

May 4, 1954

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2,677,245

APPARATUS FOR UTILIZING SOLID REFRIGERANTS

Filed Sept. 18, 1950

4 Sheets-Sheet 1

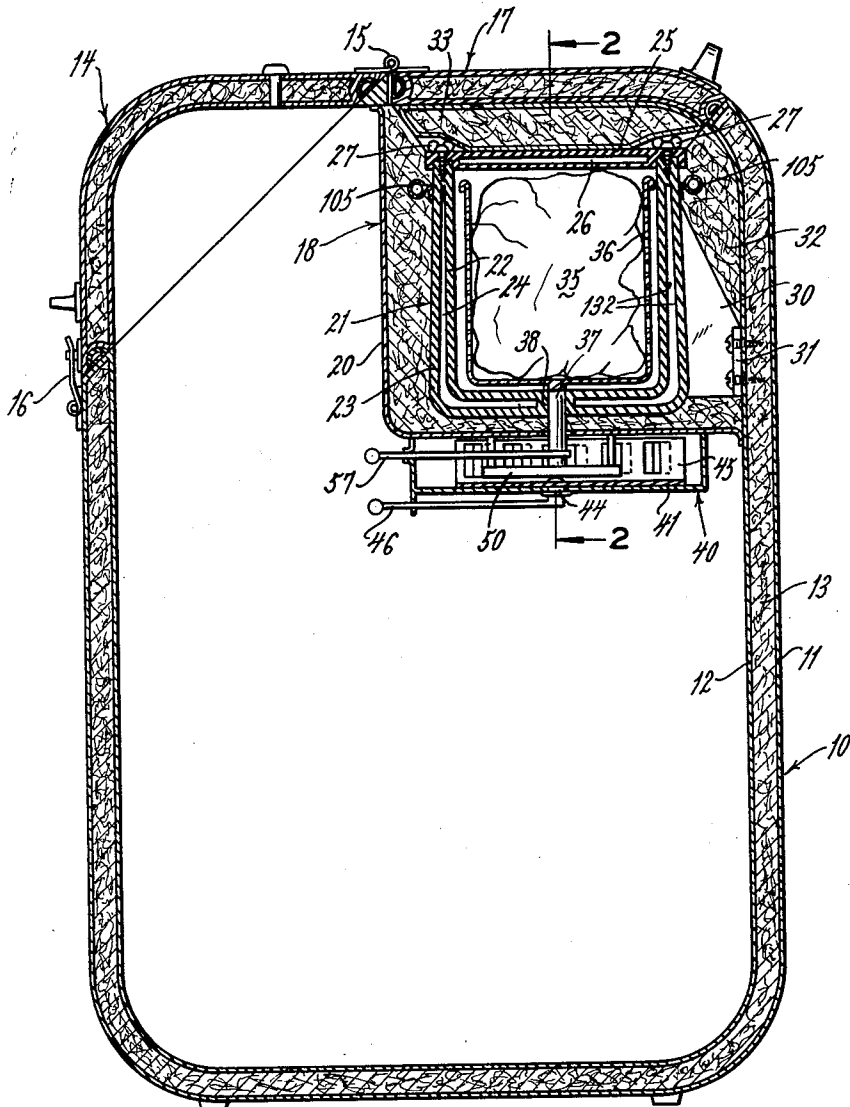


FIG. 1.

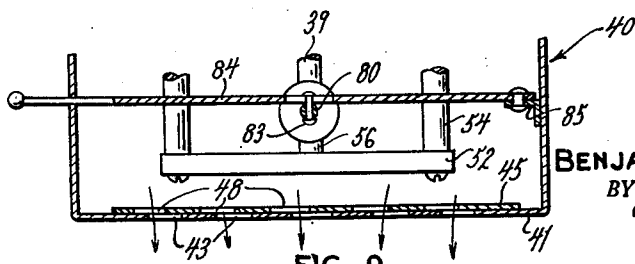


FIG. 9.

