May 17, 1938. E. G. JAY 2,117,961

APPARATUS FOR TRANSFER OF HEAT

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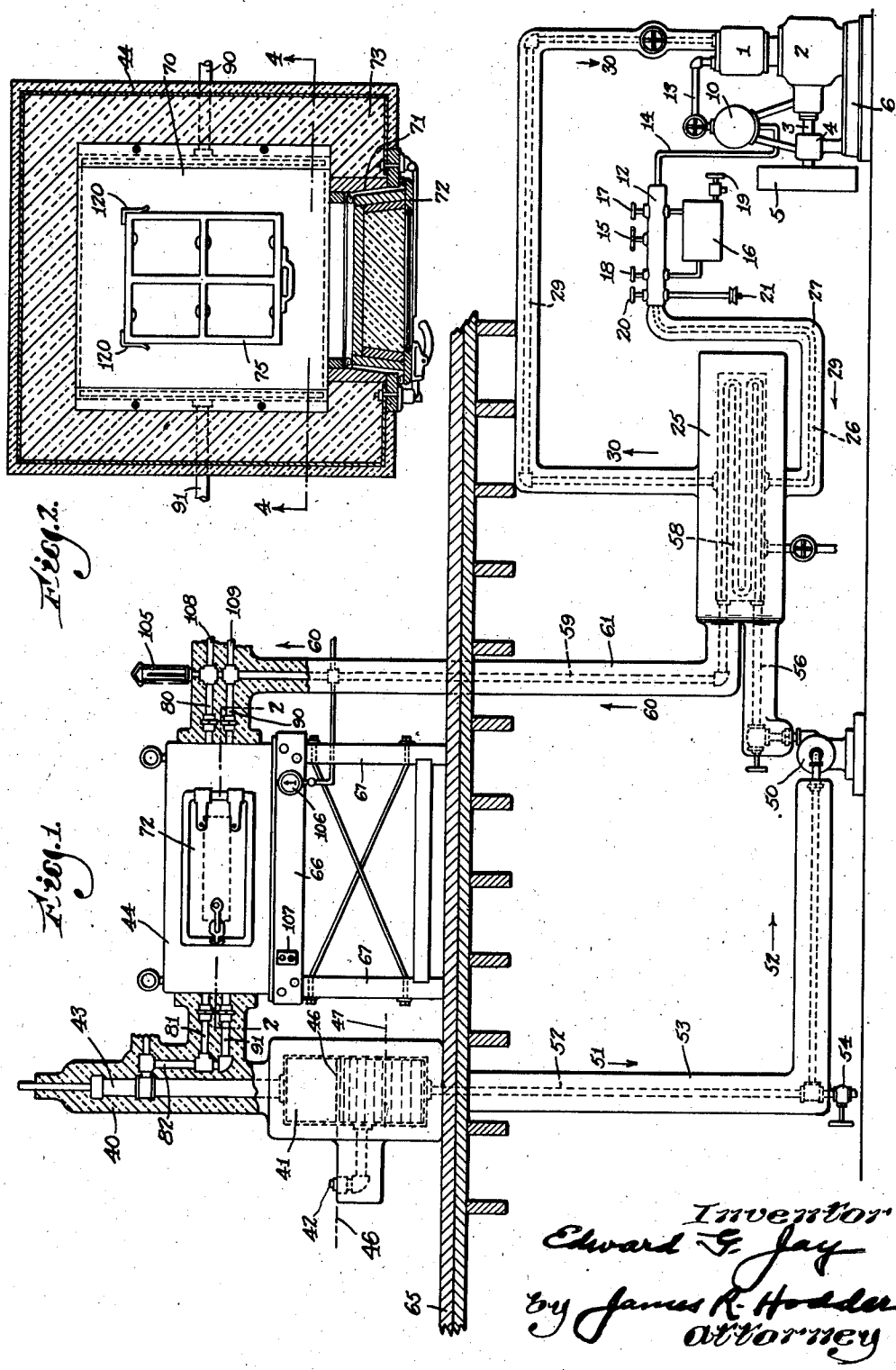


Fig. 2.

