July 6, 1937. L. H. GRENELL 2,085,746

METHOD OF MAKING REFRIGERATING APPARATUS

Filed June 17, 1935

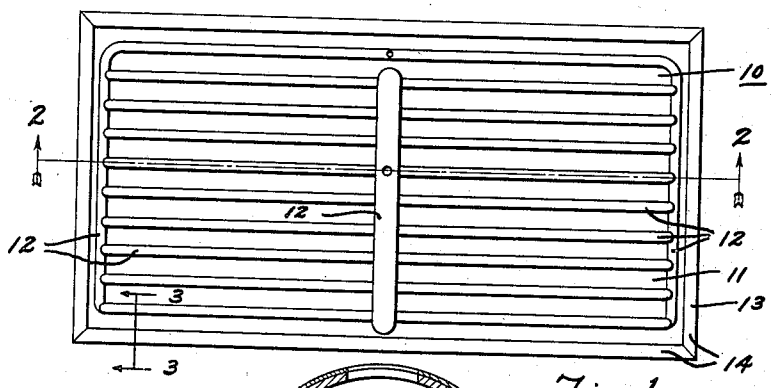

Fig. 1

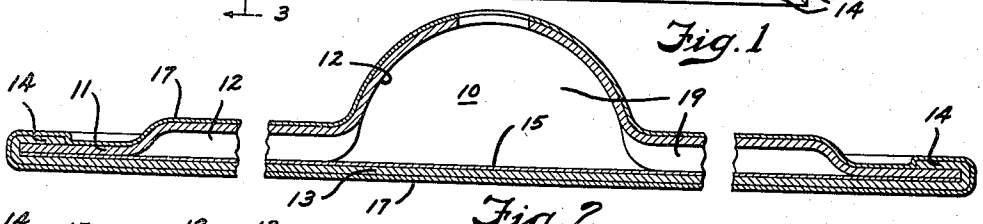

Fig. 2

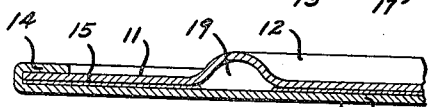

Fig. 3

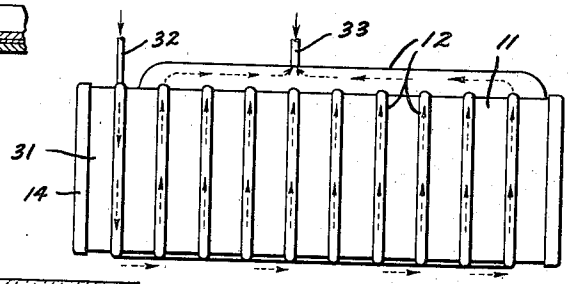

Fig. 5

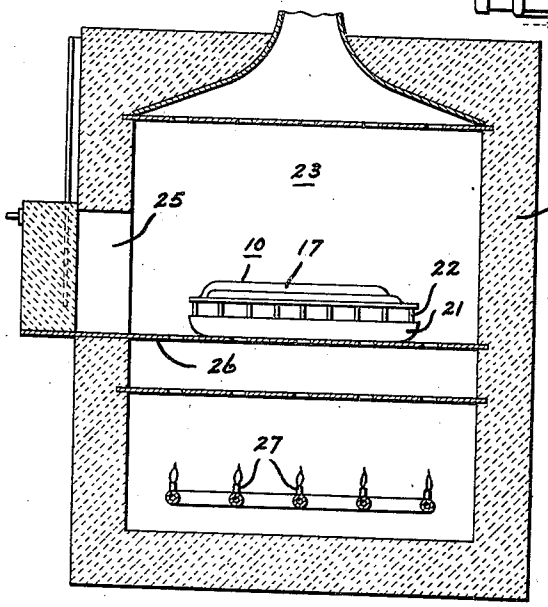

Fig. 4

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METHOD OF MAKING REFRIGERATING APPARATUS

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Application June 17, 1935, Serial No. 26,952

2 Claims. (Cl. 113—118)

This invention relates to welding or brazing and particularly to an improvement in bonding certain portions of two superimposed brass sheets together.

