

Jan. 18, 1966

R. L. PHILLIPS

3,229,765

REFRIGERATED ENCLOSURE WALL ASSEMBLY AND METHOD OF MAKING

Filed May 7, 1962

3 Sheets-Sheet 1

Fig. 1

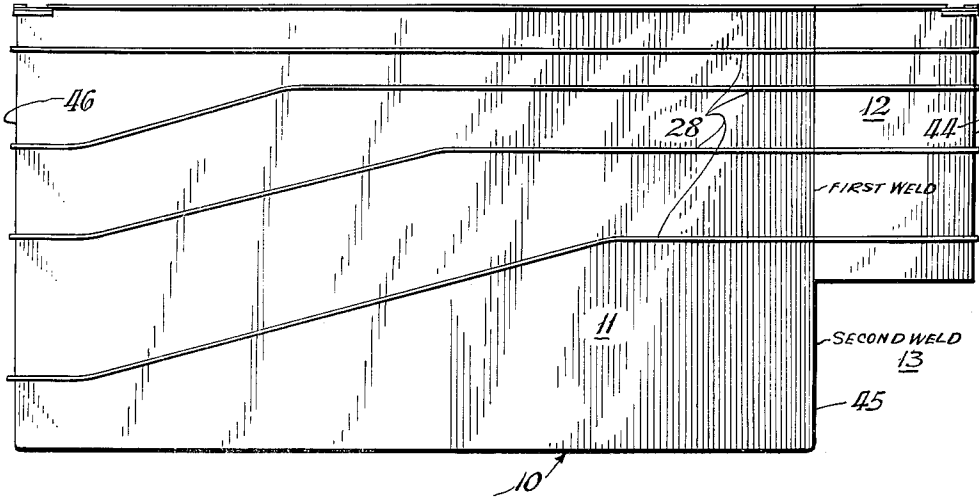


Fig. 3

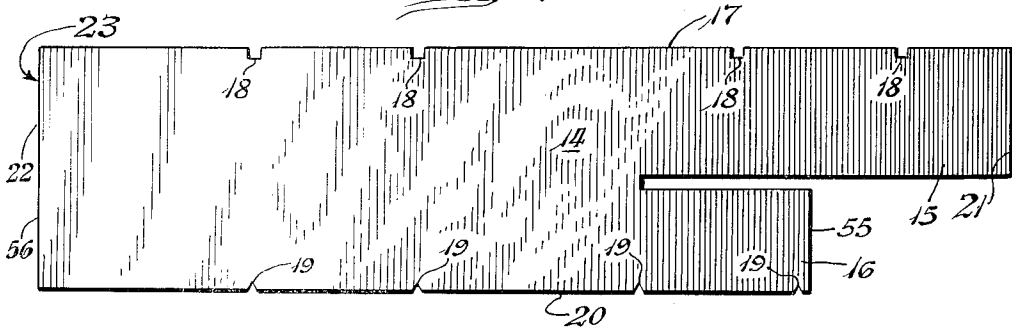
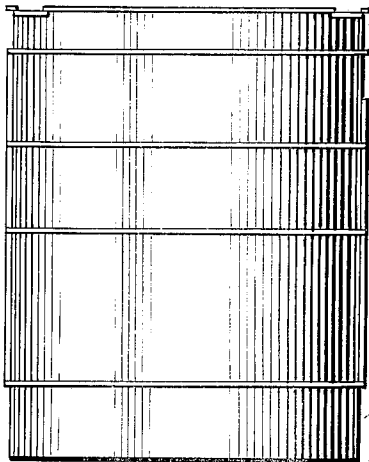


