United States Patent [19]

Laing

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[45] **Aug. 20, 1974**

[54] **INSULATING CASING FOR STORAGE HEATERS**

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[21] Appl. No.: **105,964**

Related U.S. Application Data

[63] Continuation of Ser. No. 793,524, Jan. 23, 1969, abandoned.

[52] **U.S. Cl.** **165/32,** 165/96, 126/400

[51] **Int. Cl.** **G05d 23/00**

[58] **Field of Search** 126/400, 375; 219/378; 417/51; 165/96, 104, 81, 83, 32

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Primary Examiner—William F. O'Dea
Assistant Examiner—William C. Anderson
Attorney, Agent, or Firm—Pennie & Edmonds

[57] **ABSTRACT**

A heat storing device comprising a heatable core and a heat insulating casing enclosing the core. The casing comprises major walls which are double and enclose gas-tight cavities. The cavities are filled with porous material and contain a gas at low pressure. The core is made of salt-like compositions with one or more polymorphic transitions at temperature levels at which no uncontrollable quantity of gas penetrates the casing walls and leaves said cavities.

1 Claim, 19 Drawing Figures

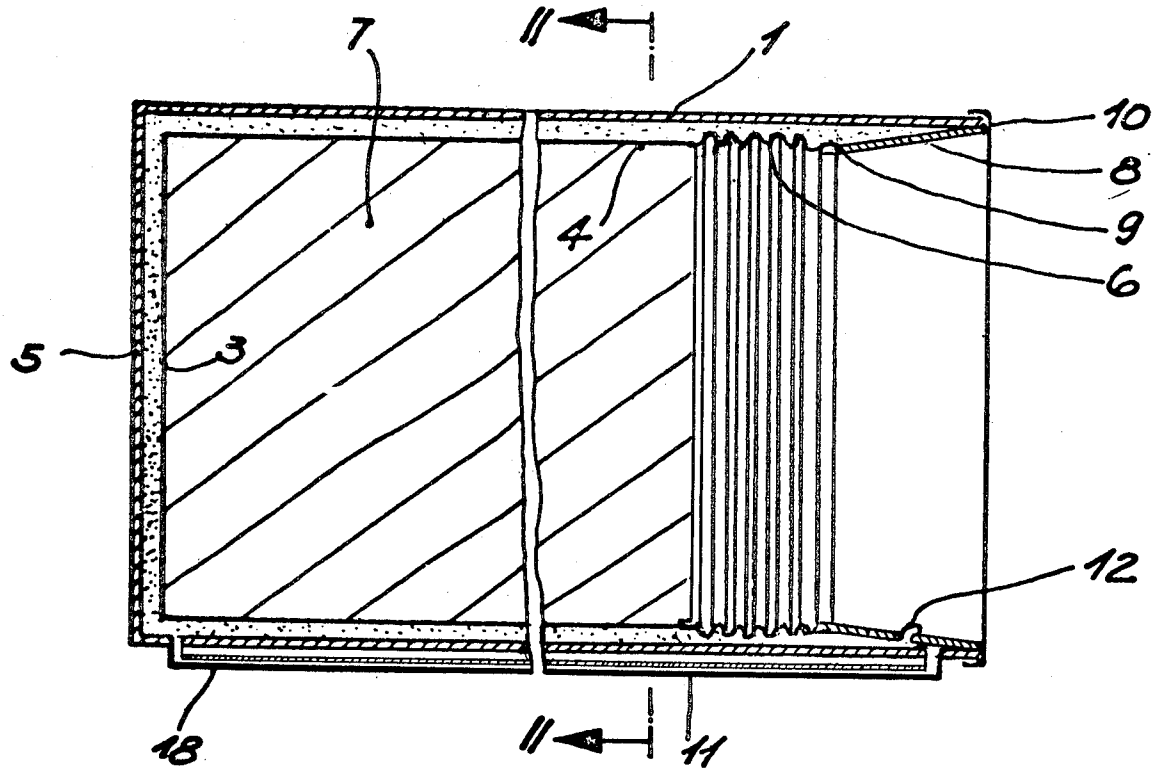


FIG. 2

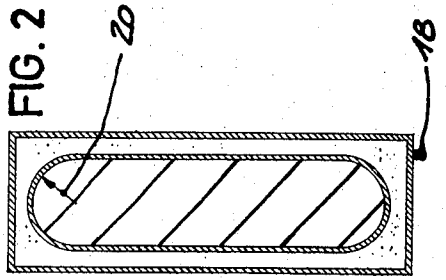
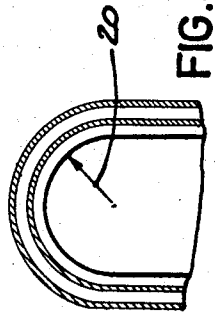


