

[54] **VESSEL FOR MELTABLE HEAT STORAGE MASSES**

[72] Inventor: Nikolaus Laing, Hofener Weg 35-37, 15 7141 Aldingen near Stuttgart, Germany

[22] Filed: July 13, 1970

[21] Appl. No.: 54,553

[30] **Foreign Application Priority Data**

July 31, 1969 Austria.....7381/69

[52] U.S. Cl. ....219/378, 126/400, 219/341, 219/365, 219/530

[51] Int. Cl. ....F24h 7/00, H05b 1/00

[58] Field of Search.....219/530, 540, 462, 325, 326, 219/341, 365, 378, 399; 126/375, 400; 165/1, 18

[56] **References Cited**

**UNITED STATES PATENTS**

|           |         |                   |            |
|-----------|---------|-------------------|------------|
| 3,410,985 | 11/1968 | Giacchero .....   | 219/222    |
| 1,146,310 | 7/1915  | Colby .....       | 219/462 X  |
| 2,022,812 | 12/1935 | Roe .....         | 219/365    |
| 2,178,049 | 10/1939 | Mouton et al..... | 219/325 UX |
| 3,356,828 | 12/1967 | Furness.....      | 219/378 X  |

|           |         |                    |           |
|-----------|---------|--------------------|-----------|
| 2,000,455 | 5/1935  | Ralston et al..... | 219/341   |
| 3,083,286 | 3/1963  | Swetlitz .....     | 219/462 X |
| 3,283,125 | 11/1966 | Snelling.....      | 219/365   |

**FOREIGN PATENTS OR APPLICATIONS**

|           |         |              |         |
|-----------|---------|--------------|---------|
| 660,030   | 8/1965  | Belgium..... | 219/378 |
| 1,249,776 | 11/1960 | France.....  | 219/341 |

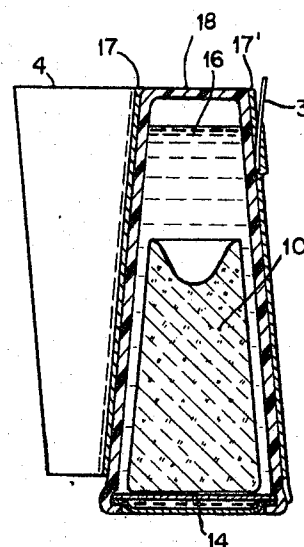
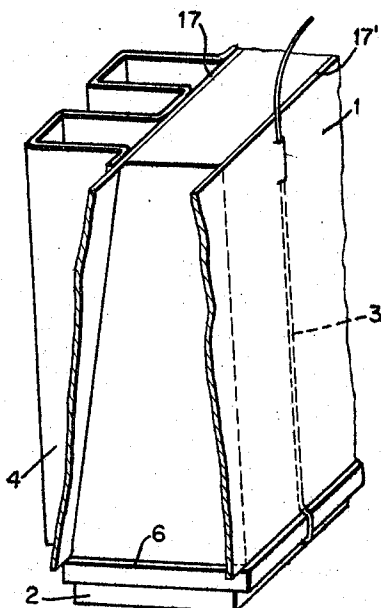
*Primary Examiner*—A. Bartis

*Attorney*—Pennie, Edmonds, Morton, Taylor and Adams

[57] **ABSTRACT**

A tapered vessel having a horizontal metallic base plate and vertically extending deformable plastic side walls contains a meltable crystalline heat storage mass having a greater density in its solid than liquid states whereby the mass is urged against the base plate by gravity. A first electric heater is disposed adjacent the base plate for melting the mass. A second electric heater of less heat output than the first heater extends vertically along a side wall of the vessel to form a connecting channel to relieve excess pressures in the region between the base plate and the bottom of the mass. The vessel is provided with corrugated heat exchange ribs to dissipate the stored heat to the air.