Fig. 2



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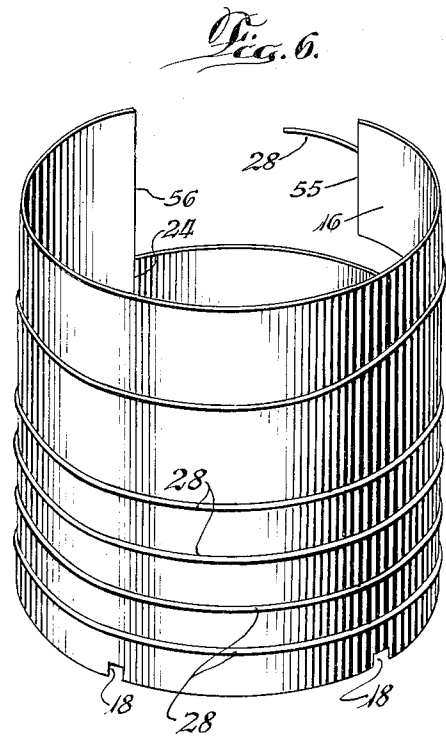
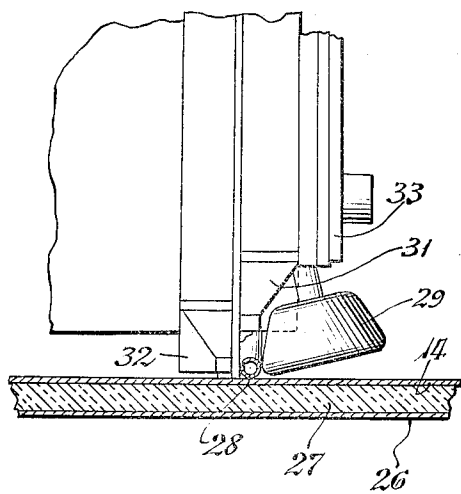
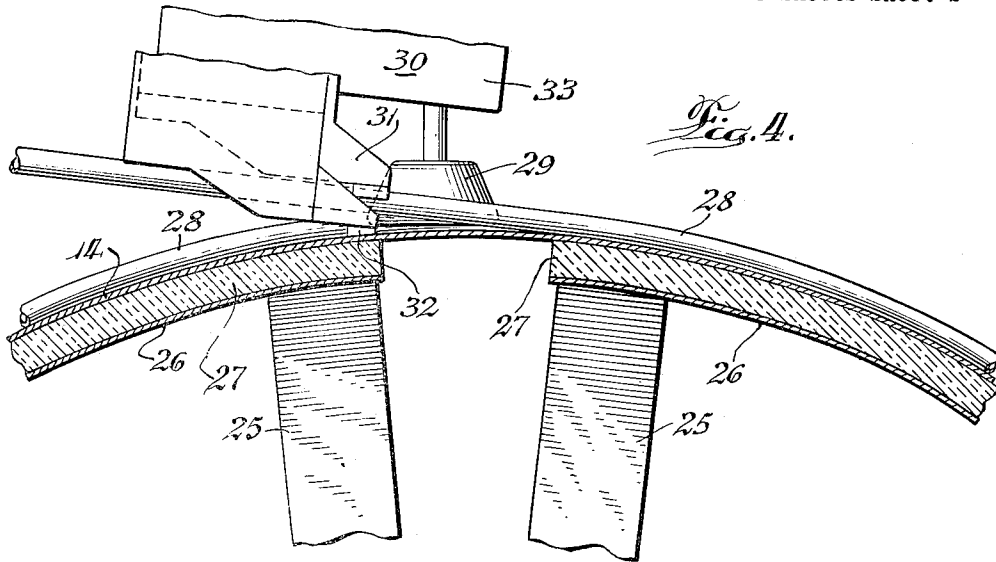