FIG. 4



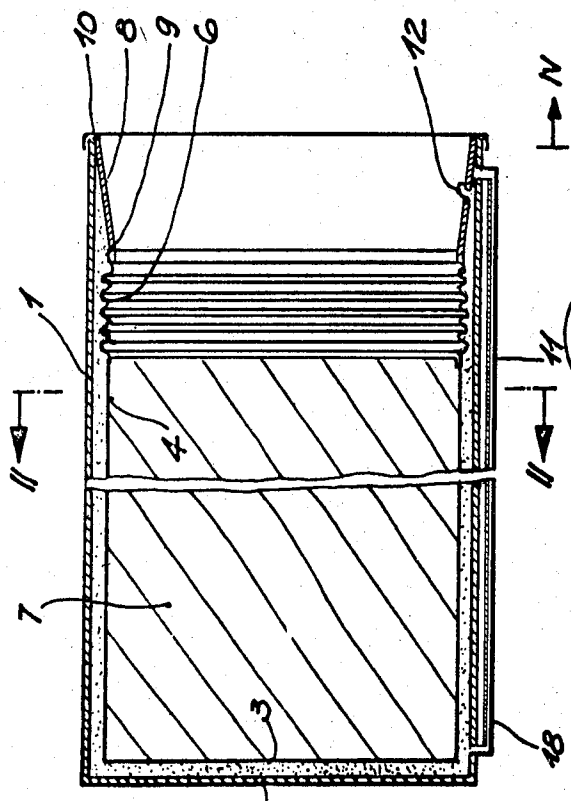


FIG. 1

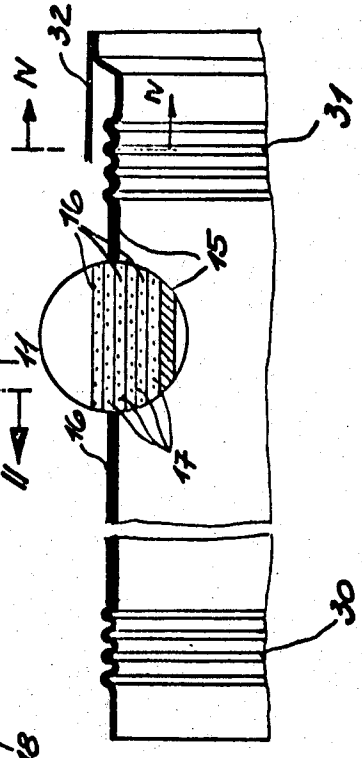


FIG. 3

FIG. 5

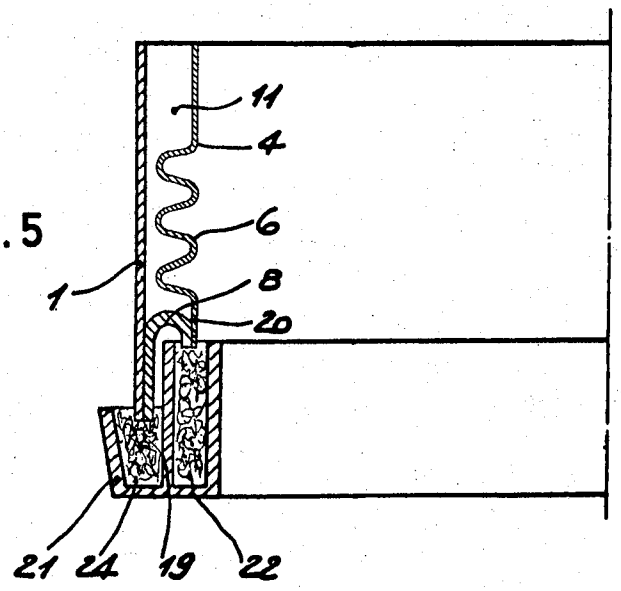


FIG. 6

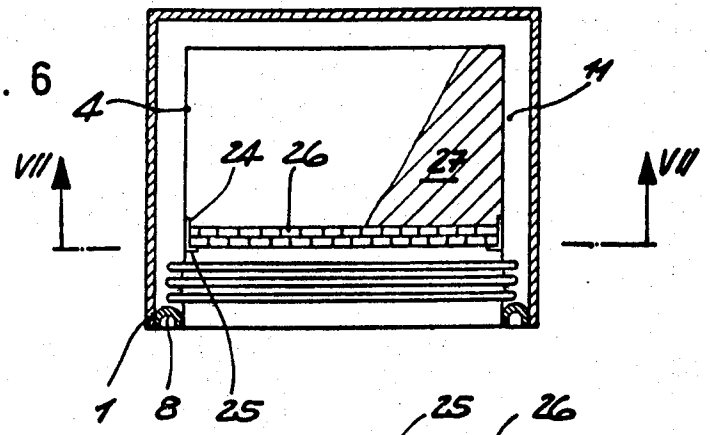
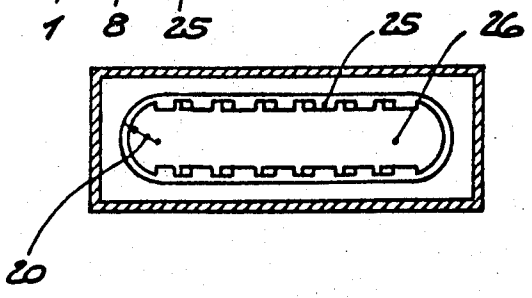