Fig. 1.

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Fig. 3.

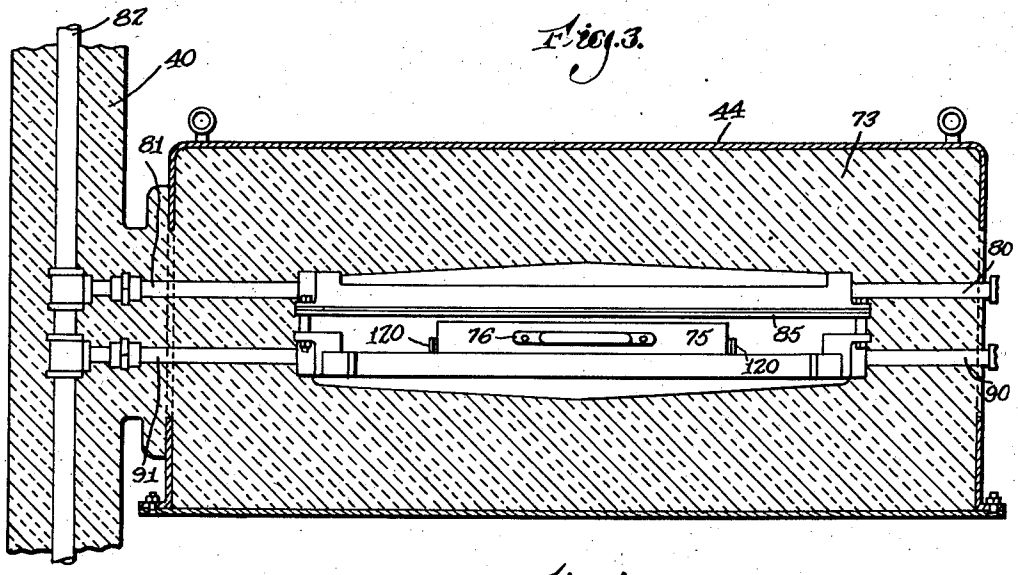


Fig. 4.

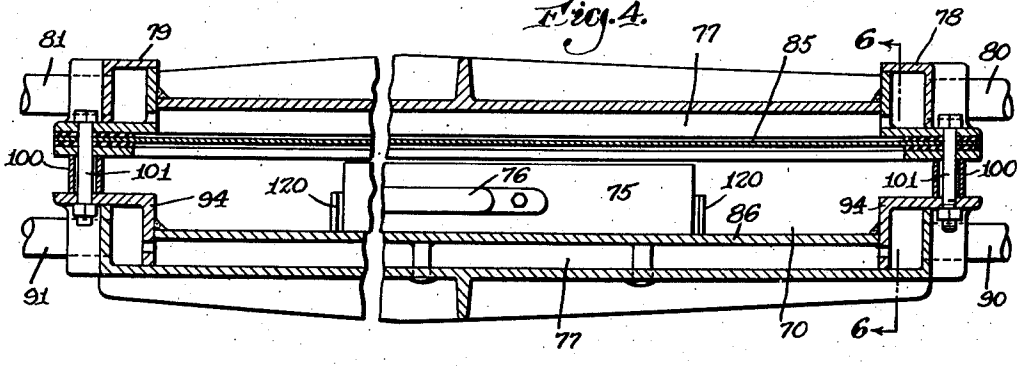
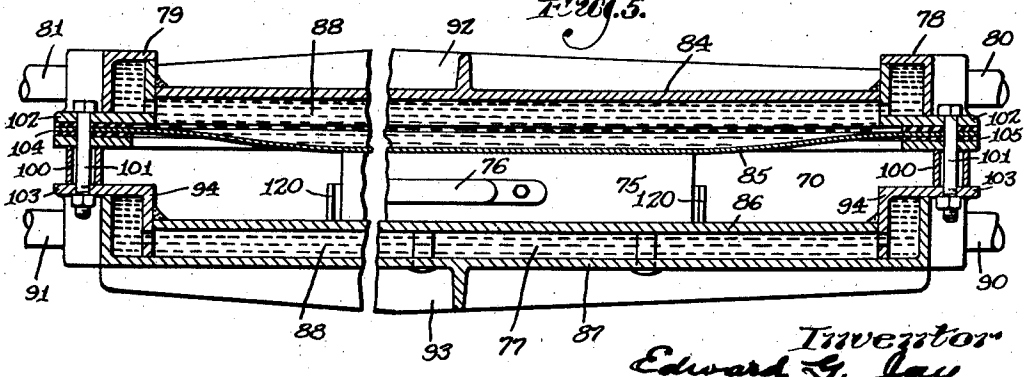