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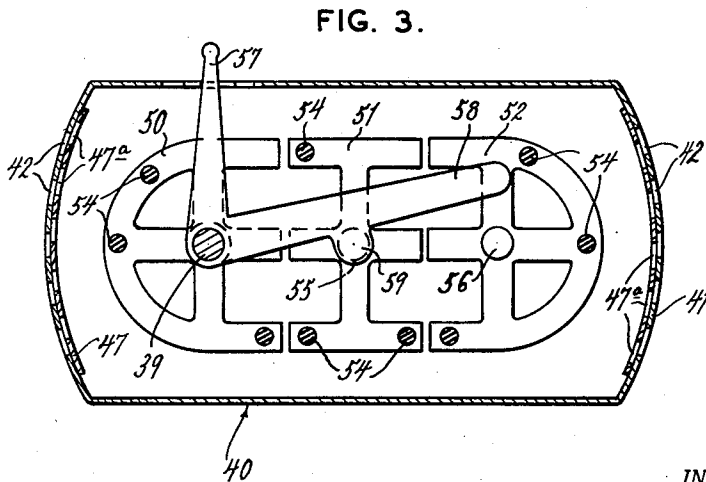
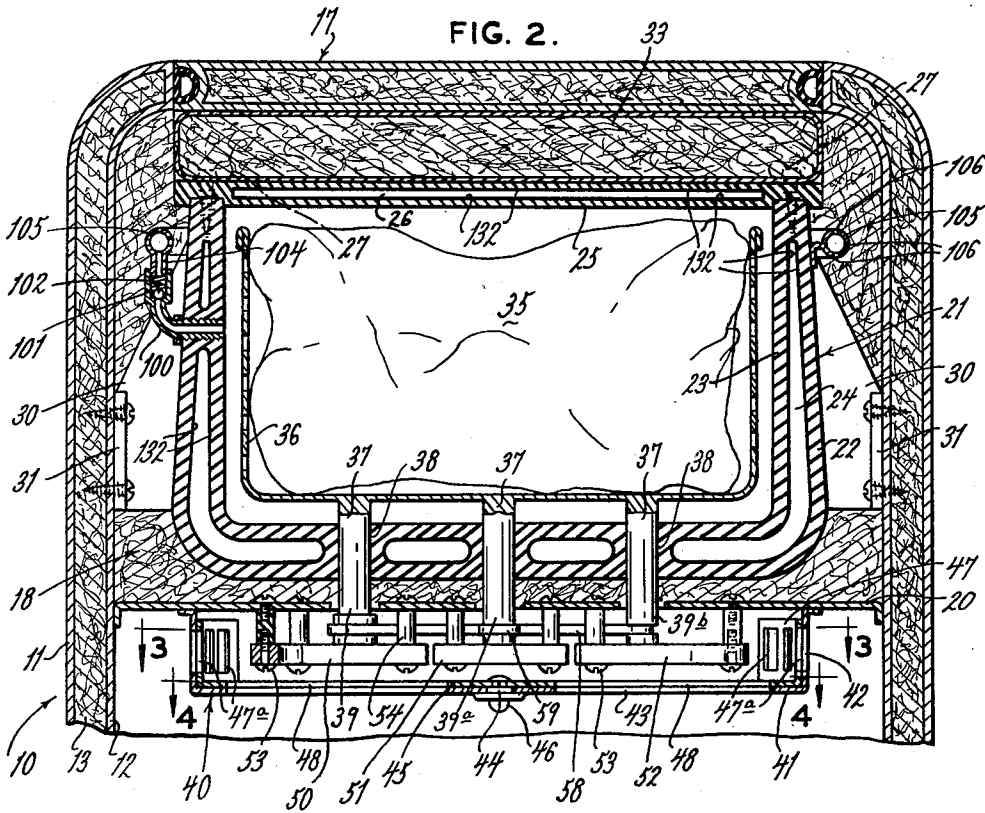
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4 Sheets-Sheet 2



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APPARATUS FOR UTILIZING SOLID REFRIGERANTS

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4 Sheets-Sheet 3

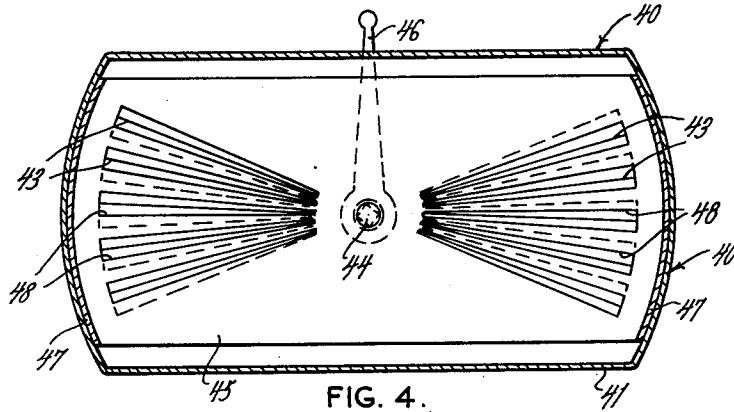


FIG. 4.

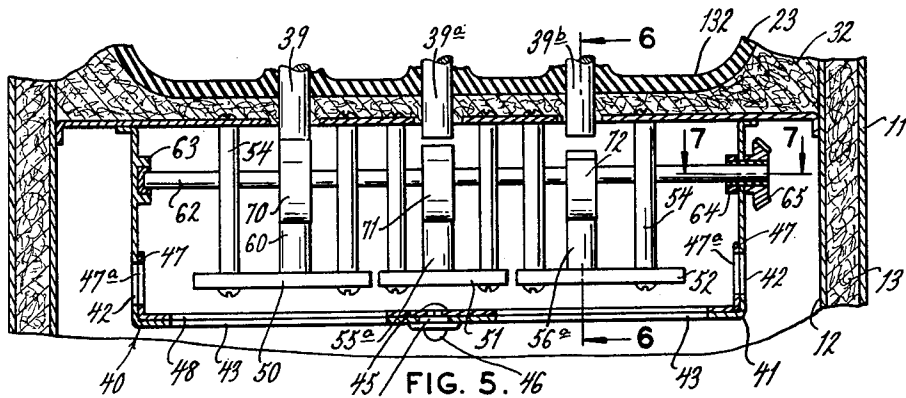


FIG. 5.

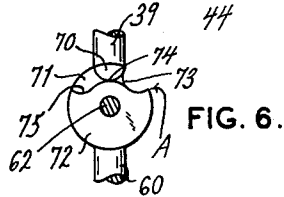


FIG. 6.

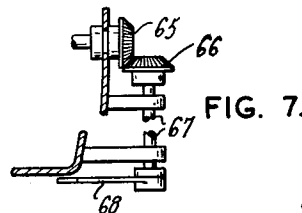


FIG. 7.