**5 Claims, 4 Drawing Figures**



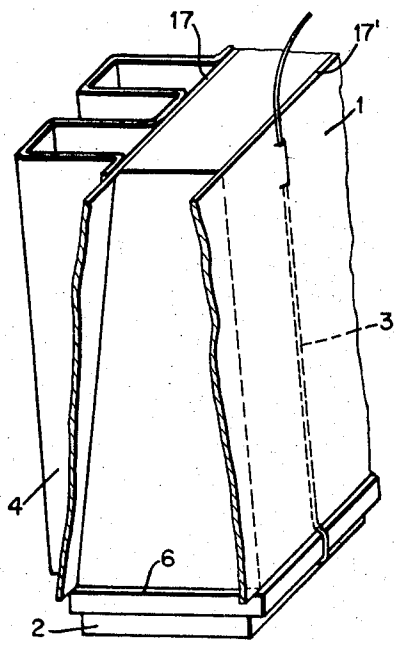


Fig. 1

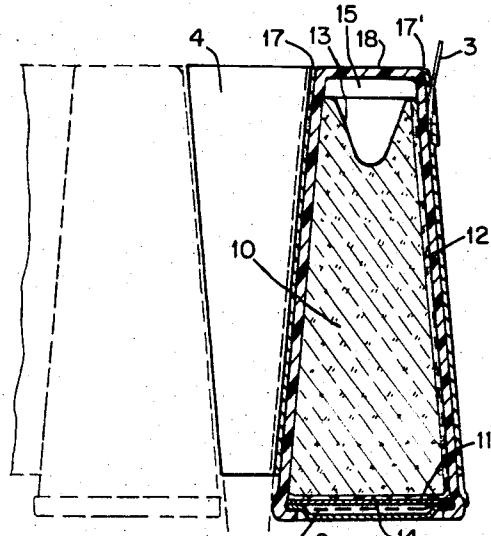


Fig. 2

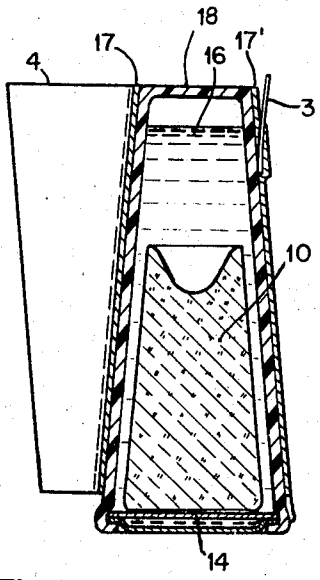


Fig. 3

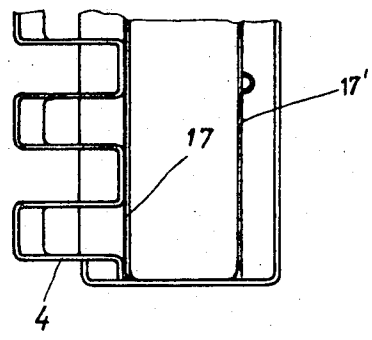


Fig. 4

*Rich & Co.*

## VESSEL FOR MELTABLE HEAT STORAGE MASSES

### OBJECTS OF THE INVENTION

The melting of solid materials enclosed in storage vessels, e.g. by means of electrical resistance heaters, for the purpose of storing latent heat frequently presents considerable difficulties, since the thermal conductivity of most of the crystalline materials suitable for heat storage is, by comparison with e.g. metals, extremely low even when in the solid state and as a rule even considerably worse in the molten state. Consequently elaborate measures for the admission of heat by means of metallic ribs or other means have to be taken in order to prevent local overheating resulting in vapor pressure or decomposition; their economics consequently become questionable.

Moreover, if the melt is lighter than its solid phase, excess pressures of an almost unlimited magnitude result locally, which cause the surrounding solid layers to burst; consequently the walls and heat exchange arrangements are frequently subjected to extremely high stresses and at the same time considerable noises are caused which preclude application to e.g. the heating of dwellings.

### DESCRIPTION OF THE INVENTION

The invention avoids these disadvantages by means of a device in which the crystalline portion of the storage mass has a flat surface which is pressed against the heater. Thereby the continuously produced melt, which is no longer capable of absorbing any latent heat and possesses only low thermal conductivity, immediately flows away, so that direct thermal contact between the heater and the layer of the crystalline body is permanently maintained. Thereby high specific heat currents may be applied for melting the material, so that the heater itself becomes small and correspondingly cheap.

As a result of giving off its storage heat in the course of crystallization, the storage body contracts, so that a cavity is formed in the last region to solidify. When it is remelted, the storage mass expands again to the same degree. In order to avoid local areas of excess pressure, the invention provides, at least in the case of storage masses which contract during solidification, a connection between the region adjacent the heater and the said cavity by producing a connecting channel through which the excess melt flows away without the formation of excess pressures, by means of a second heater. For the purpose of storage in accordance with the invention it is necessary that the core of the store should become released from the walls of the vessel, so that it can describe the vertical movement necessary for the melting process. In accordance with the invention this is accomplished by means of a tapered construction of the vessel or also by heating the vertical wall of the vessel for short periods, with the aim of melting a thin zone adjacent the walls of the vessel and thereby to detach the core of the store from the wall of the vessel. Electric heaters as well as heaters with gaseous or liquid heat carriers are suitable for providing the heating effect.

