Nov. 21, 1944. R. C. OSBORN 2,363,435

REFRIGERATION

Filed July 23, 1941 3 Sheets-Sheet 1

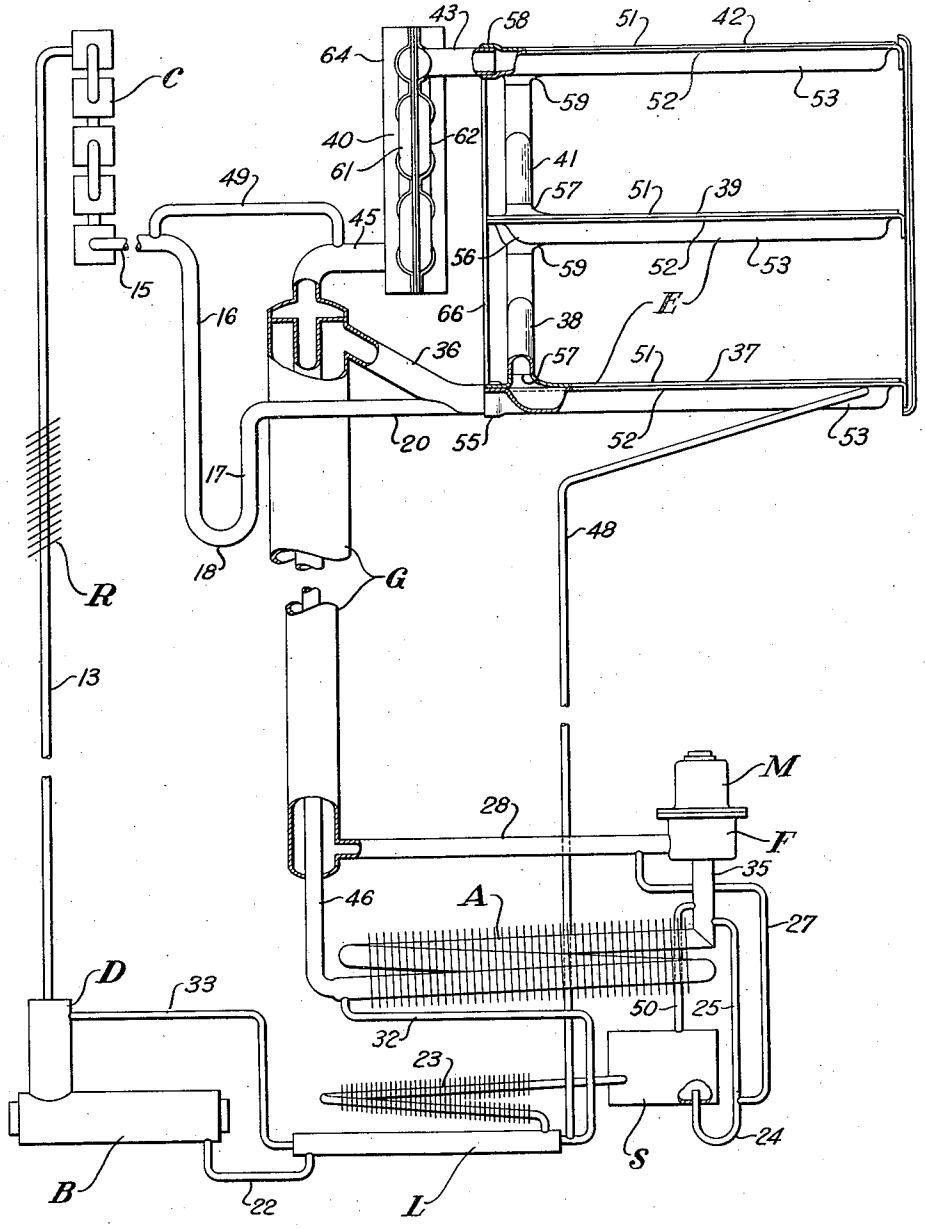


Fig.1

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Nov. 21, 1944. R. C. OSBORN 2,363,435