Evaporators for household refrigerating apparatus have heretofore been constructed of a cylindrical tank or header having refrigerant expansion pipe loops secured thereto and depending therefrom to provide a freezing compartment within the evaporator for the reception of ice trays. Such evaporators were not neat in appearance and were consequently concealed within the refrigerator cabinet by some sort of a neatly finished cover or front plate. In recent years, however, evaporators having refrigerant expansion passages and headers formed therein have been constructed by securing two sheets of metal together which sheets, after being bent to provide a sharp freezing chamber within the evaporator, were enameled with a porcelain or the like finish coating so as to render the evaporator neat in appearance and to eliminate the use of covers or front plates from refrigerator cabinet constructions. These evaporators were constructed of sheets of steel or iron which were spot or roll welded together without difficulty and which were porcelain enameled to prevent rusting thereof. However, a considerable amount of trouble and expense has occurred in the use of porcelain enameled sheet iron evaporators. For example, evaporators of refrigerating systems are usually maintained at a sufficiently low temperature to cause condensation of moisture thereon, which moisture accumulates on walls of the evaporator in the form of a layer of frost, and any small crack or chipped portion in the porcelain coating on a steel or iron evaporator will expose the steel or iron to moisture and such portions of the evaporator soon became oxidized and rusted, thereby rendering the evaporator unsightly in appearance. Thus, sheet steel or iron evaporators having walls thereof covered with a coating of enamel or the like which is inherently brittle and easily cracked or chipped, merely by the act of removing ice trays from or replacing same in the freezing compartment of the evaporator or by striking the porcelain finish with bottles and other objects, have been the major source of trouble to the guarantee and servicing of refrigerators sold by refrigerator manufacturers.

More recently, others with whom I am associated have been striving to overcome the troubles in the use of sheet metal evaporators by attempting to make or fabricate the evaporators from sheets of brass. Ordinarily brass sheets suitable for this purpose consist of approximately 85% copper and 15% zinc. It is well known that brass sheets will resist oxidation over a greater interval of time than steel or iron sheets. It is also well known that brass can be readily plated with a metallic finish, such, for example, as tin or chromium which presents a smooth neat finish that can be readily and easily cleaned with many cleaning compounds without danger of damaging the finish. Present methods of plating tin or chromium on brass provide a metallic finish over the brass which prevents discoloration thereof and which finish is difficult to scratch, crack or chip. For these reasons, such material as brass is preferable for use in fabricating sheet metal evaporators of refrigerating systems wherein existing temperatures and humidity present ideal oxidation and rusting conditions. The welding, brazing or bonding of brass sheets together, however, presents many problems to evaporator manufacturers over the comparable easy welding of steel or iron sheets together. Recently, however, those with whom I am associated have been somewhat successful in brazing brass sheets together. For example, one method of manufacturing evaporators from sheet brass consists in placing a spelter sheet, composed of approximately 60% copper and 40% zinc, between two brass sheets, at least one of which is embossed or corrugated to provide passages between the sheets, and heating the sheets by radiant heat in an oven to a temperature sufficient to melt the spelter sheet without melting the brass sheets. Heating of the brass sheets by radiant heat instead of applying heat directly to the surfaces thereof, as is the case in roll or spot welding steel or iron sheets together, is necessary in order to prevent burning the brass sheets or portions thereof. A suitable fluxing compound is of course painted or otherwise applied to the sheets to cause the material of the spelter sheet to adhere to the brass sheets and cause the brass sheets to be bonded together. The assembly of the brass sheets is preferably in the form of a flat plate-like structure during brazing thereof and after the brass sheets are bonded together the plate-like structure is then formed or bent into the shape desired. The structure is preferably bent to provide an evaporator having a sharp freezing chamber or chambers formed thereby. The evaporator structure is thoroughly cleaned and may then be plated, in any conventional and well known manner, with a tin or chromium finish to prevent discolor-

ation of the brass and to render same neat in appearance.

In the method of brazing brass sheets together as explained above provisions have heretofore been made to apply pressure to the sheets during the heating or brazing operation thereof so that portions of the brass sheets to be bonded or brazed to one another will be pressed toward one another uniformly throughout the area of the flat plate-like assembly. A plurality of removable weights have been placed on top of the plate-like structure during heating thereof to press the plates or sheets together. More recently a suction pressure has been applied between the sheets of the plate-like structure in accordance with the disclosure in the patent to Frank T. Cope No. 2,023,354 dated December 3, 1935.