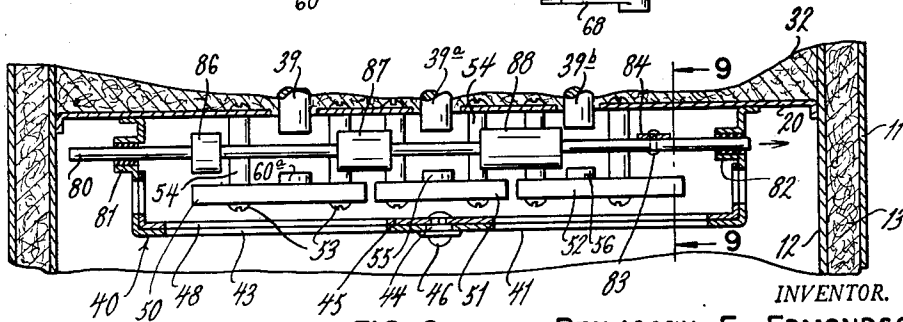


FIG. 8.

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4 Sheets-Sheet 4

FIG. 10.

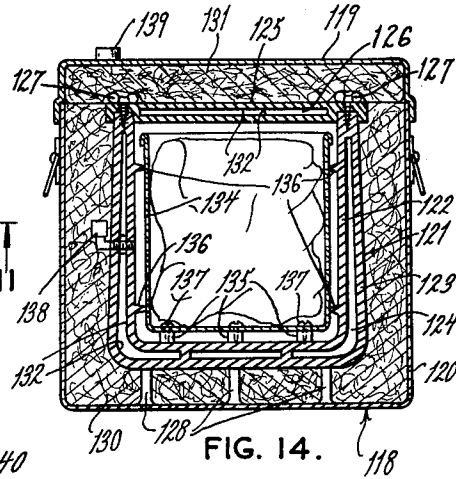
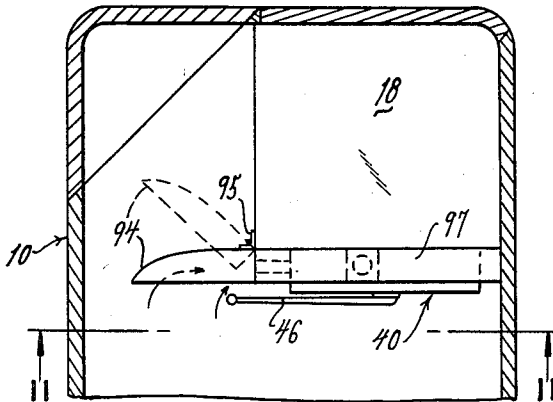


FIG. 14.

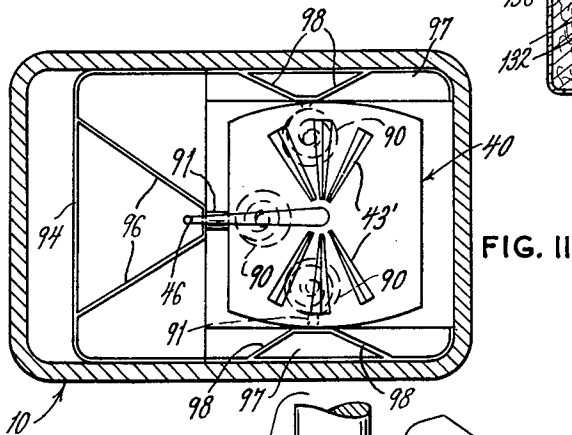


FIG. 11

FIG. 12.

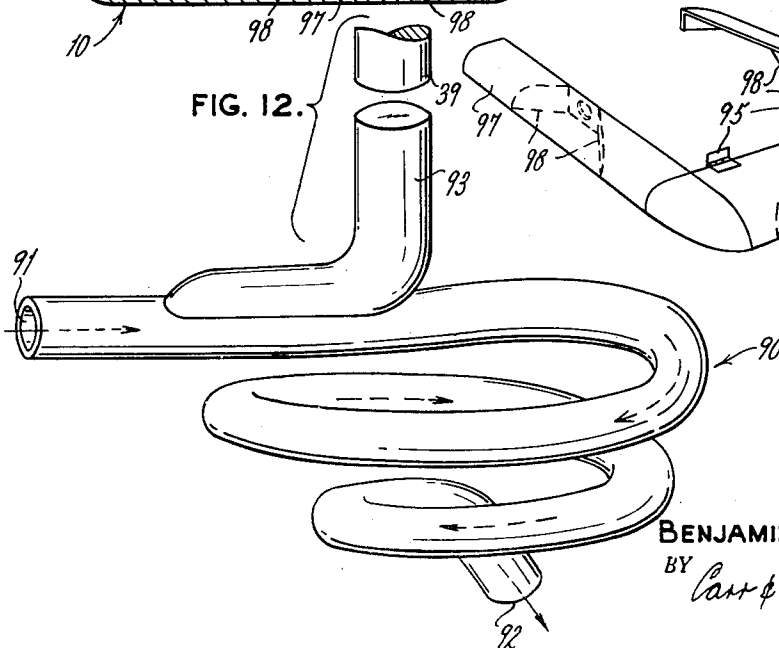


FIG. 13.

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UNITED STATES PATENT OFFICE

2,677,245

APPARATUS FOR UTILIZING SOLID REFRIGERANTS

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Application September 18, 1950, Serial No. 185,391

8 Claims. (Cl. 62—91.5)

1

This invention relates to apparatus for utilizing solid refrigerants such, for example, as solid carbon dioxide. The invention is particularly concerned with apparatus which is useful in portable cooling units of the type employed by campers, as a refrigerator unit adapted for application in bottled or bulk beverage coolers, for the transportation of perishable goods both in land and marine transportation applications, and for the refrigeration and maintenance of medical supplies. The invention is also concerned with the provision of apparatus for utilizing solid refrigerants which will make available a source of refrigeration or cooling where the absence of electricity prevents the use of electrically operated refrigerating and cooling apparatus.

