

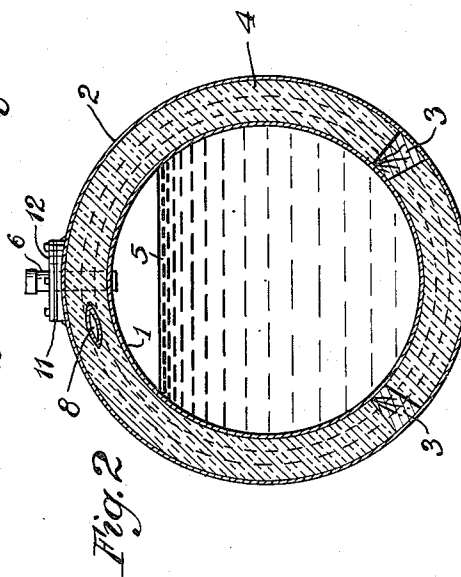
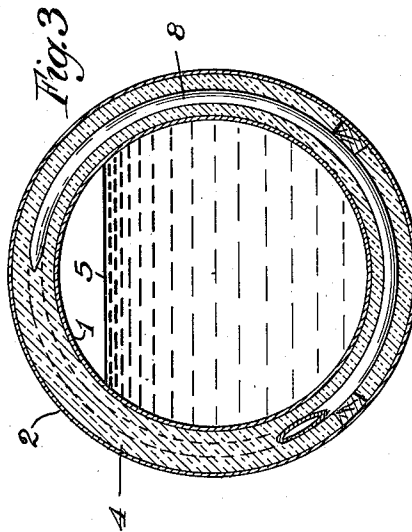
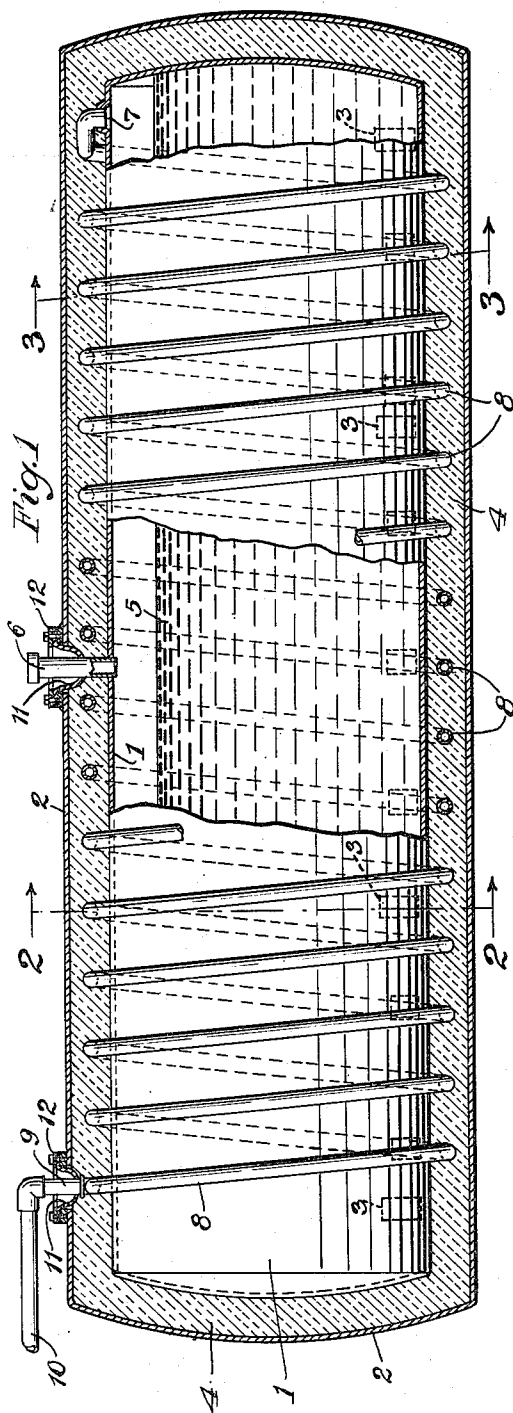
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STORAGE AND SHIPPING CONTAINER FOR COLD LIQUEFIED GAS

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STORAGE AND SHIPPING CONTAINER FOR COLD LIQUEFIED GAS

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1 Claim. (Cl. 62—1)

My invention relates to apparatus and means for storing and shipping cold, liquefied gas and has for one object to provide a device to control and limit the rate of vaporization of liquefied gas stored in a shipping container or receiver at very low temperature and atmospheric pressure whereby the rate of evaporation or boiling of the gas from the liquid may be reduced to a minimum.

This application is a continuation in part of my co-pending application Serial Number 263,309, filed December 26, 1951, now abandoned.