REFRIGERATION

Filed July 28, 1941 3 Sheets-Sheet 2

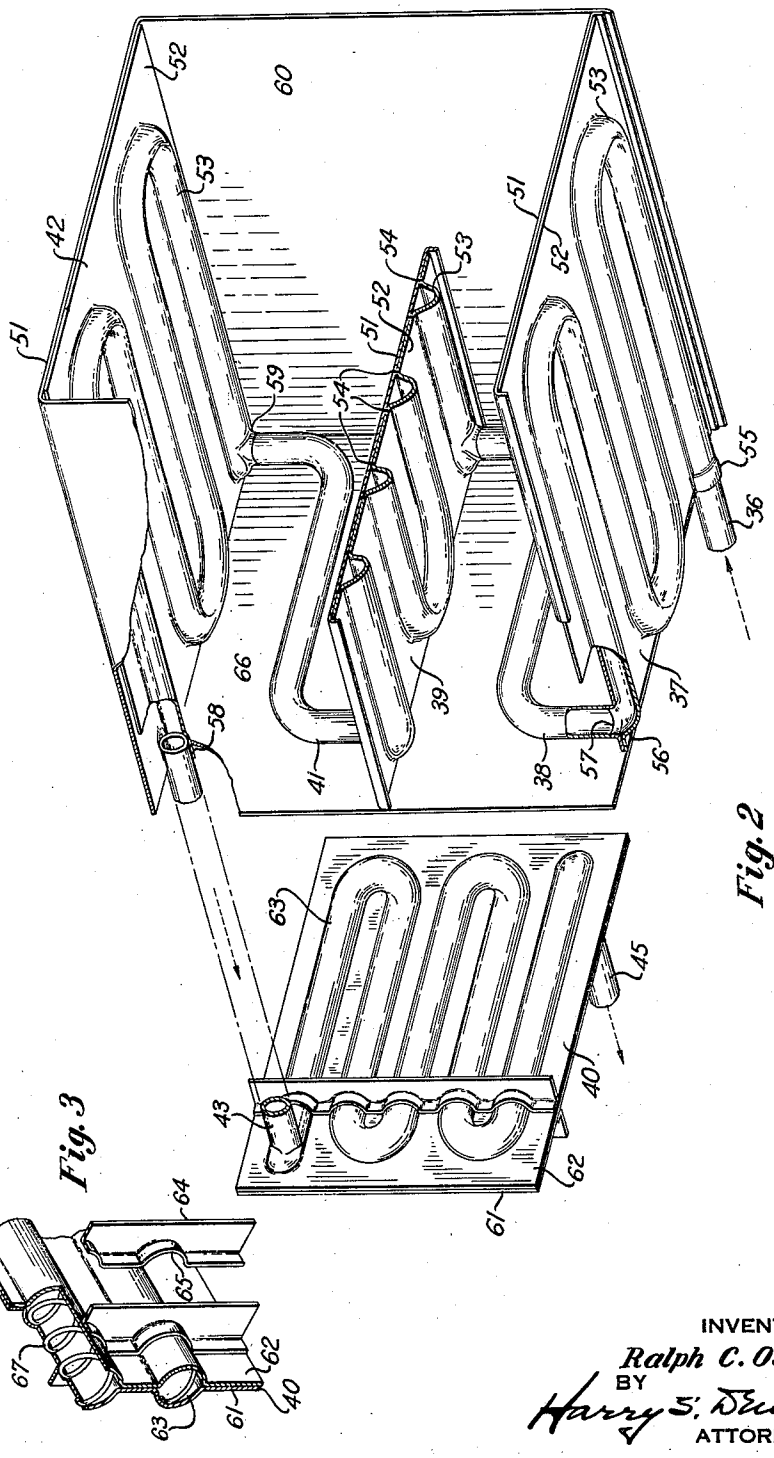


Fig. 2

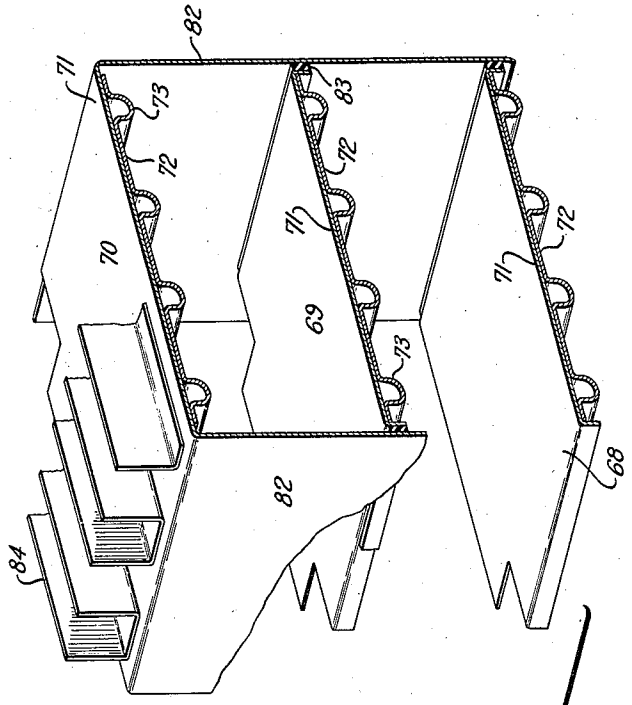
Fig. 3

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Nov. 21, 1944. R. C. OSBORN 2,363,435

REFRIGERATION

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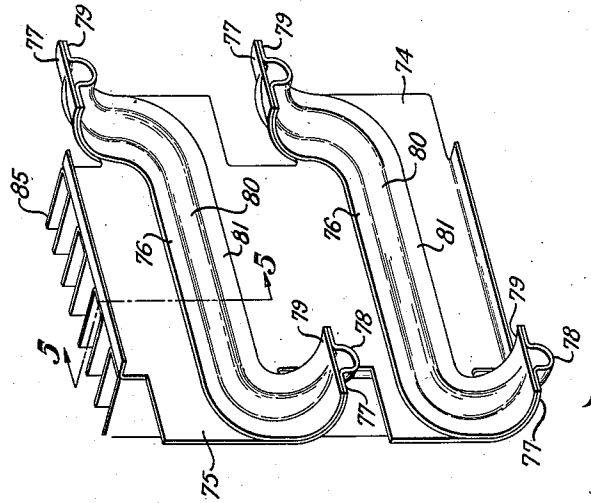


