

Feb. 13, 1940.

W. W. HIGHAM
REFRIGERATOR EVAPORATOR

2,190,288

Filed April 5, 1938

3 Sheets-Sheet 1

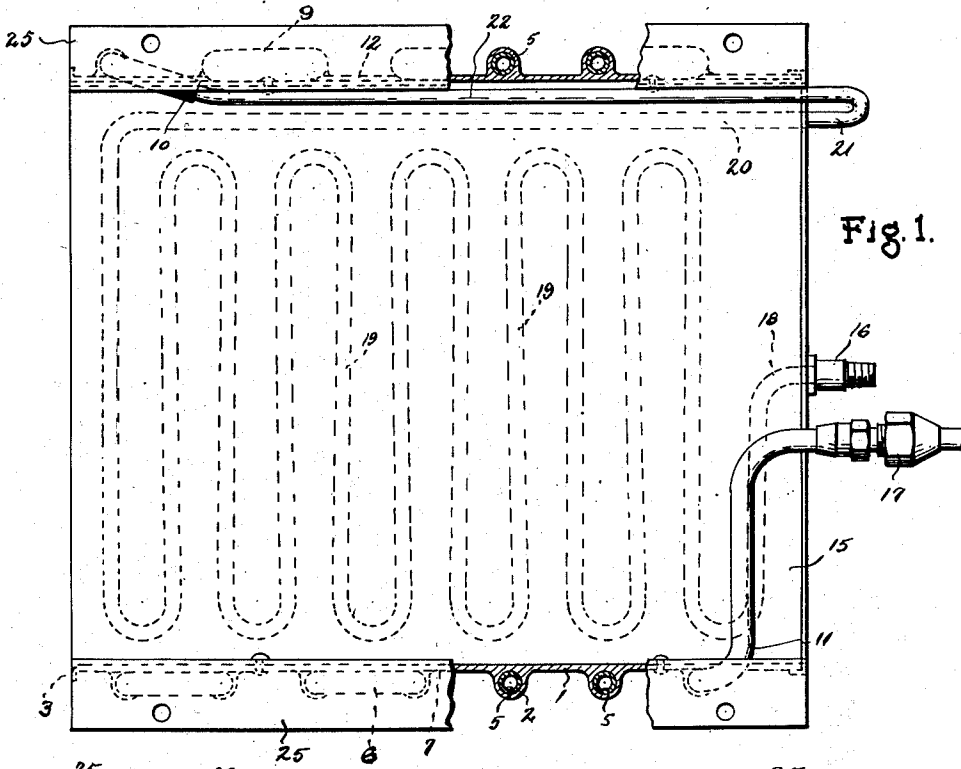


Fig. 1.

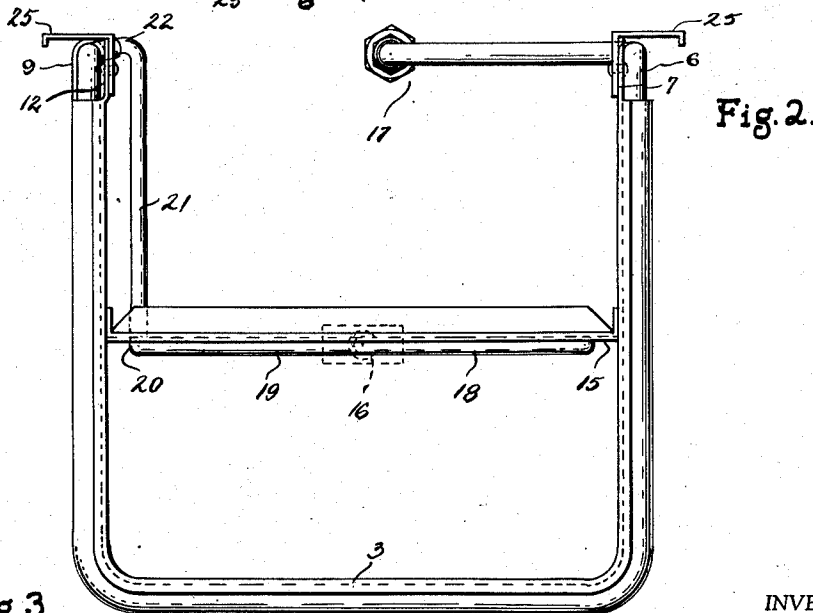


Fig. 2.