FIG. 7



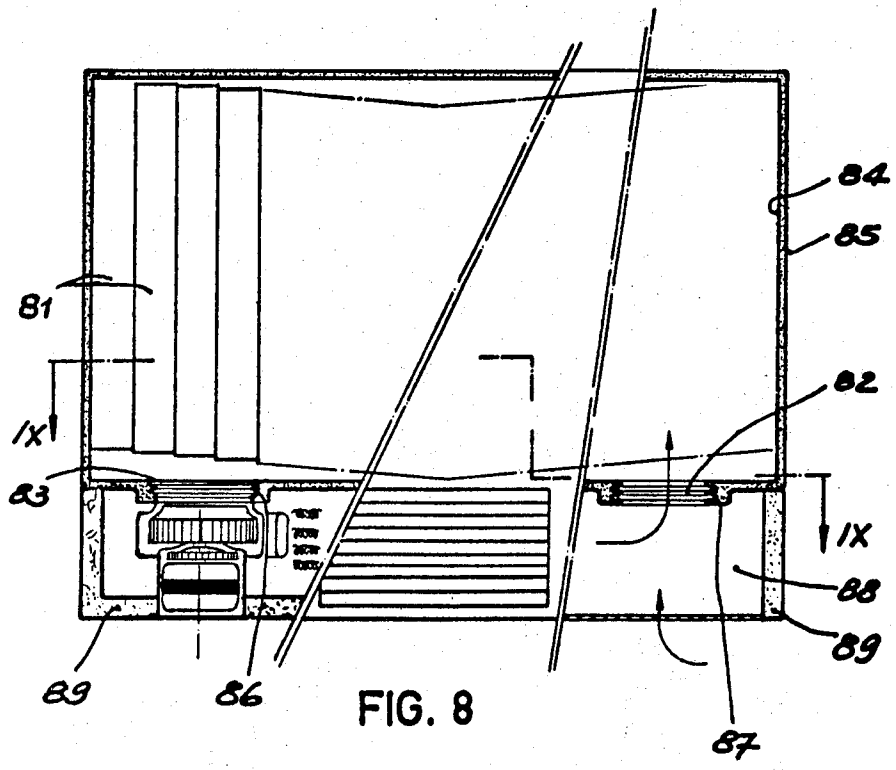


FIG. 8

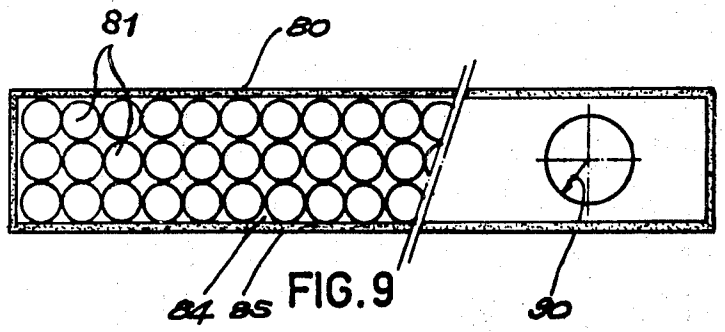


FIG. 9

FIG. 10

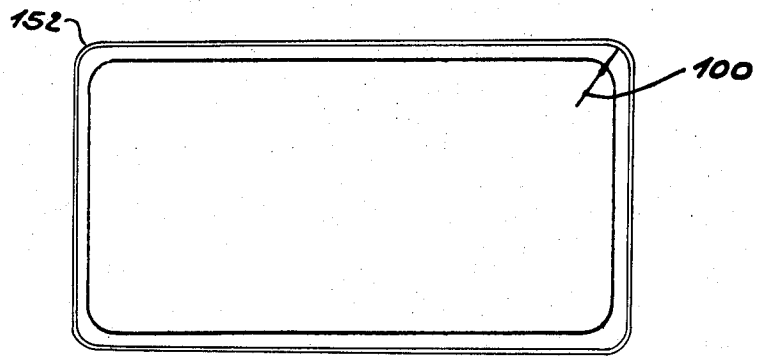
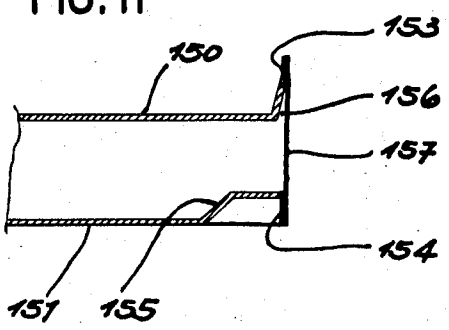


FIG. 11



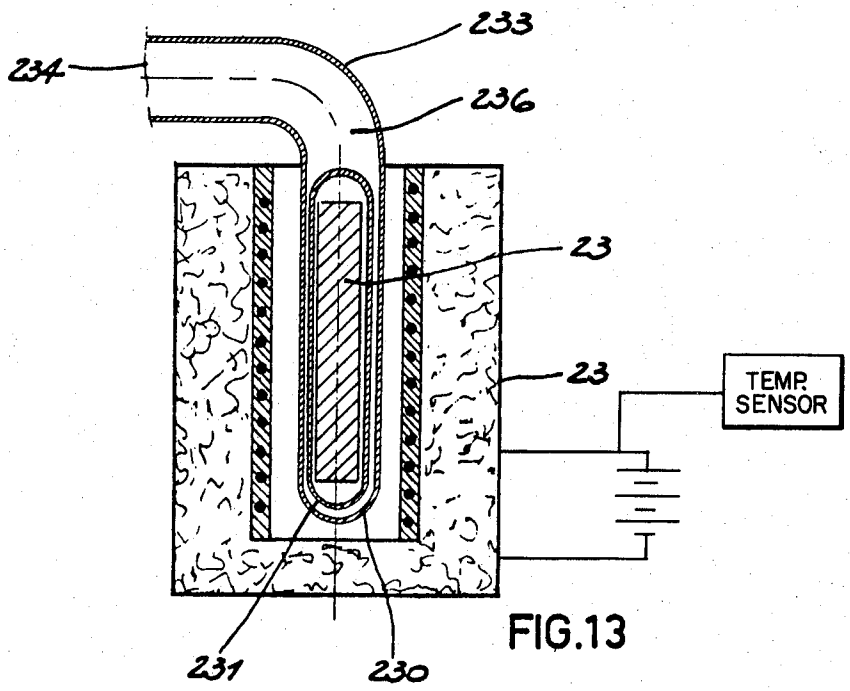

233
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TEMP. SENSOR
231
230

FIG.13

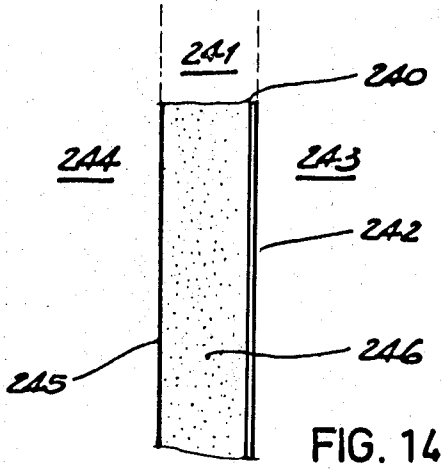
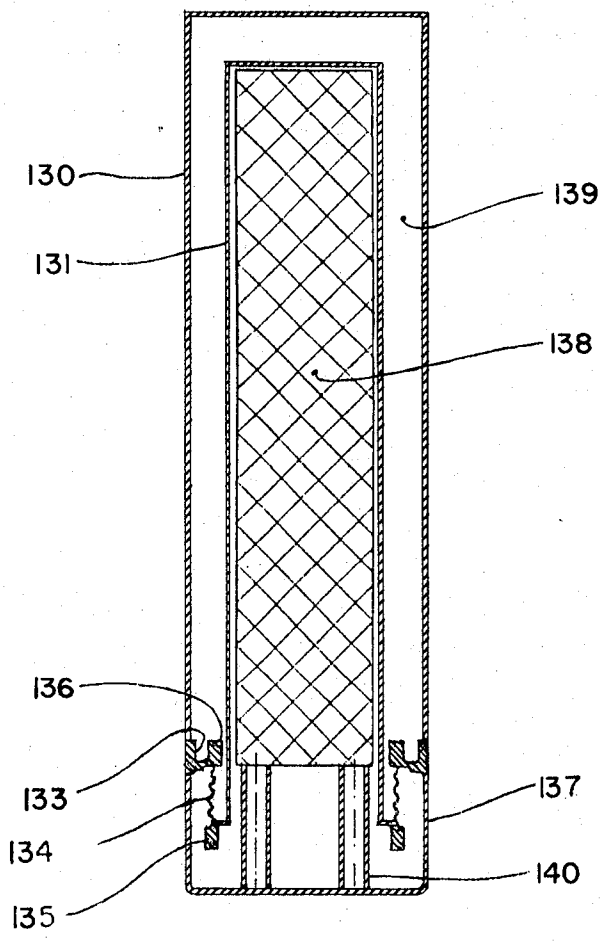