Fig. 5.



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Fig. 6.

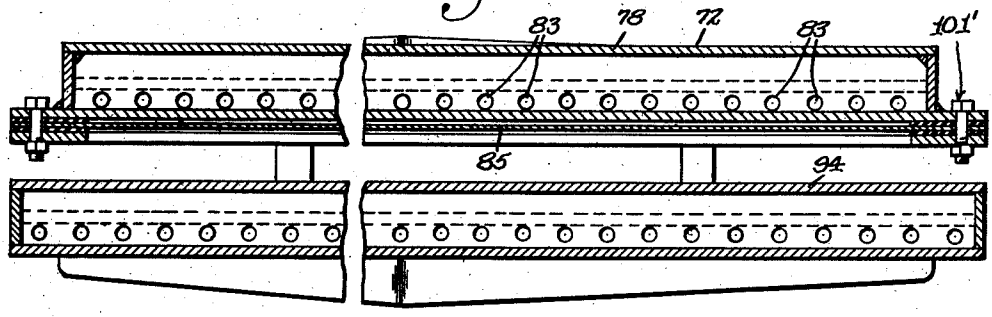


Fig. 7.

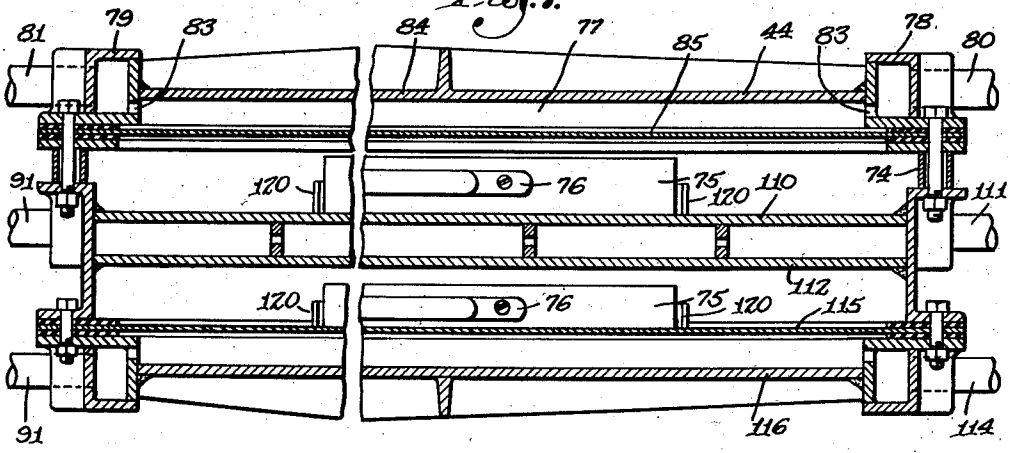
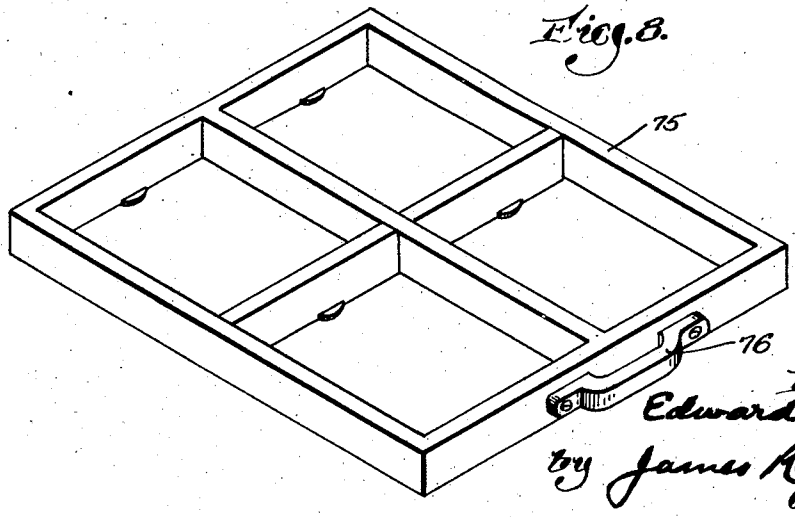