Fig. 3.



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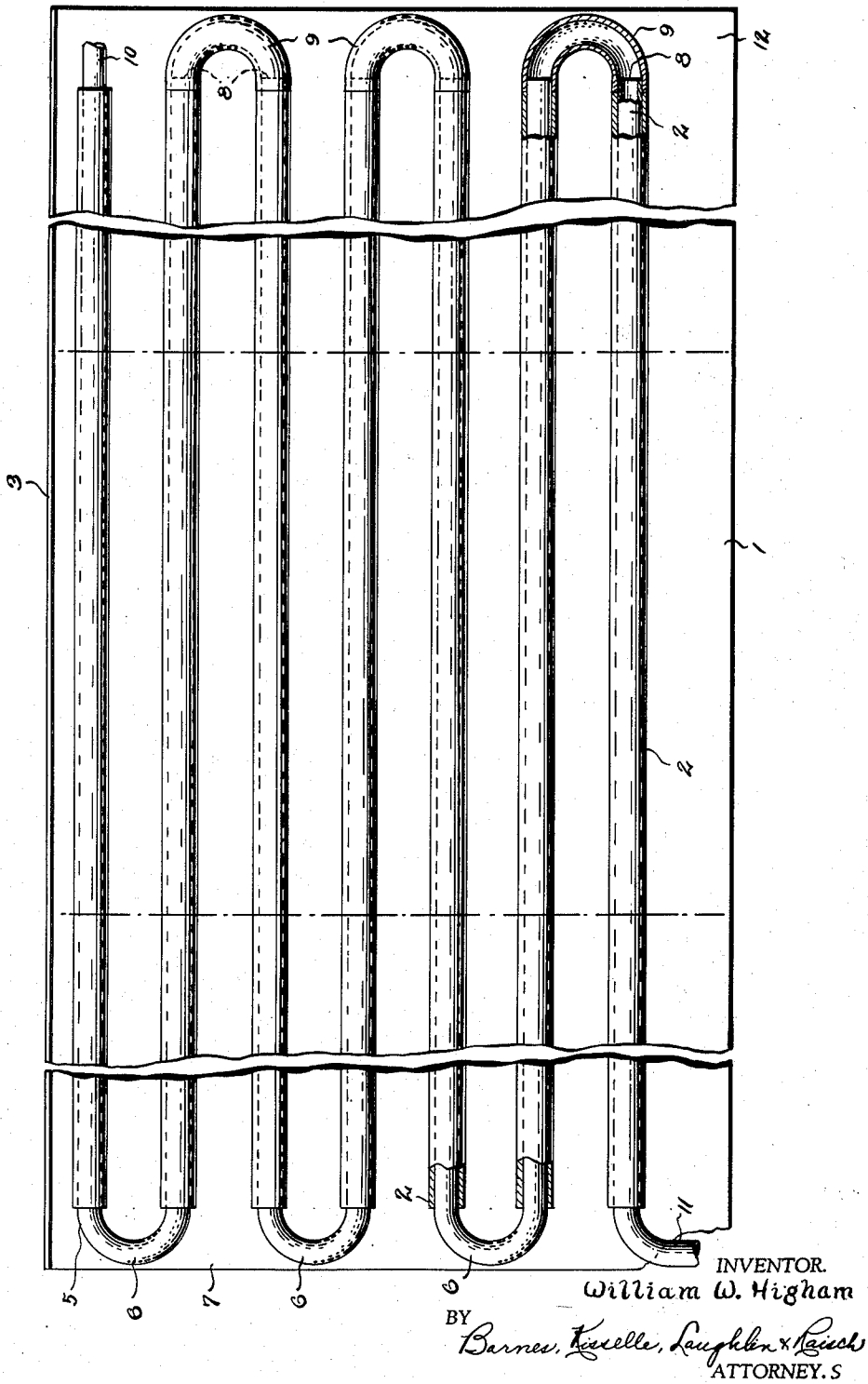
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Fig. 4.