It is an object of the present invention to provide improved apparatus which will efficiently utilize a solid refrigerant, such as solid carbon dioxide.

It is a further object of the present invention to provide improved apparatus which will permit close control of the cooling or refrigerating capabilities of the solid carbon dioxide refrigerant.

It is an additional object of the present invention to provide a unit type refrigerating or cooling apparatus which will be useful in many different installations and can be adapted to handle small as well as large cooling loads, through the provision of heat absorber means having a controllable area exposed to the heat source.

A still further object of the present invention is to be found in the provision of apparatus which will extend or prolong the useful life of solid carbon dioxide refrigerant by regulating the rate of heat transfer, and by more perfectly insulating the refrigerant through support thereof in a manner allowing its vapor to form a first heat barrier and by the use of a vacuum walled casing having reflective surface coating means applied thereto.

Another object of this invention is to provide apparatus which will be capable of holding solid carbon dioxide refrigerant at such a low rate of evaporation that it may be stored for long periods of time with very little loss or shrinkage, all of which will enable the profitable handling of the refrigerant and thereby expand its acceptance and use.

The present invention consists in the provision of a casing which is insulated from the surrounding atmosphere, a metallic supporting means or receptacle which is spaced from the internal walls of the casing and is capable of very rapidly accepting the temperature of the solid refrigerant,

2

an externally located metallic heat absorbing means which is exposed to the heat load, and in the provision of controllable means for variably and mechanically interconnecting the exposed metallic heat absorber and the metallic supporting means in the casing, whereby the heat load may be transmitted into the refrigerant in a regulated manner.

A more complete understanding of the present invention may be had in the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a sectional elevational view of a portable type refrigerator embodying means for utilizing a solid refrigerant;

Fig. 2 is a sectional elevational view as taken at line 2—2 of Fig. 1, wherein additional details of the apparatus have been shown;

Fig. 3 is a sectional plan view of one form of controllable heat absorbing means as seen at line 3—3 in Fig. 2;

Fig. 4 is a bottom sectional view as seen at line 4—4, Fig. 2;

Fig. 5 is an enlarged and fragmentary sectional view of a modified arrangement of means for controlling and regulating the interconnection between the heat absorbers and the solid refrigerant thermal conductors;

Fig. 6 is a fragmentary detail as seen at line 6—6 of Fig. 5;

Fig. 7 is a further detailed view taken at line 7—7 in Fig. 5;

Fig. 8 is a view similar to Fig. 5 but illustrating a further modified control means for the purpose indicated;

Fig. 9 is a detailed sectional view as seen at line 9—9 in Fig. 8;

Fig. 10 is a fragmentary sectional elevational view similar to Fig. 1, wherein a modified unit assembly is disclosed;

Fig. 11 is a bottom sectional view showing further details of the modified unit as seen at line 12—12 of Fig. 10;

Fig. 12 is a perspective view of a modified form of heat absorbing means which is especially useful in connection with the modified apparatus disclosed in Figs. 10, 11 and 12;

Fig. 13 is a perspective assembly view of the baffle means disclosed in connection with Fig. 10.

Fig. 14 is a sectional elevational view of apparatus which embodies certain features of the apparatus of Fig. 1 but is adapted to act as a refrigerant storage and transportation means.

Referring to Figs. 1 and 2, a preferred embodiment of the invention is seen to include a porta-

ble type container 10 having an exterior wall 11 and an interior lining 12 spaced from the exterior wall so as to permit the incorporation of a suitable layer of insulation 13 for insulating the interior space of the container 10 from atmospheric conditions outside thereof. The container is of the top open type and is therefore provided with a suitable hinged cover or lid 14 which is also constructed to embody an insulated double wall. The lid 14 is suitably connected to the container at hinge means 15 and is provided with a suitable latch 16. The casing 10 is further provided with a separate lid or door structure 17 which utilizes the hinge means 15 and is arranged in the top of the container 10 to provide convenient access to the interior of the container, and more particularly to the interior of a unit type refrigerator or cooler 18 hereinafter to be described.

Still referring to Figs. 1 and 2, the unit cooler 18 is seen to include a suitable sheet metal housing 20 attached to the top and adjacent vertical side walls so as to completely enclose a portion of the container interior located immediately adjacent and below the access opening closed by the cover 17. This housing 20 is adapted to enclose a vacuum jacketed casing 21, the main body portion of which is formed by an internal shell 22 and an external shell 23 suitably formed on their adjacent faces with means to maintain the shells in spaced relation whereby an evacuated space 24 is provided. A suitable cover structure 25 is also provided with an evacuated space 26, and is constructed in much the same manner as the casing 21. Holding elements 27 are provided for securing the cover 25 on the upper margins of the casing 21, in the manner shown. The casing 21 is suitably supported within the housing 18 by means of vertically directed bracket elements 30 suitably secured to the inner lining or wall 12 of the container by the bracket support means 31. The casing 21 is thereby held in spaced relation from the housing wall 20 to permit installation of suitable insulation 32, either in a loose form or in the well known insulation bat form. An additional body of insulation 33 is removably disposed over the casing lid 25. This insulation 33 is adapted to be removed when access to the casing 21 is necessary.

