United States Patent [19]

Corini

[11] **3,823,567**

[45] **July 16, 1974**

[54] **THERMOELECTRIC-VACUUM SHIPPING CONTAINER**

[75] Inventor: **Louis J. Corini**, Philadelphia, Pa.

[73] Assignee: **Melbro Corporation**, Philadelphia, Pa.

[22] Filed: **Apr. 5, 1973**

[21] Appl. No.: **348,183**

[52] **U.S. Cl.** **62/3**, 62/268

[51] **Int. Cl.** **F25b 21/02**

[58] **Field of Search** 62/3, 268

[56] **References Cited**

UNITED STATES PATENTS

1,532,016	3/1925	Wright	62/268
1,636,322	7/1927	O'Leary	62/268
2,000,882	5/1935	Comstock	62/268
2,991,628	7/1961	Tuck	62/3
3,078,682	2/1963	Gould	62/3
3,111,166	11/1963	Inunz	62/3
3,178,896	4/1965	Sandsto	62/3
3,194,023	7/1965	Sudmeier	62/3
3,220,198	11/1965	Muller	62/3

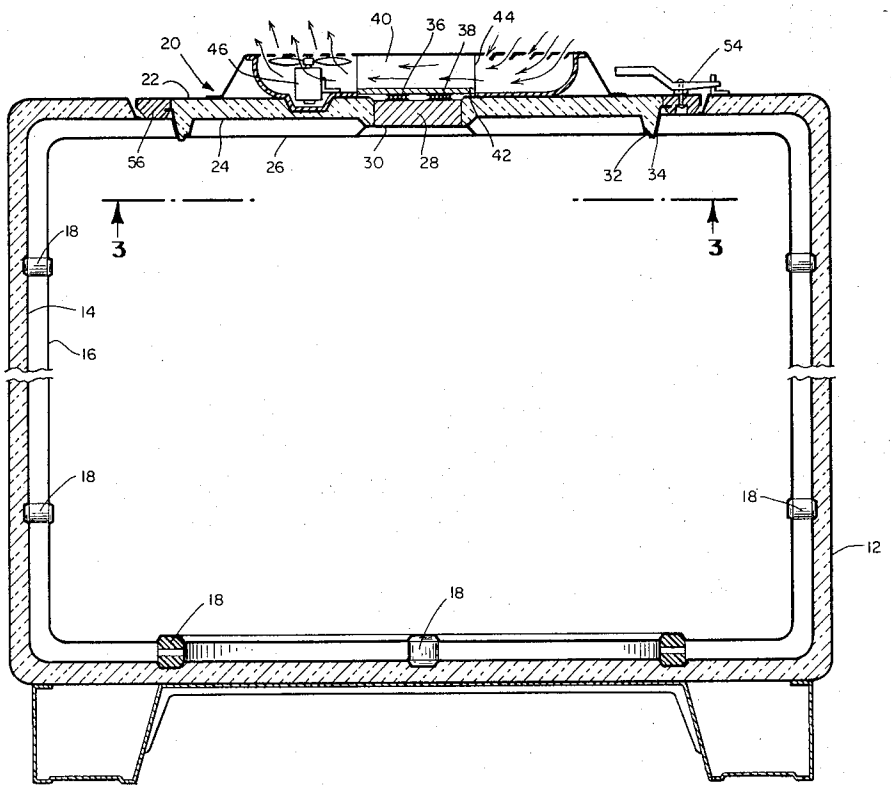
Primary Examiner—William J. Wye

Attorney, Agent, or Firm—Paul & Paul

[57] **ABSTRACT**

A container has an inner shell vacuum insulated from an insulated outer shell. A removable cap is provided with thermoelectric temperature control means actuated by a circuit which provides for reverse polarity for reversing heat flow. The thermoelectric means controls the temperature within the inner shell by making up the small heat transfer through the vacuum container construction.