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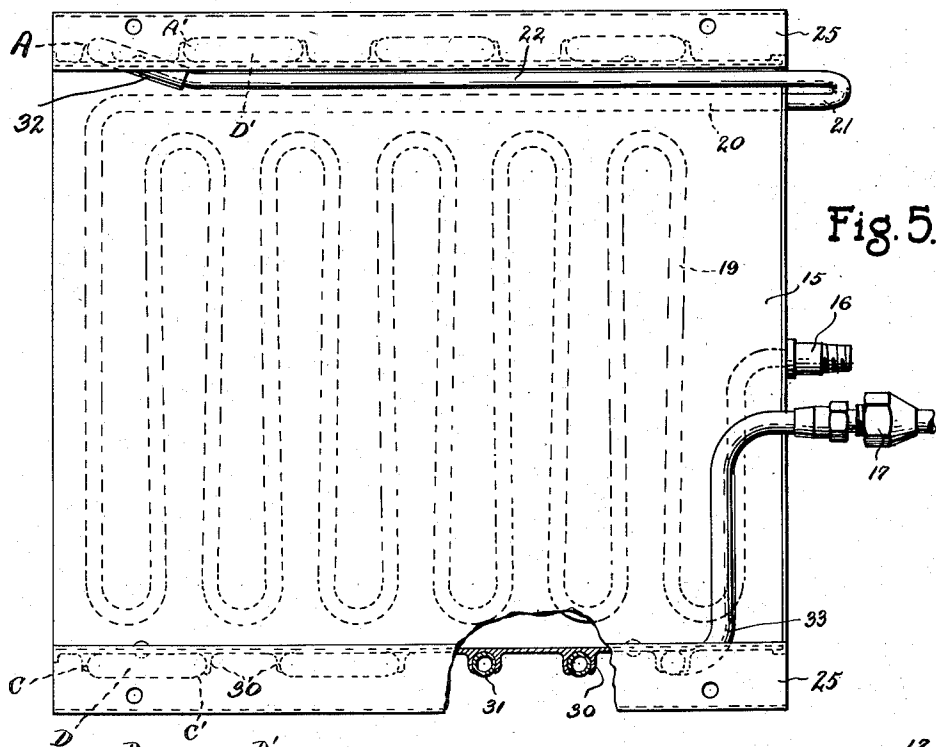


Fig. 5.

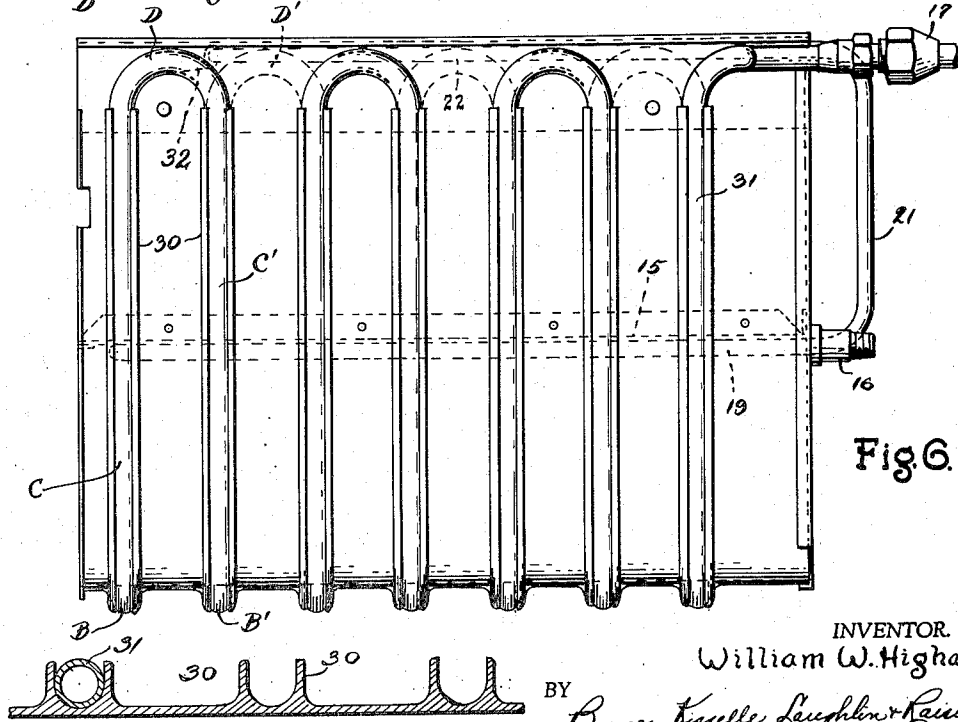


Fig. 6.