Fig. 4

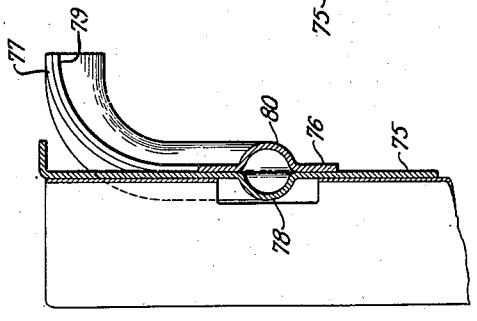


Fig. 5

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2,363,435

UNITED STATES PATENT OFFICE

2,363,435

REFRIGERATION

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Application July 28, 1941, Serial No. 404,330

8 Claims. (Cl. 62—126)

This invention relates to refrigeration and more particularly to an evaporator for an absorption refrigerating apparatus of the type using an inert gas for equalizing the pressures within the system which is adapted for use and assembly with small household refrigerator cabinets.

In such systems the pressures within the system are substantially equalized throughout all parts thereof and as a consequence all parts must be of the same strength to resist the internal pressure existing within the system.

Where ammonia is used as a refrigerant in such machines the normal internal pressures are very high and vary with the temperature of the cooling medium. If the apparatus is air-cooled the normal operating pressure is around 250 pounds per square inch. At higher room temperatures this internal pressure may exceed 400 pounds per square inch. Under certain abnormal conditions the internal pressures may go to a much higher value.

As a result the walls of the apparatus throughout their entire extent must be made sufficiently strong to withstand those high pressures and in addition provide a reasonable factor of safety to guard against accidents. Due to the high pressures involved the factor of safety must be larger than with machines operating under lower pressures due to the danger of explosion from the escaping expanding gases and vapors if the walls of the system should become ruptured.

The above difficulties have been overcome in the past by making the entire machine, including the evaporator, from heavy steel tubing welded together as an integral unit. Such machines have been quite satisfactory in operation but are costly to manufacture because of the many operations involved. That is particularly true in the case of evaporators for such machines. The evaporator must occupy a very small space when positioned in the food compartment of a small domestic refrigerator cabinet. Thus when the evaporator is made of heavy steel tubing a great number of very short bends are required or an inordinate number of welds made. That is especially true where the evaporator coils are bent to conform to the shape and size of the usual sharp freezing chamber as used in modern domestic refrigerators.

In addition, when the evaporator, including the sharp freezing chamber, is formed of heavy steel tubing the problem of transferring heat from the air in the cabinet or the material to be frozen to the evaporating refrigerant in the interior of the heavy steel tubing is a difficult one. The heat transfer path through the heavy steel tubing is quite large and in addition some means must be provided for supporting the freezing trays on the steel tubing which increases the length of the heat transfer path as well as lessens its heat conducting properties due to the necessity for joints.

When the evaporator is made from heavy steel tubing it is usual practice to provide a decorative housing around the evaporator to hide the unsightly tubes from view.

According to this invention it is proposed to form the evaporator for such machines of steel stampings having sufficient strength and welded together in such a manner that they will withstand the highest pressures likely to be found as well as to provide an ample factor of safety against rupture. At the same time a continuous path of sufficient size to provide for the smooth flow of a large quantity of inert gas and refrigerant vapor is provided throughout the entire extent of the evaporator. The steel stampings are so formed that they enclose the fast freezing chamber, provide shelves for ice trays and also provide sufficient surface for box cooling purposes. Thus the problem of transferring heat from the freezing material to the evaporating refrigerant is alleviated and the necessity for a decorative housing eliminated.

This invention is particularly applicable to machines which utilize positive means for circulating the inert gas in its circuit, which circuit includes the evaporator. In such machines if the evaporator is constructed properly the condenser can be positioned below the top of the refrigerator cabinet even with the evaporator and the inert gas at its raised pressure utilized to raise the liquid refrigerant through the evaporator as the refrigerant diffuses into the inert gas to produce refrigeration.

The evaporator according to this invention is constructed of steel stampings one or both of which has a depression stamped in one face thereof. The plates are then positioned in face to face contact and seam welded close to both edges of the depression so as to form in effect a welded seam tube in the body of the plate. The entire evaporator may be formed of a pair of such plates or a plurality of such assemblies may be welded together so as to form a complete evaporator having a continuous duct from end to end.

Where it is desired to form a fast freezing chamber the shelf for ice trays and the top of the freezing chamber may be formed of a pair

of stampings welded together as above described. The assemblies may then be connected by tubing to properly position the assemblies relative to each other and to connect the ducts of each assembly for the proper flow of inert gas and refrigerant.

In the case where the inert gas under pressure is utilized to raise the liquid refrigerant through the evaporator the connecting conduit should merge smoothly with the ducts of the various assemblies so that there are no abrupt bends in the duct through the evaporator. One way of doing this is to properly form the depressions in the plates and the shape of the connecting tubes. Another way is to form the back of a fast freezing chamber of a welded plate assembly similar to that previously described but with offset portions where the depressions end so formed that the ducts thereof merge with that of the ice tray shelves and the top of the fast freezing chamber. In this case fins can be provided on the back plate so that the refrigeration taking place in the connecting tubes can be utilized for box-cooling purposes.

In some cases it is desirable to place baffles such as a coiled wire or other type baffle in the evaporator tubes to agitate the gas and liquid flowing therethrough so as to provide for better gas and liquid contact between the inert gas and liquid refrigerant. In such a case the baffle can be easily inserted prior to the welding operation. This latter feature is just as well applicable to absorbers as evaporators.

