Jan. 10, 1939. J. N. SALER 2,143,169

REFRIGERATION APPARATUS

Filed Jan. 11, 1936 4 Sheets-Sheet 1

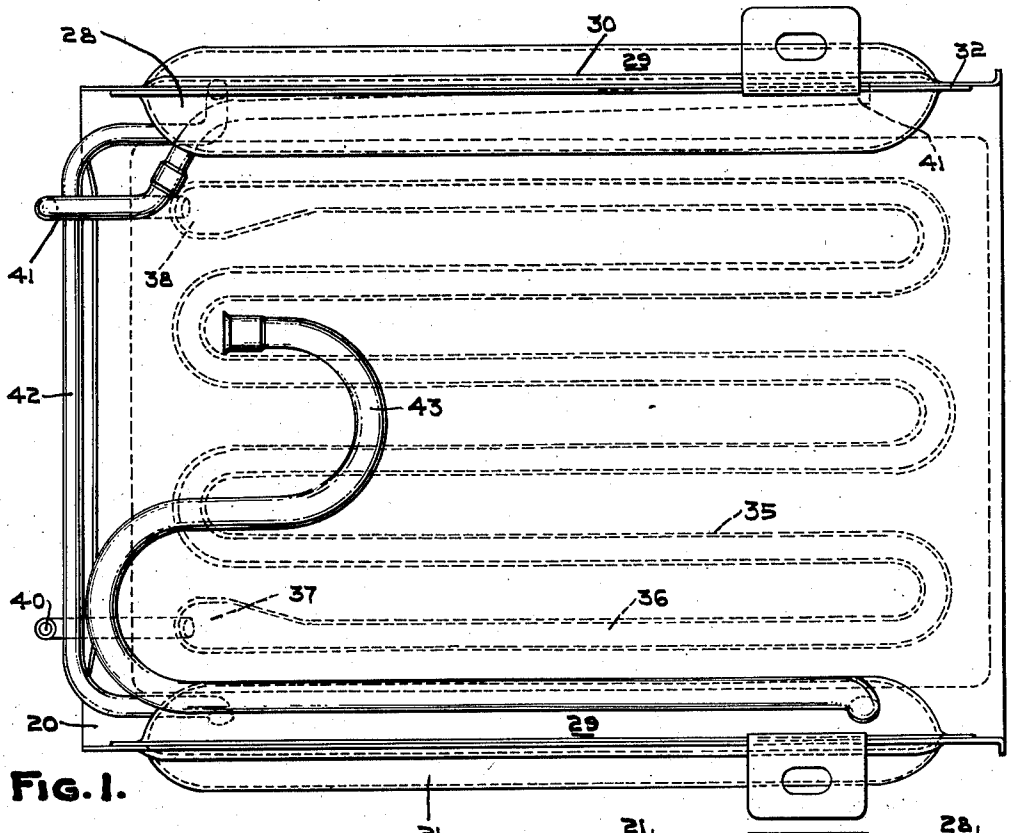


FIG. 1.

