April 27, 1965 G. C. RANNENBERG ETAL 3,180,111

COMBINED INSULATING AND COOLING BLANKET

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FIG. 4

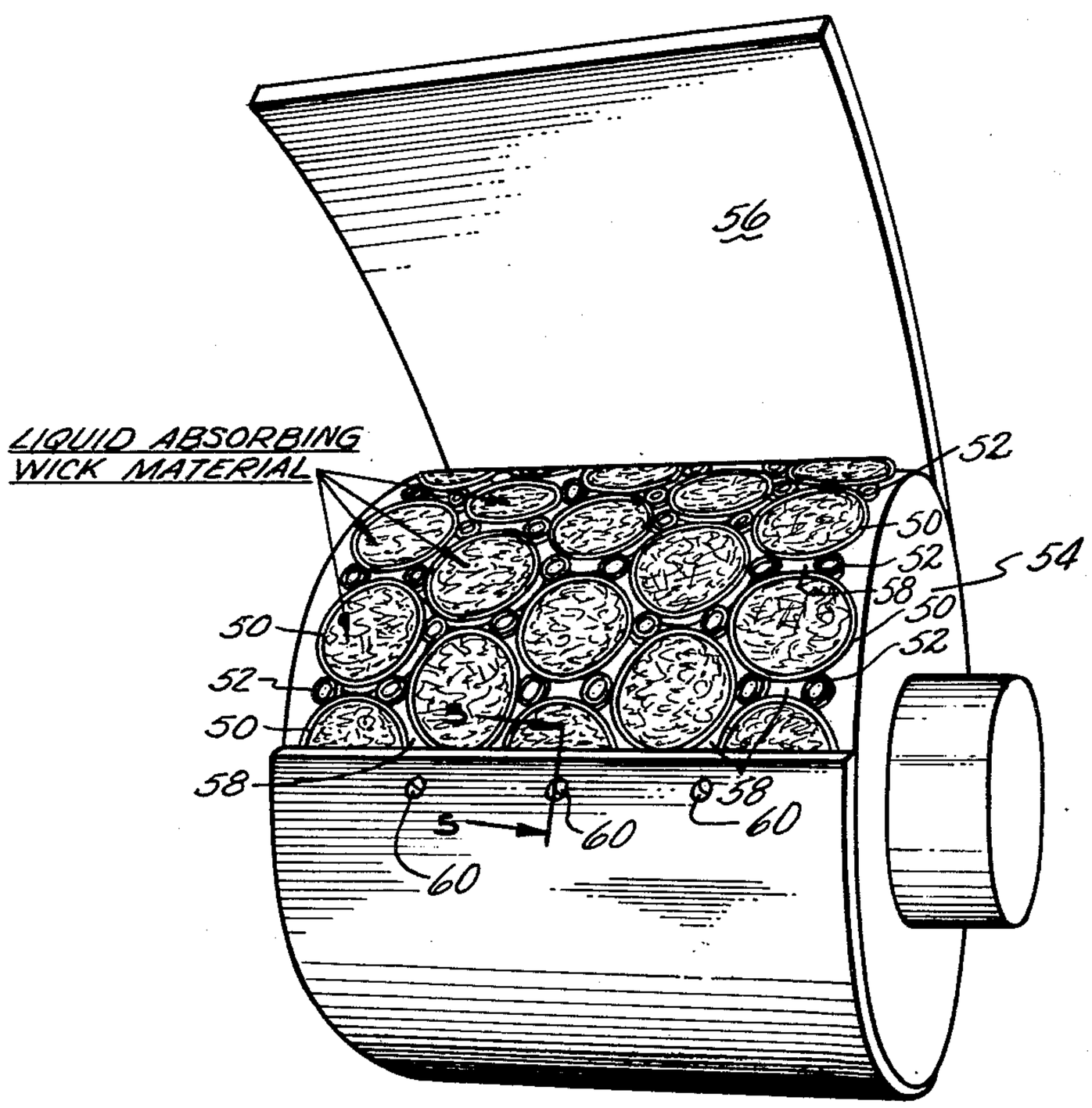

FIG. 1

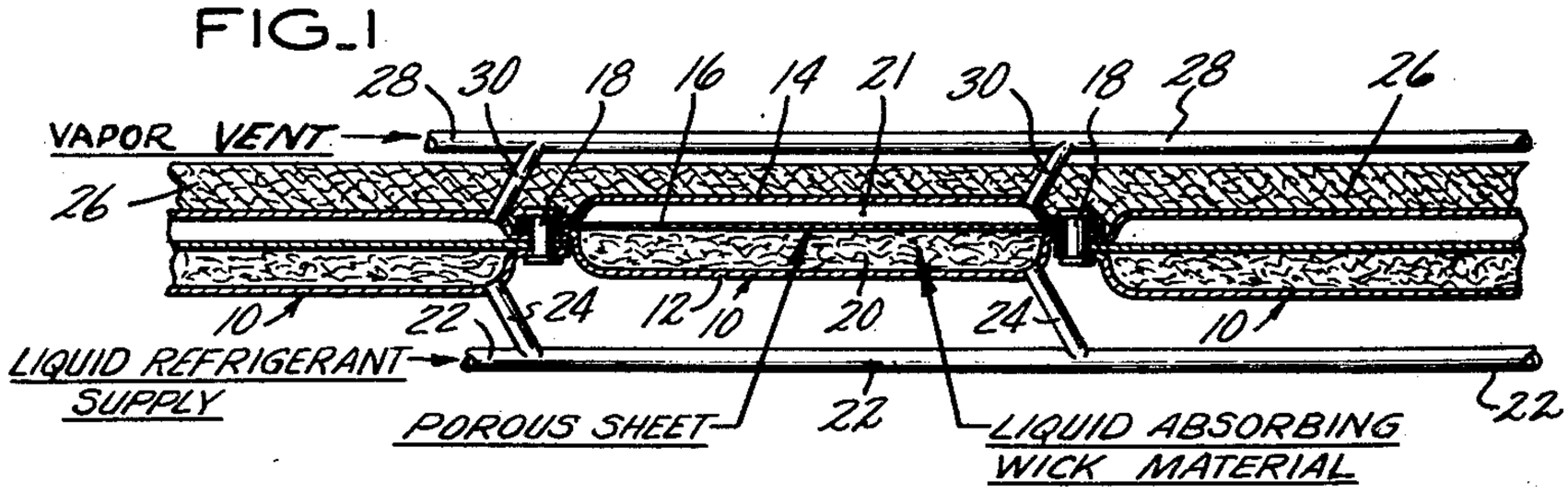

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FIG. 5

