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F. G. CORNELL, JR
EMBOSSED PLATE HEAT EXCHANGER

2,536,840

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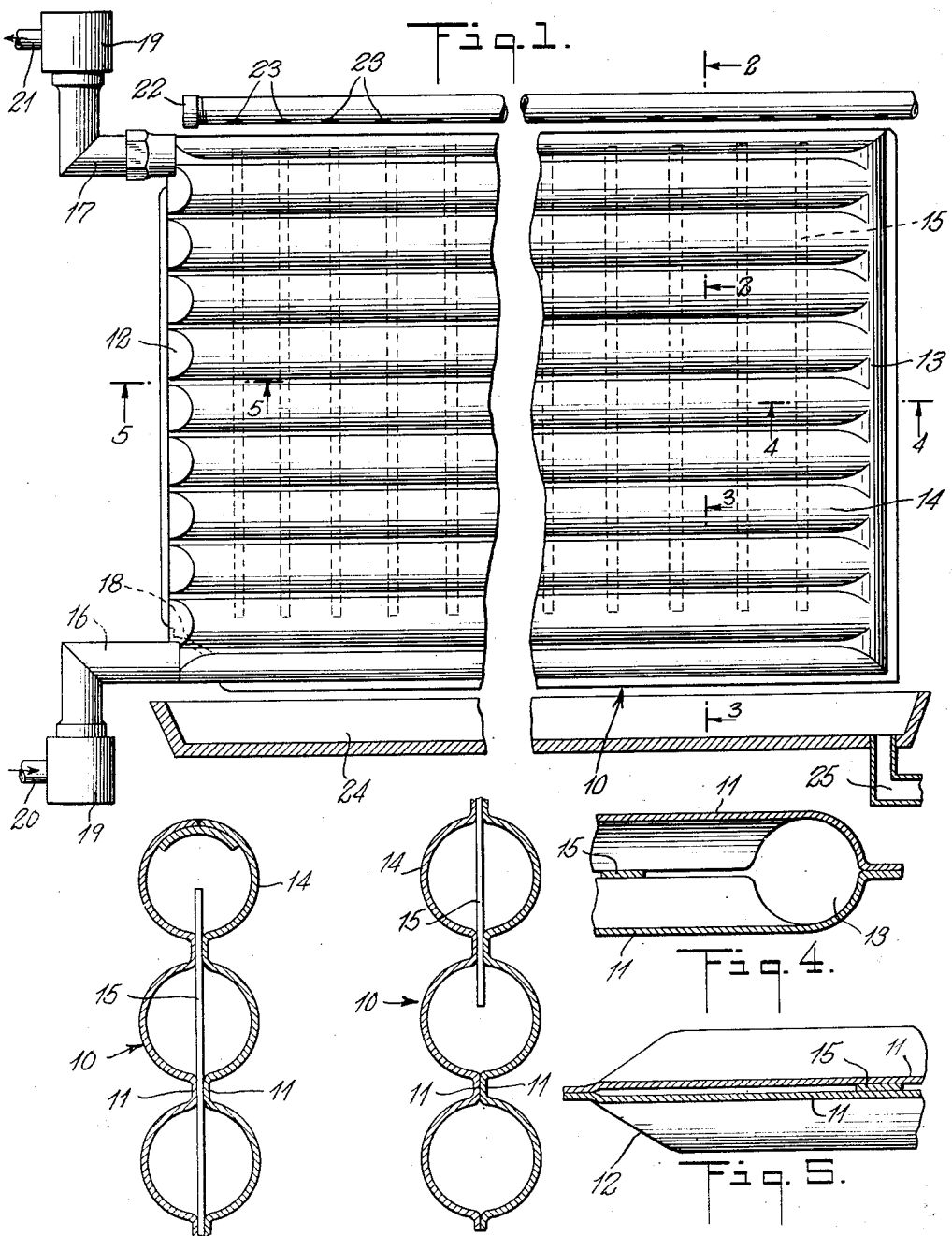


Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

INVENTOR.
FRITZ G. CORNELL JR.
BY *Kenyon & Kenyon*
ATTORNEYS

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EMBOSSSED PLATE HEAT EXCHANGER

Fritz G. Cornell, Jr., Mountain Lakes, N. J., assignor, by mesne assignments, to Chester-Jensen Company, Chester, Pa., a corporation of Pennsylvania

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2 Claims. (Cl. 257-187)

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This invention relates to heat exchange units and more especially to a unit for use with an evaporative refrigerant to cool liquids such as milk, beer and the like. A unit of this type is disclosed in Cornell Patent No. 2,120,797.

An object of this invention is to increase the efficiency and improve the operation of a heat exchange unit of the type covered by said Cornell Patent 2,120,797 when used with an evaporative refrigerant, such, for example, as ammonia.

In the construction shown in Cornell Patent 2,120,797, the vertical passageways allow the developing gases to pass within a minimum length of travel to the outlet, thus preventing the refrigerating liquid in the body of the unit being displaced by gas. It was not anticipated in the said patent that the gas be used as the refrigerant. I have, however, discovered that by introducing expanded gas from the liquid refrigerant into the unit at the point furthest away from the outlet thereof, and preventing short circuiting of the gas between the inlet and the outlet, a high degree of heat absorption can be made available throughout the entire surface of the unit, utilizing the expanded gas as a refrigerant. But I so construct the unit that the expanded gas refrigerant, after having absorbed heat to its maximum capacity, passes directly to the point of outlet. This permits the remaining gas that has not been heated to the same extent, to act as a cooling medium without hinderance from the hot gas. The unit, as improved by me, may also be used with a liquid refrigerant.

Other objects, novel features and advantages of this invention will become apparent from the following specification and accompanying drawings, wherein:

Fig. 1 is a side elevation of one from of cooling unit embodying the invention;

Fig. 2 is a section on the line 2-2 of Fig. 1;

Fig. 3 is a section on the line 3-3 of Fig. 1;

Fig. 4 is a section on the line 4-4 of Fig. 1, and

Fig. 5 is a section on the line 5-5 of Fig. 1.

The cooling unit 10 comprises two vertically arranged metal plates 11 welded together along their top, bottom and vertical edges. Each plate, as shown, is offset adjacent one vertical edge to form a vertical channel 13 extending between the top and bottom edges of the plates at the right hand end thereof, but not at the other end. Each plate also is provided with a plurality of horizontal channels 14 extending to the vertical channel 13. This may be achieved by providing each plate with offsets mutually co-

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operating to define the channels. The unit is suitably constructed to provide communication between adjacent pairs of channels 14 except the lowermost along their full lengths. This

may be achieved by interposing vertical bars 15 between the two plates 11 with their upper ends terminating in the top horizontal channel 14 and their lower ends terminating in the next to the bottom horizontal channel 14, these bars being uniformly spaced horizontally and being welded to the plates between the successive horizontal channels. Between the next to the bottom horizontal channel and the bottom horizontal channel the plates engage and are line-welded together. An inlet pipe 16 is provided for the cooling unit 10 in general alignment with the bottom supply channel and a gas outlet pipe 17 is provided in general alignment with the channel furthest away from the inlet pipe 16, said inlet and outlet pipes being arranged at the same side of the unit. The bottom horizontal channel is sealed off from communication with the intercommunicating channels above except at its discharge point, which is at a position furthest away from the gas outlet 17. The two pipes 16 and 17 are formed with elbows, the ends of which may, if desired, be swivelled in stuffing boxes 19 having supply and discharge connectors 20 and 21. A horizontal pipe 22 is supported directly above the unit 10 and is provided with downwardly directed apertures 23. Below the unit 10 is arranged a trough 24 having an outlet 25.