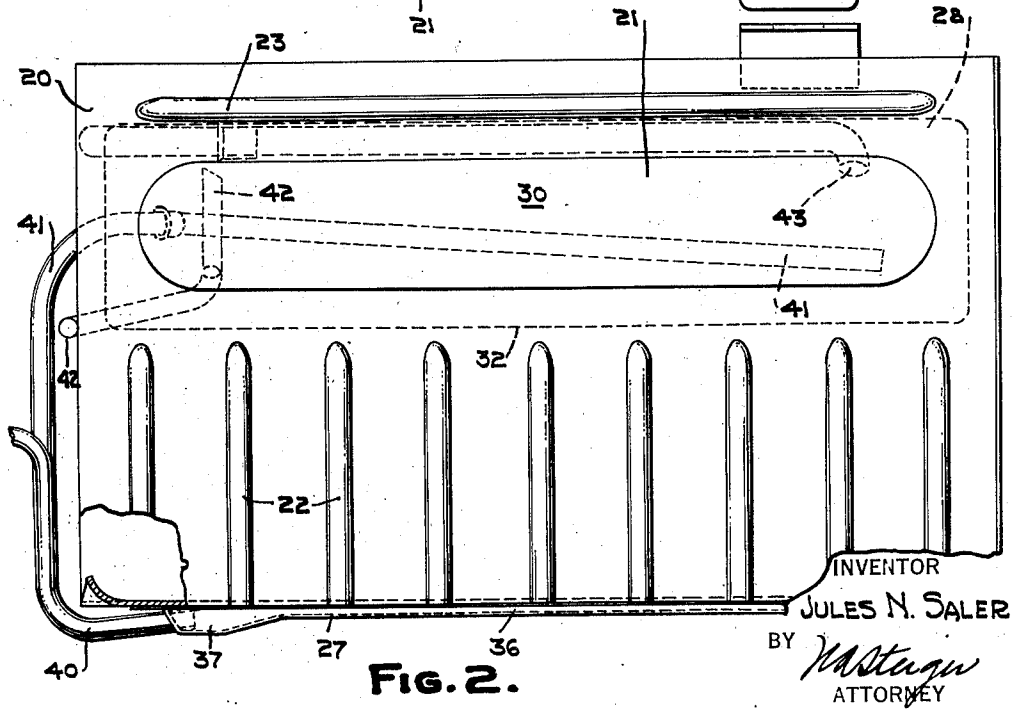


FIG. 2.

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REFRIGERATION APPARATUS

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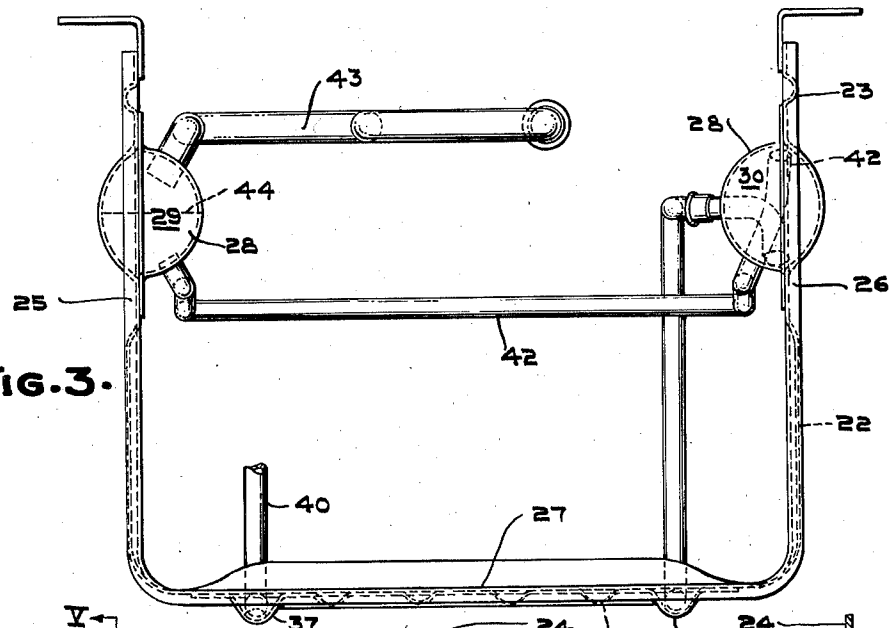


FIG. 3.