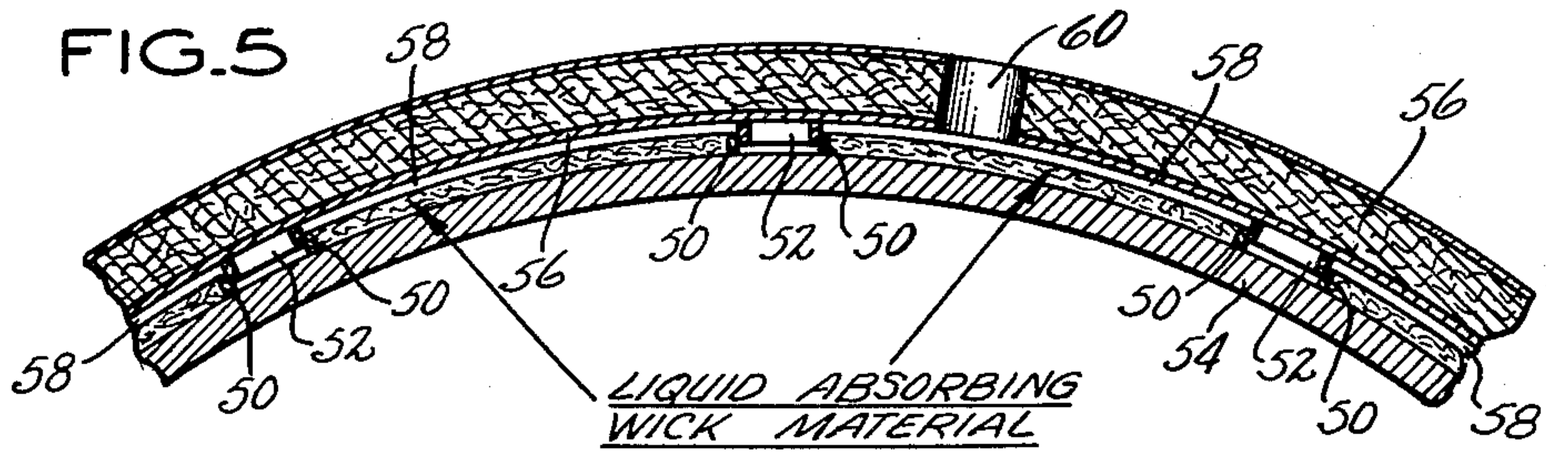


FIG. 2

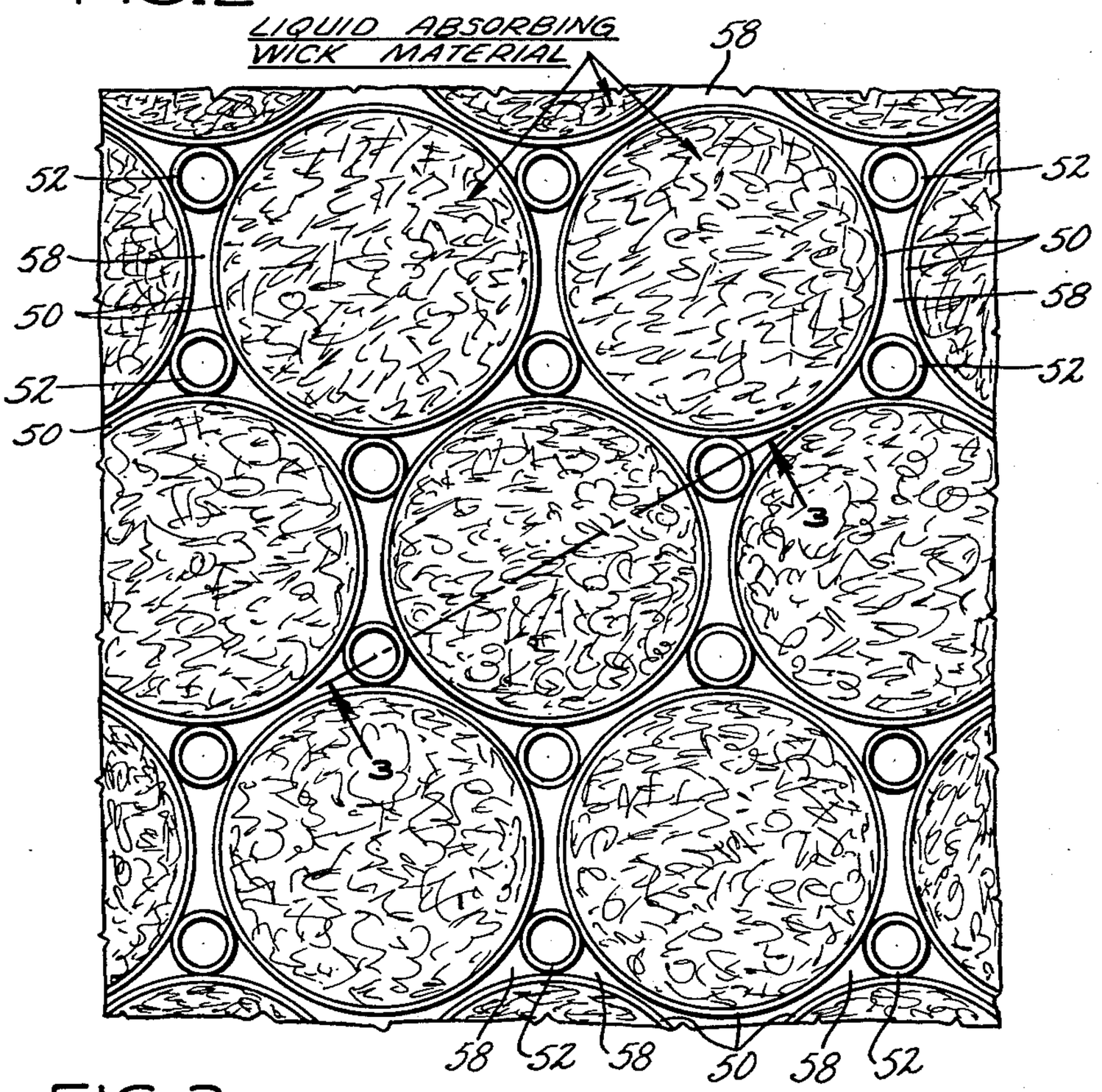
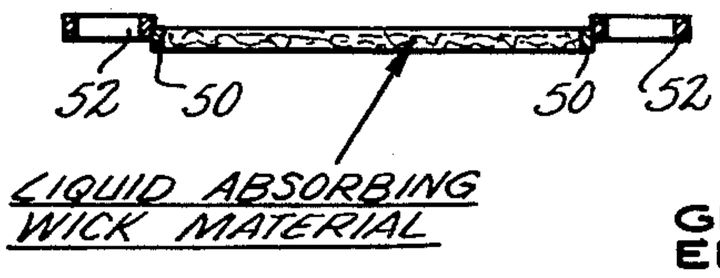


