Jan. 13, 1953 H. A. NASON 2,625,378

HEAT TRANSFER ASSEMBLY

Filed March 25, 1950

Fig. 1.

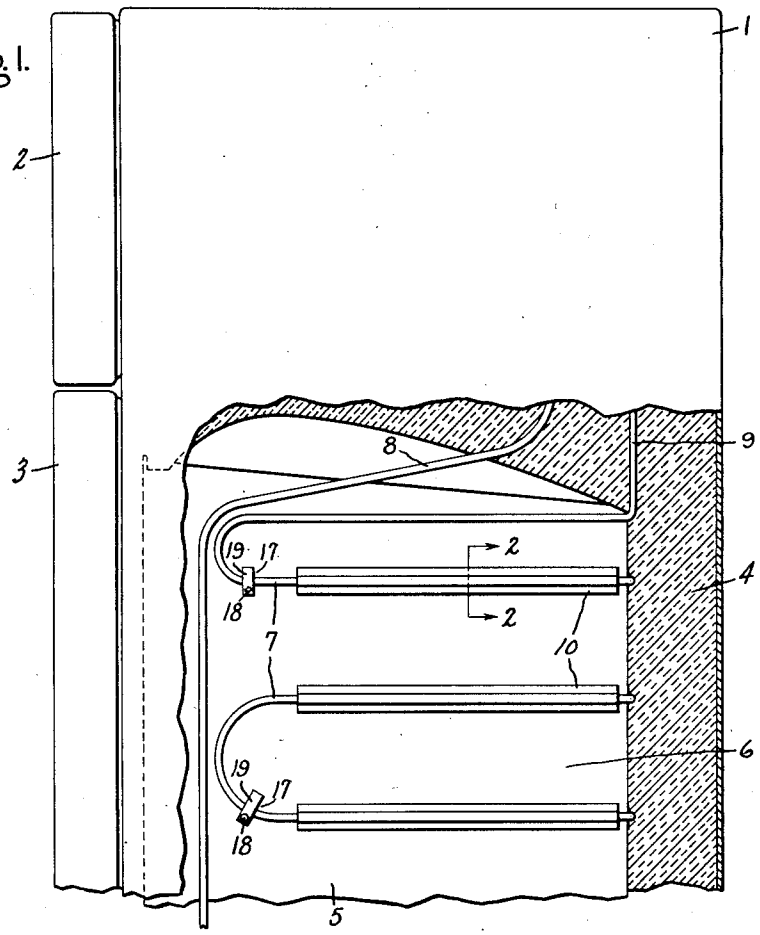


Fig. 3.

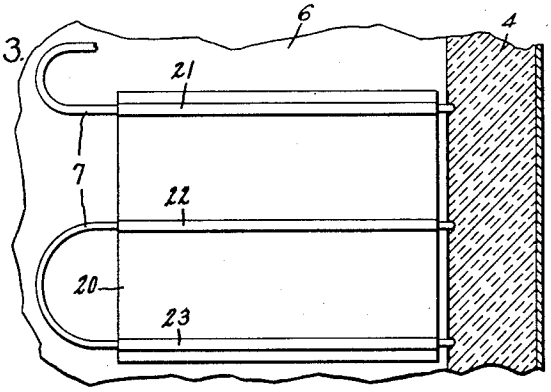
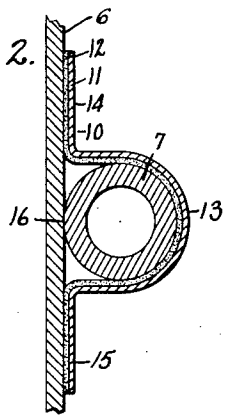


Fig. 2.



Inventor:
Harold A. Nason,
by William B. Eaton, Jr.
His Attorney.

Patented Jan. 13, 1953

2,625,378

UNITED STATES PATENT OFFICE

2,625,378

HEAT TRANSFER ASSEMBLY

Harold A. Nason, Erie, Pa., assignor to General Electric Company, a corporation of New York

Application March 25, 1950, Serial No. 151,949

4 Claims. (Cl. 257—256)

1

My invention relates to heat exchangers, and more particularly to arrangements for removably mounting a conduit in heat exchange relationship with a surface whose temperature is to be affected thereby.

It is sometimes desirable that a conduit be mounted on a surface in heat exchange relationship in such a manner that the conduit may be easily removed when necessary. The provision for removably mounting the conduit introduces the problem of making it difficult to secure a satisfactory heat exchange relationship. It is an object of this invention to provide an improved arrangement for mounting a conduit on a surface whose temperature is to be affected, which arrangement provides both for easy assembly and disassembly and also maintains the conduit and the surface in intimate heat exchange relationship.