1 Claim, 3 Drawing Figures



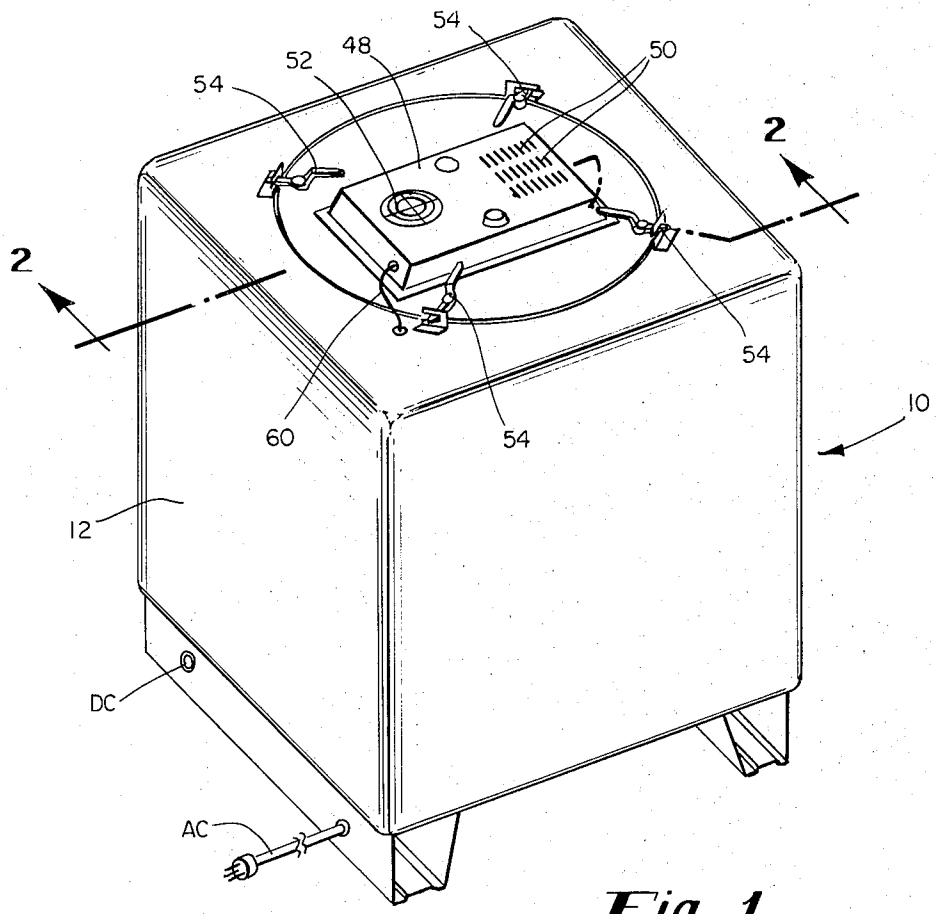


Fig. 1

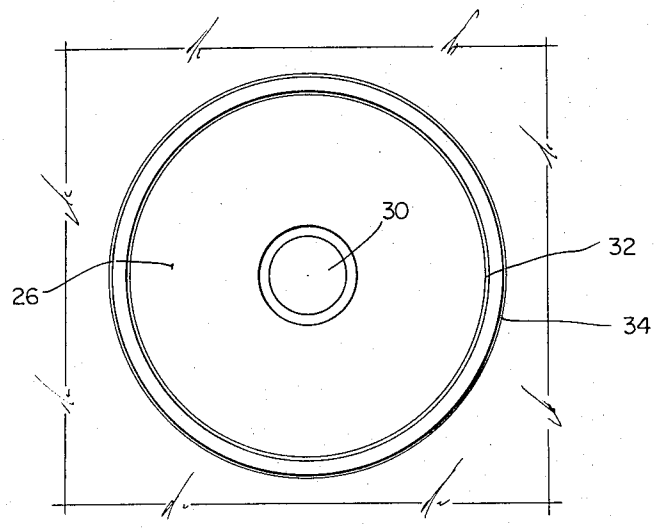


Fig. 3

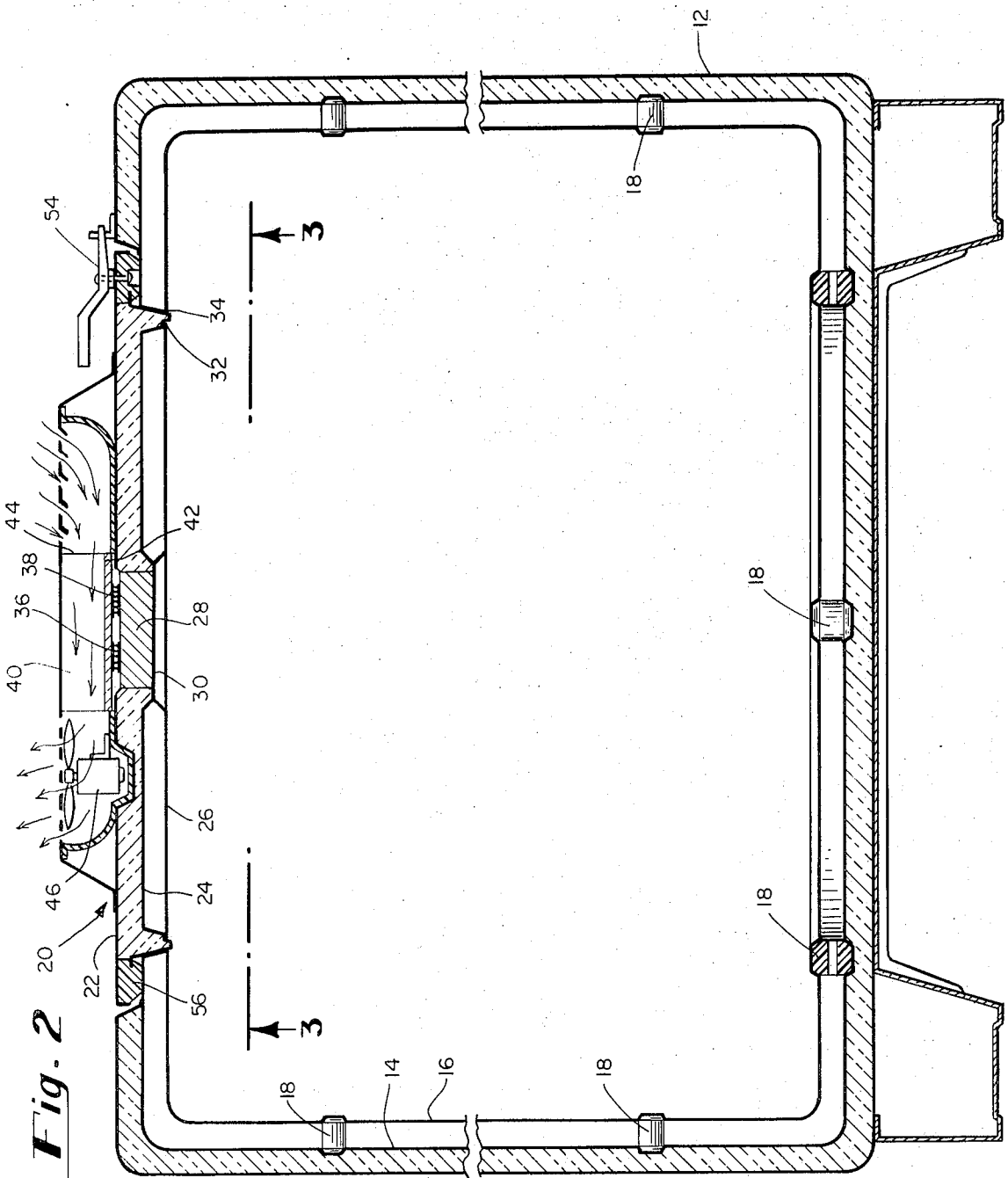

12
18
54
3
34
32
44
42
38
36
28
40
30
26
46
24
20
22
56
3
18
14
16
18
18
18

Fig. 2

THERMOELECTRIC-VACUUM SHIPPING CONTAINER

BACKGROUND OF THE INVENTION

This invention relates to a storage container of the type designed to maintain temperature within given parameters, and in particular, to a vacuum insulated container which utilizes principles of thermoelectrics to achieve controlled temperature within the container.

It is, at times, desirable to maintain the temperature of products, both while they are being transported, say for example, in a train, and while they are being stored, for example, just prior to shipment or prior to being delivered. It is known to use vacuum containers to transport materials at relatively constant temperatures. However, the construction of such containers is such that there is some "leakage" heat transfer through the structure supporting the inner shell. This is unacceptable where the goods are in transit for several days.

In theory, a vacuum is a perfect insulator with a heat transfer factor of zero. If it were possible to build a true vacuum container, that is, one vessel within another without any contact whatsoever between the two vessels and with the space between them completely void (that is, a vacuum), any product placed inside the container would remain at its initial stable temperature indefinitely. Such a container, however, is impossible to build, because the inner container must contact the outer container for support. This is true even though the points of contact between the two containers are kept to a minimum and are only made with low conductor materials.

The principles of thermoelectrics in providing temperature control are well known. See for example U.S. Pat. No. 3,445,039, issued May 20, 1969, and the patents referenced therein. Thermoelectric modules provide an excellent means of temperature control.

SUMMARY OF THE INVENTION

In the present invention I solve the problem of heat leakage by utilizing thermoelectric modules to act as compensators for the very low rate of heat leakage.