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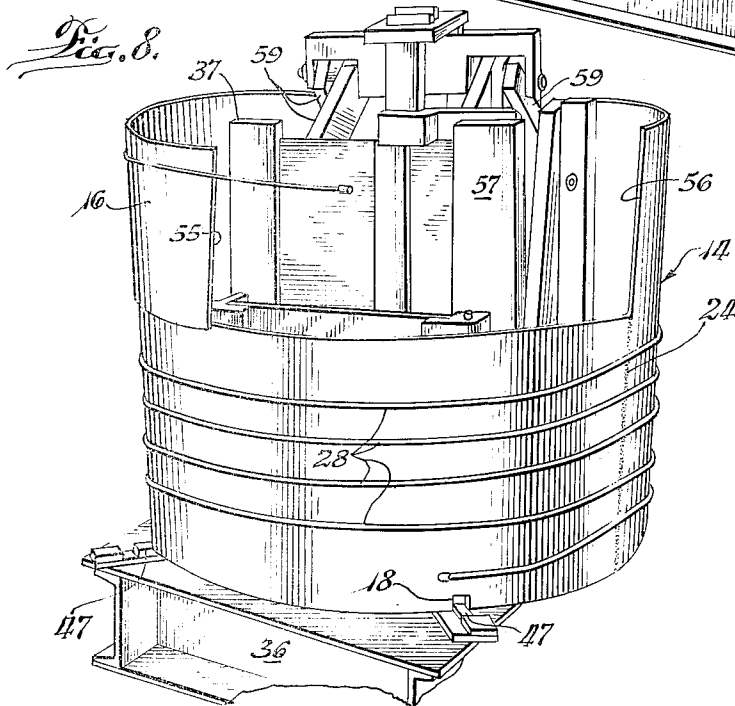
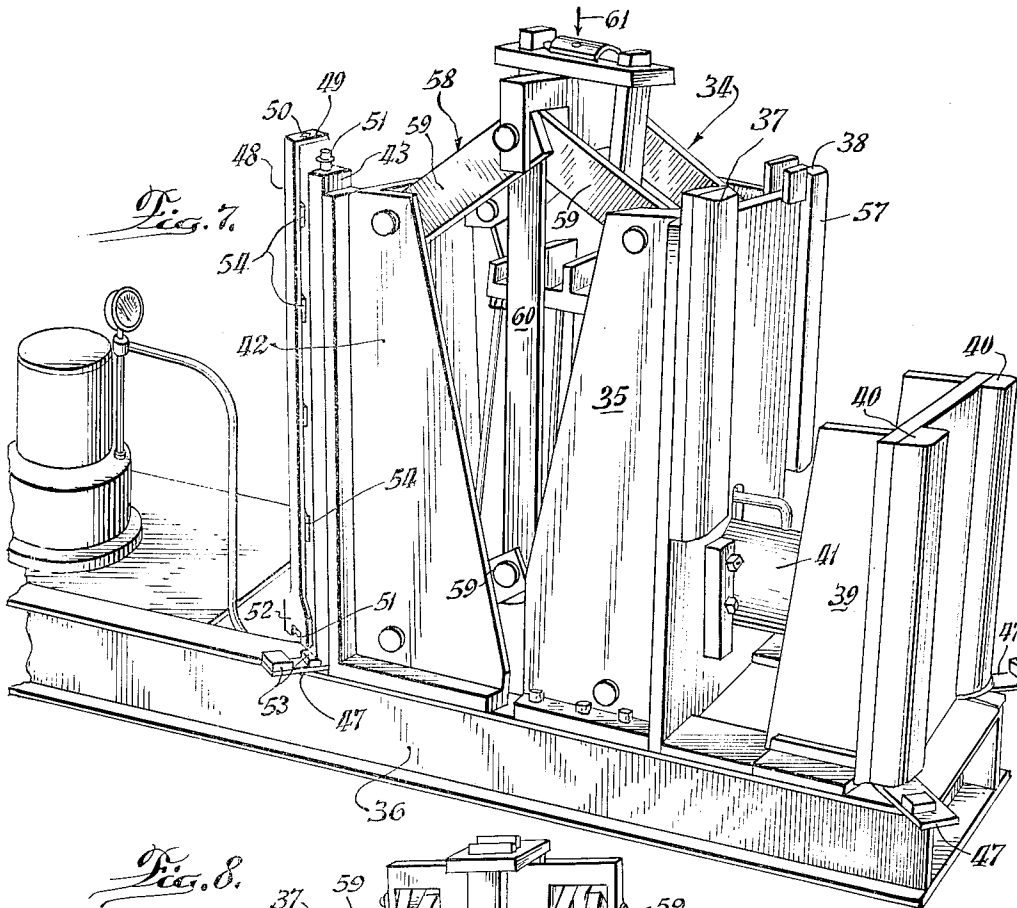
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REFRIGERATED ENCLOSURE WALL ASSEMBLY AND METHOD OF MAKING