Fig. 8.



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UNITED STATES PATENT OFFICE

2,117,961

APPARATUS FOR TRANSFER OF HEAT

Edward G. Jay, Mansfield, Mass.

Application October 12, 1935, Serial No. 44,704

8 Claims. (Cl. 62—114)

My present invention is a novel and improved apparatus for transfer of heat and, more particularly, is directed to heat exchange in a refrigerating apparatus wherein transfer of temperature is provided quickly and efficiently by conduction.

Preferably I carry out my invention by providing a suitable refrigerating receptacle with oppositely positioned hollow members arranged to receive the article or articles to be treated therebetween. The opening between the cooperating refrigerating members is, preferably, normally wider than the thickness of the articles to be treated or the container holding the same, and either one or both of the walls of the refrigerating means between which the articles to be treated are fitted, is in the form of a flexible plate, fabric, or member. Thereupon, a refrigerating substance, such for example as brine, gas, or the like is circulated thru the members under sufficient head or pressure to distort the plate or plates, thus giving a firm contact between the wall or walls of the refrigerating members and articles to be treated, thereby effecting a highly efficient exchange of heat by conduction between the articles and cooperating refrigerating members.

A plurality of such pairs of members may be arranged either in the same or adjacent apparatus, and either with the same or separate circulating systems, and either with the same or different spacings and capacity between the members to hold and contain similar or different sized articles. Also, my receptacle and the flexible contact plates or members may be arranged horizontally or vertically with equal efficiency and of practically any size and capacity which may be commercially needful for the product to be treated.

By my utilization of a flexible contact member, or members, between the product to be treated and the receptacle in which the treatment is effected, I eliminate all mechanically moving parts in the apparatus and thereby greatly simplify the construction and, furthermore, effect a quick and rapid transfer of heat by conduction from the product being treated in the receptacle or, conversely, from the receptacle to the product.

Referring to the drawings, illustrating a preferred embodiment of my invention,

Fig. 1 illustrates in diagrammatic form, partly in cross section, an apparatus for transfer of heat carrying out my present invention;

Fig. 2 is an enlarged cross-sectional view on a horizontal plane thru the refrigerating apparatus showing the freezing frame in position, on the line 2—2 of Fig. 1;

Fig. 3 is a vertical cross-sectional view on a further enlarged scale;

Fig. 4 is a cross-sectional view on an enlarged scale on the line 4—4 of Fig. 2 with the apparatus in inoperative position;

Fig. 5 is a corresponding view with the apparatus in operative position, and with the flexible plate in contact with the articles being treated;

Fig. 6 is a cross-sectional view on the line 6—6 of Fig. 4;

Fig. 7 is a diagrammatic view illustrating a plurality of units, and

Fig. 8 is a view in perspective of a suitable freezing frame to contain the articles being treated.

It will be appreciated that in carrying out my invention I may utilize any desired or standard type, form, size, or capacity of apparatus to supply either heat or cold thru the unit by the circulation of a liquid or a gaseous element, and either closely adjacent the unit or at a relatively remote distance therefrom.

