【CLAIMS】

【Claim 1】

A vacuum heat-insulation device for a low-temperature tank, the vacuum heat-insulation device comprising:

a low-temperature tank having a storage space for accommodating an ultra-low-temperature fluid therein;

a low-temperature heat-insulation layer provided to surround an outer shell of the low-temperature tank; and

a vacuum jacket having an internal space maintained in a vacuum state and sealed to surround an outer surface of the low-temperature heat-insulation layer to maintain airtightness with the outside,

wherein the vacuum jacket has a flexible structure in which at least a portion thereof is contracted or expanded, and

wherein the vacuum jacket includes a plurality of smooth portions surrounding the outer surface of the low-temperature heat-insulation layer and made of flat plates spaced apart from each other by a predetermined distance, and a deformable joint portion formed between the plurality of smooth portions and having the flexible structure.

【Claim 2】

The vacuum heat-insulation device of claim 1, wherein the deformable joint portion connects the plurality of smooth

portions, and is formed of a polymer elastic body that is stretchable in response to a deformation of the internal space of the vacuum jacket.

【Claim 3】

The vacuum heat-insulation device of claim 2, wherein the polymer elastic body is interposed between the plurality of smooth portions and is bonded to outer side ends of the plurality of smooth portions in a width direction thereof.

【Claim 4】

The vacuum heat-insulation device of claim 2, wherein the plurality of smooth portions are provided to overlap with at least one adjacent smooth portion in a thickness direction, and respond to the contraction or expansion of the internal space while being slid when the internal space is deformed, and

the polymer elastic body is provided on upper surfaces of the plurality of smooth portions overlapped with the at least one adjacent smooth portions to maintain the airtightness of the vacuum jacket and is contracted or expanded in response to the deformation of the smooth portions.

【Claim 5】

The vacuum heat-insulation device of claim 1, wherein the low-temperature heat-insulation layer is provided in plural, and

the plurality of low-temperature heat-insulation layers are provided to be spaced apart from each other to form an internal discharge space forming a flow path for forming a vacuum between the plurality of low-temperature heat-insulation layers that are adjacent to each other.

【Claim 6】

The vacuum heat-insulation device of claim 5, wherein the plurality of low-temperature heat-insulation layers are provided to form a multiple layer in the thickness direction, and are fixed to at least one of the outer shell of the low-temperature tank, the vacuum jacket, or the adjacent low-temperature heat-insulation layer using a fixing bolt to be spaced apart from each other by a predetermined distance.

【Claim 7】

The vacuum heat-insulation device of claim 6, further comprising a discharge pipe provided in the internal discharge space and having a suction hole that is formed on an outer circumferential surface and communicates with the internal space of the vacuum jacket.

【Claim 8】

The vacuum heat-insulation device of claim 1, wherein the deformable joint portion is integrally formed with the plurality of smooth portions, and forms a concave-convex portion curved outwardly in the thickness direction, and the concave-convex portion is deformed according to the contraction or expansion of the internal space of the vacuum jacket.

【Claim 9】

The vacuum heat-insulation device of claim 8, wherein the deformable joint portion is configured to form an internal discharge space forming a flow path for forming a vacuum inside the concave-convex portion curved outwardly in the thickness direction.

【Claim 10】

The vacuum heat-insulation device of claim 9, wherein the vacuum jacket is integrally formed by welding the plurality of smooth portions, and a welding line formed on the outer surface of the vacuum jacket is provided in the internal space of the vacuum jacket and is formed at a position coincident with the internal discharge space.

【Claim 11】

The vacuum heat-insulation device of claim 8, wherein the vacuum jacket is integrally formed by welding the plurality of smooth portions, and

the vacuum heat-insulation device further includes a high-temperature heat-insulation material provided inside the welding line formed on the outer surface of the vacuum jacket to prevent thermal deformation of the low-temperature heat-insulation layer near the welding line.

【Claim 12】

The vacuum heat-insulation device of claim 1, wherein the vacuum jacket includes a first vacuum jacket surrounding the outer surface of the low-temperature heat-insulation layer and a second vacuum jacket provided to surround an outer surface of the first vacuum jacket, and

the vacuum heat-insulation device further includes a spacer interposed between the first vacuum jacket and the second vacuum jacket to separate the first vacuum jacket and the second vacuum jacket from each other by a predetermined distance.

【Claim 13】

The vacuum heat-insulation device of claim 1, wherein the vacuum jacket includes a flexible portion surrounding

the outer surface of the low-temperature heat-insulation layer and having the flexible structure, and a robust portion in which at least a portion of the vacuum jacket having a robust structure supports the vacuum heat-insulation device.

【Claim 14】

The vacuum heat-insulation device of claim 13, wherein the low-temperature tank is made of a polyhedron,
the flexible portion is formed to surround the outer surface of the low-temperature heat-insulation layer forming a plane of the vacuum jacket, and

the robust portion is formed to surround the outer surface of the low-temperature heat-insulation layer forming a corner of the vacuum jacket.

【Claim 15】

The vacuum heat-insulation device claim 13, wherein the vacuum jacket is configured to form an internal discharge space forming a flow path for forming a vacuum inside the robust portion.

【Claim 16】

The vacuum heat-insulation device of claim 13, wherein the robust portion is formed to surround the outer surface of the low-temperature heat-insulation layer constituting a

lower portion of the vacuum jacket, and supports a bottom surface of the vacuum heat-insulation device.

【Claim 17】

The vacuum heat-insulation device of claim 13, further comprising a tank support body formed to support the low-temperature tank in a floating state, and separate a lower end of the vacuum jacket from the ground by a predetermined distance.

【Claim 18】

The vacuum heat-insulation device of claim 17, wherein the tank support body includes:

a tank hanger connected to the upper surface of the low-temperature tank,

an upper support body that supports the tank hanger and forms a portion of the vacuum jacket, and

a side support body that extends upwardly such that the lower end of the vacuum jacket is spaced apart from the ground to support the upper support body.

【Claim 19】

The vacuum heat-insulation device of claim 17, wherein the tank support body includes:

a tank hanger connected to a side surface of the low-temperature tank, and

a side support body that forms a portion of the vacuum jacket and extends upwardly so that the lower end of the vacuum jacket is spaced apart from the ground to support the tank hanger.