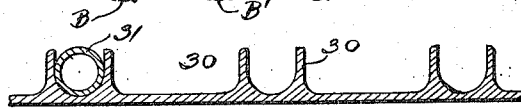


Fig. 7.

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2,190,288

REFRIGERATOR EVAPORATOR

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corporation of Michigan

Application April 5, 1938, Serial No. 200,173

7 Claims. (Cl. 62—126)

This invention relates to the art of refrigeration and is directed particularly to a low side unit or evaporator of a mechanical refrigerator or other heat exchange device.

5 The invention has as its general object the provision of an improved evaporator or heat exchange structure which will be efficient in operation and one which is of a simple construction embodying relatively few parts and, thus one
10 which lends itself advantageously from the standpoint of manufacture and assembly. In accordance with the invention the device is constructed with a body portion which may be in one piece, or substantially in one piece, and
15 which preferably is formed of extruded metal. Conduit or tubing is associated with, and in a measure supported by, the body, and which receives the refrigerant for evaporation purposes. The extruded metal of the body may be aluminum
20 or a suitable aluminum alloy or the like which gives the evaporator lightness, and a separate conduit or tubing may be of other metal, as for example, copper. The body may be formed of metals other than aluminum, such as copper,
25 copper alloys or the like. By the use of copper tubing or tubing of other suitable metal, refrigerants which are corrosive on aluminum may be used which otherwise could not be used with an evaporator constructed of aluminum. Yet an
30 evaporator is provided which has many of the desirable characteristics of an aluminum evaporator, such as is covered in a separate application now on file. These and other objects will become more readily appreciated as the detailed
35 description progresses in connection with the accompanying drawings. The drawings show one form of evaporator which exemplifies the invention, and the structure is specifically described as an evaporator, although other heat exchange devices, condensers, for example, are covered by
40 the invention.

In the accompanying drawings:

Fig. 1 is a view of an evaporator, partly in plan and with parts cut away showing parts in section
45 of an evaporator.

Fig. 2 is a front elevational view thereof.

Fig. 3 is an enlarged sectional view taken through a vertical wall of the evaporator.

Fig. 4 is a somewhat diagrammatic view illustrating a method of making the evaporator.
50

Fig. 5 is a top plan view with parts cut away and parts in section illustrating a modified form of the invention.

Fig. 6 is a side elevational view of the evaporator shown in Fig. 5.
55

Fig. 7 is an enlarged cross-sectional view illustrating the shape of some of the parts of the extruded body prior to assembly with the tubing.

The evaporator, as shown in Figs. 1 to 4, inclusive, comprises a sheet of metal preferably aluminum or aluminum alloy and which is preferably extruded in sheet form; the sheet is generally illustrated at 1 in Fig. 4 and there are integral hollow or tube-like ribs or projections 2
10 on the sheet. As shown in Fig. 2 the evaporator is generally of U-shape. The evaporator is shown with just its basic functioning parts, it being understood that the evaporator is to be closed by a suitable door or the like on the front and equipped with suitable controls or the like.
15

Referring to Fig. 4, it will be appreciated that the sheet may be extruded in a direction extending upwardly and downwardly of the sheet, and the same may be cut to the proper length. One edge of the sheet may be flanged as at 3 to give
20 a finished appearance, this being preferably the front edge, although both edges may be so fashioned if desired, and for that matter the ends may be finished by flanging or the like. The tubular parts 2 are designed to have placed therein
25 suitable tubing for the refrigerant. This tubing, as shown in the several views, is in the nature of coils or windings extending alternately back and forth relative to the sheet. This tube need not necessarily be a single tube of integral nature. An advantageous construction, and a preferred
30 construction, is that of providing several separate tube lengths as follows: A length of suitable tube 5 is bent upon itself to form a bight portion 6 with a pair of extended legs which may be
35 substantially parallel to each other. A number of these, depending upon the number desired and the size and capacity of the evaporator desired, are inserted in the tubular structures 2. It is
40 thought to be preferred that the tubular structure 2 be milled away so as to leave end flanges 7 and 12 with the flange 7 lying adjacent the extreme ends of the bight portions 6. The ends of the
45 lines of the U-shaped tubes are illustrated at 8, and they are arranged preferably to project beyond the tubular parts 2 opposite the end of the sheet adjacent the bight portions 6. Then U-shaped tubular connecting elements 9 may be
50 used for connecting adjacent ends of the U-tube. These return connectors 9 may be telescopically fitted relative to the ends of the tubes and sweated or otherwise secured thereto. By sweating is meant a joint effected by molten metal such as a suitable solder, brazing metal or the like. At one end of the evaporator, one end of a tube may
55

project as illustrated at 10 and the other may project as illustrated at 11.