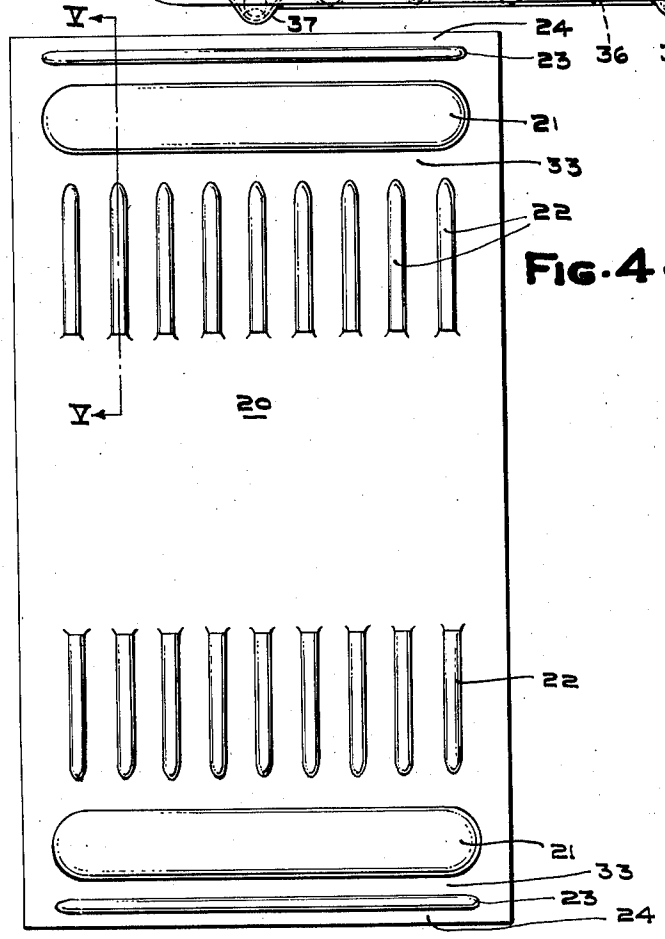


FIG. 4.

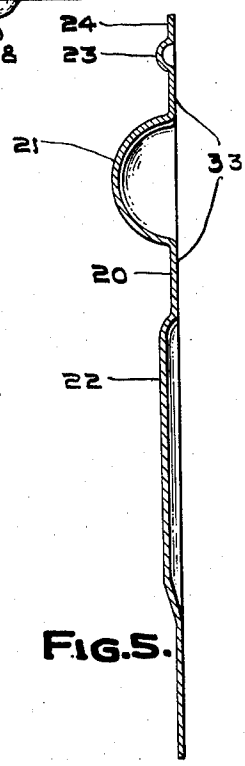


FIG. 5.

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REFRIGERATION APPARATUS

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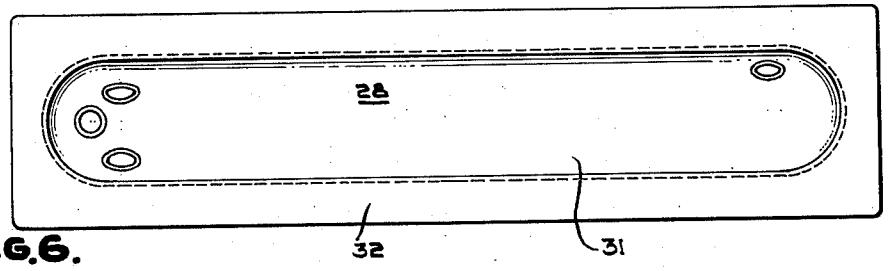


FIG. 6.

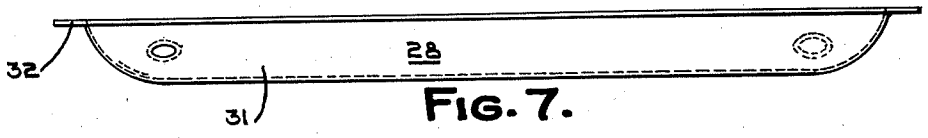


FIG. 7.

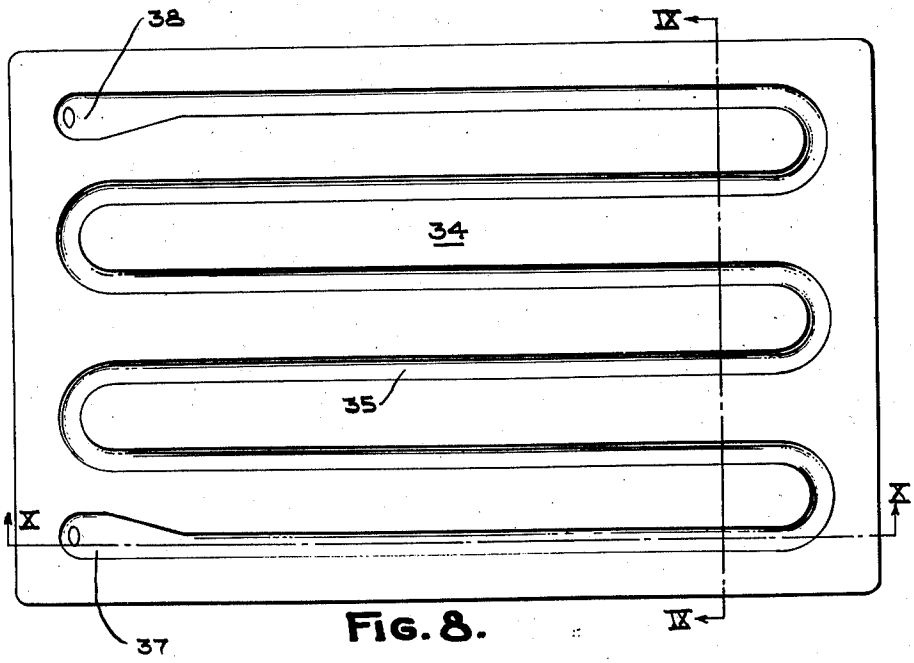


FIG. 8.