241
240
244
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246
245

FIG. 14

FIG. 12



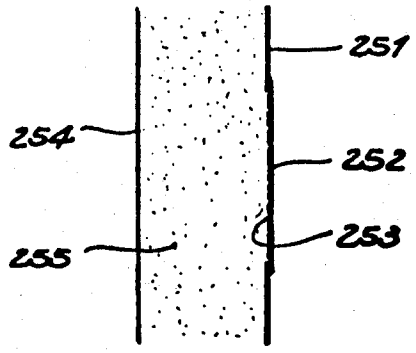


FIG. 15a

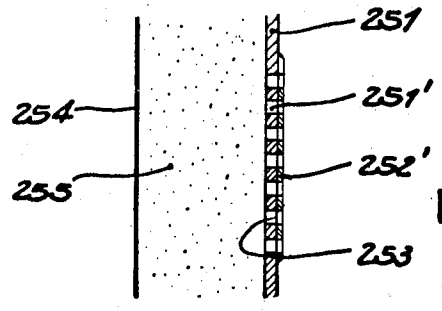


FIG. 15 b

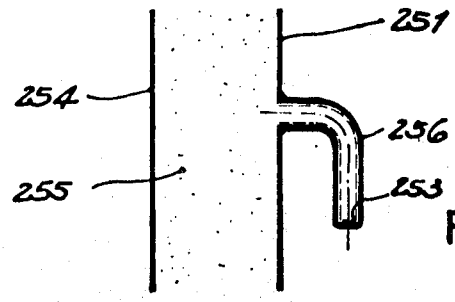
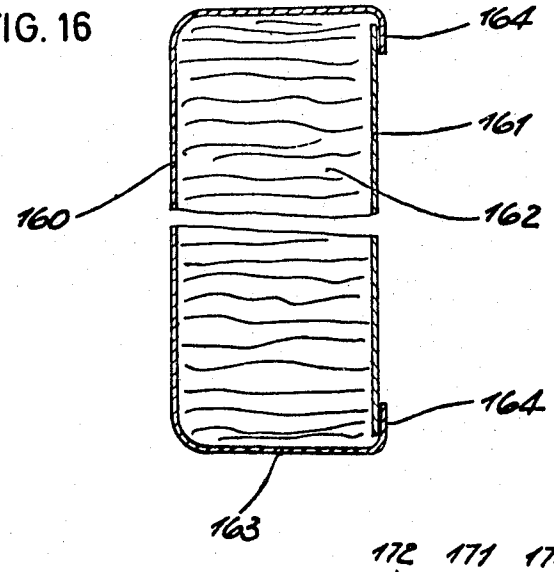


FIG. 15 c

FIG. 16



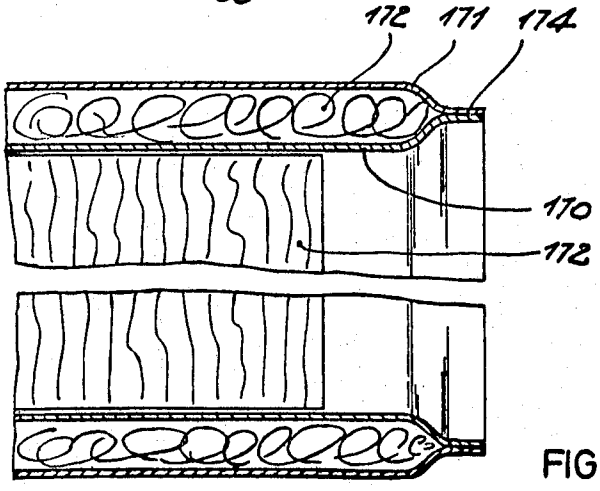


FIG. 17

INSULATING CASING FOR STORAGE HEATERS

This is a continuation of application Ser. No. 793,524, filed Jan. 23, 1969, and now abandoned.

THE PRIOR ART

Known storage heaters which are charged with cheap rate electricity have a large overall depth or width since, as their storage cores must be heated to high temperatures, thick insulation is required. These and other known heaters must be placed at an appreciable distance from the wall.

Since heaters having a large overall depth cannot be placed in that site in the room which is best from the point of view of heating, i.e. below the window, they can only be used where the heating requirements are less exacting. The object of the invention is to provide storage heaters which, like central heating radiators, can be situated below windows, in fact across the full width of the window, i.e. in which the external surface area need not be minimized. That is, the heater should form an elongated, shallow object extending over the entire width of the window and with a very small overall depth or width, and it should not be placed at an appreciable distance from the wall.