With the sheet and tube structure thus assembled, the same is formed into the evaporator shape which is shown herein as a U-shape. The bending lines may be as substantially illustrated by the broken lines on Fig. 4. The edges 7 and 12 of the sheet preferably extend to or slightly beyond the bight portions 6 and connector 9 to provide a finished even edge appearance.

With the structure thus formed into U shape it may appear as illustrated in Figs. 2 and 3. A suitable shelf 15 may be placed thereacross to divide the interior into compartments which may constitute sharp freezing chambers, the function of which is well known. As illustrated in Fig. 1 the inlet for the refrigerant is illustrated at 16 and the outlet as at 17 which is connected to the end 11 of the coil. The inlet advantageously connects into a tubular construction 18 which may be fashioned into coils or windings 19 which underlie the shelf 15. This tubular structure may extend forwardly to a point near the front of the evaporator and then rearwardly in a run 20 and then upwardly as at 21. The tubular structure may then extend forwardly in a run 22 and connect into the end 10 of the main evaporating tube structure. The tube 18 is preferably of smaller capacity than the tubes 5, the purpose of which will presently be referred to.

Suitable brackets may be secured to the upper parts of the evaporator which are in turn adapted to be secured to the underside of the top wall of the compartment to be refrigerated. It will be noted that when an evaporator such as shown in Fig. 2 is secured so as to depend from a horizontal wall that it is closed by said wall.

A modified form of the invention is illustrated in Figs. 5, 6 and 7. A number of the parts are the same and reference characters are employed which are the same as those used on the same parts of the foregoing form, thus dispensing with double description. In this form, however, the extruded body is formed with ribs or projections 30 associated in pairs. The inlet 16 may feed directly into the coil 19 which underlies the intermediate shelf 15, and its one end may be fashioned into the runs 20, 21 and 22. The principal evaporator tube, however, may be a single length of tubing 31, each run of which is designed to lie in between adjacent ribs 30. One end of the tube 31 is illustrated at 32, which is at one forward side of the evaporator. The tube is formed as follows: From the end 32 the run extends downwardly as at A, across the bottom of the unit as at B, then upwardly along the opposite side as at C. The tube is now fashioned into a return bend D and extends downwardly in a run as at C' across the bottom as at B' and upwardly as at A'. On the opposite side of the evaporator at this point the tube is again fashioned into a return bend D'. This formation of the tube continues until the end of the tube as illustrated at 33 is reached, which end is connected to the outlet fitting 17.

This form of evaporator may be made as follows: The extruded sheet may be in flat form and the fashioned tubing is laid in position with the runs between adjacent projections 30. These projections 30 may be fashioned now so as to clamp around, or partially around, the tubes as illustrated in Fig. 5, thus gripping the tubes and holding them in place. This may be done by a pressure roller or the like which is passed along the rib and tube structure. The flat form may

now be fashioned into the desired shape for evaporator purposes as for example by bending the same into U-shape as aforesaid.

In both forms of the invention the presence of the tubing in association with the metallic body materially reinforces and strengthens the body and aids in holding it in its final form which happens to be U-shaped as shown herein. It is to be appreciated that more than one intermediate shelf corresponding to the shelf 15 may be provided. The tubular construction constituting the coils 19 are in both instances preferably smaller than the main evaporator tube and the coils are connected in series. Due to the fact that the first coil through which the refrigerant enters, namely the coil 19, is smaller of capacity, it is believed that this coil acts as a sort of a reservoir in that the liquid refrigerant therein remains mostly in liquid form and does not gasify to any substantial extent, although there is an expansion in this coil and a later expansion and vaporization in the larger main coil.