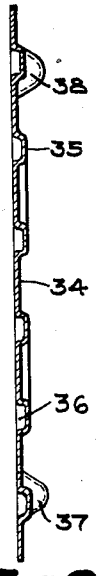


FIG. 9.

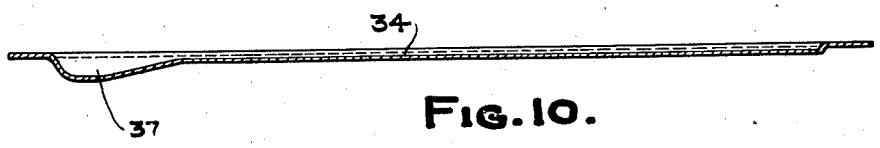


FIG. 10.

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REFRIGERATION APPARATUS

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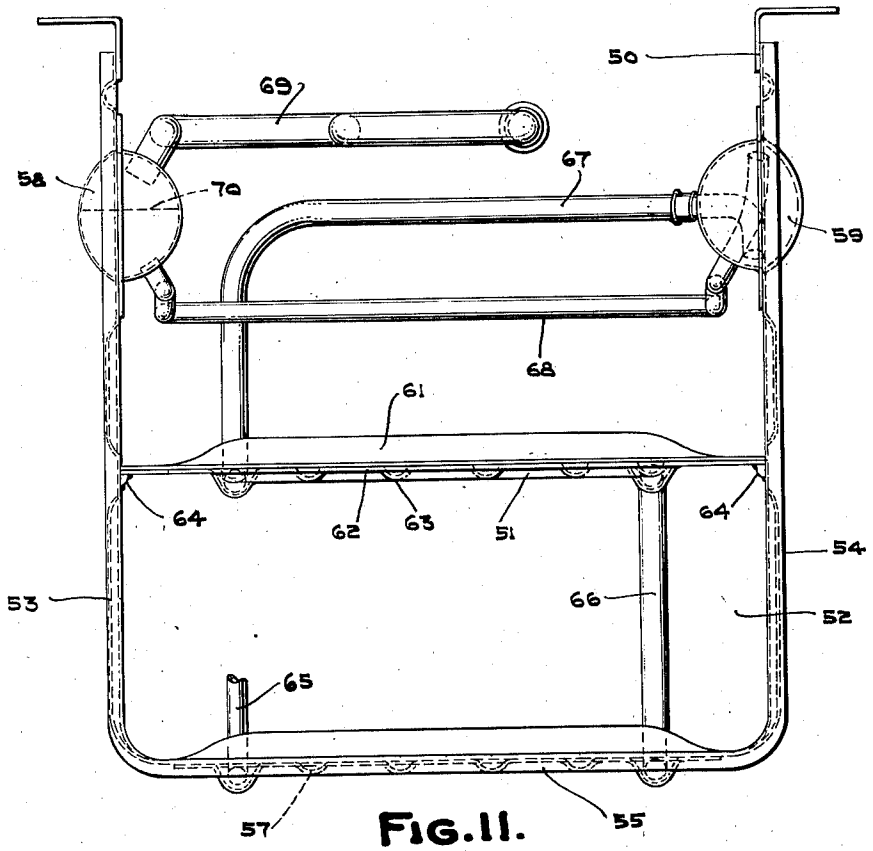


FIG. 11.

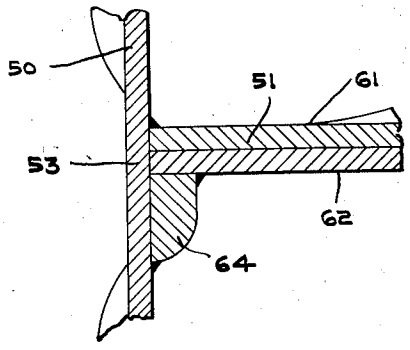


FIG. 12.

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Patented Jan. 10, 1939

2,143,169

UNITED STATES PATENT OFFICE

2,143,169

REFRIGERATION APPARATUS

Jules N. Saler, Springfield, Mass., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application January 11, 1936, Serial No. 58,612

7 Claims. (Cl. 62—126)

My invention relates to refrigeration apparatus, and particularly to a cooling element for mechanical refrigeration apparatus, as well as to a method of manufacturing the same.