I provide a means for controlling the temperature in a vacuum shipping container, comprising an insulated, vacuum shipping container having a thermoelectric module mounted to a heat transfer block attached to the lining of the cap on the container. The thermoelectric module is mounted to a finned heat transfer means positioned in a frame on the cap which cooperates with a fan to blow air through the finned means and out through the frame of the cap. The thermoelectric means is actuated by a circuit providing for reverse polarity which provides for either heating or cooling; the circuit also having means to operate from either a D.C. or A.C. current source. The thermoelectric system in accordance with this invention does not refrigerate or heat the product within the container, but rather monitors and compensates for the heat leakage defined generally as radiant and conductive heat loss or gain. Note in this regard that if the ambient temperature surrounding the container is less than the temperature of the product, heat will leak out of the container, and if the ambient temperature surrounding the container is greater than the temperature of the product, heat will leak into the container.

Accordingly, it is an object of my invention to provide a new and novel vacuum shipping container having better temperature controls than that of prior art devices, by compensating for heat leakage.

It is a further object of this invention to produce such a container which will provide the desirable results at minimal energy input.

This and other objects of my invention will become apparent from the following description with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view taken from the rear-left sides of a container in accordance with the preferred embodiment of my invention;

FIG. 2 is a section taken as indicated by the lines and arrows 2—2 in FIG. 1; and

FIG. 3 is a foreshortened plan view taken as indicated by the lines and arrows 3—3 in FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Although specific forms of the invention have been selected for illustration in the drawings, and the following description is drawn in specific terms for the purpose of describing these forms of the invention, this description is not intended to limit the scope of the invention which is defined in the appended claims.

Referring to the figures, the container is designated generally **10** and comprises an overall outer frame **12** made of a lightweight sheet material, such as steel. The inner frame **14** and inner liner **16** are also made of a lightweight sheet material. An insulating material is disposed between the outer frame **12** and the inner frame **14.** The inner liner **16** is spaced from the inner frame **14** by a plurality of spacers **18** which may be of any suitable material, such as rubber, and which are disposed in mating grooves in the liner and shell as clearly shown in FIG. **2.** The inner liner **16** and inner shell **14** are fixedly connected in sealed engagement with one another by any suitable means such as soldering or welding, so as to form a substantially hollow jacket surrounding the inner portion of the container. This hollow jacket is evacuated of air to form a vacuum barrier to heat transfer therethrough.

It is apparent from the prior art that there is some heat transfer even in a vacuum container, in that wherever the inner liner engages or is supported by the outer frame or inner frame of the container there will be a path for the transfer of heat. In the present invention I compensate for this slight "leakage" of heat by providing a specially designed cap with a thermoelectric temperature control means. The cap is designated generally **20** in the figures and has an outer frame portion **22** spaced from an inner frame portion **24** with insulating material therebetween. An inner shell **26** is provided spaced from the inner frame **24** and evacuated of air so as to form a vacuum shield against heat transfer. Centrally located in the cap **20** is a block of metallic material **28** suitably affixed to the inner frame **24** of the cap along an area which is depressed toward the inner liner **26.** The inner liner **26** is depressed toward the inner frame **24** along the same area as at **30,** so that the liner and frame are joined or in engagement with one another along this area. Thus, the block is in heat transfer relation with the frame **24** and also with the liner **26.** Since the frame and liner are joined at their outer periphery as at **32,** and since they engage the juncture of the frame and liner **14** and **16** respectively, as at **34,** the

block **28** is in heat transfer relation with both frame and liner throughout the entire container. This is important, since heat transfer, while minimal, only occurs in a vacuum container at the juncture of the liner with the supporting structure.

Suitably mounted to the block of heat conductive material **28** are a plurality of thermoelectric modules **36** and **38.** These modules are adequately described in U.S. Pat. No. 3,445,039 previously referred to and as stated therein possess numerous advantages over mechanical refrigeration. One of these advantages is that there are no moving parts necessary in order to obtain cooling or heating. The basic theory behind the thermoelectric module is that the passage of electric current through a metallic thermocouple results in a transfer in heat from one metal to the other.

To aid in this heat transfer process I have provided a finned heat sink **40.** Finned heat sinks are known in the refrigeration art and comprise a flat plate **42** having mounted thereon at right angles therefrom a plurality of thin flat plates **44** arranged in parallel planes.