Other objects and advantages of this invention will become apparent as the description proceeds when taken in connection with the accompanying drawings, in which:

Figure 1 is a diagrammatic representation of a refrigerating system and evaporator according to this invention;

Figure 2 is a perspective view partly broken away of one form of evaporator according to this invention;

Figure 3 is a perspective view partly broken away of the box-cooling portion of the evaporator shown in Figure 2;

Figure 4 is a perspective exploded view partly broken away of a modified form of the invention; and

Figure 5 is a sectional view through line 5—5 of Figure 4.

Referring to Figure 1 of the drawings, there is disclosed a three-fluid absorption refrigerating system comprising a boiler B, an analyzer D, an air-cooled rectifier R, a tubular air-cooled vertically positioned condenser C, an evaporator E, a gas heat exchanger G, a tubular air cooled absorber A, a solution reservoir S, a liquid heat exchanger L, and a circulating fan F which is driven by an electrical motor M.

The above described elements are interconnected by various conduits to form a plurality of gas and liquid circuits constituting a complete refrigerating system to which reference will be made in more detail hereinafter.

The refrigerating system will be charged with a suitable refrigerant, such as ammonia, a suitable absorbent, such as water, and a suitable inert pressure-equalizing medium, such as nitrogen.

The boiler B will be heated in any suitable manner as by an electrical cartridge heater or by gas burner as may be desired. The circulating motor M and the heater for the boiler B may be controlled in any suitable or desired manner.

The application of heat to the boiler B liberates refrigerant vapor from the strong solution contained therein. The vapor so liberated passes upwardly through the analyzer D in counterflow relationship to strong solution flowing downwardly through the analyzer. Further refrigerant vapor is generated in the analyzer by the heat of condensation of absorption solution vapor generated in the boiler. The refrigerant vapor is conducted from the upper portion of the analyzer D to the upper portion of the condenser C through a conduit 13 which includes the air-cooled rectifier R wherein any vapor of absorption solution passing through the analyzer is condensed and returns to the analyzer through the conduit 13. The refrigerant vapor is liquefied in the condenser by heat exchange relation with atmospheric air and is discharged from the bottom portion thereof through a conduit 15 into a downwardly extending conduit 16. The bottom portion of the conduit 16 connects with the bottom portion of the upwardly extending conduit 17 through a U-bend 18. The conduit 16 is appreciably longer than the conduit 17 for a purpose to be described hereinafter. The conduit 17 opens at its upper end into a conduit 20 which discharges into the evaporator in a manner to be described more fully hereinafter.

The weak solution formed in the boiler by the generation of refrigerant vapors therefrom is conveyed from the boiler through a conduit 22, the outer pass of liquid heat exchanger L and a conduit 23 into the solution reservoir S. The conduit 23 may be provided with air cooling fins as shown to constitute a pre-cooler for the weak solution. The weak solution is conveyed from the solution reservoir S through a U-shaped conduit 24 opening into a vertically extending tube 25, of small diameter forming a gas lift pump which discharges into the top of the absorber A.

It is evident that the top of the absorber is materially above the solution level normally prevailing in the boiler analyzer reservoir system whereby some means must be provided to elevate the absorption solution to the top of the absorber A. For this purpose the small bleed conduit 27 is connected to the discharge conduit 28 of the circulating fan F and leads to the junction of conduits 24 and 25 which is below the solution level normally prevailing in the reservoir whereby the weak solution is elevated into the top of the absorber by gas lift action.

In the absorber the weak solution flows downwardly by gravity in counterflow to the rich pressure equalizing medium refrigerant vapor mixture flowing upwardly therethrough. The refrigerant vapor content of the mixture is absorbed in the absorption solution and the heat of absorption is rejected to the surrounding air by air cooling fins which are mounted on the exterior walls of the absorber vessel. The strong solution formed in the absorber discharges into a conduit 32 which opens into the inner pass of the liquid heat exchanger L. From the inner pass of the liquid heat exchanger L the strong solution is conveyed to the upper portion of the analyzer D by conduit 33 whereby it flows downwardly through the analyzer in counterflow to upwardly rising vapors generated in the boiler. The lean pressure equalizing medium refrigerant vapor mixture formed in the absorber A is taken from the upper portion thereof through

the conduit 35 into the suction side of the circulating fan F in which it is placed under pressure and discharged through the conduit 28, the outer pass of gas heat exchanger G, and a downwardly extending conduit 36 into the bottom portion of the evaporator E.

As will be described more fully hereinafter the evaporator E is provided with a continuous serpentine duct from the point of entrance of the conduit 36 thereto, through the bottom wall 37, lift tube 38, intermediate shelf 39, lift tube 41 and top wall 42.

The conduit 20 opens into the bottom portion of the conduit 36 whereby the liquid refrigerant supplied to the evaporator enters the same simultaneously with the pressure equalizing medium which was placed under pressure by the circulating fan F. The diameter of the ducts formed in the evaporator are relatively small whereby the pressure equalizing medium flows through them at a relatively high velocity. The rapidly flowing pressure equalizing medium sweeps or drags the liquid refrigerant with it through the evaporator comprising the lower wall 37, lift tube 38, intermediate shelf 39, lift tube 41, upper wall 42 and conduit 43 into the box cooling section 40 which will be described in more detail hereinafter as the refrigerant is evaporating by diffusion into the pressure equalizing medium to produce refrigeration.