In the typical embodiment illustrated herein, I have shown the unit for heat exchange, with the products to be treated, as conveniently positioned on a room or floor such as of a house, or factory and with the condenser, compressor, and circulating and operating means therefor positioned at a relatively remote point, such as in the space underneath the room in which the unit is installed. Also, I have herein illustrated a typical and standard type of refrigerating apparatus comprising an ammonia compressor 1, operated by mechanism in an adjacent casing 2, thru which a shaft 3 mounted in suitable bearings 4 receives rotation by a pulley 5 belted to any suitable source of power, and the apparatus mounted on a base 6.

A condenser 10 of the usual shell and tube type is suitably associated with the compressor 1 and connected therewith and to a manifold 12 thru pipes 13 and 14, respectively. Associated with the manifold 12 is a hand expansion valve 15, an automatic float valve 16 and inlet and outlet valves from the manifold 12 thereto, as indicated at 17 and 18 respectively, a drain valve 19 and a charging valve 20 and charging connection 21, all of usual standard construction. A suitable brine cooler of appropriate capacity 25 is connected with the manifold 12 thru the pipe 26, here shown in dotted lines, and preferably insulated in a covering 27, the liquid refrigerant flow thereto being in the direction of the arrow

29 thru the cooler 25 and back to the compressor 1, thru the conduit 29 in the direction of the arrows 30. This completes a standard form of ammonia cooling system.

I provide a liquid brine cooling system which will run thru coils in a cooler 25. As herein shown, I utilize a brine circulating system as the immediate heat exchange element for operating the unit. For this purpose I provide a suitable arrangement of piping 43 spaced in relation to the receptacle 44 to be hereinafter described, which piping is arranged to provide a hydrostatic head on 82 above the receptacle, and is further provided with a vent or air relief chamber 43, the lower portion of which provides a connection to a brine reservoir 41, into which the circulating brine overflows. Suitable insulation is indicated for all of this piping arrangement as at 40. The brine reservoir and brine circulating system is filled thru a plugged extension filling connection 42.

When the system is at rest, the brine for circulating thru the system would be at a level with the filler 42, as indicated on the dotted lines 46, and when in circulating operation the level in the reservoir 41 would be substantially as shown by the line 47. A pump 50 for circulation of the brine is provided with a conduit from the reservoir 41, the current flow leading in the direction of the arrows 51 thru the conduit 52 enclosed in insulating material 53 and in the drain outlet 54 at appropriate position. A suitably driven centrifugal pump 50 circulates brine thru a pipe 56 into the cooler 25 thru the coils 58 and leading therefrom thru the pipe 59 upwardly to the unit 44, the circulation flowing in the line of the arrows 60—60 and the pipes 59 being preferably covered with insulation 61.

In the showing of the drawings I have, as previously noted, illustrated the refrigerating unit in one room, as in a house or factory and the compressor, condenser, cooler, and associated parts underneath the same, as in the cellar; and for this purpose I have designated in diagrammatic form, and as shown in cross-section, a floor 65. In order to have the unit at an appropriate or convenient height, I prefer to mount the same on a stand or platform 66, mounted on studs or legs 67—67 and suitably braced. The unit 44 may be of any desired size, capacity, and area but, as herein shown for illustrative purposes, is a rectangular casing having the central open recess 70 to receive the freezing frame 75 to contain all articles to be treated and being formed with an opening 71 and a gate or door 72, all suitably covered by insulating material 73, and adapted to receive between the inner walls and the outer walls the circulating brine or equivalent liquid or gaseous substance in chamber 77. Thus I have provided in simple form a box-like unit or receptacle with an upper and lower chamber, as well as side portions, to receive in the central section the freezing frame containing the articles to be treated.

The unit comprises essentially two or more sections, see Figs. 4 and 5, with manifolds 78 and 79 across each end, and an inlet pipe 80 in communication with the pipe 59 from the cooler, and an outlet pipe 81 leading from the unit 44 and upwardly, as shown at 82, Figs. 1 and 3, a suitable distance to provide the desired head or pressure to deflect a flexible plate wall, or partition 85 which then contacts with the top of the freezing frame 75 and the contents therein.