An important feature of the present apparatus resides in the provision of means for supporting a suitable block of solid carbon dioxide refrigerant within the casing 21 so as not to have any part of the refrigerant in direct contact with the surface of the casing shell 22 or lid 25. In the present construction, the casing 21 and its lid 25 are preferably formed of non-heat conductive material, and an excellent material for this purpose may be found in certain of the plastics now commercially available. A plastic material having the above characteristic is preferred for the casing 21 because of its low initial cost and the ease with which it may be formed or molded into the shape of the casing herein disclosed.

It is known that solid carbon dioxide refrigerant undergoes an increase in its rate of evaporation when placed in direct contact with an insulated body or insulation material. Therefore, it is most desirable, in order to prolong the life of the carbon dioxide refrigerant, to maintain the body thereof substantially free of contact with any surface that is incapable of readily accepting the temperature of the solid carbon dioxide. The use of such a supporting surface

for the carbon dioxide refrigerant serves to maintain the carbon dioxide in a more stable condition of low evaporation. Some further increase in the life of the refrigerant is achieved by permitting the body of refrigerant to be enveloped by its own low temperature vapor. Accordingly, in the present apparatus the block of solid carbon dioxide refrigerant 35 is suitably received in a metallic supporting member or receptacle 36 which in turn is spaced from the walls of the casing shell 22. The support 36 is constructed of a high thermal conductivity material having a very thin section wall so that it is capable of very rapidly accepting the temperature of the block of solid refrigerant 35.

The metallic supporting surface or receptacle 36 is supported by one or more thermal conductor means or metallic conductor elements 37 suitably connected with the under surface of the support means 36. The conductors extend through apertures 38 formed in the casing 21 whereby an outer end portion 39 of these conductors projects through the housing wall 20 for association with means now to be described. In the present embodiment, I have provided three metallic conductor elements extending from the refrigerant support 36 outwardly of housing 18, and I have indicated the end portions at 39, 39A and 39B. It is obvious that the number of such conductors may be altered from that shown and that a different arrangement thereof may be made.

Associated with the housing 18 in the zone adjacent the metallic conductors 37, I have provided a second housing structure 40 and this housing is adapted to enclose control means for regulating the transmission of heat absorbed from the interior of the container 10 to the body of the solid refrigerant 35. The housing 40 comprises a sheet metal, pan type structure 41 suitably flange connected (Figs. 2 and 5) to the bottom surface of wall 20 forming housing 18. This housing is formed to provide inlet openings 42 in the opposite curved end walls, as shown in Figs. 2 and 3. Outlet openings 43 are provided in the bottom horizontal wall of the pan 41, and these openings are arranged in spaced fan-shaped groups on each side of the location of a pivot element 44.

Control over the inlets 42 and outlets 43 in the means 41 is had through shutter 45 pivoted at element 44 and angularly moved by a shutter control lever 46 operatively mounted on the pivot 44. The shutter 45 is provided with upturned opposed shutter elements 47 (Figs. 2 and 3) having shutter ports 47A for controlling the opening and closing of opposed inlet openings 42 in the housing 40. In addition, the shutter member 45 between the upturned ends is provided with a series of control openings 48 arranged in groups for opening and closing the similar groups of ports 43 in the bottom wall of pan 41. With this control arrangement, the inlet openings 42 and the outlet openings 43 of housing 40 are simultaneously regulated by angular movement of the shutter 45 to permit a desired volume of air to pass through the inlets from the container 10 for cooling by heat absorbers before returning to the container through the outlets. Obviously suitable manipulation of the shutter 45 can result in closure of the respective ports and almost complete separation of housing 40 with respect to the interior of the container 10.

Housing 40 encloses metallic heat absorbing means in the form of solid bars or rods which are hereinafter referred to as extended surface

coils or elements 50, 51 and 52. Each of these elements (Figs. 2 and 3) is suitably secured at the under surface of wall 20 by means of the screw elements 53 and the spacer rods 54. A plurality of these spacer elements 54 are provided for each of the coils, and the length thereof may be varied. Coil element 50 in the present apparatus is directly connected with the conductor element 37 having its end portion indicated at 39. Therefore, the coil 50 is at all times in thermal conductive association with the refrigerant. The adjacent coil element 51 is disposed oppositely to the conductor element end portion 39A, and a coil boss element 55 is axially aligned with and physically separated from the conductor end portion 39A. Similarly, the heat absorber coil element 52 is provided with a boss 56 which is separate from but disposed in axial alignment with the conductor end portion 39B. With an arrangement of this nature, I am able to provide a single control element which will effectively and mechanically interconnect the coils or heat absorber elements with the associated conductors 37 for the refrigerant support means 36.

Such control means may have the form of that illustrated in connection with Figs. 1, 2 and 3, wherein a control handle 57 extends outwardly of the housing 40 from a suitable pivoted connection on the conductor end portion 39 which is connected with the heat absorber coil 50. Control lever or handle 57 is provided with an angularly extended blade or arm 58 which is of such thickness as effectively to bridge the gap or space between each of the coil bosses 55 and 56 and the conductor end portions 39A and 39B respectively. The blade 58 is suitably formed with a laterally extended surface 59 which is positioned (Fig. 3) to mechanically interconnect or bridge the space between boss 55 and its associated conductor end portion 39A, when the free end of blade 58 is disposed out of connecting relation between the boss 56 for coil 52 and the conductor end portion 39B. It is obvious from the foregoing that the present control lever 57 may be moved reversely so that the coil elements 51 and 52 are selectively cut out or brought into thermal association with the body of solid refrigerant 35 and, hence, the area of thermal connection is varied.