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 6 Claims. (Cl. 165-169)

This invention relates to a method of making a wall assembly, and particularly the endless wall assembly, for a refrigerated enclosure.

The endless wall assembly for a refrigerated enclosure will customarily be the walls of a refrigerator or freezer liner than can be circumscribed by a continuous circumference and is customarily made by forming and joining together individual wall sections to the shape and dimensions of the liner. Where such a wall assembly is used in a freezer it is customary to attach a refrigerant tube to the outer surface of this inner liner assembly so that the assembly constitutes an evaporator and can therefore be chilled to a very low temperature.

One of the features of this invention is to provide an improved method of making such a wall assembly in which a metal blank corresponding to the wall assembly is provided followed by stretching the blank beyond its yield point but not exceeding its rupture point in the general direction of the length of this blank into substantially the shape and circumference dimensions of the wall assembly to provide the wall assembly.

Another feature of the invention is to provide such a method wherein prior to the stretching a metal refrigerant conduit such as a tube is applied to the outer surface of this endless blank preferably for a distance greater than 360°.

Another feature of the invention is to provide a liner for a refrigerated enclosure comprising an endless metal wall assembly having a circumference and an internal stress in the direction of the circumference of a magnitude greater than the yield point of the metal but less than the rupture point and a metal refrigerant conduit attached to this wall assembly.

Other features and advantages of the invention will be apparent from the following description of one embodiment thereof taken in conjunction with the accompanying drawings. Of the drawings:

FIGURE 1 is a side elevational view of a liner section made up of an assembly of side and end walls for a refrigerated enclosure, specifically a household freezer, embodying the invention.

FIGURE 2 is an end elevational view of the liner section of FIGURE 1.

FIGURE 3 is an elevational view of a flat metal blank used in making the liner section.

FIGURE 4 is an enlarged view in section illustrating the operation of welding the refrigerant tube to the outer surface of the blank.

FIGURE 5 is an enlarged sectional detail view of a portion of FIGURE 4 taken at right angles to FIGURE 4.

FIGURE 6 is a perspective view of the partially completed blank after the refrigerant tube has been attached.

FIGURE 7 is a perspective view with a corner bar shown removed of an expansion jig used in stretching the endless metal blank to form the liner section.

FIGURE 8 is a perspective view of the jig of FIGURE 4 with the metal blank in position thereon prior to completing the blank.

In the method of this invention the endless wall assembly 10 of the liner section for a household refrigerator has a main section 11 for the portion of the freezer for storing frozen foods and a smaller end section 12 which will constitute the fast freezing section of the freezer. As can be seen from FIGURE 1, the end section 12 extends

only from the top of the main section 11 to short of the bottom of this section so as to leave a machinery space 13.

In producing the endless wall assembly 10 preparatory to making the completed liner by attaching bottom portions and auxiliary parts, there is provided a flat metal blank preferably of steel having the shape shown in FIGURE 3. As is shown here the principal portion of the blank is rectangular and with rectangular end portions 15 and 16 extending from one end thereof. These end portions 15 and 16 are spaced apart at their adjacent edges. What will become the top edge 17 of the finished liner section is provided with spaced notches 18 of generally square shape whose function will be described hereinafter. V-shaped notches 19 are provided in the opposite edge 20 with this opposite edge becoming the bottom of the completed liner section. The notches 19 determine the bend lines of the blank 14. As can be seen from FIGURE 3, the two right-hand notches 18 and 19 are not so vertically aligned because of the different lengths of the end portions 15 and 16.

