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HEAT ABSORPTION UNIT

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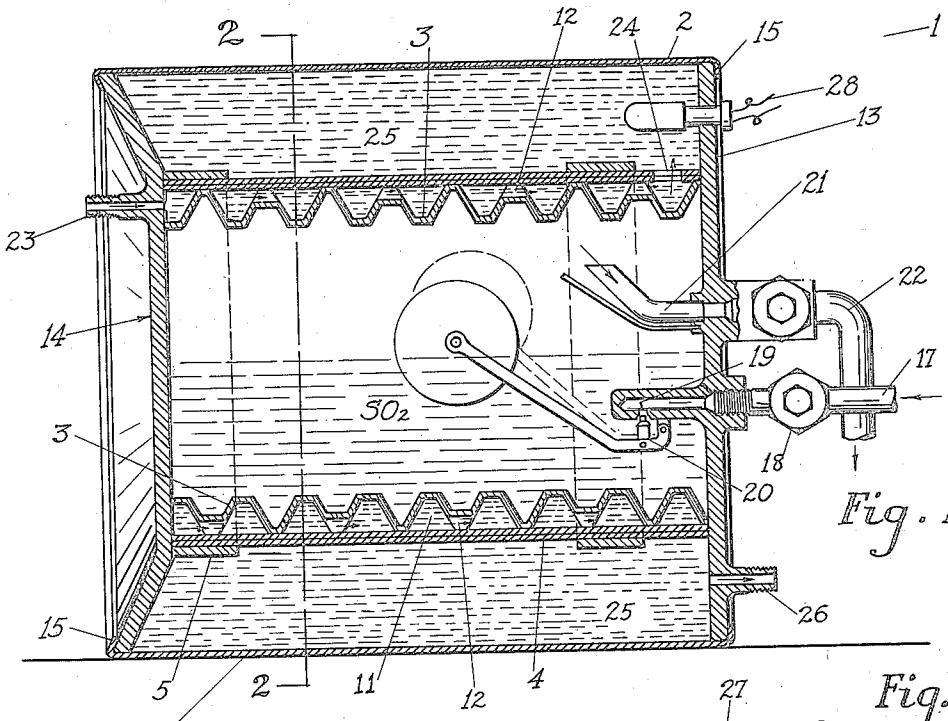


Fig. 1

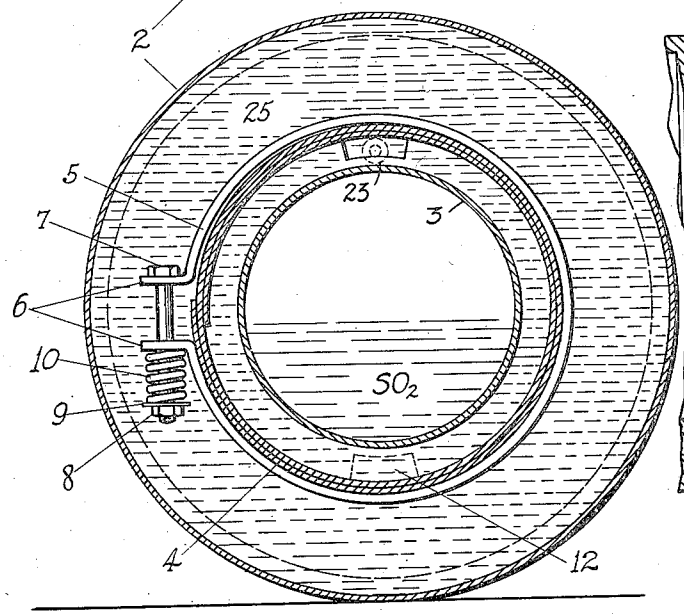


Fig. 2

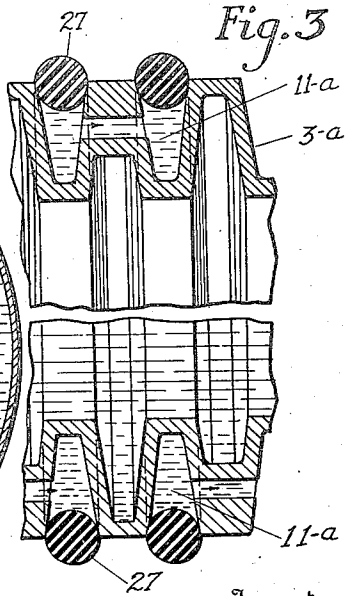


Fig. 3

Inventor

D·H·Ebinger

By W. D. McElowell

Attorney

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UNITED STATES PATENT OFFICE

DAVID H. EBINGER, OF COLUMBUS, OHIO, ASSIGNOR TO THE D. A. EBINGER SANITARY MFG. CO., OF COLUMBUS, OHIO, A CORPORATION OF OHIO

HEAT ABSORPTION UNIT

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This invention relates to improvements in refrigerating apparatus, and is particularly directed to an improved type of heat exchanger or heat absorption unit for use in connection with mechanical refrigerating systems, especially those systems employing a circulating and vaporizable liquid refrigerant.

