would become coated with frost if they were not shielded from contact with the air by means of the insulating material in which they are embedded.

The pipes 23 are here shown as substantially U-shaped branch pipes or coils which are embedded in, and extend around, three sides of the cooling chamber 14. These pipes are spaced longitudinally of the cooling chamber in substantially parallel relation to each other and are located to correspond with the spaced plates 18 and 19. The ends of the U-shaped pipes 23 are connected with supply and return pipes 25 and 26 which are embedded in one pair of walls of the chamber 14, in this instance in the top and bottom walls 11, and through which a circulation of the thermal-exchange fluid or brine can be maintained.

The cooling plates 18 and 19 may be constructed of any suitable material having a relatively high thermal-conductivity and, for example, may be made of copper. As shown in the drawings, certain of the plates are disposed in a staggered or offset relation, so as to provide a circuitous path for the air being conditioned, such path being indicated in Fig. 3 by the broken line of arrows 27. In obtaining this circuitous path, the plates 18 terminate short of one of the side walls of the cooling chamber so as to leave air passages 28 therebetween and the alternate plates 19 terminate short of the opposite side wall of the chamber to provide the passages 29 therebetween.

During the cooling and dehumidifying operation carried out with the unit 10 heat is absorbed from the air by the plates 18 and 19 which are in direct contact with such air and the high thermal-conductivity of these plates causes such heat to be readily conducted to the pipes 23 and carried away by the thermal-exchange fluid being circulated through the latter. The cooling of the air causes moisture to be deposited therefrom onto the plates 18 and 19 and such moisture runs down on the plates and collects in the bottom of the cooling chamber 14 from which it is removed through suitable drain pipes or openings 30.

From the foregoing description and the accompanying drawings it will now be readily understood that I have provided a novel form of thermal-exchange unit which is well suited for use in refrigerating and air conditioning apparatus, and wherein the cooling or conditioning can be carried out in an efficient manner and substantially without the formation of frost on the cooling surfaces.

While I have illustrated and described my novel thermal-exchange unit in more or less detail, it will be understood, of course, that I do not wish to be correspondingly limited but regard my invention as including all changes and modifications coming within the spirit of the invention and the scope of the appended claims.

Having thus described my invention, I claim:

1. A cooling unit of the character described comprising, a chamber having walls containing thermal insulating material, said walls having openings for the passage of air through said chamber, refrigerant conducting pipes extending along said walls and embedded in said insulating material, and metal plates having their edges joined to said pipes and extending into and part way across said chamber for contact with said air, said plates extending transversely to the general direction of flow of the air and certain of said plates being offset with respect to others so as to cause said air to follow a circuitous path.

2. A cooling unit comprising, a housing having walls containing thermal insulating material and defining a cooling chamber, said walls having openings for the passage of air through said chamber, refrigerant-conducting pipes embedded in said insulating material including a plurality of spaced substantially parallel pipes extending at least part way around said chamber, and a group of substantially parallel metal plates having edge portions thereof joined to said spaced pipes and extending into and part way across said chamber for contact with said air, said plates extending transversely to the general direction of flow of the air and alternate plates of said group being offset with respect to the remaining plates so as to cause said air to follow a circuitous path.

3. A cooling unit comprising, a housing having pairs of opposed walls containing thermal insulating material and defining a cooling chamber, certain of said walls having openings for the passage of air into and out of said chamber, refrigerant-conducting pipes extending along one pair of said opposed walls and embedded in the insulating material thereof, and a group of substantially parallel thermally conducting metal plates extending entirely across said chamber between said one pair of opposed walls and having one pair of their opposed edges joined directly to said pipes and other edge portions of said plates being spaced from other walls of said chamber so as to permit a flow of said air through the chamber in contact with said plates, alternate plates of said group being offset with respect to the remaining plates so as to cause said air to follow a circuitous path.

4. A cooling unit comprising, a housing having pairs of opposed walls containing thermal insulating material and defining a cooling chamber, certain of said walls having openings for the passage of air into and out of said chamber, refrigerant-conducting pipes embedded in said insulating material and including a pair of supply and return pipes and a plurality of substantially parallel branch pipes having their ends connected with said supply and return pipes at points spaced along the latter, said branch pipes extending in continuous relation along and being embedded in a pair of opposed side walls and a side wall connecting said opposed walls, and thermally conducting metal plates extending entirely across said chamber between said one pair of opposed walls and having one pair of their opposed edges joined directly to said branch pipes and other edge portions of said plates being spaced from other walls of said chamber so as to permit a flow of said air through the chamber in contact with said plates.

5. A cooling unit comprising, a housing having pairs of opposed walls containing thermal insulating material and defining a cooling chamber, certain of said walls having openings for the passage of air into and out of said chamber, refrigerant-conducting pipes embedded in said insulating material and including a pair of supply and return pipes and a plurality of substantially parallel branch pipes having their ends connected with said supply and return pipes at points spaced along the latter, said branch pipes extending in continuous relation along and being embedded in a pair of opposed side walls and a side wall connecting said opposed walls, and a group of substantially parallel thermally conducting metal plates extending entirely across

said chamber between said one pair of opposed walls and having one pair of their opposed edges joined directly to said branch pipes and other edge portions of said plates being spaced from other walls of said chamber so as to permit a flow of said air through the chamber in contact with said plates, alternate plates of said group being offset with respect to the remaining plates so as to cause said air to follow a circuitous path.

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