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(54) An eutectic solution cold accumulator.

(57) A cold accumulator comprises a tubular case (2) containing an eutectic solution that will freeze at a preset temperature, a heat exchanger (12) extending within the case to freeze said eutectic solution, and a means of supporting the heat exchanger consisting of a tubular metal beam (16) set coaxially within the case (2) and being secured along two opposed major walls (2a, 2b) thereof. The beam (16), in addition to supporting the heat exchanger (12), forms a stiffening member for the case (2).

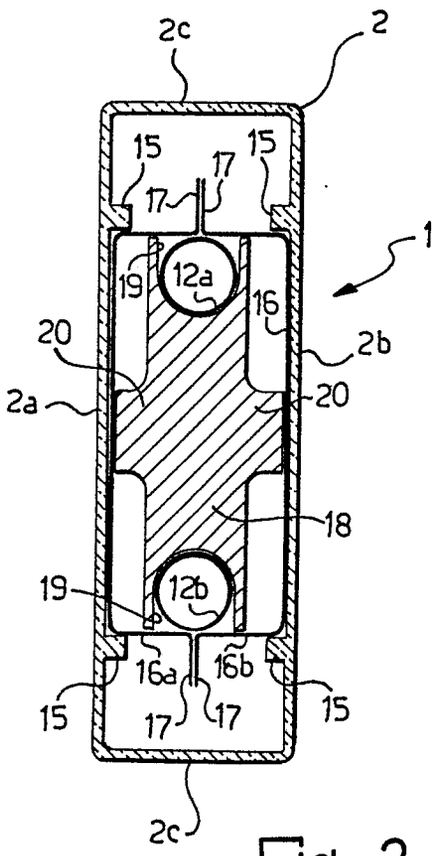

Fig-2

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This invention relates to a cold accumulator of the type which comprises a tubular case containing an eutectic solution that will freeze at a preset temperature, a heat exchanger extending within said case for freezing said eutectic solution, and a means of supporting said heat exchanger in said case.

Cold accumulators of this type are widely employed as refrigerating sets inside refrigerated vans. For this purpose, a plurality of such accumulators are suspended from the ceiling or the walls of a van. With the van inoperative, such as overnight, the eutectic solution contained in each cold accumulator would be frozen by connecting the heat exchanger to a refrigerating unit. The cold thus stored in the accumulators is then released at a low rate to refrigerate the van.

A basic problem with such vans is that of holding down the weight of the installations provided to refrigerate the products carried. Weight, in fact, penalizes a van payload, and is tied to several factors, among which the weight of the accumulators themselves and the weight of their mounts, which must be incorporated to the van load-bearing structure.

An exemplary cold accumulator of the type mentioned above is that disclosed in European Patent No. 61697, filed on March 23, 1982.

This prior accumulator comprises a tubular case made of a plastic material with a rectangular cross-section shape and having an eutectic solution with a set freezing temperature.

The accumulator length in the longitudinal direction is quite substantial (up to six meters long) compared to its cross dimension. Furthermore, it has a curtailed weight, thanks also to the case being formed from a plastics.

Accumulators of this kind are subjected to a variety of different stresses, among which static, dynamic, and thermal stresses.

Owing to the design of such accumulators, all these stresses are taken up by the plastics case. In view of the slender construction of the accumulator, it becomes necessary to provide the case with stiffening members effective to resist both longitudinal and transverse bending forces. In order to stiffen the accumulator against sideway bending forces, the major walls of the case are interconnected with a partition extending along a centerline. However, this stiffening arrangement is ineffective to resist lengthwise bending forces because the partition happens to be substantially coincident with the neutral bending axis.

Dynamic stresses are difficult to anticipate at the designing stage of an installation including a given number of accumulators on a van. Such stresses would largely depend on the way the van is used and the roadbed on which it is to travel. The stresses are also apt to change in operation of the van according to the physical (liquid or solid) state of the eutectic solution.

In an effort to obviate this, it has been suggested of providing, at the assembling stage, a greater number of supports than are strictly required to decrese the spacing between said supports. It has been preferred, moreover, to curtail the useful volume of the case, and accordingly, its charge of eutectic solution.