A further disadvantage of known heaters with storage blocks heated to red heat is the risk of fire. If combustible gases or dust are in the room, explosions may be caused, just as happens with solid-fuel stoves. Lastly, when this type of heater is discharged at the beginning of the discharge period, cold air is added to the air which has passed through the storage core, in order to prevent excessively high temperatures. The admixture is carried out automatically by means of bi-metallic controlled valve systems. If these fail, however, the air leaves the heater at a temperature high enough to ignite furniture and carpets. Also, the electrical heating elements and the leads between these elements and the switches are expensive, since only some materials can be used at red-hot temperatures.

In low-temperature apparatus thin-walled vacuum insulations are used which have heat transfer coefficients approximately one-twentieth of that of slag wool. At red-hot temperatures, however, these plates are unsuitable, since considerable quantities of gas would be released by desorption from the inner walls of the insulating plates, soon destroying the vacuum.

DESCRIPTION OF THE INVENTION

The invention relates to high-grade thin-walled insulations in storage heaters, so that the shape of the casing is no longer dependent on a minimum volume/-surface ratio. On the contrary, the heaters can be extremely shallow or narrow and may even be situated beneath window sills.

According to the invention, the storage heater has a heated core of a heat storing material through which a heat transfer medium is passed. The heater has an insulating casing enclosing the core. Features of the invention are that the heat storing material comprises a compound mixture which, when the core is charged and discharged, passes through a change in phase and thereby stores latent heat or gives if off; the casing has a depth or width which is substantially smaller than its length and height; at least two principal or major walls of the casing are double; and the cavity bounded by the double walls is hermetically sealed against atmosphere

and filled with a porous filler. Preferably, the cavities in the porous filler have diameters which are smaller than or equal to the free path of the filling gas at operating temperatures.

In one embodiment of the invention the cavity is evacuated to a pressure greater than 1 Torr, preferably greater than 100 Torr. Preferably the filling gas is hydrogen or helium.

In a variant embodiment of the invention the filling gas is a gas having a boiling point above 180°K, for instance carbon dioxide, sulphur dioxide or ammonia.

In another embodiment of the invention the filling gas has a molecular weight of at least 100. In this embodiment the negative pressure in the casing cavity is not absolutely necessary.

The porous filler used can be a mineral foam or a mineral powder, for instance, silicon dioxide powder. Preferably the depth of the insulating casing is between one-third or one-fifteenth of its greatest extension.

The substances which store latent heat must show the necessary change of phase in a temperature zone at which no uncontrollable quantity of gas emerges from the hot generated surface of the insulating casing double wall adjoining the storage heater. Experience shows that this can be done only at temperatures considerably below the red heat temperature of the wall material. By filling the cavities with the porous filler, whose pore dimensions are smaller than the free path of the filling gas at operating temperature, as a result of the resulting Knudson effect heat conduction between the generated surfaces and the hollow wall is abruptly reduced. A negative pressure of the order of magnitude of Torrs can readily be achieved technically. The invention therefore prefers light gases such as hydrogen or helium.

However, evacuating pumps can even be dispensed with altogether, and the required negative pressure can be produced by condensing the enclosed gas. Nevertheless, this can be done only with gases having a relatively high boiling point, such as sulphur dioxide, ammonia or carbon dioxide.

Since the absolute pressure required may be higher in proportion as the pore sizes of the filler are smaller, in one embodiment of the invention such small distances between the pores are selected that the absolute pressure can substantially correspond to atmospheric pressure.

A less effective insulation, but one which is still adequate for the performance of the invention, is formed by the cavity between the generated surfaces of the insulating casing being filled with a fibrous filler of as low a density as possible, and with a gas which has as high a molecular weight as possible, preferably a molecular weight of above 100. In this case the inner pressure can be equal to atmospheric pressure, so that in contrast to operation at negative pressure, very fine pores, which often occur in practice, cannot lead to disturbance. However, the insulating event must in any event be dense so that there can be no gas exchange between the cavity in the double walls and the outer atmosphere, since an exchange of this kind would render the insulation useless.

It has now been found that the vacuum plates used in low-temperature technology cannot be used after all. An insulating casing built of such plates consists of six plates, and each of these plates is made by connecting

the inner and outer walls at their periphery by means of a metal edging strip with poor thermal conductivity. This edging strip, of course, transmits heat far better, than the other parts of the insulating plates. In low temperature technology, in which the temperature differences relative to the external air are only 10 to 30°C, the unequal distribution of heat to the outer wall of the casing is not disadvantageous. In a storage heater, however, in which the temperature difference amounts to some hundreds of degrees, the higher thermal conductivity of the edging strips would produce extremely high temperatures at the edges of the casing, i.e., exactly where people are most likely to touch the heater. The invention therefore avoids this local heating by making the dimension of the insulating edging strip in the direction of the heat flow substantially greater than the distance between the walls defining the housing shells.

A further feature is that more than one edging strip round the wall-plates runs along one edge of the casing. This can be achieved according to the invention by insulating only the principal surfaces with wall-plates, while the side surfaces connecting the front and rear are insulated by conventional means, or by placing the outer and inner walls of the wall-plates one inside the other like tubes so that the edging strips for connecting them are needed only at two opposite ends, possibly only at one end or along the edge of an opening.

To compensate for the relatively extensive thermal expansion and contraction of the inner generated surface of the insulating casing, according to the invention the edging strips are not rectangular frames, but frames inscribed within a rectangle which have at the corners large radii of curvature which, in the case of deformations resulting from thermal expansion of the inner generated surface, remain within the resilient range of the material of the edging strip. Preferably, the edging strip is corrugated — i.e., it is like a bellows.

It has been found that the vacuum plates used in low-temperature apparatus will not provide good insulation over a long period. They have a high vacuum, and very small quantities of gas destroy the insulating effect. According to the invention, therefore, the substances used as filling are not the usual mineral substances, which are intended chiefly to keep the two walls a given distance apart under atmospheric pressure, but substances with extremely small pores having average pore radii below 5×10^{-5} cm. In the case of these pore radii, the pressure within the plates need only be reduced until the free path of the trapped gas (which depends on both the pressure and the temperature of the gas), at the temperatures occurring, is down to approximately twice the pore radius. By this means, in accordance with the invention, heat transfer by gas transmission can be prevented even at pressures only one hundredth of atmospheric pressure, whereas in low-temperature technology the pressures are lower by some powers of 10. As a result, the insulating effect will not be destroyed until more gas, to the extent of the reciprocal pressure ratio, has entered the insulating space.