Liquid refrigerant, for example, ammonia, is introduced through the inlet 16 and vaporized refrigerant is withdrawn through the pipe 17 and the connection 21. The liquid refrigerant is conducted by the bottom horizontal channel 14 to the right hand bottom corner of the unit from whence it is discharged into the right hand end of the next to the bottom horizontal channel. From there, the refrigerant is distributed uniformly throughout the remainder of the unit, the bars 15 providing a series of vertical channels through which the vaporized refrigerant may escape directly from one horizontal channel to the next channel and so on until it reaches outlet 17. Milk, beer or other liquid to be cooled is delivered to the top of the unit 10 through the pipe 22 and after traversing the cooling unit is collected in the trough 24 from which it is drawn off through the outlet 25. Where the swivel support for the unit 10 is used, the unit may be swung into and out of aligned relation to pipe

22 and trough 24, thereby facilitating cleaning of the unit.

As the refrigerant is delivered by the lowermost horizontal channel to the end of the unit most remote from the outlet 17, short circuiting of the refrigerant directly between the inlet and the outlet is effectively avoided. However, after the refrigerant has become heated to its maximum extent, the heated gas will, because of its low specific gravity, pass in the shortest route possible upwardly through the channels above it to the outlet 17 so that the remainder of the refrigerant can effect an efficient heat transfer. This easy and unobstructed escape of the hot gas avoids back pressure build-up in the gas which would partly neutralize the pressure head in the refrigerant supply line. It also prevents the heated gas from acting upon the refrigerant and causing pregasification thereof before the proper time. The compressor suction applied at the outlet of the unit is exerted over substantially the full surface of the unit, thus improving uniformity of heat absorption. The refrigerant is effectively active throughout the entire unit.

While this application discloses but a single unit, it is contemplated that a plurality of these units may be collectively mounted in an attenuating apparatus of the type illustrated in Cornell Patent No. 2,200,355.

While a specific embodiment of the invention is disclosed, variations in structural detail within the scope of the claims is possible and is contemplated. There is no intention, therefore, of limitation of the exact details shown and described.

I claim:

1. A heat exchange unit comprising two vertical metal plates joined together at their top, bottom and vertical edges, at least one of said plates having outwardly offset portions defining a plurality of vertically superposed horizontal channels, vertical bars interposed between and secured to said plates between channels, said bars terminating at their upper ends in the top horizontal channel and at their lower ends in the horizontal channel adjacent the bottom horizontal channel thereby providing direct intercommunication between all horizontal channels above the bottom horizontal channel for direct gas travel upwardly therethrough, an inlet pipe communicating with one end of the bottom horizontal channel, an outlet pipe communicating

with the corresponding end of the top horizontal channel, and means including said pipes for pivotally supporting said unit for swinging movement about a vertical axis, said plates being continuously interjoined between the bottom horizontal channel and the adjacent horizontal channel except beyond the vertical bar most removed from the ends of the channels with which said inlet and outlet pipes communicate, and at least one of said plates having an outwardly offset portion defining a vertical channel communicating with all of the horizontal channels.

2. A heat exchange unit comprising two vertical metal plates joined together at their top, bottom and vertical edges, at least one of the said plates having outwardly offset portions defining a plurality of horizontal channels, vertical bars interposed between and secured to said plates between channels, said bars terminating at one of their outer ends in an outermost horizontal channel at one side of the unit and at their other ends in the horizontal channel next to the outermost horizontal channel at the opposite side of the unit, an inlet pipe communicating with one end of said last-named outermost horizontal channel, an outlet pipe communicating with the corresponding end of said first-named outermost horizontal channel, and means including said pipes for pivotally supporting said unit for swinging movement about a vertical axis, said plates being continuously interjoined between the first outermost horizontal channel and the adjacent horizontal channel except beyond the vertical bar most removed from the ends of the channels with which said inlet and said outlet pipes communicate, and at least one of said plates having an offset portion defining a vertical channel communicating with all of the horizontal channels adjacent said last-named vertical bar.

FRITZ G. CORNELL, JR.

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The following references are of record in the file of this patent:

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2,120,797	Cornell	June 14, 1938
2,211,514	Newhall	Aug. 13, 1940