The pressure equalizing medium refrigerant vapor mixture formed in the evaporator is conducted therefrom into the inner pass of gas heat exchanger G through a conduit 45. The opposite end of the gas heat exchanger G communicates with the bottom portion of the absorber A through a conduit 46. In the absorber A the rich pressure equalizing medium refrigerant vapor mixture flows upwardly in counterflow to absorption solution whereby the refrigerant vapor content of the mixture is absorbed by the weak solution.

The bottom duct of the evaporator E is provided with a drain conduit 48 which opens into the strong solution return conduit 32. The conduit 48 opens into the top portion of the bottom duct of the evaporator whereby it will not completely drain such duct. The upper portion of the discharge conduit 15 of the condenser is vented through a vent conduit 49 into the inner pass of the gas heat exchanger G. The solution reservoir S is vented through a conduit 50 into the suction conduit 35 of the circulating fan.

The circulating fan F places the pressure equalizing medium discharged therefrom under a small pressure in the neighborhood of a pressure of 4½ inches of water. In order to prevent this pressure, which also prevails in the conduit 36, from being carried back through the condenser discharge conduit, the condenser and conduit 13 to the analyzer, the conduit is made appreciably longer than the conduit 17 whereby a pressure balancing column of liquid is formed in the conduit 16 which extends above the point of connection between the conduits 17 and 20 a distance sufficient to overcome the pressure produced by the circulating fan in the conduit 36.

The refrigerating system just described is shown diagrammatically in Figure 1. In actual practice the system is arranged in compact form so that it can be easily assembled with a domestic refrigerator cabinet in the manner shown in Figure 1 of the patent to Kitto et al. 2,203,497 of June 4, 1940 with the box cooling portion 40 of evaporator E positioned in the food storage compartment at the rear of the fast freezing chamber.

One form of the evaporator according to this invention is shown in more detail in Figures 2 and 3. The bottom wall 37 as well as the intermediate shelf 39 constitute supports for ice trays. The top wall 42, intermediate shelf 39 and the bottom wall 37 are formed in somewhat the same manner. Each comprises a top plate 51 and bottom plate 52. The top plate is made flat for good thermal contact with ice trays while the bottom plate is stamped with a sinuous or serpentine depression 53. The depression 53 in each case is reversely bent at two points near the front of the evaporator and at one point near the rear, as shown in Figure 2. During the stamping operation the depression 53 in the lower wall 37 is enlarged at 55 to receive a conduit 36 so that when in assembled relationship the conduit 36 and the depression 53 will merge smoothly and have substantially the same area. Likewise, depression 53 of the top wall 42 is enlarged at 58 to receive the conduit 43. The opposite end of the depression 53 in the top wall 42 and one end of the depression 53 in the intermediate shelf 39 is stamped downwardly as at 59 to form an opening having an annular wall the same size as the lift conduits 41 and 38, respectively, so as to merge smoothly therewith. The opposite ends of the depression 53 in the lower wall 37 and in the intermediate shelf 39 are inclined upwardly as shown at 56. Immediately above the incline 56, the upper plate 51 of the lower wall 37 and the intermediate shelf 39 are punched outwardly as at 57 to form openings having an annular wall of the same diameter as the lift conduit 38 and 41, respectively, so as to merge smoothly therewith. The inclines 56 are so formed relative to the punched out portions 57 that when the plates 51 and 52 are assembled the recesses 53 will merge smoothly with the openings formed by the punched out annuli 57.

The lift conduits 38 and 41 each rise upwardly above the annuli 57 for substantially half the distance of their vertical height, then bend smoothly toward the opposite side of the evaporator and then bend smoothly upwardly to the annuli 59. The purpose of this construction will be explained in more detail hereinafter.

After the stamping operation, the plates 51 and 52 are placed in face to face relationship with the depressions 53 of plate 52 facing plate 51 and seam welded together as shown at 54 of Figure 2 near the edges of depressions 53. The welding of the plates 51 and 52 at the edges of the depressions 53 forms in effect a welded seam tube with the plates attached. Such a construction will have substantially the same strength against internal pressures as would a true welded seam tube made in the ordinary manner. If desired, the depressions can be formed in both plates 51 and 52 to form a duct of true cylindrical shape but it is preferable to make the top plate flat so that it will have good thermal contact with ice trays supported thereon. If desired, heat transfer fins may be bonded to the plate 51 of the top wall 42 so that the refrigeration taking place in the top wall can be better utilized for box cooling purposes. The plate 51 for the upper wall 42 has downwardly turned portions 60 which when the parts are in assembled relationship form the side walls of the sharp freezing chamber.

The box cooling section 40 comprises two com-

plementary and duplicate plates 61 and 62 each having a sinuous or serpentine depression 63 stamped therein. At one end the depression 63 of each plate is bulged outwardly similar to the annuli 59 of the plates 52, at the opposite ends the depression 63 merges into the plate similar to the inclined portion 56 of depressions 53 in the plates 52. After the plates 61 and 62 are formed as just described, they are rotated through 180°. A wire coil insert 67 then may be placed between the plates in the depression 63 and the plates seam welded together as were the plates 51 and 52. Flanged heat transfer fins 64 having depressions 65 in the flanged edge thereof to fit the bulges formed by the depressions 63 may then be bonded to the section 40 as shown in Figure 3.