It is another object of this invention to provide a plurality of paths for heat flow between a heat transfer conduit and the heat conducting surface on which it is mounted in order to increase the rate of heat transfer.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

In carrying out the objects of my invention a heat transfer assembly is provided which includes a plate or surface whose temperature is to be affected, a conduit adapted to convey heat transfer fluid for affecting the temperature of the surface, and a strip of flexible heat-conducting material having an adhesive coating for maintaining the conduit in intimate heat exchange contact with the surface.

For a better understanding of my invention reference may be had to the accompanying drawing in which Fig. 1 is a view of a portion of a refrigerator cabinet, partially broken away, showing the arrangement for mounting the conduit; Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1; and Fig. 3 shows a modified form of my invention.

By way of illustration I have shown in the drawing specific embodiments of my invention applied to a household refrigerator. In order to cool a food storage compartment of such a refrigerator, the expedient is sometimes used of providing an evaporator in the form of a refrigerant-conducting conduit and of mounting the conduit on the outside of a wall forming the compartment. Referring to Figs. 1 and 2 there is shown a refrigerator cabinet 1, which is provided with a door 2 for a freezing compartment (not shown) and a door 3 for a cooling compartment. Suitable insulation 4 is provided for the refrigerator cabinet. Within the cabinet there is shown a portion of a food storage compartment 5 for the storage of food.

2

The food storage compartment is formed by a metal wall or surface 6. This wall 6 is cooled, and the compartment 5 is thereby refrigerated, by an evaporator which is mounted on the outside of the wall. In the embodiment shown in this figure, an evaporator in the form of several turns of conduit or tubing 7 is provided, and the tubing is maintained in heat exchange relationship with the metal wall 6 along the back and two sides of the food storage compartment. Liquid refrigerant is supplied to the evaporator tubing 7 through a conduit 8, and the vaporized refrigerant is withdrawn from the evaporator through a conduit 9. The conduits 8 and 9 may be connected to any suitable refrigerant condensing apparatus (not shown).

In order to maintain the conduit 7 in intimate heat exchange relationship with the wall 6 a plurality of flexible strips 10 are provided as shown in detail in Fig. 2. Each of these flexible strips includes a layer 11 of a material of high thermal conductivity, for example, aluminum or copper foil, and a second layer 12 which is composed of a suitable adhesive material. By way of example, this adhesive material may be silicone rubber, such as that disclosed in copending applications of Robert Smith-Johannsen, Serial Nos. 77,044 and 77,045, filed February 17, 1949, now Patents 2,601,336 and 2,601,337, both granted June 24, 1952, and assigned to the same assignee as the present invention, although any other adhesive material having suitable adhering properties may be employed. The adhesive layer 12 is bonded to the flexible heat-conducting layer 11 of the strip 10. After the conduit 7 has been assembled generally adjacent the wall 6 each length of conduit is easily secured in position in heat exchange contact with the wall 6 by applying a strip 10 thereto. The central portion 13 of the strip 10 adheres tightly to the conduit 7, partially enveloping this conduit, as shown in Fig. 2. Parallel side portions 14 and 15 of the flexible strip are pressed into engagement with the wall 6 along each side of the conduit 7, these portions being held firmly against the wall 6 by the adhesive layer 12.

The construction shown provides a heat trans-

fer path between the conduit 7 and the wall 6 not only through the direct engagement of the conduit and the wall at the area 16 but also through paths extending through substantially one-half the outer surface of the conduit 7. These additional heat paths extend from the wall 6 through the layer 11 of heat-conducting material and increase the rate of heat transfer between the wall and the conduit. The adhesive layer 12 is made of the minimum thickness of adhesive consistent with the necessary adhering requirements and consistent with the requirement for possible re-use, so as to minimize interference with the heat path through the heat-conducting layer 11. The heat-conducting layer 11 is made thin enough to secure the necessary flexibility. The heat-conducting layer may be made of any desired thickness consistent with the requirement for flexibility, the thicker this layer, of course, the greater the amount of heat transfer therethrough. By way of example, I have found that the thickness of the adhesive layer should not exceed .004 inch and, for best results, this layer should be about .002 inch. I have found thickness of heat-conducting layer ranging from .0015 inch to .003 inch to be satisfactory.

Should it become necessary to replace the refrigerating system including the conduit 7, this replacement is readily accomplished with the heat transfer assembly of my invention. Thus the conduit 7 is easily removed by merely peeling off the flexible strips 10. After the replacement conduit has been positioned it may be firmly maintained in heat exchange relationship with the wall by merely replacing the strips 10 since the adhesive layer is satisfactory for at least this small amount of re-use. The assembly of the replacement conduit is easily accomplished in the field. If desired, one or more clips 17 may be employed in addition to the strips 10 for resisting movement of the conduit relative to the wall by strong forces which might accidentally be applied. Each of these clips 17 may include merely a portion 18 welded or otherwise secured to the wall 6 and a portion 19 extending over the conduit 7. The portions 19 may readily be bent outwardly to permit removal of one conduit 7 and the replacement with another conduit, the clips then being bent back into position to assist in holding the conduit 7 in position.