It is an object of my invention to provide an improved sheet metal cooling element for mechanical refrigeration apparatus.

It is another object of my invention to provide an improved method of manufacturing a sheet metal cooling element for mechanical refrigeration apparatus.

It is another object of my invention to construct a sheet metal cooling element for domestic refrigeration apparatus in which the amount of material utilized is reduced from that generally used heretofore in cooling elements of this type, and at the same time to provide a large cooling surface for the medium to be cooled in the refrigeration apparatus.

It is still another object of my invention to provide a cooling element utilizing a minimum amount of material and to provide for quick freezing of liquids which are to be frozen by the cooling element.

It is a further object of my invention to provide a novel refrigerant circuit in a cooling element for mechanical refrigeration apparatus.

It is another object of my invention to provide a refrigerant circuit which will ensure forced feed of refrigerant and which will concentrate refrigeration at the surfaces on which pans of liquid are to be placed for freezing the liquid.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a top plan view of one embodiment of my sheet metal cooling element;

Fig. 2 is a side view, partly in section, and partly broken away, of the evaporator shown in Fig. 1;

Fig. 3 is a front elevational view of the cooling element shown in Fig. 1, showing the refrigerant connections to the cooling element;

Fig. 4 is a plan view of the main sheet metal blank from which the cooling element shown in Fig. 1 is formed;

Fig. 5 is a sectional view of the main blank taken on line V—V of Fig. 4;

Figs. 6 and 7 are plan and side views respectively of the header blank for the cooling element;

Fig. 8 is a plan view of the sheet metal blank which forms refrigerant passages with the horizontal wall of the cooling element shown in Fig. 1;

Fig. 9 is a sectional view of the blank shown in Fig. 8 taken on line IX—IX thereof;

Fig. 10 is a sectional view of the blank shown in Fig. 8 taken on line X—X thereof;

Fig. 11 is a front view of another embodiment of my invention illustrating a cooling element provided with a horizontal refrigerated shelf disposed above the lower horizontal wall member; and,

Fig. 12 is a partial sectional view of the cooling element shown in Fig. 11 illustrating the support for the refrigerated shelf.

Referring specifically to Figs. 1 to 10 for a detailed description of one embodiment of my invention, numeral 20 designates a main sheet metal blank, illustrated best in Figs. 4 and 5. The main sheet metal blank 20 is provided with depressed header forming portions 21 and with a plurality of short corrugations 22 extending perpendicularly to the header forming portions and arranged in two rows adjacent each header forming portion. Corrugations 23 are arranged parallel to the header forming portions 21 between edges 24 of the main sheet metal blank 20 and the header forming portions 21. As shown in Figs. 1 to 3, the main sheet metal blank 20 is finally bent to form two vertical wall members 25 and 26 and a horizontal wall member 27.

Complementary header forming blanks 28, shown in Figs. 6 and 7, are welded to the main blank 20 and form, with the header portions 21 thereof, headers or passages 29 and 30 for containing refrigerant, as illustrated in Figs. 1 to 3. The header forming blanks 28 are provided with arcuate depressions 31, and a marginal portion 32. The header forming blanks 28 are fastened to the main blank 20 by welding the aforesaid marginal portions 32 to inner flat portions 33 of the upper side of the main blank 20 which extends between the perpendicular corrugations 22 and the parallel corrugations 23.

A flat sheet of metal 34 is provided with a serpentine corrugation 35, as illustrated in Figs. 8 to 10, and is welded to the horizontal wall 27 of the main blank 20, forming therewith passages 36 for refrigerant, thus providing a sharp freezing plate for freezing liquids. The sheet 34 is also provided with enlarged depressions 37 and 38 at the respective ends of the serpentine corrugation 35, for a purpose hereinafter described.