A series of openings or recesses 83—83, see Fig. 6, lead from the manifold 78 into the chamber 77 formed between the rigid top wall 84 of the upper chamber and the flexible plate 85 constituting the lower wall of the same and between which the brine will circulate.

A similar construction for the lower portion of the unit is provided, as shown in Figs. 4, 5, and 6, except that I have here shown both the upper plate or member 86 and the outer or bottom wall 87 as rigid, leaving the chamber 77 therebetween thru which the circulating brine 88 will flow thru end manifolds 94, having an inlet thru the pipe 90 also in communication with the inlet conduit 59 and from thence to an outlet pipe 91 into the common outlet 82, as clearly shown in Figs. 3, 4, and 5. Similar manifolds are used in both upper and lower chambers, and strengthening webs or ribs 92 and 93 are also supplied, if desired, to the upper and lower outer walls, respectively.

I so space the upper chamber and the lower chamber to form an appropriate opening 70 between the flexible plate 85 of the upper section and the rigid plate 86 in the lower section to receive the freezing frame 75 and contents with a normal clearance when they rest upon the bottom plate 86.

In order to accomplish this desired result and to provide suitable adjustment for different capacities in the same machine, if desired, I supply spacing members 100 to contact the edges or ends of the chamber 70, uniting the upper and lower members by bolts 101 passing thru suitable recesses in flanges 102 in the upper and 103 in the lower member, and with rubber washers 104, 105 to have the same pressure-tight.

I may also pass the ends of the flexible plate 85 thru to register with the flanges 102 so that the bolts 101 and additional bolts 101' will likewise retain the edge portions of the plate 85 and prevent displacement of the same when said plate is distorted for contact with the freezing frame 75 and its contents during the operation and effecting the heat exchange during direct contact with the contents of the freezing frame.

In order to secure increased efficiency and appropriate distortion of the plate 85 with comparatively slight head of the brine during circulation as afforded by the height of the pipe 82, I prefer to increase the area of the plate 85 proportionately with the area of the freezing frame 75 and the contents therein. Thus a head pressure of the brine 88 over the relatively large area of the flexible or distortable plate 85 proportionate with the area of contact on the freezing frame 75, or the contents therein, will considerably magnify the effect of the head and give perfect contact, the normal clearance between the top of the frame and the flexible plate being also properly proportioned for this purpose.

The operation of the unit just described is extremely simple and efficient; the construction is rigid and allows for considerable adjustment when installing by the depth of the spacing members 100. When the circulating system is at rest the door 72 may be opened; the frame 75 with its contents is placed within the unit or receptacle, sliding the same in on the floor 86 of the bottom portion of the unit positioned by the lugs 120, a handle 76 on the freezing frame being provided to facilitate applying and removing same.

The door 72 is then closed and, assuming that the system has been properly filled with brine to the level of the filler 42 and the ammonia compressor is in operative condition, the valves are opened; the compressor is started thru the ap-

plication of power to the pulley 5 or otherwise, and the pump 50 functions to circulate the brine around the unit while being cooled in the coil contained within the cooler 25 by the operation of the compressor, condenser, and associated parts. The flow of brine from the pump upwardly thru the pipe 59 and into the upper and lower sections of the unit by the inlet pipes 80 and 90, respectively, and thence outwardly and again upwardly thru the outlet pipes 81 and 91 and common pipe 82 at once build up a suitable head or pressure on the flexible plate 85 to distort the same and cause contact therewith against the freezing frame 75 and contents, the circulation of the brine being maintained by overflowing and flowing downwardly into the reservoir 41 and pipe 52 to the pump 50.

A thermometer 105 is provided and a pressure indicator 106 and, if desired, a switch 107 to start the pump motor are all in convenient position for inspection and use adjacent the unit, as shown in Fig. 1.

A multiple unit can be readily operated from the same source of power as outlined in Fig. 1, having a duplicate unit to the right of that shown in Fig. 1, expanding the inlet pipes 108 and 109 into the adjacent duplex unit and operating the same simultaneously with the construction just described, and as shown in Fig. 1.

