Claims

1. A modular insulation arrangement comprising one or more tessellating insulation units, each unit comprising a first inwardly facing layer and a second outwardly facing layer spaced from the first layer, the two layers defining a space therebetween and one or more spacing members extending between the first and second layers, and wherein the surfaces defining the first layer, the second layer and the outer perimeter extending around the arrangement are air impermeable surfaces, wherein the air impermeable surface defining the outer perimeter of the arrangement is formed of a first portion coupled to the first layer and a second portion coupled to the second layer and further comprising a third portion coupled to the first and second portions, and wherein the third portion has a lower thermal conductivity coefficient than the first and or second portions.

2. An arrangement as claimed in claim 1, wherein the space between the first and second layers and the surface defining the outer perimeter of the arrangement defines an internal volume to the arrangement and wherein the spacing members are arranged in use to resist atmospheric pressure acting on the surfaces when the internal volume is evacuated of air.

3. An arrangement as claimed in claim 2, wherein the arrangement comprises a valve in fluid communication with the internal volume, the valve arranged in use to allow air to be evacuated from the internal volume.

4. An arrangement as claimed in any preceding claim, wherein the spacing member(s) is/are in the form of a plurality of columns extending between the first and second layers.

5. An arrangement as claimed in claim 4, wherein each column comprises an aperture allowing air to enter and leave the volume within the column.

6. An arrangement as claimed in any preceding claim wherein the spacing member(s) is/are formed all or in part from a material selected from wood, plywood, wood composites, bamboo, cardboard, polyurethane, PEEK, PTFEE or stainless-steel.

7. An arrangement as claimed in any preceding claim wherein the spacing member(s) is/are formed of a first portion extending from the first surface and a second portion extending from the second surface and an intermediate portion connecting the first portion to the second portion of the spacing member.

8. An arrangement as claimed in claim 7, wherein the intermediate portion has a lower thermal conductivity coefficient than the first and or second portions.

9. An arrangement as claimed in claim 7 or 8, wherein the first portion and second portion of the spacing element are formed of aluminium or an alloy thereof and wherein the intermediate portion is formed from a material selected from the list of aluminium, aluminium alloy, stainless-steel, rubber, POM, PTFE or PEEK.

10. An arrangement as claimed in any preceding claim, wherein the perimeter of the or each tessellating unit comprises a connection surface for abutment with an adjacent tessellating unit,

wherein the connection surface provides a continuous contact between adjacent units along the connection surface when adjacent units are brought together.

11. An arrangement as claimed in claim 10, wherein the connection surface is in the form of a radially extending rim extending from the perimeter of the unit.

12. An arrangement as claimed in claim 11, wherein each unit comprises a first radially extending rim on the inwardly facing surface of the unit and a second radially extending rim on the outwardly facing surface of the unit.

13. An arrangement as claimed in any preceding claim, wherein the tessellating insulation units have a shape selected from triangle, square, rectangular, hexagonal or tessellating polygon.

14. An arrangement as claimed in any preceding claim wherein the tessellating insulation units are hexagonal, and the one or more spacing elements are hexagonal in cross-section.

15. An arrangement as claimed in claim 14, wherein the spacing element is in the form of a single matrix of hexagonal columns.

16. An insulation system comprising a plurality of modular insulation arrangements as claimed in any preceding claim and wherein multiple modular insulating arrangements are in gaseous communication with one another such that evacuation of one arrangement causes air to be drawn from other arrangements.

17. An insulation system as claimed in claim 16, wherein adjacent modular insulation arrangements are welded together along a perimeter of each arrangement.

18. An insulation system as claimed in claim 16 or 17, further comprising one or more air pumps in gaseous communication with one or more insulation arrangements and arranged in use to draw air from the or each arrangement.

19. An insulation system as claimed in any of claims 16 to 18 further comprising

A a pressure detector arranged in use to monitor the pressure within the or each arrangement and further comprising a control arrangement arranged to activate an air pump in response to the detected pressure;

And/Or

B a temperature sensor arranged in use to monitor the temperature within the or each arrangement and further comprising a control arrangement arranged to activate an air pump in response to the detected temperature.

20. A cryogenic containment tank comprising an outer insulation layer formed of a modular insulation arrangement as claimed in any of claims 1 to 15 or insulation system as claimed in any of claims 16 to 19.

21. An ocean-going ship comprising a cryogenic containment tank as claimed in claim 20.

22. A method of insulating a cryogenic containment tank comprising a modular arrangement as claimed in any of claims 1 to 15, the method comprising the step of evacuating the space within one or more modular arrangements.

23. A method as claimed in claim 22, wherein the vacuum is intermittently measured, and further evacuation carried out to maintain the vacuum.

24. A liquefied gas transport arrangement comprising a tank for containing a liquefied gas and an insulation layer surrounding the outer surface of the tank, wherein the insulation layer is in the form of a first inwardly facing layer facing the tank and a second outwardly facing layer facing away from the tank, the first and second layer being spaced from one another and defining a space between the first and second layers, and wherein the surfaces defining the first layer and the second layer are air impermeable surfaces, wherein the air impermeable surface defining the outer perimeter of the arrangement is formed of a first portion coupled to the first layer and a second portion coupled to the second layer and further comprising a third portion coupled to the first and second portions, and wherein the third portion has a lower thermal conductivity coefficient than the first and or second portions.

25. A transport arrangement as claimed in claim 24, wherein the insulation layer surrounding the tank is divided into separate insulating sections and wherein the separate insulating sections are arranged in use to abut one another to envelope the tank.

26. A support structure containing the transport arrangement as claimed in claim 24 or 25 wherein the support structure is arranged in use to be coupled to adjacent and corresponding support structures to form an array of individual liquefied transport arrangements.

27. A shipping insulation system comprising one or more tessellating modular insulation arrangements as claimed in any of claims 1 to 14, arranged against or proximate to a cargo containing tank of the ship and defining a primary insulation layer the system comprising a second insulation layer, spaced from said first layer, and defining a space therebetween.

28. A system as claimed in claim 27, wherein the second layer is also a plurality of tessellating insulations units or a layer or polyurethane.

29. A system as claimed in claim 27 or 28, wherein a gap or cavity between the one or more tessellating insulation units and the cargo containing tank of the ship is filled with a gas selected from helium or hydrogen or may be a vacuum.