In the form shown in Figs. 1 to 4 the tubing is pretty well confined by the tubular construction of the body. This will prevent accumulated ice, which will come about in the frosting of the unit, from getting in between the walls of the tubular form 2 and the evaporator tube 5. To this extent, and with this in view, the form shown in Figs. 1 and 4 is preferred since the evaporator tube 31 is exposed in the form shown in Figs. 5 to 7. However, this ice formation would not be such as to disrupt the connection between the tube 31 and formed projections 30, as this connection may be made of ample strength and the overlap of the formed projections 30 may be sufficiently great to prevent disconnection.

In some of the claims appended hereto the material constituting the extruded sheet is specified as being of aluminum. It is to be understood that this includes not only aluminum but aluminum alloys which may be found to be suitable for this purpose. The terms "windings" and "coils" are used herein in a rather broad sense and in a synonymous sense, it not being the intention to limit the case to windings which may not look like coils; the windings shown herein are to be considered also as coils.

The structure herein shown embodies a body sheet having a width such that it comprises the entire length of the formed unit. However, the body may be more narrow or even wider than that shown, and where a body sheet is used which is relatively narrow as compared to the completed evaporator, condenser or other heat exchange unit, the body sheet itself may be arranged in a plurality of strips, coils or runs disposed in edge to edge relationship.

I claim:

1. A refrigerator evaporator comprising, an extruded sheet of aluminum having integral hollow projections thereon, tubing for refrigerant arranged in windings with the tubing having runs lying within said hollow projections on the sheet so as to be held in place on the sheet, said sheet and the windings of the tubing being fashioned into evaporator form.

2. An evaporator comprising, an extruded sheet of aluminum having integral hollow projections running lengthwise thereof, tubing for refrigerant arranged in windings with each winding having a section extending through one of the hollow projections and having a reverse bend and another section extending from said bend through an-

other hollow projection, said sheet and the windings of the tubing fashioned into a substantially hollow-like form.

5 3. A refrigerator evaporator comprising, a single sheet of extruded aluminum fashioned substantially into U shape, said sheet having integral hollow projections, each extending across the bottom of the U and up the sides, and said projections being spaced from each other later-
10 ally, and tubing for refrigerant arranged in windings with each winding having a section extending through one of the tubular projections and a section extending through the next adjacent hollow projection and having a reverse
15 bend in the intermediate portion for connecting the two sections of the winding.

4. A refrigerator evaporator comprising, an extruded sheet of aluminum fashioned substantially into U form, said sheet of aluminum hav-
20 ing a plurality of ribs thereon, each extending across the bottom of the U and up the sides, said ribs being arranged in pairs to provide grooves, and tubing for refrigerant arranged in windings with each winding having a section located in one
25 of the grooves, said ribs being fashioned so as to at least partially overlie said sections of the windings to hold the tubing secured to the said sheet.

5. The method of making an evaporator for a
30 refrigerator which comprises, extruding a sheet of aluminum having integral projections thereon, fashioning tubing for refrigerant in the form of coils on said sheet while substantially in flat form and in cooperative relation with the projections
35 whereby the projections hold the tubing assem-

bled with the sheet, and then simultaneously bending the sheet and the windings of the tubing thereon into the desired evaporator form.

6. The method of making an evaporator for a refrigerator which comprises, extruding a sheet
5 of aluminum having integral ribs thereon with the ribs arranged in parallel pairs to form grooves, disposing refrigerant tubing in the form of windings on the sheet with each winding hav-
10 ing a section lying in one of the grooves, fashioning the ribs so that they partially overlie said sections of the tubing to hold the tubing in place on the sheet and then bending the sheet and the tube windings into the desired evaporator form.

7. An evaporator for a refrigerator comprising,
15 an extruded sheet of metal of relatively great length in the direction of extrusion and having a width measured transversely of the direction of extrusion which is substantially equal to one dimension of the evaporator and which is relatively
20 narrow as compared to the length of the sheet, said sheet having projecting formations thereon running lengthwise of the sheet and substantially in parallel relationship with the formations
25 spaced from each other transversely of the sheet, tubing for refrigerant disposed in windings on the sheet with the runs of the windings held in assembly with the sheet by the projections, said
sheet and the windings of tubing thereon being
30 fashioned into an evaporator body with the sheet forming a plurality of walls of the evaporator and said evaporator having one dimension substantially equal to the width of the sheet.

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