It follows that, for a given refrigerating capacity, a comparatively large number of accumulators are to be fitted in the van and hung from a relatively large number of supports.

As the number of the accumulators which make up a refrigerating bank increases, the bare cost of the bank and its installation cost also increase.

The latter cost factor includes, inter alia, connection of the heat exchangers in the individual accumulators to a refrigeration set arranged to freeze the eutectic solution.

Another drawback of the conventional accumulators just described is that the case major walls, under the bond of the partition which interconnects them, are not free to deform adequately where the accumulator is charged with eutectic solutions that are apt to expand on freezing. In this instance, additional stresses are generated in the case walls, especially along the partition region, which may result over time in the case being damaged, by adding to the unavoidable stresses already discussed hereinabove.

The problem underlying this invention is that of providing a cold accumulator so structured as to overcome all of the drawbacks affecting the cited prior art.

The solutive idea of this problem is that of discharging a significant quota of the mechanical stresses affecting the accumulator to a metal beam provided on the case interior.

While such an approach runs contrary to the present engineering trend toward eliminating metal parts as far as feasible from the accumulators in order to reduce their weight, it has been found that the overall weight of an accumulator bank installation, according to this invention, can be held, for a given overall thermal capacity, within the same order as the overall weight of a conventional accumulator bank, where said overall weight would include the weight of the supports required to secure the accumulator bank to the van own structure.

Accumulators embodying this invention show to be easily handled and to afford long-term reliability. Further, it would become possible to provide larger size accumulators, so as to decrease, over the prior art, the number of accumulators required to achieve a sought thermal capacity, with

attendant reduction in the assembling cost and cost for connecting the heat exchangers to the refrigeration unit.

The aforementioned problem is solved by the provision of an accumulator of the type specified hereinabove being characterized in that said mounts comprise a tubular metal beam arranged to extend substantially coaxially within said case and being tied to at least two opposed walls thereof.

The features and advantages of a cold accumulator according to the invention will become apparent from the following detailed description of a preferred embodiment thereof, given herein by way of illustration and not of limitation with reference to the accompanying drawings, where:

Figure 1 is a fragmentary longitudinal section view through an accumulator embodying this invention; and

Figure 2 is a sectional view taken along the line II-II in Figure 1.

In the drawing figures, the numeral 1 designates comprehensively a cold accumulator according to this invention. The accumulator 1 comprises a tubular case 2 which is extruded from a plastic material to a substantially rectangular cross-section configuration.

The case 2 is closed at opposed ends by end elements 6,7. The element 6 is formed with a filling port closed removably by a screw-on cap 9.

Formed in the element 7 are two throughgoing holes 10 accommodating the free ends 13 of a heat exchange tube 12. Said ends 13 are held in their respective holes 10 by a screw fastening arrangement 14, known per se.

The heat exchange tube 12 is bent into a "U" with two legs 12a,b and extends longitudinally within the case 2.

With reference to the sectional view of Figure 2, in the case 2 there may be recognized two opposed major walls 2a, 2b and two minor walls, both denoted 2c.

Molded in the major walls 2a, 2b, integrally therewith, are two pairs of elevations, all indicated at 15, which are juxtaposed and parallel to one another and extend from corresponding positions on the case inwards and throughout its length.

The elevations 15 provide support for and guide a metal beam 16 extending coaxially with the case 2 along the entire length thereof. Thus, the beam 16 has opposed ends abutting the end elements 6,7.

Said beam 16 is constructed by welding from two perforated sheet metal shells 16a,b of omega-like shape which are laid with facing concavities and have corresponding wings 17 mating with each other.

The two shells 16a,b are welded along the wings 17.

The beam 16 encloses and supports the heat exchange tube 12. The two legs 12a,b of the latter are held firmly against the walls of the beam 16 by means of a plurality of supporting members 18 lying at pitch intervals along the length direction of the beam 16, inside it.

Said supporting members 18 are formed with two opposed seats 19 for a corresponding leg of the heat exchange tube 12, and with two opposed lugs 20 acting on the major walls of the beam 16 to hold them pressed against the corresponding major walls 2a, 2b of the case 2 to thereby discharge on the beam 16 all the stresses to which the case 2 is subjected.

