

【DESCRIPTION】

【Invention Title】

LEAKAGE DETECTION AND PREVENTION SYSTEM FOR LIQUID
HEATER

【Technical Field】

[0001] The present invention relates to a leakage detection and prevention system for a liquid heater that is applied to a low temperature liquid pressurizing device which is used to pressurize or heat a low temperature liquid such as liquefied natural gas (LNG) or liquid petroleum gas (LPG) to produce a liquid or gas having a higher pressure and temperature in order to supply the same to a place where high pressure gas is used, thereby primarily detecting the leakage of natural gas and preventing a secondary accident by stopping a supply of a heating medium when the natural gas is leaked.

【Background Art】

[0002] Generally, a low temperature liquid pressurizing device which is used to pressurize or heat a low temperature liquid such as liquefied natural gas (LNG) or liquid petroleum gas (LPG) to produce a liquid or gas having a higher pressure and temperature in order to supply the same to a place where high pressure gas is used is configured to include a liquid storage tank, a high pressure pump, a heater, and the like.

[0003] The liquid of about - 160 °C is pressurized by a high pressure pump and the pressurized liquid is vaporized by the heater to produce the high temperature and high pressure vaporized gas which is supplied to an engine, and the like. A heating medium within the heater heat-exchanges with a low temperature liquid and is circulated through a heating medium regenerator.

[0004] However, the existing heater has a problem in that gas may be leaked inside the heater and when the gas is leaked, the leaked gas may be mixed with the heating medium.

[0005] For example, when natural gas is leaked and thus is mixed with steam which is the heating medium, the natural gas mixed with the steam may be introduced into a boiler through steam condensate, which may lead to big accidents such as fire or explosion.

[0006] In particular, in the case of a ship, since a heating medium regeneration source is generally disposed in an engine room of the ship and thus greater risks may be additionally involved.

[Disclosure]

[Technical Problem]

[0007] An object of the present invention is to provide a leakage detection and prevention system for a liquid heater capable of primarily detecting a leakage of

natural gas and preventing a secondary accident by stopping a supply of heating medium when the natural gas is leaked.

[0008] Another object of the present invention is to provide a leakage detection and prevention system for a liquid heater capable of temporarily storing and treating leaked gas and a heating medium.

【Technical Solution】

[0009] In one general aspect, a leakage detection and prevention system for a liquid heater includes a high pressure pump 10 configured to be supplied with a low-temperature, low-pressure liquid to increase a pressure; a heater 20 configured to be supplied with a high pressure liquid from the high pressure pump 10 to increase temperature; a heating medium introduction line 30 configured to be connected to a heating medium inlet of the heater 20 to introduce the heating medium being heat-exchanged with the liquid into the heater 20; a second detector 25 configured to have at least one of the pressure detector, the temperature detector, and the gas detector which are mounted in the heater 20; and a controller configured to control the heating medium inlet shut-off valve 35 on the basis of a signal detected by the second detector 25.

[0010] The leakage detection and prevention system for a liquid heater may further include: a heating medium

discharge line 40 configured to be connected to a heating medium outlet of the heater 20 to discharge the heating medium from the heater 20; a heating medium outlet shut-off valve 45 configured to be mounted at a heat medium discharge line 40; a leakage gas accumulation tank 60 configured to be mounted at the heating medium discharge line 40 to store leaked gas and a heating medium; and a first detector 65 configured to have at least any one of a pressure detector, a temperature detector, a gas detector, and a water level detector which is mounted at the leakage gas accumulation tank 60, wherein the controller performs a control to shut-off the heating medium inlet shut-off valve 35 on the basis of the signal detected by the first detector 65.

[0011] The heating medium outlet shut-off valve 45 may be disposed at an outlet side of the leakage gas accumulation tank 60.

[0012] The leakage detection and prevention system for a liquid heater may further include: a steam trap 80 configured to be mounted at the heating medium discharge line 40 and disposed at an inlet side of the leakage gas accumulation tank 60 to store a condensate generated from the heater 20; and a first detector 70 configured to be mounted at the heating medium discharge line 40 and mounted at an inlet side of the steam trap 80 to detect a water

level of the condensate, wherein the heating medium is steam and the controller performs a control to shut-off the heating medium inlet shut-off valve 35 on the basis of the signal detected by the first detector 70.

【Advantageous Effects】

[0013] According to the leakage detection and prevention system for a liquid heater according to the exemplary embodiments of the present invention, the following effects may be obtained.