After the lower wall 37, intermediate shelf 39 and top wall 42 are formed, the lower ends of lift conduits 38 and 41 may be welded to the annuli 57 and the upper ends thereof welded to the annuli 59. The depending portions 60 may then be welded to the edges of the bottom wall 37 and the intermediate shelf 39. A back wall 66 for the fast freezing chamber is then welded in place. The conduit 43 is then welded into the enlargement 58 and to the box cooling section 40. These welds may be made separately or a suitable jig provided whereby all the welds may be made simultaneously by any suitable welding method.

The complete evaporator is then tested under 800 pounds per square inch or more hydraulic pressure and then welded to the conduits 36 and 45. The entire evaporator may be coated with vitreous enamel or other ornamental coating either before or after testing, preferably before.

In operation the inert gas under pressure will enter the duct in the bottom wall 37 simultaneously with liquid refrigerant and carry the liquid refrigerant along with it through the duct in the bottom wall as the refrigerant is evaporating by diffusion into the inert gas. When the gas and liquid refrigerant reaches the incline 56 and the first lift of the lift conduit 38, the rapidly flowing gas will sweep or drag the liquid refrigerant up this lift and then along the horizontal portion of the lift conduit and up the second lift portion of the lift conduit 38. Similarly the flow of liquid refrigerant will be produced by the rapidly flowing inert gas through the duct in the intermediate shelf 39, lift conduit 41 and the duct in the top wall 42. Any liquid refrigerant remaining will be carried through the conduit 43 into the box cooling section 40 and flow downwardly therethrough by gravity aided by the flow of the inert gas.

The reason the lift conduits 38 and 41 are made in two stages is that it has been found that in this type of gas and liquid movement a certain pressure differential of the gas will raise the liquid refrigerant a greater total height when more than one stage is used than it will in one stage. Thus the lifting action of the gas has been broken up into stages so that the pressure differential produced by the fan need not be so great.

When the inert gas first enters the duct in the bottom wall, it is comparatively weak in refrigerant vapor and therefore comparatively rapid evaporation takes place in that duct. Comparatively rapid evaporation also takes place in the lift conduits 38 and 41 due to the better contact between the inert gas and liquid refrigerant. When the inert gas and the remaining liquid refrigerant reach the duct in the top wall 42 and the box cooling section 40, the inert gas will be comparatively rich in refrigerant vapor and little liquid refrigerant will remain. This will result in the top wall 42 and the box cooling section 40 being at a higher temperature than the lower wall 37 and the intermediate shelf 39. Thus extreme cold is produced for freezing purposes and the box cooling portions of the evaporator will be maintained at the proper temperature for cooling the air in the food compartment. As previously stated, the refrigeration taking place in the upper wall 42 may be utilized for box cooling purposes to a greater extent if fins are provided on the top wall 42.

If desired, an evaporator in which the liquid refrigerant flows downwardly through the evaporator may be made in the manner described in connection with the evaporator shown in Figures 2 and 3. In such a case, some baffling means similar to the wire coil 67 of the box cooling section 40 should be provided to form pools in the ducts of the evaporator for better contact of the inert gas with the liquid refrigerant. This invention is also particularly adapted to such evaporators since in that case it is an easy matter to assemble the baffle before the welding operation, whereas in prior construction such baffles had to be separately assembled in short lengths or threaded through the ducts.

In the evaporator made in accordance with the showing of Figures 2 and 3, the only extra coverings for the evaporator other than those parts forming the system walls is the downward extension 60 and the back wall 66. In prior evaporators for domestic absorption refrigerating apparatus of this type in which the entire unit is made of heavy steel tubing, it was necessary to provide an extra ornamental covering to hide the steel tubing from view. By the construction according to this invention all this extra material and expense is avoided. As previously pointed out the parts forming the system walls themselves can be coated with a vitreous enamel or other ornamental coating so as to present a pleasing appearance without the necessity of providing an auxiliary ornamental covering.

Figures 4 and 5 show a modification in which advantage is taken of the refrigeration taking place in the lift conduits for box cooling purposes and at the same time eliminates the necessity of a separate back wall for the fast freezing chamber.

In this modification, the fast freezing chamber is provided with the bottom wall 68, intermediate shelf 69 and top wall 70 substantially the same as in the first modification. The separate box cooling section, however, has been omitted and the refrigeration taking place in the lift ducts and in the top wall is utilized for box cooling purposes.

The bottom wall 68, intermediate shelf 69 and top wall 70 are made of upper plates 71 and the lower plates 72 substantially the same as in the first modification. The lower plates 72 are provided with a continuous serpentine depression 73 and the upper and lower plates are seam welded together as in the first modification. The depressions 73 differ from those of the first modification in that the ends thereof continue to the back edge of the plates 72. As viewed in Figure 4 a cut out is provided in the near rear corner of the bottom wall 68, in both rear corners of the intermediate shelf 69 and in the far rear corner of the top wall 70. These cut outs are for the purpose of cooperating with portions of the rear wall 74 to provide a smooth duct throughout the

entire extent of the evaporator as will now be explained.