Thus, the beam 16 serves, on the one side, to stiffen the structure of the cold accumulator and support the heat exchange tube 12 while increasing, on the other side, the heat exchange surface area of the latter.

The cold accumulator of this invention operates as follows. An eutectic solution is introduced into the case 2 through the cap 9. Said case would preferably be provided transparent for the purpose of checking the level of the eutectic solution therein.

To freeze the eutectic solution, through the heat exchange tube 12 there is flown a fluid refrigerated at a lower temperature than the freezing temperature of the eutectic solution.

By virtue of the contact relationship existing between the heat exchange tube 12 and the walls of the beam 16, the beam will also aid in improving the transfer of heat required to thoroughly freeze the eutectic solution.

The accumulator 1 would be freezed on the spot, while suspended from the ceiling of a refrigerated van.

Once the eutectic solution is frozen, the flow of refrigerated fluid to the heat exchanger 12 is cut off.

The refrigerating capacity of the accumulator 1 is a function both of the type of the eutectic solution employed, specifically of its freezing temperature, and of the volume of the solution contained in the case 2, that is of the physical dimensions of the case, as well as of the outside surface area of the case 2 intended for heat exchange with the refrigerated van interior space.

In particular, the ratio of the outer heat transfer surface area of the case 2 to the amount of eutectic solution contained therein will govern the refrigeration output capacity of the accumulator.

Since the beam 16 imparts the accumulator 1 with significant rigidity in both the lengthwise and transverse directions thereof, it becomes possible to optimize the aforesaid parameters to suit the refrigerating capacity demand. Accordingly, the number of the required accumulators to provide a

sought thermal capacity can be reduced by increasing their size. It also becomes possible to reduce the number of the mounts to be distributed along the longitudinal extent of the accumulator 1 in order to secure its case to the van ceiling.

The advantage is afforded, therefore, that for a given overall weight and thermal capacity, a bank of accumulators according to this invention will include a smaller number of accumulators, each supported by a lesser number of mounts than an accumulator bank constructed in accordance with the prior art. The cost of an installed accumulator bank will therefore be generally lower.

Advantageously, the structure of this accumulator can be easily assembled. Firstly, the heat exchange tube 12 is provided with its mounts 18 within either shell 16a,b of the beam 16. Then, the other shell is superimposed with the wings 17 in mating relationship.

After welding the beam 16, this is fitted inside the case 2, wherein it is held aligned by the elevations 15. The accumulator is finally completed by assembling the end elements 6,7 to the ends of the case 2.

An additional advantage of this cold accumulator is that the case 2 is less liable to cracks or other failures as may occur to plastics when used in a low temperature environment. This is due to the mechanical stresses on the accumulator being almost fully taken up by the beam 16 and only marginally discharged to the case.

Claims

1. A cold accumulator comprising a tubular case (2) containing an eutectic solution that will freeze at a preset temperature, a heat exchanger (12) extending within said case (2) for freezing said eutectic solution, and a means of supporting said heat exchanger (12) in said case, characterized in that said supporting means comprise a tubular metal beam (16) extending substantially coaxially within said case (2) and being tied to at least two opposed walls (2a, 2b) thereof.

2. An accumulator according to Claim 1, characterized in that said case (2) is formed from a plastic material, and that said beam (16) and said case (2) have a substantially rectangualr cross-section shape.

3. An accumulator according to either Claim 1 or 2, characterized in that said beam (16) is held in close contact with said heat exchanger (12) to increase the heat transfer surface area of the latter.

4. An accumulator according to one or more of the preceding claims, characterized in that said beam (16) has perforated sheet metal walls.

5. An accumulator according to one or more of the preceding claims, characterized in that it comprises two pairs of elevations (15) lying parallel lengthwise on opposed major walls (2a, 2b) of said case (2) and extending inwardly thereof to form supporting guides for said beam (16), and in that said heat exchanger (12) is formed of a U-like bent tube with legs (12a, 12b) held close against said beam (16) by a plurality of supporting elements (18) distributed at pitch intervals in said beam (16).

6. An accumulator according to one or more of the preceding claims, characterized in that said beam (16) comprises two shells (16a, 16b) substantially of an omega-like pattern connected to each other along respective wings (17).