It is obvious that the patch header forming blanks 28 and the sheet 34 having the serpentine corrugations 35 therein may be both at-

tached to the main blank 20 before or after the main blank 20 is bent to U-shape. It will also be apparent that the corrugations 22 and 23 in the vertical walls 26 and 27 strengthen the walls and improve the appearance thereof, but do not form passages for refrigerant. Since the patch header forming blanks 28 stop at the top of the corrugations 22 in spaced relation to the bottom horizontal wall 28, it is clear that the majority of the extent of the vertical walls 25 and 26 is of a single thickness of metal, thus saving a considerable amount of material and providing an extremely easily fabricated cooling element. Whether such a cooling element is formed of steel, stainless steel, or of a brass alloy, the saving in material is considerable, and the amount of heat absorbing surface is substantially the same as in the conventional double walled sheet metal cooling element. In addition, the rupture point of the resulting cooling element is many times above that of the normal operating pressures.

Referring now to Figs. 1 to 3 for a description of the refrigerant connections for the above-described cooling element, numeral 40 designates a liquid refrigerant inlet conduit which connects with the enlarged depression 37 in the sheet 34 which is fastened to the bottom wall 27 of the cooling unit. Liquid and gaseous refrigerant are conveyed through the serpentine passage 36 to a conduit 41 which connects the enlarged depression 38 at the other end of the serpentine passage 36 to header 30, and extends from the rear of the header 30 to the front thereof below the liquid in the header 30. A conduit 42 extends from adjacent the top of the interior of the header 30 to the bottom of the header 29, thus conveying liquid refrigerant which overflows and also gaseous refrigerant which has been vaporized in the passages 36 and header 30 to the header 29. Additional vaporization of refrigerant takes place in header 29. An outlet conduit 43 extends from the upper portion of the interior of the opposite end of the header 29 from the end through which the conduit 42 enters. The level of liquid in the header 29 is designated at 44, this level being regulated by the amount of refrigerant charged into the system to ensure that only gaseous refrigerant is withdrawn through outlet conduit 43.

The side walls 25 and 26, formed of a single thickness of metal from the blank 20, are cooled by evaporation of refrigerant in the passages 36 and in headers 29 and 30, heat being conducted to the refrigerant contained therein through the metal of the cooling element. The side walls therefore cool air circulating over their outer surfaces, and also provide a shield of cooled metal for the interior of the U-shaped cooling element so that liquids may be quickly congealed therein when disposed in heat exchange relation with the bottom horizontal wall 28. Refrigeration is concentrated at the bottom wall 28 because of direct contact with refrigerant in the passages 36, thus ensuring rapid freezing of liquids placed in heat exchange relation therewith.

Referring now to Figs. 11 and 12 for a detailed description of a second embodiment of my invention, a cooling element generally designated at 50 is formed substantially in the same manner as that shown in Fig. 1 except that an intermediate refrigerated shelf 51 is disposed in a U-shaped freezing compartment 52 formed by side walls 53 and 54 and a lower horizontal wall 55 of the cooling element 50. Passages 57 for refrigerant are formed in the bottom wall 55 in the same manner as the passages 36 are formed in the first embodiment of my invention. Headers 58 and 59 are formed at the upper extremities of the vertical walls 53 and 54, respectively, also in the same manner as disclosed in the first embodiment of my invention shown in Figs. 1 to 10.

The refrigerated shelf 51 embodies a substantially flat sheet of metal 61 welded to a sheet of metal 62 similar to the sheet 34 shown in Figs. 8 to 10, so that a serpentine passage 63 for refrigerant is provided. Bumps 64 are formed in the side walls 53 and 54 and the refrigerated shelf is supported thereon, as best shown in Fig. 12.

The refrigerant circuit for the cooling element shown in Fig. 11 is as follows: Liquid refrigerant enters the passages 57 in the lower horizontal wall member 55 through an inlet conduit 64. Refrigerant liquid and vapor is then conveyed to the serpentine passages 63 in the refrigerated shelf 51 through conduit 66. Refrigerant liquid and vapor from the refrigerated shelf 51 is then conveyed to the header 59 through a conduit 67, and to header 58 through a conduit 68, in the same manner that refrigerant is conveyed from passages 36 to the headers 29 and 30 in the embodiment of my invention shown in Figs. 1 to 10. Further vaporization of refrigerant occurs in header 58. A refrigerant outlet conduit 69 conveys refrigerant vapor only from the header 58, the level of refrigerant in the header 58 being designated at 70 and being maintained below the opening of the outlet conduit 69 by regulating the charge of refrigerant. The cooling element 50, therefore, provides two surfaces, namely, the lower wall 55 and the refrigerated shelf 51, for quickly congealing liquids and also provides for adequately cooling the vertical walls 53 and 54 by the vaporization of refrigerant in passages 57 and 63, and in headers 58 and 59, whereby air coming into contact with the extended surfaces of said walls 53 and 54 is cooled. It is obvious that the headers 58 and 59, and the sheet forming the passage 57 in the lower horizontal wall may be attached to the cooling element 50 at any time before or after it is bent into U-shape.