In practicing the method of this invention the metal blank 14 is curved into a generally cylindrical shape and the free end 21 of the long end portion 15 is welded to the corresponding section 22 of the opposite end 23 of the blank by means of a continuous weld 24. The weld 24 is made so that the edge 17 of the blank is now endless and in a single plane.

The next step in the method is to place the now generally cylindrical blank 14 on a cylindrical jig, a portion of which is shown in FIGURE 4 at 25. This jig has a generally cylindrical steel backing 26 and an insulated covering 27 of asbestos or the like between the backing 26 and inner surface of the now cylindrical blank 14. This insulated covering prevents excessive heat loss from the blank 14 during the welding operation and provides electrical insulation from ground.

During the welding the jig 25 and thus the blank 14 are rotated about a generally horizontal axis and a metal, preferably steel, refrigerant tube 28 is continuously welded to the outer surface of the blank 14. During the rotation a guide wheel 29 on the welding apparatus 30 holds the tube 28 against a contact 31 and against the outer surface of the blank 14. A second contact 32 bears against the outer surface of the blank 14. The welding is done by a high frequency welding current apparatus 30 in the manner shown and described in U.S. Patent 2,376,762 of May 22, 1945. With such an apparatus which is well known and widely used the tube 28 is attached to the outer surface of the blank 14 as the jig 25 and the blank are rotated. It is of course possible to accomplish the same results by holding the jig 25 and blank 14 stationary and causing the welding head 33 of the welding apparatus 30 to move around the outer surface of the blank. The method shown is preferred, however, as the apparatus required is simpler. Furthermore, with the apparatus as shown, it is easier to index the tube 28 so as to vary the spacing of the convolutions of the tube from each other, as shown in FIGURES 1 and 2. As is shown here, the tube convolutions are closer together at the top of the liner section than they are at the bottom.

The next step in the method is to remove the blank with the now attached tube 28 from the jig 25 and place it on an expanding device or expanding jig 34. This expanding jig includes a fixed section 35 bolted to a form 36 and having rounded corner members 37 and 38. Opposite the fixed section 35 is a smaller movable section 39 also having corner forming members 40. The distance between the sections 35 and 39 is controlled by means of a fluid cylinder 41. Cooperating with the fixed section 35 on the side thereof opposite the section 39 is a movable section 42 also slidable on the form 36. This movable sec-

tion 42 is provided with two corner members 43 similar to the members 37 and 40.

As can be seen from an inspection of FIGURE 7, the expanding jig 34 can be arranged in the general shape of the completed liner section 10 as shown in FIGURE 1. Thus, the corner members 40 will form the corners 44 of the end section 12, the corner members 37 and 38 will form the corners 45 on the bottom of the main section 11 beneath the end section 12, while the corner members 43 will form the other end corners 46 on the liner section.

The blank 14 is centered on the expanding jig 34 by arranging the four notches 18 in the edge 17 of the blank to engage outwardly projecting metal strips 47 at the four corners of the expanding jig in the manner shown in FIGURE 8. The blank 14 is held on the expanding jig with the notches 18 in the above-described engagement with the metal strips 47 by means of a lock bar 48. As is shown in FIGURE 7, this lock bar 48 has a top flange 49 with an opening 50 therein adapted to fit over a vertical pin 51 on the top of a corner member 43. The bottom of the bar 48 is provided with a notch 51 adapted to fit over an intermediate section of the strip 47 at this corner so that the bottom 52 of this bar is held against outward movement by a pair of spaced blocks 53. The inner surface of the bar 48 is provided with a plurality of vertically spaced projections 54, here shown as four, to bear against the outer surface of the blank 14 and hold the inner surface thereof against the outer surface of the corner member 57.

After the blank 14 is placed on the expanding jig 34, in the manner shown in FIGURE 8, the outer free end 55 of the short end portion 16 of the blank 14 is welded to the edge section 56 opposite the edge 55 in the same manner that the edges 21 and 22 were welded. This welding operation is performed along the surface 57 of the corner member 38 by electric welding. In order to assist in this welding the surface 57 is preferably provided with an overlay of copper to serve as one of the welding contacts.