7. An accumulator according to Claim 6, characterized in that said beam (16) extends longitudinally within said case (2) over substantially the entire length thereof.

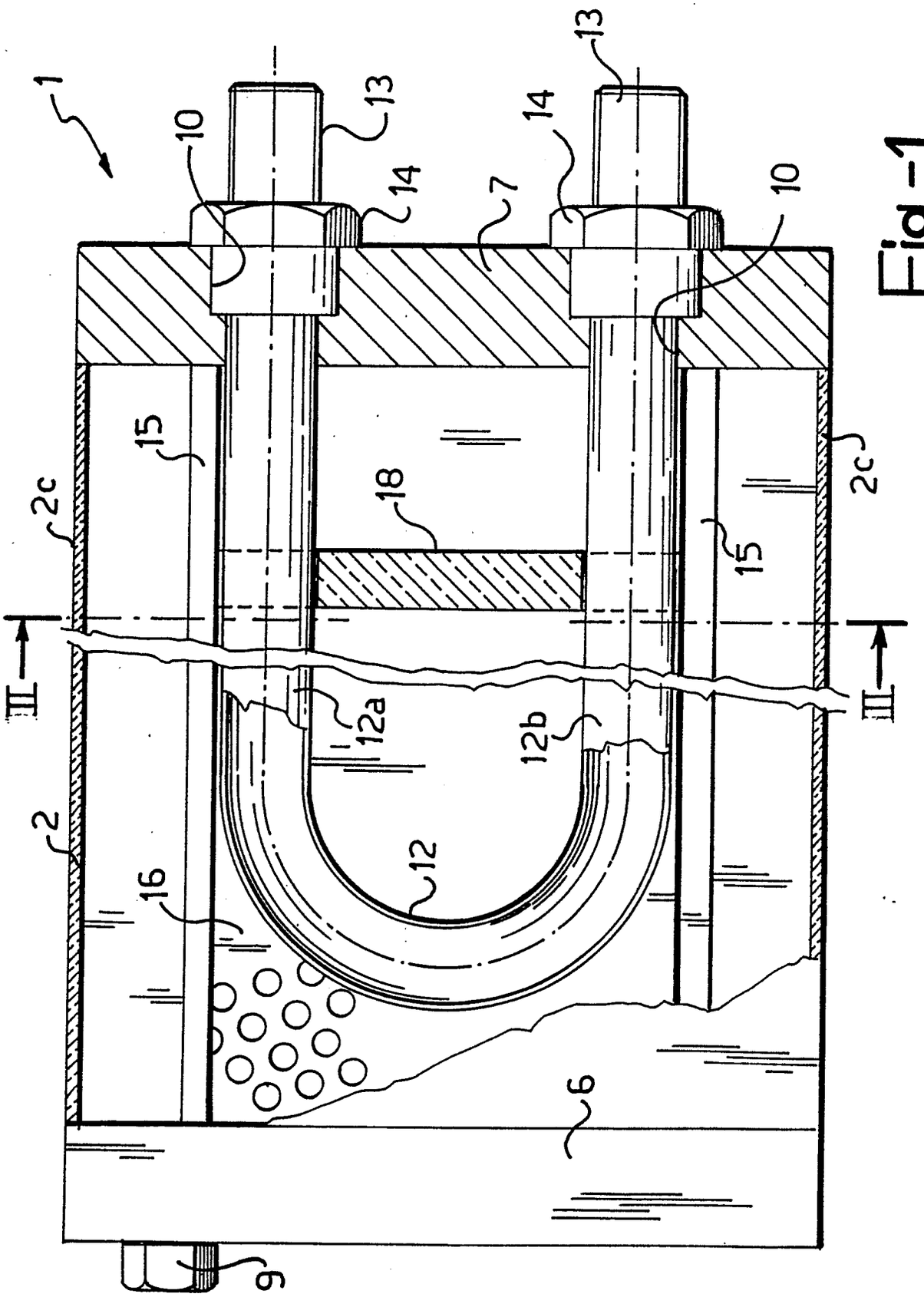

Fig-1

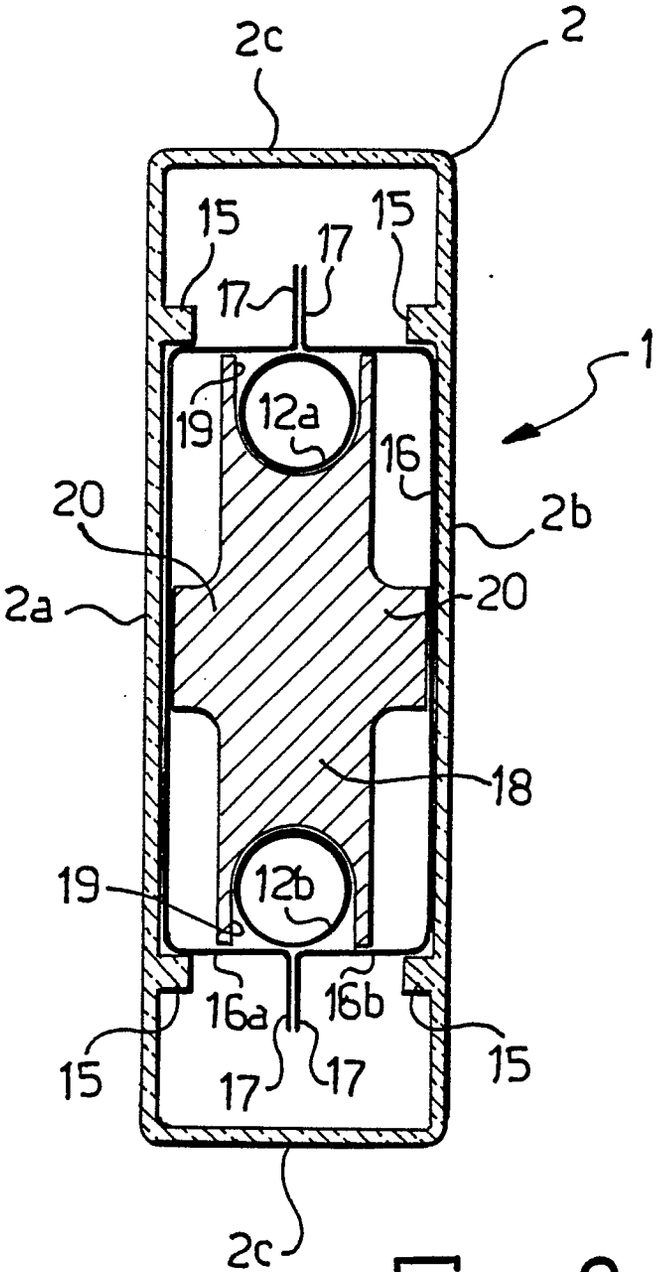
2c
2
15
15
17
17
1
19
12a
16
20
2b
2a
20
18
19
12b
16a
16b
15
15
17
17
2c

Fig-2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 87 83 0470

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	EP-A-0 213 339 (SÜTRAK TRANSPORTKÄLTE) * Column 3, line 23 - column 5, line 6; figures 1,2 *	1	F 25 D 3/00 F 28 F 9/00
A		2,5	
Y	US-A-2 399 484 (GUNTER) * Page 1, right-hand column, line 53 - page 2, left-hand column, line 42; figures 5-10 *	1,2,5,7	
D,A	EP-A-0 061 697 (KUNSTSTOFF- UND KÄLTETECHNIK GROSSKOPF) * Page 4, line 20 - page 6, line 25; figures 1-4 *	1,2,5	
A	US-A-1 775 706 (TRANE) * Page 1, line 99 - page 2, line 62; figures 1-7 *	1,2,5	
A	GB-A- 272 852 (TRANE) * Page 2, lines 20-53; figure 1 *	1,2,5,7	
A	FR-A-2 405 453 (ATELIERS ET CHANTIERS DE BRETAGNE ACB)		TECHNICAL FIELDS SEARCHED (Int. Cl.4) F 25 D F 28 F F 28 D
A	FR-A-1 148 310 (SVENSKA FLÄKTFABRIKEN)		
A	US-A-2 656 157 (WASIELEWSKI)		
A	US-A-2 338 016 (VASSILIOU)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14-06-1988	BOETS A.F.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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