In the known low-temperature apparatus, the expansion of the inner plates of the insulating jacket as the store temperature rises would be up to several millimeters greater than that of the outer plate, depending on the width of the heater. According to the invention, therefore, the plates are connected in a gas-tight manner at their peripheries to a thin strip of material of minimum thermal conductivity, the width of the strip being more than the distance between the shells of the plates.

If a negative pressure is maintained inside of the plates, the filling for the insulating plates must serve two ends: spacing and the formation of cells. Spacing is effected either by the cell-forming material or by special supporting elements. The filter must also prevent convection in the cavity of the insulating casing.

A further object of the invention is to make elongated insulating casings with an extremely small overall depth and to reduce the distance required between the heaters and the wall compared to that previously required. To this end, the insulating casing can be built as an outer member (outer shell of plates), in which a second inner member (inner shell of the insulating casing) is provided. This second member preferably has rounded edges. A distance of a few millimetres remains between the two members. Insulation material is introduced into this space in bulk form, or else a cloth is wound round the inner member before the latter is pushed into the outer member. A combination of sheets of very thin aluminum foil with cloth made from very fine glass fibres and interleaved with these sheets has proved effective as insulation, particularly at high store temperatures. If a vacuum is maintained in the casing cavity, the mechanical strength of the layer inserted between the two members should be high enough to withstand the external air pressure. The inner member is preferably connected to the outer member in a fluid-tight manner at both ends by welding or soldering, by means of a chime. Between the outer and inner members there is a compensation portion, formed for example by corrugating the end portion of the inner tube.

In contrast to conditions known in vacuum technology, heaters according to the invention cannot be designed on the assumption that the gas yield inside the container during the life of the heater will be negligible, or that an undesirably high gas yield can be absorbed by large-area surface-active getters. It is well known that at high temperatures practically all wall materials, and especially metals, release gases, partly by desorption from the surface of the material, partly by diffusion from within the material towards the vacuum, and partly by passage through the wall from the atmosphere.

The preferred vacuum insulation for the storage heater according to the invention has an operating pressure higher by at least four powers of ten, and the quantity of gas produced during its life is more than five powers of ten higher than the order of magnitude usual in conventional electronic tubes. The known getter processes are therefore useless. The invention uses known getter substances in a novel technique which permits the getter to be used in solid form and to act over a small area and/or a small volume. The getters preferably used are phosphorus, magnesium, barium, aluminum, titanium or zirconium or alloys of these, which do not vaporise at temperatures of 300 to 800° C even in a vacuum, but react chemically with oxygen, nitrogen, water and CO_2 at these temperatures. No protective layer which passivates the surface must arise. In accordance with the invention, these substances are deposited in a reaction space which communicates with or forms part of the vacuum-insulation space proper. The required temperature of reaction is reached either by means of the temperature-peak attained periodically

in the storage heater during operation or by means of an additional heating system. This additional system may be controlled by a thermal sensor adapted to detect whether the insulating effect has been diminished by a rise in the pressure in the vacuum space. Also, the system may be controlled so that periodically the reaction space is briefly heated to above the melting and/or boiling point of the getter in order to destroy passivation layers on the getters. The reaction space is so formed, in accordance with the invention, that no vaporisation and/or melting losses of getter occur.

Undesirably high hydrogen pressures may arise in the vacuum space as a result of cracking or catalytic processes, and although most wall materials are relatively highly permeable to hydrogen, these pressures may not disappear fast enough. The invention therefore uses the known "hydrogen window". To this end, a portion of palladium sheeting or foil with a supporting grid, or a length of palladium tubing, is set in the wall facing the hot side. Alternatively, palladium alloys may be used. At the given wall temperature the rate of hydrogen diffusion can be considerably increased with an uranium nitrite coating, preferably only on the vacuum side of the hot wall. The hydrogen window may also be heated (continuously or periodically) by means of an auxiliary heating system.

The invention will be described by the way of example with reference to the drawings.

FIG. 1 is a longitudinal section through an insulating casing with a compensation portion at one end, in accordance with the invention;

FIG. 2 is a section through the insulating casing along a line II — II in FIG. 1;

FIG. 3 shows the inner cylinder of an insulating casing with compensation portions at both ends, in partial section, one portion of the wall being shown on a larger scale;

FIG. 4 shows a partial section through a completely rounded insulating casing, along a line IV — IV in FIG. 3;

FIG. 5 illustrates a process of simultaneously dip soldering the inner and outer walls of the casing, in partial section through the insulating jacket;

FIG. 6 shows a storage heater, in section, with means for holding the storage material in the insulating casing;

FIG. 7 shows the heater illustrated in FIG. 5, and as seen along the line VII — VII in FIG. 6;

FIG. 8 shows a section through a storage heater with two circular air apertures in the underside of the insulating casing;

FIG. 9 shows a partial section along a line IX — IX in FIG. 8;

FIG. 10 is a front view of a flat insulating plate with rounded corners;

FIG. 11 is a section on a larger scale through the insulating plate shown in FIG. 10, along a line XI — XI;

FIG. 12 is a section through an insulating casing in the form of a double-walled cowl;

FIG. 13 is a section through a simple getter pump with a heating element;

FIG. 14 is a partial section through a vacuum insulating plate showing the arrangement of getter material in the cavity inside the plate;

FIGS. 15*a*, 15*b*, and 15*c* show various forms of hydrogen window, in partial sections through vacuum insulating plates;

FIG. 16 is a section through the wall of an insulating sheet according to a further embodiment of the invention and

FIG. 17 shows an insulating casing having a cylindrical wall construction.