In general, I propose to use a double walled receiver. The inner wall of the receiver being gas tight and apertured only at the top. The outer wall of the receiver will enclose and entirely surround the inner wall and provides an insulating chamber between the two walls, a non-conductive structure will be provided between the two walls to hold them in proper position. There will be a filling pipe extending through both walls so that liquefied hydrocarbon, which at ordinary atmospheric pressure and temperature is gaseous but which at very cold temperature remains a liquid, may be introduced into the inner chamber of the receiver.

Since the surrounding atmosphere and the walls of the receiver will be above the temperature of the liquefied gas, there will be a gradual absorption of heat by the liquid. This will cause the gas to boil or vaporize off without change in temperature.

Contained within the space or insulating chamber between the inner and outer walls will be a coil or coils of pipe communicating with the inner chamber of the receiver so that the gas which boils off will pass through such pipe and circulate around the inner container, thus furnishing in effect, a blanket of cold gas interposed between the source of outside heat and the mass of liquefied gas. The coil or coils will discharge through the outer receiver wall and be connected to any suitable pipe to conduct the gas at atmospheric pressure for further use or treatment. The space between the two walls will be filled with any suitable porous insulating material, for instance, powdered cork asbestos, mineral wool, expanded mica or the like to assist in resisting heat flow.

Under some circumstances, if the outer wall is also gas tight, the gas discharged from the inner receiver by evaporation may be introduced directly into the space between the two walls without the use of any pipe or coils of pipe. Under these circumstances, the supporting structure between the two walls will baffle the flow of gas through or around the porous insulating filler in the insulating chamber and the gas will be discharged from the outer vessel as before. Under some circumstances, the insulating filler may be omitted and the cold gas as it flows from the inner chamber to the outside, will alone be relied upon to limit heat penetration into the liquid.

Thus the cold gas boiling off, rises in temperature as it moves toward the point of discharge from the receiver and while limiting penetration of heat to the liquid, will be raised in temperature to more nearly approach a temperature at which the gas can be used. Of course, gas at

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—258 degrees F., the temperature of liquefied methane cannot be burned successfully until its temperature has been substantially raised.

Whether I use pipe coils to conduct gas around the inner receiver walls or merely use baffles in the space between the two walls, in either case, I provide what is in effect a blanket of cold gas interposed between the outside heat and the liquefied gas mass whereby the rate of evaporation is reduced though, of course, evaporation never entirely stops.

My invention is illustrated more or less diagrammatically in the accompanying drawings, wherein

Figure 1 is a longitudinal section through the preferred form of receiver;

Figure 2 is a section along the line 2—2 of Figure 1; Figure 3 is a section along the line 3—3 of Figure 1.

Like parts are indicated by like characters throughout the specification and drawing.

1 is the inner wall, 2 the outer wall of the receiver or tank. 3 are non-conductive structural members interposed between the two walls, holding them in proper alignment. The structural members 3 are preferably made of balsa wood which while light is an exceedingly good non-conductor and experience has taught that balsa wood under the cold conditions of use in a device such as this is greatly increased in strength over balsa wood at ordinary room temperature. These structural members are interposed between the bottom portions only of the inner and outer walls so that relative expansion and contraction of the two walls will not be interfered with by the supports. The insulating material being sufficiently flexible and yielding to permit relative change in position and dimensions between the inner and outer walls resulting from change in temperature. 4 is solid porous insulating material contained between the two walls. 5 is the mass of liquefied gas in the inner chamber of the receiver. 6 is a filling pipe through which liquefied gas is supplied to the receiver. 7 is a port in the inner receiver wall registering with and permanently connected to a pipe 8 forming one of a series of coils wound about but out of contact with the inner receiver wall in the insulating chamber between the walls. 9 is a sleeve extending through the outer wall, connected permanently to the pipe 8. 10 is a pipe connected to the sleeve 9, to conduct the gas away for further use or treatment.

The pipe 8 may be dispensed with, in which case the structural members holding the two tank walls in proper alignment will serve as baffles to guide the flow of gas so as to distribute it throughout the space between the two tank walls.

Suitable closures or valves for filling pipe 6 and sleeve 9 may be provided but since their details form no part of the present invention, they have in the interest of simplicity been omitted. 11 indicates flexible packing sleeves interposed between the pipe 6 and the wall 2 and the sleeve 9 and the wall 2. These sleeves encircle respectively the pipe 6 and the sleeve 9 and are anchored as indicated, by collars 12 on the outer wall 2 so that there being clearance between the sleeve and the pipe and the outer wall, relative expansion and contraction either longitudinally or radially between the inner and outer walls may be permitted without leakage into the space between the two walls.

