CLAIMS

[Claim 1] Portable cargo handling equipment for liquid hydrogen,

the portable cargo handling equipment transferring the liquid hydrogen stored in a land-side cryogenic tank to a ship-side cryogenic tank,

the portable cargo handling equipment comprising:

a liquid hydrogen pipe through which the liquid hydrogen is guided and which includes

a first joint connectable to an end portion of a ship-side liquid pipe extending from the ship-side cryogenic tank and

a second joint connectable to an end portion of a land-side liquid pipe extending from the land-side cryogenic tank;

a first emergency release coupling located at the liquid hydrogen pipe;

a hydrogen gas pipe through which a hydrogen gas generated by evaporation of the liquid hydrogen is guided and which includes a third joint connectable to an end portion of a ship-side gas pipe extending from the ship-side cryogenic tank;

a second emergency release coupling located at the hydrogen gas pipe;

a vent pipe including one end connected to the hydrogen gas pipe and the other end that is open to an atmosphere;

a frame supporting the liquid hydrogen pipe and the hydrogen gas pipe; and

a liquid receiver located under the first emergency release coupling and the second emergency release coupling;

wherein:

the first emergency release coupling includes a first coupling located at a land side and a second coupling located at a ship side and separably connected to the first coupling;

the second emergency release coupling includes a third coupling located at the land side and a fourth coupling located at the ship side and separably connected to the third coupling; and

the first coupling and the third coupling are supported by the frame while being connected to the second coupling and the fourth coupling, respectively.

[Claim 2] The portable cargo handling equipment according to claim 1, further comprising:

a vehicle body supporting the frame; and

a traveling driving source supported by the vehicle body, wherein:

the portable cargo handling equipment is a traveling vehicle; and

the liquid receiver is supported by the vehicle body.

[Claim 3] The portable cargo handling equipment according to claim 1 or 2, further comprising a heater located at the vent pipe.

[Claim 4] The portable cargo handling equipment according to claim 1 or 2, wherein:

at least a portion of the liquid hydrogen pipe which is located between the first emergency release coupling and the first joint includes a first flexible hose; and

at least a portion of the hydrogen gas pipe which is located between the second emergency release coupling and the third joint includes a second flexible hose.

[Claim 5] The portable cargo handling equipment according to claim 4, wherein:

the liquid hydrogen pipe includes

a fixed liquid pipe fixed to the frame,

a first hose including the first flexible hose, and

a first emergency release assembly including the first emergency release coupling, a fourth joint connectable to an end portion of the fixed liquid pipe, and a fifth joint connectable to an end portion of the first hose; and

the hydrogen gas pipe includes

a fixed gas pipe fixed to the frame,

a second hose including the second flexible hose, and

a second emergency release assembly including the second emergency release coupling, a sixth joint connectable to an end portion of the fixed gas pipe, and a seventh joint connectable to an end portion of the second hose.

[Claim 6] Portable cargo handling equipment for liquid hydrogen, the portable cargo handling equipment transferring the liquid hydrogen stored in a land-side cryogenic tank to a ship-side cryogenic tank, the portable cargo handling equipment comprising:

a liquid hydrogen pipe through which the liquid hydrogen is guided and which includes

a first joint connectable to an end portion of a ship-side liquid pipe extending from the ship-side cryogenic tank and

a second joint connectable to an end portion of a land-side liquid pipe extending from the land-side cryogenic tank;

a first emergency release coupling located at the liquid hydrogen pipe;

a hydrogen gas pipe through which a hydrogen gas generated by evaporation of the liquid hydrogen is guided and which includes a third joint connectable to an end portion of a ship-side gas pipe extending from the ship-side cryogenic tank;

a second emergency release coupling located at the hydrogen gas pipe;

a vent pipe including one end connected to the hydrogen gas pipe and the other end that is open to an atmosphere; and

a frame supporting the liquid hydrogen pipe and the hydrogen gas pipe;

wherein:

the first emergency release coupling includes a first coupling located at a land side and a second coupling located at a ship side and separably connected to the first coupling;

the second emergency release coupling includes a third coupling located at the land side and a fourth coupling located at the ship side and separably connected to the third coupling;

the first coupling and the third coupling are supported by the frame while being connected to the second coupling and the fourth coupling, respectively;

at least a portion of the liquid hydrogen pipe which is located between the first emergency release coupling and the first joint includes a first flexible hose;

at least a portion of the hydrogen gas pipe which is located between the second emergency release coupling and the third joint includes a second flexible hose;

the liquid hydrogen pipe includes

a fixed liquid pipe fixed to the frame,

a first hose including the first flexible hose, and

a first emergency release assembly including the first emergency release coupling, a fourth joint connectable to an end portion of the fixed liquid pipe, and a fifth joint connectable to an end portion of the first hose;

the hydrogen gas pipe includes

a fixed gas pipe fixed to the frame,

a second hose including the second flexible hose, and

a second emergency release assembly including the second emergency release coupling, a sixth joint connectable to an end portion of the fixed gas pipe, and a seventh joint connectable to an end portion of the second hose;

the frame includes

a frame upper portion located above the first emergency release coupling and the second emergency release coupling and

a frame lower portion located under the first emergency release coupling and the second emergency release coupling; and

the end portion of the fixed liquid pipe and the end portion of the fixed gas pipe are located higher than the frame lower portion,

the portable cargo handling equipment further comprising a lifter that lifts the first emergency release assembly and the second emergency release assembly to such positions that the first emergency release assembly and the second emergency release assembly are connectable to the end portion of the fixed liquid pipe and the end portion of the fixed gas pipe, respectively.