FIG. 1 illustrates a longitudinal section through an insulating casing embodying the invention. The outer member 1 of the casing is made of thick sheet metal in the form of a tube (seen in section in FIG. 2) closed in the present case by an end wall 5. Inside the outer member, which is in the form of a tube with a rectangular cross-section, there is a second member or tube 4 also of sheet metal. This tube also has an end wall 3. The term "tube" means an elongated generated surface of substantially constant cross-section along its axis, e.g. tubes with rectangular cross-sections with or without rounded-off corners. The cross-section of the tube 4 is such that there are no sharp corners. That end of the inner tube 4 which points towards the open end has corrugations 6. Since there are no sharp corners on the inner tube, the corrugations can be formed by means of conventional corrugating machines. Also, stresses which cannot be controlled are avoided as a result of the rounded portions.

The corrugations 6 are intended to absorb longitudinal expansion of the inner tube 4 relative to the outer tube 1, and to keep the axial dimension of the tube 4 outside the area of the storage core 7 as small as possible while providing as long a path as possible for the heat flow. Over the relatively short distance containing the corrugations 6, the temperature drops from that inside the storage material almost to the external temperature. Between the rectangular outer tube 1 and the rounded inner tube 4 there is a transition frame 8, whose inner end 9 follows the rounded cross-section of the inner tube and is connected to this tube in a gas-tight manner, e.g. by seam welding, whereas the outer cross-section at 10 follows the rectangular cross-section of the outer tube. The end portion 10 is preferably bent round the outer tube and connected to it in a gas-tight manner by soft soldering. In accordance with the invention, this connection has the advantage that the outer tube does not become displaced, as easily happens when welding temperatures are used. The cavity between the inner tube 4 and outer tube 1 is filled with insulating material, preferably pourable bulk material 11. A spigot 12 permits evacuation of the insulation space.

The insulation space is preferably filled with a powder whose bulk weight is as low as possible, but which is capable of absorbing the pressures due to the external atmospheric pressure.

To ensure good insulation, in accordance with the invention foams or powders are used in which there are cavities smaller than the free path of the evacuated air. According to the invention, the fillings are preferably mineral foams ground so that the cells are revealed and then mixed with carbon black so that the molecular cells are sufficiently small. A further improvement is obtained in accordance with the invention, if the interior is filled with a heavy gas, e.g. halogenated hydrocarbons of high molecular weight, before evacuation.

FIG. 3 shows the inner tube 15 of an insulating casing open at both ends. Such casings are preferably constructed as highly elongated casings, since the pure heat transfer losses through the wall can be kept extremely low relative to the transfer losses in the end

portions. Steps, according to the invention reduce the losses otherwise caused by the thermal conductivity of the edging strips to one or at most two areas of the periphery. Aluminium foil **16** is wound round the inner tube **15** as insulation. The sheets of this foil enclose layers **17** of insulating material between them. Preferably, the aluminium foil is covered with a thin layer of fine mineral or glass cloth, the latter being coated with very fine-grained material, e.g. carbon black. Alternatively, in accordance with the invention, the aluminium foil is just dusted with such very fine grained materials. Advantageously, if the insulating casing is to be open at both ends, both ends of the inner tube **15** have corrugations **30, 31,** in order to compensate for longitudinal expansion and reduce heat conduction.

Instead of substantial evacuation, there may be a filling consisting of a gas of a compound of high molecular weight, e.g. sulphur dioxide, fluorinated hydrocarbon, etc.

In accordance with the invention, the vapour pressure of the filling gas at the maximum room temperature should be below atmospheric pressure. For this reason the invention proposes a condenser **18** (FIG. **2**), which may, for example, be in the form of a tube and is situated at the bottom of the heater. Since some air convection always occurs during operation, this ensures that this lowest portion of the casing is approximately at the temperature of the air in the room, so that the vapour pressure arising in the insulating casing tube is determined by the vapour pressure associated with this minimum temperature within the system.

According to the invention, this tube **18** contains a small store of the high-molecular gas in a liquid or solid phase, so that any losses arising from polymerisation or the formation of compounds at the high temperature can be compensated. In one embodiment, this condenser merely produces the first vacuum and is then crushed. For this end the connection between the condenser and the casing cavity can be squeezed.

FIG. **5** illustrates a process according to the invention for forming a vacuum-tight soldered connection for an insulating casing. For clarity's sake, the walls are not shown to scale. The transition frame **8** is inserted in the end of the outer casing **1,** so that the outer edge **19** ends flush with the end of the outer tube **1** whereas the edge **20** ends flush with the end of the inner tube **4.** Both end portions **19, 20** are dipped simultaneously into a bath **21** containing liquid solder **22, 24** at two different levels.

FIGS. **6** and **7** show, also diagrammatically, an insulating casing **1** embodying the invention, with a transition frame **8** and an upwardly closed inner tube **4.** A supporting frame **24** is permanently connected to the inner tube **4.** The inwardly projecting portion **25** of this supporting frame is toothed and supports a plate **26,** which is also toothed around its periphery and which carries the storage core **27,** only part of which is shown. The weight of the storage core **27** is therefore borne on the inner shell **4.**

FIGS. **8** and **9** illustrate an embodiment in which the insulating jacket **80** almost entirely encloses the storage material, which is arranged in the form of cylinders **81.** The insulating jacket **80** is interrupted by the air inlet **82** and air outlet **83.** The relative thermal expansion of the inner cylinder **84** and outer cylinder **85** is taken up by the corrugated tubes **86, 87,** which are connected in a gas-tight manner to the inner cylinder **84** and outer cylinder **85.** The blower cabinet **88** is insulated with conventional insulating materials **89.**

FIGS. **10** and **11** show an insulating plate embodying the invention, consisting of a wall **150** near the storage material and an outer wall **151** (FIG. **11**).

The corners **152** are rounded (FIG. **10**), and a rebate **153, 154** runs around the periphery on both sides. The sheet **151** is displaced by the width of the rebate **154** by means of a groove **155,** whereas the rebate **153** forms an extension of a conical wall portion **156.** A very thin strip **157** of sheet metal, e.g. austenitic chrome-nickel steel, is permanently connected to these rebates **153, 154** (preferably by soldering or by seam welding). The thickness of this strip may for example be 15 μ, so that the strip has very high resistance to heat, the heat-transfer coefficient of such steels being extremely low.