In my present apparatus, I have provided a casing which is effectively insulated from the surrounding atmosphere and have provided also controllable surface type thermally conductive metallic coils exposed to the atmosphere to be refrigerated, so that the exposed coils or thermally conductive heat absorbing means transmit the absorbed heat to the body of solid refrigerant in a selective and controllable manner. The control provided is arranged so that a balanced heat load can be maintained in the space to be cooled or refrigerated by increasing or decreasing the exposed heat absorbing surface which communicates with the refrigerant. Therefore, the cooling effect of the refrigerant can be increased or decreased as desired, and it is noted here that the heat absorbing means 50 (Fig. 3) is maintained interconnected with the body of refrigerant by end portion 39 of one of the conductors 37 so that the space within the container 10 will be at a predetermined temperature condition which may be calculated to just equal or balance the heat loss through the insulated wall of the container. If the contents of the container increases the heat load of the

space, all that is necessary is to shift control lever 57 to cut in the heat absorber coil 51, and if this is not sufficient a further movement of the lever 57 can be made to cut in the coil 52 further increasing the transmission of container heat to the body of solid refrigerant.

In cooperation with the heat absorber control means, control over the cooling of the container space is provided by the controllable shutter member 45 adapted to increase or decrease the effective area of the relatively warmer air inlets 42 and cold air outlets 43. In this manner, the natural convection currents or circulation of air due to change in density thereof may be closely regulated by the proper positioning of shutter 45 through shifting of the control lever 46. It is possible to almost completely close off the heat absorbing elements 50, 51 and 52 from the interior space of the container 10, thereby restricting the cooling or refrigerating of this space to an amount which would be the result of heat loss into the housing 18 because of the exposed metallic surfaces of wall 20 and housing 40.

Referring to Fig. 5, I have disclosed a modified control mechanism in association with the above described conductor elements 37 having the end portions 39, 39A and 39B thereof adjacent the corresponding heat absorbing coils 50, 51 and 52. In this modified form, the heat absorbing coil 50 is not permanently interconnected with conductor end portion 39, but is separated therefrom and is provided with an upwardly extended boss 60, corresponding in effect to the previously described bosses 55 and 56 for heat absorber coils 51 and 52 respectively. These coil bosses are increased in length, as at 55A and 56A to suit the conditions in Fig. 5. In the place of the pivoted and swingable control lever 57 and 58 of Fig. 3, there is provided a rotary type means for mechanically interconnecting, in a selective manner, the oppositely arranged conductor elements and coil bosses. The rotary means includes a shaft 62 suitably supported in bearings at 63 and 64 in the opposite wall portions of housing 40, one end portion of shaft 62 being extended outwardly of the housing for the attachment of a suitable gear element 65, in turn, connected with a control gear 66 (Fig. 7) fixed on the control shaft 67 associated with a control handle or lever 68. The shaft 62 carries a series of spaced cam elements 70, 71 and 72, each cam element having a cylindrical body and a cutout portion, all as indicated in Fig. 6. For example, the cam element 70 is provided with a relatively small cutout portion 73, cam element 71 is provided with a relatively larger cutout portion 74 and cam element 72 is provided with a still larger cutout portion 75. It is also to be noted that the cutout portions for each of the cam elements are so arranged that they all have one edge of the cutouts in alignment, as indicated at "A" in Fig. 6. Accordingly, rotation of shaft 62 in a clockwise direction, as viewed in Fig. 6, will effect a progressive mechanical interconnection of the coil bosses 60, 55A and 56A with the respective conductor end portions 39, 39A and 39B by cam elements 70, 71 and 72. The modified control means just above described is disclosed in combination with the swingable control shutter 45 previously described in connection with Figs. 2 and 4. Due to the size of the cams 70, 71, and 72, the housing 40 has a deeper section and the coils 50, 51 and 52 are carried by the elongated elements 54 similar to

those described in Fig. 2, except for length. Accordingly, no further detailed description will be given of this shutter control means in connection with Fig. 5. It is understood that in certain installations the shutter 45 may not be required.

Referring to Figs. 8 and 9, I have shown a further modified control means operatively mounted in housing 40 which encloses the controllable shutter 45 previously described. The modified control means referred to here includes a longitudinally movable or shiftable rod 80 which is suitably supported in bearings 81 and 82 in the opposite end walls of the housing 40. One end of rod 80 is pivotally interconnected at pin 83 with a control lever 84, the control lever 84 extending in a direction generally transverse to the length of rod 80 and having one end pivotally mounted in a bracket 85, Fig. 9, and its opposite end directed outwardly of housing 40 for control access. Rod 80 carries elements 86, 87 and 88, having a progressively increased axial length in the order named. These elements 86, 87 and 88 are adapted to mechanically interconnect the coil bosses 60A, 55 and 56 with the respective end portions 39, 39A and 39B of the conductor elements 37 in successive order, so that the heat absorbing coils may be brought into or removed from thermal association with the body of solid refrigerant in a selective manner. It is noted in Fig. 8 that the coil bosses are like those of Fig. 2, except for boss 60A which is modified over that of Fig. 5. Also, the length of elements 54 again is chosen to meet conditions.