[Claim 7] Portable cargo handling equipment for liquid hydrogen, the portable cargo handling equipment transferring the liquid hydrogen stored in a land-side cryogenic tank to a ship-side cryogenic tank, the portable cargo handling equipment comprising:

a liquid hydrogen pipe through which the liquid hydrogen is guided and which includes

a first joint connectable to an end portion of a ship-side liquid pipe extending from the ship-side cryogenic tank and

a second joint connectable to an end portion of a land-side liquid pipe extending from the land-side cryogenic tank;

a first emergency release coupling located at the liquid hydrogen pipe;

a hydrogen gas pipe through which a hydrogen gas generated by evaporation of the liquid hydrogen is guided and which includes a third joint connectable to an end portion of a ship-side gas pipe extending from the ship-side cryogenic tank;

a second emergency release coupling located at the hydrogen gas pipe;

a vent pipe including one end connected to the hydrogen gas pipe and the other end that is open to an atmosphere;

a frame supporting the liquid hydrogen pipe and the hydrogen gas pipe;

wherein:

the first emergency release coupling includes a first coupling located at a land side and a second coupling located at a ship side and separably connected to the first coupling;

the second emergency release coupling includes a third coupling located at the land side and a fourth coupling located at the ship side and separably connected to the third coupling; and

the first coupling and the third coupling are supported by the frame while being

connected to the second coupling and the fourth coupling, respectively;

the first emergency release coupling is located such that the second coupling separated from the first coupling falls by its own weight; and

the second emergency release coupling is located such that the fourth coupling separated from the third coupling falls by its own weight,

the portable cargo handling equipment further comprising an impact absorber that absorbs falling impact of the second coupling and the fourth coupling.

[Claim 8] Portable cargo handling equipment for liquid hydrogen, the portable cargo handling equipment transferring the liquid hydrogen stored in a land-side cryogenic tank to a ship-side cryogenic tank, the portable cargo handling equipment comprising:

a liquid hydrogen pipe through which the liquid hydrogen is guided and which includes

a first joint connectable to an end portion of a ship-side liquid pipe extending from the ship-side cryogenic tank and

a second joint connectable to an end portion of a land-side liquid pipe extending from the land-side cryogenic tank;

a first emergency release coupling located at the liquid hydrogen pipe;

a hydrogen gas pipe through which a hydrogen gas generated by evaporation of the liquid hydrogen is guided and which includes a third joint connectable to an end portion of a ship-side gas pipe extending from the ship-side cryogenic tank;

a second emergency release coupling located at the hydrogen gas pipe;

a vent pipe including one end connected to the hydrogen gas pipe and the other end that is open to an atmosphere; and

a frame supporting the liquid hydrogen pipe and the hydrogen gas pipe;

wherein:

the first emergency release coupling includes a first coupling located at a land side and a second coupling located at a ship side and separably connected to the first coupling;

the second emergency release coupling includes a third coupling located at the land side and a fourth coupling located at the ship side and separably connected to the third coupling;

the first coupling and the third coupling are supported by the frame while being connected to the second coupling and the fourth coupling, respectively;

the portable cargo handling equipment further comprising a mover which supports the second coupling separated from the first coupling and the fourth coupling separated from the

third coupling and realizes movements of the second coupling and the fourth coupling relative to the frame.

[Claim 9] Portable cargo handling equipment for liquid hydrogen, the portable cargo handling equipment transferring the liquid hydrogen stored in a land-side cryogenic tank to a ship-side cryogenic tank, the portable cargo handling equipment comprising:

a liquid hydrogen pipe through which the liquid hydrogen is guided and which includes

a first joint connectable to an end portion of a ship-side liquid pipe extending from the ship-side cryogenic tank and

a second joint connectable to an end portion of a land-side liquid pipe extending from the land-side cryogenic tank;

a first emergency release coupling located at the liquid hydrogen pipe;

a hydrogen gas pipe through which a hydrogen gas generated by evaporation of the liquid hydrogen is guided and which includes a third joint connectable to an end portion of a ship-side gas pipe extending from the ship-side cryogenic tank;

a second emergency release coupling located at the hydrogen gas pipe;

a vent pipe including one end connected to the hydrogen gas pipe and the other end that is open to an atmosphere; wherein:

a shutoff valve that is manually operated is located at a portion of the liquid hydrogen pipe which is located between the second joint and the first emergency release coupling; and

the shutoff valve is located at a position that is lower than a discharge port of the vent pipe and away by five meters or more in a horizontal direction from the discharge port in a top view.