In the heating or brazing operation of plate-like structures of the type herein described, wherein the structures are heated by radiant heat simultaneously over their entire exposed surfaces, it has been found that the structures quite frequently buckle or warp irrespective of the manner in which the brass sheets thereof are pressed together or forced toward one another. I have found that this warping or buckling of the plate-like structure is caused by the rapid heat absorbing properties of the non-reflecting portions of the brass sheets at certain points along the surface of the structure as compared to the poor heat absorbing properties of the brass sheets provided by bright reflecting portions at certain other points along the surface of the structure. This variation in the heat absorbing properties of the brass sheets along the surface thereof has created considerable waste and my invention is directed to eliminating this waste in the manufacture of sheet metal evaporators for refrigerating systems.

One of the objects of my invention is to provide an improved step in the art of bonding brass sheets together by decreasing the period of time the brass sheets are to be exposed to heat.

Another object of my invention is to insure uniform absorption of heat by brass sheets of a double walled plate-like structure during heating thereof by radiant heat.

A still further object of my invention is to conceal the bright reflecting surfaces of brass sheets in a double walled plate-like structure during heating thereof, to thereby cause uniform heating of the structure by radiant heat in a furnace.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred form of the present invention is clearly shown.

In the drawing:

Fig. 1 is a top plan view of a flat plate-like assembly from which evaporator of the present invention is constructed;

Fig. 2 is an enlarged fragmentary sectional view taken on the line 2—2 of Fig. 1 showing a corrugated brass sheet superimposed upon a flat brass sheet with a spelter sheet interposed therebetween and having a coating of a non-reflecting material over the assembly;

Fig. 3 is a fragmentary sectional view taken on the line 3—3 of Fig. 1 showing a portion of the evaporator after the brass sheets have been bonded together;

Fig. 4 is a vertical sectional view through a furnace in which the plate-like assembly shown in Figs. 1 and 2 is adapted to be placed to be heated; and

Fig. 5 is a side elevational view of an evaporator of a refrigerating system made in accordance with the method herein disclosed.

This invention is particularly useful in the manufacture of sheet metal evaporators for refrigerating systems of the type and in accordance with the methods disclosed in the co-pending applications of Sylvester M. Schweller, Serial No. 725,416 filed May 14, 1934 and Serial No. 727,942 filed May 28, 1934 but it is equally applicable to other articles of manufacture. The method of assembling the brass sheets is fully described in the above referred to applications and it is believed necessary to herein only briefly describe these methods. Referring to Fig. 1 of the drawing I have shown an assembled plate-like structure generally designated by the reference character 10 comprising a brass sheet 11, having a plurality of corrugations 12 formed therein, superimposed upon a flat brass sheet 13 (see Fig. 2) with the peripheries 14 of the sheet 13 bent around and over the peripheries 14 of sheet 13, between the brass sheets 11 and 13. The folding or bending of the peripheries 14 of sheet 13 over the edges of sheet 11 holds the brass sheets 11 and 13 and spelter sheet 15 in assembled relation prior to placing the flat plate-like assembly 10 in a furnace or oven to be heated.

The surfaces of the brass sheets of the plate-like structure or assembly 10 are ordinarily variegated in reflecting properties and, as before stated, certain portions of the surfaces are brighter than other portions thereof. I have found that the warping or buckling of the assembled structure 10 during heating thereof by radiant heat in an oven is caused by the variegated reflecting exposed surfaces of the brass sheets which prevents even or uniform absorbing of heat by the structure.

These variegated reflecting portions of the brass sheets of the structure 10 must be concealed during heating thereof or must be covered prior to heating the structure by radiant heat in an oven so as to render the entire exposed surfaces non-reflecting to insure uniform absorption of heat by the structure to be brazed and to thereby prevent warping or buckling. I therefore coat the exposed surfaces of the brass sheets 11 and 13 of the assembled structure 10 with a suitable solution to conceal the reflecting properties of the surface of the structure. I have found that a glycerin, water and lamp-black paint or solution is suitable for the purpose described in this solution may be painted onto the structure 10 or the structure may be dipped in the paint so as to cause the paint to entirely surround or enclose the structure to provide a relatively dark non-reflecting coat 17 thereover, (see Fig. 2). The dark non-reflecting coating 17 placed on the structure 10 conceals the bright or variegated reflecting surfaces thereof and greatly reduces the time required to braze the brass sheets together in the furnace due to the increase in the heat absorbing properties of the metal sheets. The fluid passages 19 formed between the brass sheets 11 and 13, by the corrugations 12, are arranged in any desirable formation and are ordinarily cleaned or flushed out with a suitable cleaning solution and this solution is also adapted to remove the coating 17 from the structure 10 after the brazing operation.