From the foregoing, it is obvious that I have provided a novel cooling element for mechanical refrigeration apparatus in which very little material is necessary to form the cooling element and in which adequate cooling for air and space for quickly freezing liquids are provided. Furthermore, I have provided a novel method of manufacturing such a cooling element, and have provided novel refrigerant circuits for the two illustrated embodiments of my invention which ensure forced refrigerant feed throughout the cooling element and concentrated refrigerating effect at the surfaces on which liquids are to be frozen to obtain fast freezing of said liquids.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. A cooling element for mechanical refrigeration apparatus comprising a first sheet of metal bent to form a vertical wall member and a horizontal wall member therebelow, both of said wall members being formed of single thickness of metal, a second sheet of metal welded to the ver-

tical portion of the first sheet of metal to form, with said first sheet, a refrigerant containing header, said second sheet of metal terminating short of said horizontal wall member, a third sheet of metal welded to said horizontal wall member and having corrugations therein to form, with the horizontal wall member, a refrigerant containing passage, and refrigerant connecting means between said header and said passages.

2. A cooling element for mechanical refrigeration apparatus comprising a first sheet of metal bent to form a vertical wall member and a horizontal wall member therebelow, both of said wall members being formed of a single thickness of metal, a second sheet of metal welded to the vertical portion of the first sheet of metal to form, with the first sheet, a refrigerant containing header, said second sheet of metal terminating short of said lower horizontal wall member, a third sheet of metal fastened to the horizontal wall member and having corrugations therein to form, with the horizontal wall member, refrigerant containing passages, and means for conveying refrigerant gas therefrom.

3. A cooling element for mechanical refrigeration apparatus embodying a pair of spaced vertical wall members, a horizontal wall member extending across the lower extremities of said vertical wall members, said vertical wall members and said horizontal wall member being formed of a single thickness of metal, a sheet of metal welded to each of said vertical wall members to form, with said vertical wall members, two refrigerant containing headers, said sheets of metal being spaced from the bottoms of said vertical wall members, another sheet of metal welded to said horizontal wall member and having corrugations therein to form, with said horizontal wall member, refrigerant containing passages, and refrigerant connecting means between one of said headers and said passages.

4. A cooling element for mechanical refrigeration apparatus embodying a pair of spaced vertical wall members, a horizontal wall member extending across the lower extremities of said vertical wall members, said vertical wall members and said horizontal wall member being formed of a single thickness of metal, a piece of metal fastened to each of said vertical wall members to form, with said vertical wall members a pair of refrigerant containing headers, said pieces of metal being spaced from the bottoms of said vertical wall members, and means attached to the horizontal wall member to form refrigerant containing passages in contact with the horizontal wall member.

5. A cooling element for mechanical refrigeration apparatus embodying a pair of spaced vertical wall members, a horizontal wall member extending across the lower extremities of said vertical wall members, said vertical wall members and said horizontal wall members being formed of a single thickness of metal, sheets of metal welded to each of said vertical wall members to form, with said vertical wall members, refrigerant containing passages, said sheets of metal being spaced from the bottoms of said vertical wall members, and means attached to said horizontal wall member to provide refrigerant passages in thermal contact with said horizontal wall member.

6. A cooling element for mechanical refrigeration apparatus embodying a pair of spaced vertical wall members, a horizontal wall member extending across the lower extremities of said vertical wall members, said vertical wall members and said horizontal wall member being formed of a single thickness of metal, means associated with said vertical wall members to form therewith a pair of refrigerant containing headers, the space intervening on the side wall members between said headers and said horizontal wall being formed of a single thickness of metal without refrigerant passages therein, and means attached to the horizontal wall member to form refrigerant containing passages in contact therewith.

7. A cooling element for mechanical refrigeration apparatus embodying a pair of spaced vertical wall members, a horizontal wall member extending across the lower extremities of said vertical wall members, means associated with said vertical wall members to form therewith a pair of refrigerant containing headers, the space intervening on the side wall members between said headers and said horizontal wall being formed without refrigerant passages therein, and means attached to the horizontal wall member to form refrigerant containing passages in contact therewith.

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