If desired, a further duplex or plurality of heat-exchange units can be assembled as shown in Fig. 7, wherein two freezing frames 75—75 are positioned horizontally over each other, with the upper unit having the flexible plate 85 and associated portions as previously described, and with the intermediate unit having rigid upper and lower walls 110 and 112 respectively, and the lower unit with a flexible bottom plate 115 and rigid outer wall 116, with suitable inlets 111 for the intermediate unit and 114 for the lower one, and appropriate outlets corresponding to 81 and 91 of the single unit.

In this form when the unit is in operation and the brine circulating, the flexible plate 85 will be deflected downwardly in contact with the freezing frame 75, and the lower flexible plate 115 will be distorted upwardly, raising or lifting the freezing frame 75 for contact with the lower wall 112 of the intermediate section, as will be appreciated.

I find that under average conditions one to one and one-half hours will effectually produce sufficient heat exchange to freeze the contents of the freezing frame 75 to the desired rigidity with suitable brine and an ammonia cooler of appropriate capacity and standard form in a system substantially as outlined.

I have eliminated all moving parts except the pump, and from the refrigerating unit have eliminated entirely all moving mechanism, thus preventing wear, adjustments, replacements of parts and reducing maintenance and operation to a minimum.

I claim:

1. In apparatus for effecting the process of transfer of heat between said apparatus and articles contained therein to be treated, means providing for a circulating medium thru said apparatus, and hydrostatically actuated means producing positive contact between said articles and an adjacent wall of the apparatus during said heat transfer.

2. In apparatus for effecting the process of transfer of heat between said apparatus and articles to be treated, comprising initially a space within said apparatus permitting the application of and removal therefrom of articles to be treated with sufficient clearance for such purpose, a distortable wall in said apparatus adjacent said space, and means to distort hydrostatically said wall and eliminate said clearance to effect a positive contact between the apparatus and said articles.

3. In apparatus for effecting the process of transfer of heat between said apparatus and articles to be cooled, comprising a recess within said apparatus permitting the application of and removal therefrom of articles to be treated with sufficient clearance for such purpose, refrigerant space having a distortable wall in said apparatus adjacent said recess, mechanism producing the flow of a circulating medium over said distortable wall, and hydrostatic pressure means for increasing the refrigerant space to distort the wall and eliminate said clearance during the heat transfer operation.

4. Apparatus for effecting heat transfer from a circulating medium to articles to be cooled, comprising apparatus having spaced members cooperating with the said articles to permit insertion and removal of said articles with suitable clearance, and providing for contact between the apparatus and the articles by a volumetric increase in refrigerant space to distort one of said members.

5. Apparatus for effecting heat transfer from a circulating medium to articles to be cooled, comprising apparatus having spaced members cooperating with the said articles to permit insertion and removal of said articles with slight clearance for such insertion and removal while providing for contact between the apparatus and the articles by introducing a circulating medium thru said member and distorting the outward wall adjacent said articles by increasing the refrigerant space for said medium and increasing the pressure on said distortable wall.

6. Apparatus for effecting heat transfer employing a fluid circulating medium, which consists in providing hollow members thru which said medium may circulate, means to receive and hold articles to be treated adjacent a wall of a hollow member, and hydrostatic means for effecting an increase in pressure of said medium to distort one of said walls and thereby effect a contact between said wall and said articles during the heat transfer operation.

7. Apparatus for effecting heat transfer employing a fluid circulating medium, which consists in providing hollow members thru which said medium may circulate, means to receive and hold articles to be treated adjacent a wall of a hollow member, and hydrostatic means for effecting an increase in pressure of said medium to distort one of said members to effect a contact between said wall and said articles during the heat transfer operation.

8. Apparatus for effecting heat transfer comprising cooperating spaced hollow members, a container for articles to be treated proportionately formed to be positioned between said members with initial clearance when applying the same, one of said members being a flexible member adjacent the articles positioned within the apparatus, and hydrostatic means operative to eliminate said clearance by the action of said flexible member during the heat transfer process.

EDWARD G. JAY.