At the completion of this final welding the blank now has the general shape of the liner section 10 but is slightly smaller. Force is then exerted through a toggle 58 composed of parallelogram bars 59 and vertical bars 60 constructed in the well known manner so that a downward force, as indicated by the arrow 61, will cause the movable section 42 of the expanding jig 34 to move away from the fixed section 35. The section 42 is continued to be moved until the metal blank has been stretched to the shape and dimensions shown in FIGURES 1 and 2. At the same time force is applied through the cylinder 41 to move the section 39 away from the fixed section 35 a distance equal to the longitudinal length of the end section 12 of the liner 10. During these movements of the movable portions 39 and 42, the metal of the liner is stretched so as to create internal stresses of a magnitude beyond the yield point of the metal. This causes the metal of the liner to take a permanent set so that it retains the shape of the liner. At the same time, the tube 28 where it passes around the corners of the liner may be flattened to a small degree.

To complete the freezer liner bottom wall sections are attached to the main section 11 and the end section 12 of the liner in the customary manner and the usual auxiliary parts are also attached in the well known manner.

With the method of this invention it is possible to make the continuous circumferential section of the liner rapidly and efficiently. In addition, the stretching of the liner metal beyond its yield point but short of its rupture point makes the liner metal harder and sets it to the desired generally rectangular shape in the illustrated embodiment. In addition, it flattens the refrigerant tube to a small degree at the corners so as to increase the heat transfer.

Having described my invention as related to the embodiment shown in the accompanying drawings, it is my

intention that the invention be not limited by any of the details of description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

1. The method of making the continuous wall assembly linear for a refrigerated enclosure, comprising: providing a continuous metal blank having a circumference slightly less than the circumference of said wall assembly; attaching a metal refrigerant conduit to the outer surface of said blank generally around said blank circumference; stretching said blank beyond its yield point into substantially the shape and circumference dimensions of said wall assembly; and stretching said conduit simultaneously with said stretching of the blank.

2. The method of making the continuous wall assembly liner for a refrigerated enclosure having wall sections of different circumferences, comprising: providing a continuous metal blank having a plurality of continuous portions of different circumferences each slightly less than that of the corresponding liner section; and stretching said continuous portions beyond their yield points into substantially the shape and circumference dimensions of said wall assembly to provide said wall sections.

3. The method of making the continuous wall assembly liner for a refrigerant enclosure having wall sections of different circumference at least one of which has refrigerant conduits on the outer surface thereof, comprising: providing a metal blank in which a portion corresponding to said one section is continuous with a circumference slightly less than the corresponding circumference of said liner section; attaching a metal refrigerant conduit to the outer surface of said one portion; joining the ends of an additional blank portion to form an additional continuous blank portion; and stretching said continuous blank portions beyond their yield points into substantially the shape and circumference dimensions of said wall assembly to provide said wall sections.

4. The method of claim 3 wherein said conduit is attached to said portion while rotating said blank.

5. The method of making the continuous wall assembly liner for a refrigerated enclosure having wall sections of different circumference at least one of which has refrigerant conduits on the outer surface thereof, comprising: providing a metal blank in which a portion corresponding to said one section is continuous with a circumference slightly less than the corresponding circumference of said liner section; attaching a metal refrigerant conduit to the outer surface of said one portion over a distance of more than 360°; joining the ends of an additional blank portion to form an additional continuous blank portion; and stretching said continuous blank portions beyond their yield points into substantially the shape and circumference dimensions of said wall assembly to provide said wall sections.

6. A liner for a refrigerated enclosure, comprising: a continuous metal wall assembly having a circumference and prestressed in the direction of said circumference to beyond the yield point of said metal; and a metal refrigerant conduit attached to said wall assembly and also prestressed in the direction of said circumference.

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WHITMORE A. WILTZ, *Primary Examiner.*