If low melting point storage masses are used, the storage vessel can be made of heat sensitive materials, such as plastics materials. The walls of the vessel may

also be so thin that they are deformable in a bellows-like manner, as soon as melting commences.

### DESCRIPTION OF THE DRAWINGS

Referring to the drawings in which a preferred embodiment of my invention is illustrated:

FIG. 1 shows a broken perspective view of a vessel constructed according to the invention;

FIG. 2 is a section of the vessel of FIG. 1 showing the mass in the solidified form and also showing the relationship of the vessel with adjacent vessels;

FIG. 3 is a view similar to FIG. 2 showing a portion of the mass in solidified form and in melted form; and

FIG. 4 is a plan view of a portion of FIG. 1.

### DETAILED DESCRIPTION OF THE DISCLOSURE

The invention will now be explained with reference to the drawings.

FIG. 1 shows diagrammatically a storage body for a night storage heater, which comprises a tapered plastic vessel 1 having a top portion 18 where the vessel is closed at the bottom by a metallic base. Underneath the base a resistance heater 2 is provided which together with the base is connected to the vessel 1 by the bead 6. The supply conductor 3 to the heater also comprises a resistance wire extending over the height of the container and is connected with the vessel 1 in heat conducting manner. Corrugated aluminum ribs 4 are connected with the walls of adjacent vessels in heat conducting manner and dissipate heat to air which is conducted through them.

FIG. 2 shows a vertical section through a vessel in accordance with FIG. 1 in its discharged condition. The interior is charged with a storage mass 10. Since the storage mass, in its solid condition, occupies an appreciably smaller volume than in its liquid condition, a trough 13 is formed in the upper region of the solid body. As soon as the heater 2 is switched on, the storage mass above the base 11 begins to melt. Since however the supply conductor 3 also develops heat and since it possesses a smaller heat capacity than the heater 2, a strip 12 of melt is produced along a boundary line of the solid body of storage mass 10, so that the melt 14 above the base 11 communicates with the upper region 15 of the vessel 1. Thereby an excess pressure may be created. In view of the higher specific gravity of the storage mass 10, the melt 14 is compressed into a thin film, so that a very good heat conducting contact is formed between the heater 2 and the body of storage mass 10.

FIG. 3 shows the vessel in its partially charged-up condition. The body of storage mass 10 has by now melted to a large extent and is surrounded on all sides by melt. Nevertheless the layer 14 remains extremely thin until the body of storage mass 10 has melted in its entirety. The small amount of heat generated by the supply conductor 3 is transmitted to the molten storage mass 16 by convection. At least those portions of the wall of the vessel not heated by the heaters may be made of a thin deformable plastics material such that the walls will move in a bellows-like manner when melting commences; this further assures that the solid portion of the storage mass may move vertically within the vessel.

3

4

FIG. 4 shows the construction of the ribs 4 which consist of a corrugated metal sheet and very thin metal plates 17 and 17' which serve the purpose of heat distribution. The angle 5 is of such a value that adjacent storage vessels can be contiguously juxtaposed in sequence.

I claim:

1. A vessel having a horizontally extending base plate and vertically extending side walls for containing a meltable heat storage mass, said vessel having a first heater for melting the storage mass, a heat exchange arrangement for removing the heat of crystallization which is produced during solidification of the storage mass, and a storage mass having different densities in its solid and liquid states; characterized in that said first heater is disposed in a substantially horizontal plane adjacent said base plate, that the crystalline portion of the storage mass is urged against the base plate by gravity, and that the vertically extending walls define a tapered

shape, the vessel being wider at its base, and having in addition a second heater which extends vertically from the first heater along a portion of the side walls to approximately the portion of the vessel opposite said base plate and where said first heater has a greater thermal output than the second heater.

2. A storage vessel according to claim 1 characterized in that at least the portions of the walls of the vessel which are not heated comprise a plastic material.

3. A storage vessel according to claim 2 characterized in that said base plate is metallic.

4. A storage vessel according to claim 2 characterized in that the portion of the side walls that are of a plastic material are deformable whereby the storage mass when in a solid state can move vertically in the vessel.

5. A storage vessel according to claim 1 characterized in that said base plate is metallic.

\* \* \* \* \*

20

25

30

35

40

45

50

55

60

65