The rear wall 74 comprises an outer plate 75 of the same extent as the cross sectional area of the fast freezing chamber except for certain cut-out portions to be later described and two duplicate inner plates 76. During the stamping operation the plate 75 is provided with four forwardly bent portions 77 and two depressions 78. Each of the plates 76 is provided with a forwardly bent portion 79 corresponding in shape to the forwardly bent portions 77 of the plate 75, with a horizontally extending portion 81, and vertically extending portions which merge into the forwardly bent portion 79. The plates 76 are also provided with a depression 80 which faces in the opposite direction from the depressions 78 in the back plate 75. The depressions 78 and 80 in the forward extensions 77 and 79 and in the vertical portion of plate 76 form lift ducts corresponding to the ducts 38 and 41 of the first modification. At the lower end the depressions 78 are of substantially the same cross sectional area as the depressions 73 and the forwardly bent portions 79 are so formed as to merge smoothly with the top plate 71 when the parts are assembled.

At the upper end, the depression 78 in the plate 75 merges smoothly with the metal of the forward extensions 77. The depressions 80 in the plates 76 on the other hand merge smoothly with the metal of the forward extensions 79 at the lower ends and are of the same cross section as the depressions 73 at their upper ends. The construction just described results in the duct through the evaporator being of the same area throughout the extent of the evaporator when the parts are assembled as well as a duct in which the various branches thereof merge smoothly with each other without any abrupt bends.

After the stamping operation the plates 75 and 76 are seam welded together as in the case of plates 51 and 52 of the first modification. The parts 68, 69, 70 and 74 may then be placed in a suitable jig and welded together to form an integral unit in any suitable manner.

The ducts formed by the depressions 78 and 80 in the plates 75 and 76 as shown constitute the lift ducts of the evaporator.

The downward extensions 82 of the top plate 71 are insulated from the intermediate shelf 69 and the bottom wall 68 so that the refrigeration taking place therein will be confined to freezing ice. This insulation may comprise rubber elements 83 bonded or cemented between the extension 82 and the ice tray shelves.

Fins 84 are bonded to the top wall 70 and fins 85 to the back wall 74 so that the refrigeration taking place in the lift ducts and in the top wall may be utilized for box-cooling purposes. In this way a separate box-cooling section is dispensed with.

After the parts are all secured together the evaporator is tested as in the first modification. Thereafter it may be coated with a vitreous enamel or other ornamental coating so as to present a pleasing appearance. The evaporator unit is then ready to be welded to a refrigerating apparatus such as is shown diagrammatically in Figure 1.

The evaporator constructed in accordance with Figures 4 and 5 eliminates the necessity of the provision of separate ornamental covering for the evaporator with its resulting waste of time and material. In addition the evaporator is so constructed that it is compact and confines the lowest temperature produced to freezing purposes and utilizes the evaporation which takes place at high temperatures for box-cooling purposes without the necessity of providing a separate box-cooling section.

As can be seen from the foregoing this invention provides an evaporator for an absorption refrigerating apparatus of the type utilizing an inert pressure equalizing medium and which operates with internal pressures in excess of 250 pounds per square inch which is constructed entirely of sheet steel stamping, welded together into an integral unit which will withstand the high pressures involved and at the same time eliminate the necessity for providing separate ornamental covering for the evaporator unit, which is simple and economical to manufacture and well adapted to present day mass production methods.

It can also be seen that this invention has provided a refrigerating apparatus of the type utilizing an inert gas under pressure for circulating the liquid refrigerant upwardly through the evaporator in which the evaporator has a smooth continuous duct throughout its entire extent, in which the evaporator is entirely made of steel stampings suitably welded together and in which the evaporation taking place in the lift ducts of the evaporator is utilized for box-cooling purposes whereby the provision of a separate box-cooling section is unnecessary.

While I have shown but two embodiments of my invention it is to be understood that these embodiments are to be taken as illustrative only and not in a limiting sense. I do not wish to be limited to the particular structure shown and described except as limited by the scope of the claims.

I claim:

1. A two-temperature evaporator for an absorption refrigerating apparatus of the type which utilizes an inert gas under pressure for blowing liquid refrigerant upwardly through the evaporator comprising, a sharp freezing chamber, a box cooling section, said sharp freezing chamber comprising a top horizontal wall, an upper horizontal ice tray shelf and a bottom horizontal wall forming a lower ice tray shelf, said upper wall, upper shelf and lower wall each comprising an upper flat plate and a lower plate with a depression formed in its upper surface and sealed in face to face relationship to the upper plate so that the depression forms a continuous duct between the plates having an inlet and an outlet, said box cooling section comprising two vertically positioned plates having complementary depressions in one face thereof, sealed together in face to face relationship with the depressions facing each other so as to form a continuous duct between the plates having an inlet and an outlet, means for leading liquid refrigerant and an inert gas under pressure to the inlet of the duct in the lower wall, and conduit means connecting the outlet of the duct in the lower wall to the inlet of the duct in the upper shelf, the outlet of the duct in the upper shelf to the inlet of the duct in the upper wall and the outlet of the duct in the upper wall to the inlet of the duct in the box cooling section.