A still further modification of my present invention is disclosed in connection with Figs. 10 to 13 inclusive, wherein I have illustrated schematically container 10 and the refrigerator or cooling unit 18. I have further indicated in schematic outline the location of housing 40 and the control lever 46 which is adapted to shift or pivotally displace the shutter 45. In this apparatus, however, shutter 45 is adapted to control only a series of bottom air outlet ports indicated at 43'. The present modified construction which my apparatus may have includes hollow or tubular heat absorbing elements or coils of the type shown at 90 in Fig. 12. These heat absorbing coils are provided with an inlet opening at 91 for air or other medium to be cooled and a discharge at 92, the air or medium following the path indicated by the dotted arrows in this view. I have provided a plurality of coils 90 Fig. 11, each of these coils being similar to that disclosed in connection with Fig. 12. Each coil 90 is provided with a thermally conductive element 93 which is adapted to be placed in opposite spaced alignment with the end portions 39, 39A and 39B of the conductor elements 37. The space or gap formed between the coil elements 93 and each of the conductors associated with the solid refrigerant is controllably and mechanically interconnected by means of any one of the forms of control devices shown and described in connection with Figs. 2, 5, and 8. Accordingly, no further reference will be made to the control means other than to note that it may have the characteristics of the control means previously described.

In connection with the use of tubular coils 90 in container 10, I prefer to direct the air inlet openings 91 thereof in different directions and to provide each opening 91 with a hood or air collecting scoop. With reference to Figs. 11 and 13, the scoop means 94 is associated with an intermediate coil 90 and is further hingedly mounted

to the wall 20 of housing 18 at the hinges 95 so that it may be lifted out of the way when entering the container. This scoop 94 is further provided with baffle elements 96 which converge toward a port closely adjacent the location of coil opening 91, thereby effectively directing the upwardly moving currents of air toward and into the opening 91 for coil 90. In a similar manner each of the laterally located coils 90 is provided with an air scoop 97 projecting laterally outwardly from the lower portion of housing 18 so as to lie closely adjacent the vertical walls of the container and direct the upward currents of air toward and into the respective openings 91 of the associated coils 90. Each member 97 is provided with baffle elements 98 convergently directed with respect to the coil opening 91 associated therewith.

In connection with the preferred construction which my apparatus may have I have shown in Figs. 1 and 2 means for restricting the pressure within the casing 21 so that the body of solid refrigerant will not be confined therein at pressures higher than would normally be generated upon slow evaporation. For this purpose I provide the casing 21 with an outwardly projecting nipple 100 open at the inside of the casing and having an enlargement or valve chamber 101 at its outer end for the reception of a ball type valve element 102. The enlargement 101 which forms the valve chamber is suitably connected with the inlet nipple 104 of a tube 105 which is horizontally directed and completely encircles the casing 21, as is indicated by comparison of Figs. 1 and 2. The tube 105 is provided with a plurality of ports 106 for permitting the escape of the carbon dioxide vapor as the same is expelled from the casing by way of the valve element 102. In this connection it is noted that valve element 102 is selected as to its weight so that the proper regulation of vapor pressure within the casing 21 can be maintained. In no case, however, is the ball valve 102 intended to act to maintain the body of solid refrigerant at more than one atmosphere, or equivalent minimum pressure condition, the object being to safeguard the casing 21 against excessive pressure and to exclude foreign matter and air leaks while allowing vapor release.

Fig. 14 discloses apparatus which is useful for solid refrigerant storage or transportation purposes, its general construction following that for the refrigerating apparatus of Fig. 1 with the elimination of the exposed heat absorbers. The storage apparatus comprises a housing 118 having a removable lid or cover 119 fitted to the wall structure 120. A casing 121 is disposed within the housing and is constructed with inner and outer spaced walls 122 and 123 respectively to form a vacuum space 124 which is maintained by the provision of suitable ribs and similar wall spacers, not particularly shown because they are well understood. The casing 121 is provided with a removable cover 125, also having the vacuum space 126. Cover 125 is held in closed position by elements 127.

This casing 121 may be supported on a plurality of studs or brackets 128 disposed along the length and width of the bottom of housing 118 so that the casing is well separated from the housing. A suitable quantity of light weight insulation 130 is located in the space between casing 121 and housing 118, and the cover 119 likewise carries a layer of insulation 131, or an independent removable layer of insulation may be used. The

cover 119 is suitably secured over the housing walls 120 to provide a tight fit and to hold the insulation 130 and 131 in tight surface contact along the parting line thereof.

Casing 121 may be made of molded plastic material which has a desired degree of resiliency at the low temperature involved in handling solid carbon dioxide. The casing walls 122 and 123, along the internal facing surfaces of the vacuum space 124 are covered or lined with any of the high reflective surfacing materials, such as bright aluminum foil, aluminum or other paint and the reflective surfacing materials which can be applied by spraying. This reflective surface covering is indicated at 132 on the opposing surfaces of the vacuum space of both the casing 121 and its cover 125. This same reflective covering material is applied to the apparatus of Fig. 1 in the same location and areas, and has been so indicated at 132 therein.

The solid carbon dioxide refrigerant is placed in the casing 121 and is supported on thin walled metallic means 134 which is capable of very rapidly accepting the low temperature of the solid carbon dioxide so that the least possible loss of the same may result. The use of such an excellent thermal conductor in a thin walled form reduces the time of and extent to which the solid carbon dioxide forms a liquid film on the contacting surfaces. Reduction of the time of existence of this liquid film will decrease loss of the solid carbon dioxide. The support means 134 is held from contact with the inner casing wall 122 by means of a plurality of bottom and side spacer elements 135 and 136 respectively. The bottom elements 135 are suitably formed or molded with the wall 122 to provide several screw posts for the screws 137 which are used to hold the support 134 in the casing 121, but permit its removal for cleaning.