In lieu of employing individual flexible strips 10 for holding the conduit 7 in heat exchange relationship with the liner 6 an arrangement such as that illustrated in Fig. 3 may be used. In the modification shown in Fig. 3 a single sheet 20, formed of a heat-conducting layer and an adhesive layer, bonded together as in the form shown in Figs. 1 and 2, extends along one side of the liner 6 and engages a plurality of generally parallel sections 21, 22 and 23 of the conduit 7. The portions of the sheet 20 intermediate the sections 21, 22 and 23 and the portions extending beyond the sections 21 and 23 are adhesively held to the liner 6 in the same manner as the flexible strips 10. Thus, in the form shown in Fig. 3, several parallel sections of tubing along one side of the liner are secured to the liner by the flexible sheet 20 applied to all of the parallel sections of tubing instead of applying individual flexible strips 10 to the individual parallel sections. Sheets similar to the flexible sheet 20 are employed along the back of the liner and along the opposite side for holding the tubing to the liner in these areas.

While I have shown and described specific embodiments of my invention as applied to refrigerating conduits for a household refrigerator, other heat transfer applications will readily occur to those skilled in the art and I intend, therefore, by the appended claims, to cover all modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a heat transfer apparatus, a heat transfer surface, a length of conduit for conducting heat transfer fluid to affect the temperature of said surface, and means for readily removably maintaining said conduit in intimate heat exchange relationship with said surface, said means comprising only a flexible strip overlying said conduit and engaging said conduit and said surface, said strip including a layer of flexible heat-conducting material and a layer of permanently tacky adhesive material bonded to one surface of said first-mentioned layer, said adhesive layer engaging said conduit and said heat transfer surface for holding said conduit firmly and removably in engagement with said heat transfer surface, said first-mentioned layer providing a heat transfer path between said conduit and said heat transfer surface.

2. In a heat transfer apparatus, a heat transfer surface, a length of conduit for conducting heat transfer fluid to affect the temperature of said surface, and means for readily removably maintaining said conduit in intimate heat exchange relationship with said surface, said means comprising only a flexible strip overlying said conduit and engaging said conduit and said surface, said strip including a layer of flexible metallic material and a layer of permanently tacky adhesive material bonded to one surface of said first-mentioned layer, said adhesive layer engaging said conduit and said heat transfer surface for holding said conduit firmly and removably in engagement with said heat transfer surface, said first-mentioned layer providing a heat transfer path between said conduit and said heat transfer surface.

3. In a heat transfer apparatus, a heat transfer surface, a length of conduit for conducting heat transfer fluid to affect the temperature of said surface, and means for readily removably maintaining said conduit in intimate heat exchange relationship with said surface, said means comprising only a flexible strip overlying said conduit and engaging said conduit and said surface, said strip including a central portion engaging and partially enveloping said conduit and two parallel side portions each engaging said surface, said strip further including a layer of flexible heat-conducting material and a layer of permanently tacky adhesive material bonded to one surface of said first-mentioned layer, said adhesive layer engaging said conduit and said heat transfer surface for holding said conduit firmly and removably in engagement with said heat transfer surface, said first-mentioned layer providing a heat transfer path between said conduit and said heat transfer surface.

4. In a heat transfer apparatus, a heat transfer surface, a continuous conduit for conducting heat transfer of fluid to affect the temperature of said surface, said conduit being arranged in serpentine fashion and including a plurality of generally parallel sections and means for readily removably maintaining said conduit in intimate heat exchange relationship with said surface.

said means comprising only a flexible sheet overlying said sections of said conduit and engaging said conduit and said surface, said sheet including a layer of flexible heat-conducting material and a layer of permanently tacky adhesive material bonded to one surface of said first-mentioned layer, said adhesive layer engaging said sections of said conduit and said heat transfer surface for holding said conduit firmly and removably in engagement with said heat transfer surface, said first-mentioned layer providing heat transfer paths between said sections of said conduit and said heat transfer surface.

HAROLD A. NASON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,800,150	Musgrave et al.	Apr. 7, 1931
1,987,422	Steenstrup	Jan. 8, 1935
2,124,232	Kittredge et al.	July 19, 1938
2,391,507	Philipp	Dec. 25, 1945
2,486,822	Cameron	Nov. 1, 1949