The assembled structure 10 as shown in Figs. 1 and 2 of the drawing, after having been painted with or dipped in the glycerin, water and lamp-black solution to provide the non-reflecting coat-

ing 17 thereover, is then placed upon a rack or sled 21 which is provided with a plurality of upright rods 22 for supporting the structure at a plurality of small spaced apart points. The sled 21 with the structure 10 positioned thereon is moved into the heating compartment 23 of any suitable or conventional furnace or oven 24 (see Fig. 4) through the door opening 25 thereof. A stationary perforated member 26 in oven 24 supports the sled 21 above a plurality of gas jets 27, or any other suitable elements, for heating the non-reflecting assembled structure 10 by radiant heat. The door which closes the door opening 25 of furnace 24 is then closed and the gas flames at jets 27 are increased to provide the necessary heat for causing the structure 10 to absorb heat and be brazed together by melting of the spelter sheet 15. It is to be understood that the brass sheets of structure 10 are adapted to be pressed or forced toward one another, during heating of the structure, by either of the arrangements previously explained and preferably by the method disclosed in the co-pending application of Sylvester M. Schweller Serial No. 725,416 filed May 14, 1934. After the structure is brazed it is removed from the furnace or oven 24 and washed or flushed with a suitable solution to clean the residue from the fluid passages 19 thereof and to remove the residue of the coating 17 remaining on the surface of the structure 10. In Fig. 3 I have shown a portion of the structure 10 as it appears after being brazed in the oven 24 and after having been cleaned by the cleaning solution. The brazed or bonded structure 10 is then adapted to be bent into any desirable form and, for example, into the form of an evaporator for a refrigerating system as shown in Fig. 5 of the drawing. The completed evaporator 31 shown in Fig. 5 has a refrigerant inlet connection 32 and a refrigerant outlet connection 33 and is preferably formed into a shape to provide walls of a sharp freezing compartment adapted to receive ice trays. The fluid passages 19, formed by the corrugations 12 in the brass sheet 11, may be arranged to provide any desirable number of headers and communicating passageways to form various refrigerant circuits through the walls of the evaporator. The evaporator 31 may be plated with tin or chromium in any suitable and well-known manner to provide same with a neat and easily cleanable finish which finish will not become discolored or oxidized.

Ordinarily the heating of the assembled structure 10 in the oven 24 as previously carried out in accordance with the disclosure in the co-pending applications referred to requires about five or six minutes. By providing the coating 17 over the structure 10 the bright heat reflecting surfaces of the structure is concealed and the time required to heat and braze or bond the brass sheets together is materially reduced.

From the foregoing it will be seen that the time required for heating a structure in carrying out my invention has been reduced to two or two and one-half minutes and this reduction greatly facilitates and reduces the cost of manufacturing evaporators. My improved step in the method of manufacturing evaporators therefore not only facilitates and reduces the cost of producing evaporators for refrigerating systems but also eliminates buckling or warping of the flat plate-like assembly during heating thereof to form the bonded structure. Obviously my improved step in the method of making evaporators also cuts down waste by decreasing the number of rejected evaporators ordinarily produced in methods of manufacture heretofore employed.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In the art of making fluid-tight heat exchangers wherein heat is applied by radiation to a substantially bright reflecting sheet member superimposed upon another substantially bright reflecting sheet member with a bonding material therebetween to cause melting of the spelter material and bonding of the sheet members together, that step which comprises, covering the exposed reflecting portions of the sheet members with a non-reflecting substance prior to heating same to cause the members to absorb heat uniformly over their entire exposed surfaces.

2. In the art of making fluid-tight heat exchangers wherein heat is applied by radiation to a substantially bright reflecting sheet member superimposed upon another substantially bright reflecting sheet member with a bonding material therebetween to cause melting of the spelter material and bonding of the sheet members together, that step which comprises, covering the exposed reflecting portions of the sheet members with a glycerin, water and lamp-black solution prior to heating same to cause the members to absorb heat uniformly over their entire exposed surfaces.

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