The spacing of support means 134 from the wall 122 of casing 121 creates the room for an envelope of carbon dioxide vapor about the solid block thereof and further aides in maintaining the block in a low temperature insulating blanket. This same vapor enveloping the insulation blanket is created in the apparatus of Fig. 1. The blanketing vapor which is slowly given off by the solid block is vented at low pressure, in the range of one atmosphere, to the exterior of casing 121 at vent valve nipple 138 which is similar to the vent valve nipple 100 of Fig. 1. The vapor issuing to the housing 118 may be vented to atmosphere by a ball type vent plug, as shown at 139 on cover 119 in Fig. 14.

The support means 134 of Fig. 14 and the support means 36 of Fig. 1 may have a solid wall, that is a wall which is not perforated, or they may be perforated wall structures. It is preferred that perforations be formed so that the vapor can quickly surround the same and to reduce the mass of the support which has to react rapidly to accept the low temperature involved.

The storage apparatus of Fig. 14 may have any suitable or convenient dimensions to adapt it for the uses to which it may be put. It is contemplated the sizes may vary from the small local merchant vending size to the greatly increased, large quantity transportation and storage sizes.

It should now be obvious, from the foregoing description of the preferred structural arrangements which my invention may have, that there has been provided a simple apparatus for utilizing solid refrigerants, as carbon dioxide, wherein the same may be stored or the cooling ability of

the solid refrigerant can be controlled and regulated closely in accordance with an applied heat load. It should be understood that my present invention includes within its scope the provision of solid type heat absorbing elements such as that of Fig. 3 or the hollow or tubular type of heat absorbing elements disclosed in connection with Fig. 13. It is especially useful to employ hollow coil elements in connection with the cooling or refrigerating of certain liquids and beverages commercially dispensed from bulk containers or the like. Numerous other applications will occur to those skilled in the art and I deem it within the scope of my invention to have included all such modifications and rearrangements of parts that fall within the spirit of the claims herein-after appearing.

What I claim is:

1. Apparatus for utilizing solid refrigerant comprising, a casing insulated from external temperature conditions, a thermally conductive support positioned in said casing for receiving the refrigerant and for maintaining it spaced from said casing, thermally conductive means disposed outside said casing, said conductive means having a large area for exposure to external temperature conditions, and means for interconnecting said thermally conductive support and exposed conductive means to provide a path for the transmission of solid refrigerant cooling effect to the exterior of said casing, said conductive means including portions movable into and out of contact with said thermally conductive support to vary the cooling effect.
2. Portable apparatus for utilizing solid refrigerant comprising, a container having a top opening, an insulation housing near the top of said container, a refrigerant casing in said housing, metallic refrigerant support means within and spaced from the walls of said casing, metallic conductor means extending between said metallic support and the exterior of said housing, thermally conductive metallic members positioned at the exterior of said housing exposed to the temperature conditions in the container, and means thermally interconnecting said exposed members and conductor means to establish a path for transmission of refrigerant cooling effects into the container, said last means being movable to a position out of contact with said metallic conductor means to break the path for transmission of the cooling effect.
3. Portable apparatus for utilizing solid carbon dioxide refrigerant comprising, a portable container, a casing disposed in said container for access through the top thereof and being insulated from the interior temperature conditions of said container, support means in said casing providing a thermally conductive surface for supporting the solid carbon dioxide refrigerant free of contact with said casing, said support means including thermal conductors extending to the outside of said casing, thermally conductive means exposed in said container, and means movably arranged to occupy a position for mechanically interconnecting said conductors and said exposed conductive means to transmit the cooling effect of the solid carbon dioxide refrigerant to the interior of said container and to occupy a position interrupting the mechanical interconnection of said conductor and exposed conductive means.
4. Apparatus for utilizing solid carbon dioxide refrigerant including, a container to be refrigerated, a thermally insulated casing in said con-

tainer, metallic heat absorbing means at the exterior of said insulated casing exposed in said container, a thin walled metallic support in said casing to hold the solid carbon dioxide refrigerant out of contact with the casing walls and reach a temperature substantially that of the refrigerant, metallic conductor means extending from contact with said support to the casing exterior adjacent said heat absorbing means, and metallic means movable to a position thermally connecting said metallic conductor and heat absorbing means.

5. Apparatus for utilizing solid carbon dioxide refrigerant as defined in claim 4, and wherein said metallic movable means includes spaced surfaces for progressively varying the thermal connection thus established.

6. Apparatus as defined in claim 4, and wherein said metallic heat absorbing means is of a hollow tubular form presenting an interior surface also exposed to the medium in said container to be refrigerated.

7. Apparatus as defined in claim 6, and wherein baffle means is provided for said tubular means to direct the medium to be refrigerated into the coils.

8. In apparatus for utilizing solid carbon dioxide refrigerant the combination including, means to support a quantity of the refrigerant, a casing separated from but insulatingly enclosing

said support means, a housing surrounding said casing, thermal conductor means extending from said support means through said casing and outwardly of said housing, a second housing having ports therein and being located adjacent said conductor means, heat absorbing metallic means in said second housing, metallic elements movably mounted adjacent said heat absorbing and thermal conductor means and adapted to selectively connect and disconnect the latter means, and shutter means operable to open and close said ports for the second housing for regulating the passage of surrounding currents through said second housing from the space outside the latter housing.

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