FIG. 3



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3,180,111
COMBINED INSULATING AND COOLING BLANKET

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3 Claims. (Cl. 62—467)

This invention relates to an insulating and cooling blanket combination and more particularly to a flexible blanket containing a refrigerant, which blanket includes means for allowing the escape of gaseous substances generated by the boiling of the refrigerant.

It is an object of this invention to provide an insulating and cooling blanket combination which does not require external power to cool and insulate a member.

It is still a further object of this invention to provide a flexible blanket comprising a cooling device formed by a plurality of cells, each of which contain a section of wick material and a chamber adjacent the wick material.

We have found that an insulating and cooling blanket, made in accordance with the present invention, has exhibited extremely good insulating and cooling characteristics without the requirement of an external power supply system. This has been accomplished by constructing a fluid retaining cell comprising a layer of wick material for retaining fluid refrigerant disposed adjacent to a chamber for receiving the gaseous substance when the liquid is boiled off. The cells may be formed from a flexible material such as plastic or any other suitable synthetic and are joined to form a blanket to fit closely to the contour of the surface of the member to be cooled. By virtue of the refrigerant changing from a liquid phase to a gaseous phase, an efficient cooling system has been devised. Means are provided for collecting the gaseous substance so that it may be vented out of the insulating blanket.

Other features and advantages will be apparent from the specification and claims and from the accompanying drawings which illustrate an embodiment of the invention.

FIGURE 1 is a cross-sectional view showing the details of the cells.

FIGURE 2 is a partial plan view of a modified version of the device shown in FIGURE 1.

FIGURE 3 is a partial sectional view taken along the line 3—3 of FIGURE 2.

FIGURE 4 is a perspective view showing the device in FIGURE 2 which is assembled to insulate a cylindrical member.

FIGURE 5 is a partial sectional view taken along line 5—5 of FIGURE 4.

Reference is now made to FIGURE 1, which shows the present invention as comprising a plurality of cell members indicated by the numeral **10**, consisting of members **12** and **14** which may be formed from a flexible material such as plastic or a synthetic or the like. Members **12** and **14** are joined together at their ends to form a sealed chamber. A porous or pierced middle layer **16** extends across the chamber and is fastened between the under and upper layers and is secured around its outer surface by cement, welding, rivets, or other suitable means to define a pair of chambers. A plurality of cells are fastened together by any suitable fastener indicated generally by numeral **18** to form a flexible body. Obviously, if the body intended to be insulated is flat, the material selected may be more rigid. The chamber **20** is filled with a wick material which is adapted to retain a liquid refrigerant. The liquid refrigerant is supplied to chamber **20** through an inlet manifold **22** which communicates with chamber **20** via connecting line **24**.

It is to be understood that once the wick material is filled with the liquid, the manifold is closed off to prevent escaping of the liquid. An insulating blanket of any known construction may overlie the top surface of the cells to form an outer layer **26**. The combined insulating and cooling blanket may then be fitted around the surface of the device intended to be cooled. When the device intended to be insulated and cooled becomes sufficiently hot, the liquid in chamber **20** will change to a gaseous state and effectively reduce the temperature of the member to be cooled. The vapor passes through middle layer **16** into chamber **21** and is bled off through the vapor vent **28** which communicates with chamber **21** through passages **30**. It will be appreciated that the size of the cells is selected by considering the use for which the blanket is intended to be employed; for example, if the blanket is intended to be used for insulating ammunition such as missiles and the like, which are subjected to *g*-loadings acquired by virtue of transporting such ammunition, the size of the cell is made sufficiently small so that the *g*-loads will not adversely affect the capillary action of the wick material. That is to say that the cells are not oversized so that the *g*-loadings will force the moisture in a position in the cell so that the wick can no longer support the fluid by capillary action. Also, connecting line **24** and inlet manifold **22** may be eliminated by filling through steam vent **28** and passages **30**. Vapor vent **28**, passages **30**, chamber **21** and chamber **20** are all flooded and then vapor vent **28**, passages **30** and chamber **21** are drained out the bottom. The wick holds fluid in chamber **20** by capillary action.