FIG. **12** illustrates an embodiment in which the outer and inner shells of the vacuum insulation are formed by two sheet-metal boxes **130, 131,** open along one common narrow side, are nested one inside the other. The edge of the outer box **130** is bent inwards and crimped over, preferably by means of a welded-on section **133.** A very thin, corrugated sheet-metal strip **134,** made from a high-grade steel having poor thermal conductivity, is welded onto the rebate of this section. The edge of the inner box **131** is drawn outwards and welded to the sheet-metal strip **134.** This strip forms a resilient, enclosing border which acts like a bellows and takes up slight displacements of the two nesting boxes. The distance between the two boxes is defined by spacers or porous bulk material. To facilitate seam welding or brazing, the extremely thin sheet-metal strip **134** is preferably gripped between the rebate and a support **135, 136** of sheet metal having the same thickness. The entire cowl is mounted on a base **137** in direct contact only with the cool outer box **130.** The hot storage core, as already shown in FIGS. **1** to **3,** is carried on thin-walled tubes **140** of high-grade steel. One advantage of the vacuum cowl is that it can form the outer casing of the heater.

FIG. **13** shows a getter pump for a vacuum insulation, according to the invention, for using solid getter material at a relatively high operating pressure. The air-tight glass ampule **231** containing the getter material **232** is inserted in a space **236** in a soft (e.g. copper) tube **230,** which is closed at one end, before the bend **233** is formed in the tube, so that any reduction in cross-section in the bend does not matter. The bend acts as a vapour lock and also prevents the ampule from falling out during handling. The open end **234** of the tube **230** is connected to the vacuum insulation jacket. After evacuation and outgassing of the entire vacuum space, the glass ampule **231** is broken by deforming the tube **230** or melted by heating by the oven **235.**

The required temperature of reaction of the getter agent is reached either by means of the temperature peak attained periodically in the vacuum insulation jacket or by means of an oven or heating means **235.** The heating means **235** may be controlled by a sensor which is responsive to an increase of pressure of a filling gas in the insulation jacket the effect of which would be to decrease the insulating properties of the jacket. Actuation of the heating means by the sensor will increase the reaction between the getter agent and the filling gases in the insulating jacket to remove portions of the gases from the jacket and thus reduce the

pressure and increase the insulation properties of the jacket. Further the electrical heating means may be made responsive to the temperature on the outside of the insulation jacket rather than pressure of the filling gas whereby the heating means will be turned on when the outside of the jacket reaches a predetermined temperature.

In addition the heating means may be controlled so that periodically it is actuated for a brief period of time whereby the getter agent will be heated above its melting or boiling point in order to destroy any passivation layers that may have formed on the getter agent. The tube **233** is so formed that there will be no loss of getter agent due to any melting or vaporization during the brief time it may be heated above its melting point.

In FIG. **14**, a section through the vacuum insulating jacket, the reaction space is part of the insulation space. The getter material **240** is inside the vacuum space **241**, immediately adjacent to the hot wall **242.** It is in the form of sheeting or foil or is rolled with the material of the wall **242. 243** denotes the hot interior of the storage heater and **244** the cold exterior. Between the cold wall **245** and getter material **240** there is the filling **246.**

FIGS. **15***a* – **15***c* show sections through walls of a vacuum insulation jacket illustrating the preferred embodiments of the hydrogen window. In FIG. **15***a* a solid sheet **252** of material which is permeable to hydrogen, possibly with a layer **253** of uranium nitrite on its interior, is inserted in the hot wall **251.** The cold wall **254** and the filling **255** are substantially as shown in the previous figures. The hydrogen window tends to reduce any undesirable high hydrogen pressures which arise in the vacuum space due to any cracking or catalytic processes. If the hydrogen pressure were not reduced, the insulation properties of the insulation jacket would decrease and thermal conductivity between the walls of the jacket increase.

In FIG. **15***b* the hot wall **251** has a perforated or porous portion **251'**. This portion is covered by palladium foil **252'**, which acts as a hydrogen window to remove hydrogen from the vacuum space.

In FIG. **15***c* the wall **251** contains not a window, having a large surface area, but a straight or bent tube closed at one end, so that hotter portions of the storage-heater core can be reached or a small additional heating system (not shown) can take effect. The tube, which acts as a hydrogen valve to reduce hydrogen pressures in the vacuum space, may alternatively be used in order to save material or to simplify the construction.

FIG. **16** is a section through an insulating wall according to the invention, in which the generated surface **160** is turned towards the hot storage heater core and the generated surface **161** is turned towards the outer air. The interior contains a porous material **162,** for instance mineral fibers. The generated surface **160** is made of a very thin material such as aluminum foil, so that heat conduction along the edge zone **163** is low. The material of the inner generated surface is glued at a place **164** to the outer generated surface **161** at which there is substantially the temperature of the outer air.

FIG. **17** shows a similar arrangement for a cylindrical wall whose inwardly directed generated surface **170** faces the storage heater core **172.** The inner generated surface is glued to the outer generated surface **171** at a zone **174** or connected by some other, non-temperature-resistent manner, for instance, by soft soldering. The zone **174** is also exposed to the outer air. The cavity **172** is either evacuated or filled with a heavy gas.

I claim:

1. An insulating wall element for separating a cold area from a hot area, comprising a first wall facing the cold area, a second wall spaced from said first wall and facing the hot area, an edge strip joining said first and second walls to hermetically seal the space therebetween, a porous filler material in said space, and a filler gas in said space, the improvement comprising having getter agent means in contact with said filler gas for reaction with and absorption of the same when said getter agent means is heated, heating means for heating said getter agent means, and heater control means responsive to the temperature of the side of said first wall facing the cold area whereby when said side exceeds a predetermined temperature, said heating means is activated.

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