The heat absorption unit of a mechanical refrigerating system of conventional form is referred to ordinarily as the "boiler". This unit consists of a casing provided with an interior chamber which is adapted to receive the circulating vaporizable liquid refrigerant. In accordance with the present invention, the walls of this chamber are formed from sheet metal and are corrugated to provide a plurality of annular or helical passages through which is forced the water or other liquid to be cooled, the latter coming into wiping contact with the thin heat transfer walls during the passage of the liquid through the exchanger, whereby to effect a marked reduction in the temperature of the liquid during its passage through the relatively short length of the boiler unit.

In the operation of apparatus of this character, some difficulty has been encountered in preventing injury to the water circulating walls of the unit by reason of the freezing of the water undergoing cooling. Such freezing results in placing considerable stress or strain on the walls of the boiler with which the liquid is in contact, and it is therefore a primary object of the present invention to so construct these walls as to compensate automatically for pressures incident to freezing of the liquid undergoing cooling to prevent effectual injury or damage to said walls.

For a further understanding of the invention reference is to be had to the following description and to the accompanying drawings wherein:

Figure 1 is a vertical sectional view taken through a boiler unit for mechanical refrigerating systems disclosing the structural features of the present invention,

Figure 2 is a transverse cross-sectional view taken on the line 2—2 of Figure 1, and

Figure 3 is a vertical longitudinal sectional view taken through a modified form of the boiler unit.

Referring more particularly to the drawings, the numeral 1 designates the absorption or boiler unit comprising the present invention. This unit is employed as a heat exchanger in mechanical refrigerating apparatus, and in the form of the invention here under consideration, the said unit is adapted particularly for the cooling of a liquid, especially drinking water, although the invention is not limited to that specific purpose but may be adapted generally to the cooling of various kinds of fluids.

In Figure 1 of the drawings, there has been represented a boiler or heat absorption unit which comprises an outer cylindrical casing 2 of smooth-wall construction, and arranged within the casing 2 and disposed axially thereof is an inner corrugated shell 3 formed preferably from thin sheet metal such, for example, as copper or an alloy thereof. The sheet is surrounded by an expansible wall structure 4 which, in the preferred form of the invention, consists of a suitable length of helically wrapped metallic sheeting provided with free and unsecured ends. Straps or bands 5 are employed to surround the wall structure and are provided at their ends with out-turned portions 6, which receive bolts 7, these bolts having their ends provided with nuts 8 and washers 9, there being a coil spring 10 arranged so as to surround the bolts 7 and positioned between certain of the out-turned portions 6 and the washers 9, the purpose of the spring being to normally tighten the bands 5 around the wall structure 4 so as to retain the latter in a secured but expansible position around the corrugated shell 3.

The corrugations of the shell 3 produce in this instance a plurality of annular grooves or passages 11 which are closed by means of the expansible wall structure 4 so as to permit of the circulation of water or the like therethrough. In the present instance since the passages 11 are of annular form the same are permitted to intercommunicate for the passage or circulation of water therebetween by the presence of longitudinal recesses 12.

These recesses are formed in the wall of the shell 3 and are arranged in relatively staggered order, as shown in Figure 1, their arrangement serving to cause the water undergoing cooling to circulate completely through each of the annular grooves or passages before being permitted to pass to the next successive groove or passage. In this way the water undergoing cooling is brought into contact with many feet of cooling surface in the comparatively short length of the boiler unit. This, of course, provides for a compact and at the same time highly efficient construction.

To complete the construction of the boiler unit, the latter is formed with a pair of cast end plates 13 and 14. These plates closely engage with the ends of the casing 2, the shell 3 and the expansible wall structure 4, and are held in such engagement by inwardly directed flanges 15 formed on the ends of the casing 2. The plate 13 carries an inwardly disposed nozzle 16 which is connected by means of an exteriorly leading pipe line 17 to a compressor (not shown) or other source of liquid sulphur dioxide supply, the line 17 being provided with a control valve 18. The nozzle 16 is provided with a discharge orifice 19, which is opened or closed by means of an automatic float actuated valve 20 of standard construction. It will be seen that as the liquid level within the unit recedes, the float valve is operated to permit of the inflow of a greater quantity of the SO_2 liquid and, conversely, as the liquid level rises the valve 20 is operated to partially or fully close the orifice 19. As the SO_2 liquid vaporizes following the extraction of heat therefrom by the circulating water in the outer walls of the shell 3, the vapors or gases developed are removed from the casing by way of the outlet pipe 21, which is connected with a valve controlled pipe line 22, leading to the inlet side of the compressor. It will be understood that the mechanism for admitting of the inflow of the liquid refrigerant into the unit, the exhaust of the gases or vapors from such refrigerant and the associate compressing apparatus are of standard construction and operation and, therefore, any other equivalent apparatus may be employed in connection with the absorption unit for controlling the admission or exhaust of the refrigerant with respect thereto.