2. An evaporator for an absorption refrigerating apparatus of the type utilizing an inert gas under pressure for flowing liquid refrigerant upwardly through the evaporator comprising, a top

horizontal wall, an intermediate horizontal wall and a bottom horizontal wall, said walls each comprising a top plate and a lower plate having a continuous depression in its upper face sealed in face to face relationship to the upper plate so as to form a continuous duct between the plates, having an inlet and an outlet, a multiple lift conduit connecting and merging smoothly with the outlet of the duct in the lower wall and the inlet of the duct in the intermediate wall and a second multiple lift conduit connecting and merging smoothly with the outlet of the duct in the intermediate wall and the inlet of the duct in the upper wall.

3. An evaporator for an absorption refrigerating apparatus of the type utilizing an inert gas under pressure for flowing liquid refrigerant upwardly through the evaporator comprising, a top horizontal wall, an intermediate horizontal wall and a bottom horizontal wall, said walls each comprising a top plate and a lower plate having a sinuous depression in its upper face sealed in face to face relationship to the upper plate so as to form a continuous sinuous duct between the plates, having an inlet and an outlet, a multiple lift conduit connecting and merging smoothly with the outlet of the duct in the lower wall and the inlet of the duct in the intermediate wall and a second multiple lift conduit connecting and merging smoothly with the outlet of the duct in the intermediate wall and the inlet of the duct in the top wall, said top and bottom walls forming the top and bottom of a fast freezing chamber and box cooling fins secured to the upper plate of the top wall.

4. An evaporator for an absorption refrigerating apparatus of the type utilizing an inert gas for raising liquid refrigerant upwardly through the evaporator, said evaporator comprising a top horizontal wall, an intermediate horizontal wall, a bottom horizontal wall and a back vertical wall, said top, intermediate and bottom walls each comprising an upper plate and a lower plate having a sinuous depression in its upper face secured in face to face relationship to the upper plate so as to form a continuous sinuous duct between the plates, having an inlet and an outlet, said back wall comprising a back plate and two inner plates one above the other secured in face to face relationship to the back plate, said inner and back plates being so constructed and arranged as to form two multi-stage lift conduits, the lower of which connects and merges smoothly with the outlet of the duct in the bottom wall and the inlet of the duct in the intermediate wall and the upper of which connects and merges smoothly with the outlet of the duct in the intermediate wall and the inlet of the duct in the top wall.

5. An evaporator for an absorption refrigerating apparatus of the type utilizing an inert gas for raising liquid refrigerant upwardly through the evaporator, said evaporator comprising a top horizontal wall, an intermediate horizontal wall, a bottom horizontal wall and a back vertical wall, said top, intermediate and bottom walls each comprising an upper plate and a lower plate having a sinuous depression in its upper face secured in face to face relationship to the upper plate so as to form a continuous sinuous duct between the plates, having an inlet and an outlet, said back wall comprising an outer plate and two inner plates one above the other secured in face to face relationship to the outer plate, said inner and outer plates being so constructed and arranged as to form two multi-stage lift conduits the lower of which connects and merges smoothly with the outlet of the duct in the bottom wall and the inlet of the duct in the intermediate wall and the upper of which connects and merges smoothly with the outlet of the duct in the intermediate wall and the inlet of the duct in the top wall, said top, bottom and back walls forming top, bottom and back walls of the fast freezing chamber, the upper plate of the top wall extending downwardly beside the intermediate and bottom walls to form the side walls of the fast freezing chamber, said downwardly extending portion being insulated from the intermediate and bottom walls and said top and back walls having box cooling fins secured thereto.

6. An evaporator for an absorption refrigerating apparatus of the type utilizing an inert gas under pressure for raising liquid refrigerant upwardly through the evaporator comprising, an upper horizontal wall, an intermediate horizontal wall, a bottom horizontal wall and a back vertical wall to form a rectangular freezing chamber, said walls being formed of stampings secured in face to face relationship and being so constructed and arranged as to form a continuous conduit between the stampings which extends continuously from one lower back corner of the evaporator to the opposite upper back corner thereof.

7. An evaporator for an absorption refrigerating apparatus of the type utilizing an inert gas under pressure for raising liquid refrigerant upwardly through the evaporator comprising, an upper horizontal wall, an intermediate horizontal wall, a bottom horizontal wall and a back vertical wall which form a rectangular freezing chamber, said walls being formed of stampings secured in face to face relationship and being so constructed and arranged as to form a sinuous conduit between the stampings which extends continuously from the back end of the lower wall to the back end of the upper wall, the conduit of said back wall forming lift tubes whereby the inert gas under pressure may raise liquid refrigerant from the bottom wall to the intermediate wall and from the intermediate wall to the upper wall.

8. In an absorption refrigerating apparatus of the type which utilizes an inert gas under pressure for blowing liquid refrigerant upwardly through the evaporator and operating with internal pressures in excess of 250# per square inch, that improvement which consists of a freezing chamber having vertically spaced ice tray shelves formed of two heavy steel plates secured together in face-to-face relationship, and being so constructed as to form a duct for the refrigerant and inert gas therebetween and a rear wall for the freezing chamber formed of two recessed plates of heavy steel secured together in face-to-face relationship in which the recesses are so constructed as to form a duct for refrigerant and inert gas therebetween, said last mentioned duct being constructed to merge smoothly with the ducts in the ice tray shelves and means for supplying liquid refrigerant and inert gas under pressure to the inlet of the duct in the lower shelf.

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