FIGURES 2–5 show a modification of the present invention wherein the cells are formed by a plurality of rings or hollow disk members which may be formed from a glass silicon material or other synthetic material or the like. The rings or hollow disk members may be formed into two diameters. As is shown in FIGURE 3, the larger diameter rings **50** are connected to the smaller diameter rings **52** and may be bonded together by a suitable cement such as one of the epoxides. As shown in FIGURE 3, the hollow disk members are mounted so that the larger disks lie in a different plane than the smaller rings. As noted from the drawing, when the cells are sandwiched between the insulating blanket and the body to be cooled and insulated, small pockets are formed. This serves to form vent chambers for receiving the gaseous substance when the liquid refrigerant changes from one phase to another. The wick material is inserted into the larger diameter disk, and the material may be of any well known substance, such as fiberglas matting.

As is shown in FIGURE 5, the cells are sandwiched between the outer surface of the member **54** intended to be cooled and an insulating blanket **56** of any known construction. As shown in FIGURE 5, it will be appreciated that by virtue of placing the larger diameter rings in a different plane than the smaller diameter rings, the face of the larger diameter rings forms a surface for fitting the contour of the member **54**, while the top face of the smaller diameter ring forms a surface for receiving the surface of the insulating blanket. This fit defines chambers **58** which serve to receive the vapor or gaseous substance generated by the liquid refrigerant.

FIGURE 4 shows the cooling and insulating blanket in its assembled form as it would be applied for the purpose of cooling and insulating the member **54**. Thus, as was noted in the description of FIGURE 1, in the event that the temperature of member **54** increases beyond the point where the refrigerant begins to boil, the refrigerant, by virtue of the boiling, changes state to a gas and escapes through vent **58**. The steam or gaseous substance then flows over the top surface of the large di-

ameter cells and escapes out of the blanket by passages 60 formed in the insulating member 56.

Filling of the insulating and cooling blanket of the type shown in FIGURES 2–5 may be accomplished by directing refrigerant through vent 60, then draining out any excessive refrigerant that was not absorbed by the wicks. The wicks hold the useable change of fluid by capillary action.

It should be understood that the invention is not limited to the particular embodiments shown and described herein, but that various changes and modifications may be made without departing from the spirit or scope of this novel concept as defined by the following claims.

We claim:

1. A combined insulating and cooling blanket comprising:

(*a*) a plurality of laterally spaced disk members having inner surfaces for mounting adjacent a body to be cooled,

(1) liquid retaining material inserted centrally of said disk members,

(2) coolant liquid in said liquid retaining material,

(*b*) an outer blanket member overlying said disk members,

(*c*) a plurality of ring means disposed between said disk members and said outer blanket to provide cavities between an outer surface of said disk members and an inner surface of said blanket member, and

(*d*) means for venting vaporized coolant liquid from said cavities through said blanket member.

2. A combined insulating and cooling blanket comprising:

(*a*) a plurality of cylindrically shaped hollow members each having an inner surface for mounting adjacent a body to be cooled,

(1) said cylindrically shaped hollow members having liquid absorbing wicked material filling the hollow portion,

(2) liquid refrigerant in said liquid absorbing wicked material,

(*b*) a plurality of cylindrically shaped disks mounted between said cylindrically shaped hollow members and holding said members in spaced relation,

(*c*) a blanket member overlying said cylindrically shaped hollow members and said disks,

(*d*) said hollow members being offset vertically from said cylindrically shaped disks for defining a spaced between the top surface of said cylindrically shaped hollow members and the inner surface of said blanket, and

(*e*) means for venting vaporized liquid refrigerant from said space through said blanket member.

3. A combined insulating and cooling blanket as defined in claim 2 wherein the planar area of said disks is less than the planar area of said cylindrically shaped hollow members.

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