In operation, drinking water enters the unit by way of the inlet line 23 and circulates through the annular passages 11 and communicating recesses 12 from one end of the unit to the other. During this circulation the water comes into contact with the cold corrugated walls forming the shell 3 so that there takes place an efficient transfer of heat between the liquid refrigerant and the water undergoing cooling. The expansible wall structure 4 at one end is provided with port or ports 24 leading into a secondary cooling chamber 25 formed between the wall structure 4 and the casing 2, and from this chamber the drinking water may be discharged by way of a pipe line 26, leading to any suitable point of utilization. In the event the drinking water flowing or standing in the passages 11 becomes frozen, the expansion thereof is absorbed automatically by the wall structure 4, thus preventing injury to the more or less delicate structure comprising the shell 3, preventing specifically contamination of the drinking water by direct contact with the liquid refrigerant. This construction therefore provides for a boiler unit of not only very efficient design from a heat transfer standpoint, but one which is capable of giving indefinite service without requiring attention for repair, adjustment or replacement purposes. In Figure 3 a modification of the invention has been shown wherein the passages 11*a* are closed by means of elastic rings 27, preferbaly formed of rubber or a rubber composition. These rings closely engage the walls of the shell 3*a* and while they serve to retain the water within the grooves 11*a* under normal pressures yet when abnormal pressures are developed, due to the expansion of the water by freezing, the rings expand to compensate for this unusual condition and to prevent injury to the shell structure. The secondary cooling chamber 25 may be provided with a thermostatic switch 28 for automatically regulating the operation of the associated compressor in accordance with the temperature of the water in said chamber.

What is claimed is:

1. In a heat absorption unit for mechanical refrigerating systems, a casing structure comprising an inner metallic shell of thin sheet metal construction having corrugated walls, said shell being adapted to contain a vaporizable liquid refrigerant, expansible means surrounding said shell and forming in conjunction with the corrugated walls thereof a circuitous water circulating passage, an outer metallic wall spaced from said expansible means and forming a secoundary liquid receiving chamber communicating with the discharge end of said passage, and end members for closing the refrigerant chamber of said shell and the ends of said secondary cooling chamber, said cooling chamber being provided with a water outlet.

2. In a heat absorption unit for mechanical refrigerating systems, a casing structure comprising an inner metallic shell of thin sheet metal construction having corrugated walls, said shell being adapted to contain a vaporizable liquid refrigerant, a helically wrapped metallic sheeting surrounding said shell and forming in conjunction with the corrugated walls thereof a circuitous water circulating passage, an outer metallic wall

spaced from said metallic sheeting and forming a secondary liquid receiving chamber communicating with the discharge end of said passage, and end members for closing the refrigerant chamber of said shell and the ends of said secondary cooling chamber, said cooling chamber being provided with a water outlet.

3. In a heat absorption unit for mechanical refrigerating systems, a casing structure comprising an inner metallic shell of thin sheet metal construction having corrugated walls, said shell being adapted to contain a vaporizable liquid refrigerant, a metallic sheeting provided with free and unsecured ends helically wrapped so as to surround said shell and forming in conjunction with the corrugated walls thereof a circuitous water circulating passage, means for retaining said helically wrapped sheeting in a secured expansible position around said inner metallic corrugated shell, an outer metallic wall spaced from said retaining means and forming a secondary liquid receiving chamber communicating with the discharge end of said passage, and end members for closing the refrigerant chamber of said shell and the ends of said secondary cooling member, said cooling chamber being provided with a water outlet.

4. In a heat absorption unit for mechanical refrigerating systems, a casing structure comprising an inner metallic shell of thin sheet metal construction having corrugated walls, said shell being adapted to contain a vaporizable liquid refrigerant, a metallic sheeting helically wrapped so as to surround said shell and provided with free and unsecured ends, and forming in conjunction with the corrugated walls of said shell a circuitous water circulating passage, bands surrounding said helically wrapped sheeting for retaining the same in a secure expansible position around said inner metallic corrugated shell, spring means associated with the ends of said bands for permitting of the expansion thereof, an outer metallic wall spaced from said spring means and forming a secondary liquid receiving chamber communicating with the discharge end of said passage, and end members for closing the refrigerant chamber of said shell and the ends of said secondary cooling chamber, said cooling chamber being provided with a water outlet.

In testimony whereof I affix my signature.

DAVID H. EBINGER.