The pipe coils 8 are so disposed within the insulation that they do not contact either the inner or the outer walls. This is very important. If the pipe coils are in contact with the inner wall or tank containing the liquefied gas, then the coils will be in general the same temperature as the temperature of the inner tank and its contents. Of course, the outer portion of the coil would be able to absorb a little heat but not enough to make any difference. On the other hand if the coils 8 carry-

ing the cold vaporized gas were in contact with the outer wall 2, the outer wall would be so cold that it would sweat and this would be disadvantageous but with the pipe coils suspended in the insulation between the inner and the outer walls, they serve as the desired blanket or interposed heat intercepting mechanism so that the gas as it is discharged through the pipe 10 has increased in temperature and the coils as they extend around the inner tank 1 have absorbed heat penetrating through the walls 2 and the insulation so as to protect the liquid contents of the inner tank 1 against excessive heat absorption.

I have illustrated my invention in the case where the inner tank is chilled by its contents and as the contents evaporate, the resultant cold gas furnishes a shield or blanket around the tank to protect it from heat absorption.

If means were provided for cooling the inner tank other than by its contents, if for example the inner tank were a freezing compartment and if the evaporator of a refrigerating system were in or were associated with the walls of the inner tank, it would be equally important to encircle the tank with cold gas. In this case, the cold gas would be the cold gas evaporated in the evaporator which on its way to the compressor of a refrigerating machine would encircle the tank and the evaporator and so would be warmed by ambient heat on its way to the compressor and would at the same time furnish a shield or blanket to protect the contents of the tank against ambient heat. Such an arrangement would in no wise interfere with the operation of the refrigerating machine because some of the heat which usually is added in the compressor would now be added to the cold gas on its way to the compressor.

I have illustrated the cold gas blanket as being positioned by pipe coils interposed between the inner receptacle and the outer housing and insulated from both of them and I have used the language "pipe" in its broadest sense. The pipe might be of any shape or size, the point being that I have arranged mechanically, the element through which the cold gas passes is such an element as will guide the gas in its passage between the tank and the housing so as to insure the presence of the cold gas blanket encircling the inner housing.

The use and operation of my invention are as follows:

No effort is made to prevent the escape from the vessel or receiver of the gas which is evaporated off from the body of liquid as a result of entrance of heat into the liquid mass and the pressure in the receiver is therefore maintained at substantially atmospheric, exceeding atmospheric only to an amount representing the increased pressure required to cause gas to flow out of the tank.

This gas that boils off from the liquid mass does so at substantially the same temperature as the liquid mass itself just as steam boiling off water at atmospheric pressure leaves the water at the same temperature as the water, namely, 212 degrees F., the difference being that in this case the temperature is -258 degrees F.

Whether the gas leaving the tank passes through coils encircling the inner tank between the inner and outer

walls thereof or passes directly into the space between the inner and outer walls, in either case, the cold gas as it travels from the interior of the tank to the outside furnishes a shield or blanket surrounding the liquid mass and the inner receptacle containing it so as to minimize the amount of heat entering the liquid mass and so as to prevent excess evaporation.

This use of a blanket of cold gas surrounding the receiver accomplishes a double purpose. It limits entrance of heat to the liquid mass and so prevents excessive evaporation of the liquid. It also warms the cold gas evaporated off from the liquid, this warming being essential if the gas is to be used because gas cannot be burnt without first raising its temperature far above the temperature at which the gas is liquefied, namely -258 degrees F.

I have illustrated a single length of pipe wound in a multiplicity of coils surrounding the inner vessel. Obviously the spacing of these coils or the provision of a pair of manifolds with a plurality of coils between them or an arrangement of the coils so that they run parallel with instead of about the axis of the vessel would depart in no way from the spirit of my invention, the point being that the pipe or pipes are so arranged that there is a shield or blanket of moving cold gas between the inner and outer walls of the container to protect the inner gas holding container from excessive heat absorption while resulting in a progressive warming of the gas as it approaches discharge.

I claim:

In combination a cylindrical horizontally disposed tank adapted to contain liquid methane and the like at atmospheric pressure and temperatures in the order of -258° F., a coiled vent pipe encircling the tank substantially from end to end, out of contact therewith except at the intake end where it communicates with the upper portion of the tank, an enclosure for the tank generally concentric therewith, the space between the outer surface of the tank and the inner surface of the enclosure being substantially the same throughout, insulating spacing members of wood of low heat conductivity interposed between the lower portions of the tank and the enclosure whereby the tank is centered in and supported by the enclosure, loose friable, readily flowing insulating material filling the remaining space between the tank and enclosure walls and insulating the coiled vent pipe from the tank and from the enclosure, the enclosure being apertured at the opposite end from the connection between the vent pipe and the tank, the vent pipe extending outwardly through the aperture, the vent pipe furnishing the sole discharge from the tank and being arranged for discharge only outside of the enclosure.

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