To maintain the temperature of the product when the ambient temperature surrounding the container is greater than the temperature of the product, a D.C. current is passed through the thermoelectric module to cool the metallic material **28** and the inner liners **16** and **26.** Heat is dissipated through the finned heat sink **40.** To aid in this dissipation of heat, I have provided a fan **46** which draws air across the fins **44** to remove the heat. The cover **48** is provided with air inlet louvers **50** and an outlet grill **52** covering the fan. Air, therefore, passes as shown by the arrows directly from the outside, through the heat sink **40,** and out through the grill **52.** In doing so it removes heat from the fins **44.**

To maintain the temperature of the product within the container when the ambient temperature surrounding the container is less than the product temperature, the D.C. current polarity is reversed and heat is pumped into the liners **16** and **26** through the material **28.**

The lid or cap **20** of the container is suitably formed of thin sheet metallic material and filled with polyurethane insulation as previously described. A plurality of cam catches **54** are provided equally spaced about the lid and a seal **56** is provided around the entire margin.

The electrical elements and circuitry necessary to achieve the desirable ends of my invention will not be described in detail, since the necessary circuitry is well known in the art. Suffice it to say for purposes of the present disclosure, that the device contains an A.C. input marked in FIG. **1,** and a D.C. input also marked in FIG. **1,** which, through suitable transformers and wiring, and whatever other circuitry is necessary, are connected to the thermoelectric modules **36** and **38** as for example, by the wire **60,** FIG. **1.** Thermostatic controls are also well known in the art and form no part of the present invention. Accordingly, none of the electrical parts of the invention will be described herein. See for example, the following U.S. Pat. Nos. 2,991,628, 3,351,233, 3,480,015, 3,220,198, 3,111,166, and 2,276,835.

In practice, the user determines whether the container is to operate in a hot or cold environment, and then adjusts the polarity accordingly. The corresponding thermostat, hot or cold, is then set at the desired control temperature.

The system as above described and explained provides an efficient and reliable method and apparatus for controlling cooling or heating to a vacuum shipping container, from either an A.C. or D.C. source. It is thus possible with minimal energy input, to maintain the temperature in the vacuum shipping container, since the make-up energy input need only be sufficient to overcome the "leakage". The method of making this device comprises the steps of providing an insulated vacuum container, providing a heat conductive material in heat transfer relation to the liner of said container and then providing a thermoelectric controlled temperature means in heat transfer relation to said heat conductive material. The thermoelectric vacuum shipping container in accordance with the present invention will maintain the product in the container at the temperature it was when placed within the container for as long as the thermoelectric unit is energized with D.C. current. In transit, this D.C. current can be supplied directly from the generator of the vehicle within which the container is disposed. When the container is stored, the D.C. current can be supplied from a stationary storage battery or from an A.C. current through a power converter. Such converters are well known in the art and it is within the scope of this invention to place such a converter within the container, such as for example, in the base of the container.

It will be understood that various changes in the details, materials and arrangement of parts which have been herein described and illustrated in order to explain the nature of this invention may be made by those skilled in the art within the principle and scope of the invention as expressed in the following claims. For example, the type and amount of insulation surrounding the outer shell which is provided to further cut down or radiant leakage to the inner shell, can be varied in accordance with expected environmental conditions.

It will further be understood that the "Abstract of the Disclosure" set forth above is intended to provide a non-legal technical statement of the contents of the disclosure in compliance with the Rules of Practice of the United States Patent Office, and is not intended to limit the scope of the invention described and claimed herein.

What is claimed is:

1. A controlled temperature compensating vacuum storage container comprising: an outer frame; an inner frame spaced from said outer frame; insulating material disposed between said frames to insulate one from the other; an inner liner connected to said inner frame and forming therewith a vacuum chamber; a removable cap having outer and inner frame members and insulation disposed between said members to insulate one from the other, and an inner liner engaging said inner frame and forming a vacuum chamber therewith; said cap engaging said first mentioned vacuum chamber along the line formed by said first mentioned inner liner and said first mentioned inner frame so as to be in heat transfer relation therewith; the inner liner and inner frame portions of said cap engaging each other along an area intermediate their periphery of contact and having a block of heat conductive material mounted in heat transfer relation thereto within said area; thermoelectric controlled temperature means mounted in heat transfer relation to said block of material and exposed

to the environment outside of said container to compensate for the heat lost through the points of contact between said liners and said inner frames, comprising a thermoelectric module mounted in heat transfer relation to said block of material and heat sink means mounted in heat transfer relation to a second portion of said module.

* * * * *