[0014] It is possible to primarily detect the leakage of natural gas from the evaporation tube 21 by the second detector 25 and prevent the secondary accidents by stopping the supply of the heating medium at the time of the leakage of the natural gas by making the controller shut off the heating medium inlet shut-off valve 35 depending on the signal detected by the second detector 25.

[0015] Further, it is possible to more effectively monitor the leakage of natural gas by the first detector 65 and temporarily store and treat the leaked natural gas and heating medium by mounting the leakage gas accumulation tank 60 in the heating medium discharge line 40.

[0016] Meanwhile, when the natural gas is leaked, the water level of the steam trap 80 is reduced and therefore the leakage of natural gas may be detected by the water level detector which is mounted at the heating medium

discharge line 40 and the leakage of natural gas may be primarily detected by the second detector 25 which is mounted at the heater 20, and is detected by the first detector 65 even in the leakage gas accumulation tank 60 to make the controller shut off the heating medium inlet shut-off valve 35, thereby stopping the supply of steam.

[0017] Further, the steam mixed with the already leaked natural gas is accumulated within the leakage gas accumulation tank 60, thereby preventing the secondary risks.

【Description of Drawings】

[0018] FIG. 1 is a schematic diagram illustrating a leakage detection and prevention system for a liquid heater according to a first exemplary embodiment of the present invention.

[0019] FIGS. 2 and 3 are schematic diagrams illustrating an operation of a controller in FIG. 1.

[0020] FIG. 4 is a schematic diagram illustrating a leakage detection and prevention system for a liquid heater according to a second exemplary embodiment of the present invention.

【Best Mode】

[0021] Hereinafter, exemplary embodiments of the present invention will be described in detail with reference to the accompanying drawings. The terms and

words used in the present specification and claims should not be interpreted as being limited to typical meanings or dictionary definitions, but should be interpreted as having meanings and concepts relevant to the technical scope of the present invention based on the rule according to which an inventor can appropriately define the concept of the term to describe most appropriately the best method he or she knows for carrying out the invention. Therefore, configurations described in embodiments and shown in drawings of the present specification indicate only the most preferred example rather than indicating all the technical ideas of the present invention and therefore, it is to be understood that various equivalents and modifications that can replace the above configurations may be present.

[0022] A leakage detection and prevention system for a liquid heater according to an exemplary embodiment of the present invention may be applied to a low temperature liquid pressurizing device which is used to pressurize or heat a low temperature liquid such as liquefied natural gas (LNG) or liquid petroleum gas (LPG) to produce a liquid or gas having a higher pressure and temperature in order to supply the same to a place where high pressure gas is used, and in particular, the following exemplary embodiment describes an LNG heater as an example but is not limited

thereto.

[0023] First, a leakage detection and prevention system for a liquid heater according to a first exemplary embodiment of the present invention is illustrated in FIG. 1.

[0024] Referring to FIG. 1, the leakage detection and prevention system for a liquid heater according to the first exemplary embodiment of the present invention includes a high pressure pump 10, a heater 20, a heating medium introduction line 30, a heating medium inlet shut-off valve 35, a heating medium discharge line 40, a heating medium outlet shut-off valve 45, a second detector 25, a controller (not illustrated), a leakage gas accumulation tank 60, and a first detector 65.

[0025] Low-temperature, low-pressure LNG stored in an LNG storage tank (not illustrated) is supplied to the high pressure pump 10 and thus a pressure of the LNG is increased and the low-temperature LNG of which the pressure is increased is introduced into the heater 20 through the LNG introduction line 11. The LNG introduction line 11 is provided with the LNG introduction shut-off valve 12 so as to prevent the introduction of LNG if necessary.

[0026] The low-temperature LNG introduced into the heater 20 is heat-exchanged with the high-temperature heating medium supplied into the heater 20 while flowing in

the evaporation tube 21 within the heater 20 to generate vaporized gas. The so generated vaporized gas is supplied to a place at which the high-pressure gas is used.

[0027] The heating medium introduction line 30 through which the heating medium is introduced into the heater 20 is connected to a heating medium inlet of the heater 20.

[0028] The heating medium introduction line 30 is provided with the heating medium inlet shut-off valve 35 to prevent the introduction of the heating medium if necessary and is provided with a reflow shut-off valve 36 to prevent the reflow of the heating medium.

[0029] The heating medium discharge line 40 through which the heating medium heat-exchanged with the liquid is discharged from the heater 20 is connected to the heating medium outlet of the heater 20.

[0030] The heating medium discharge line 40 is provided with the heating medium outlet shut-off valve 45 which prevents the discharge of the heating medium if necessary.

[0031] By the above configuration, the high-temperature heating medium is introduced into the heater 20 through the heating medium introduction line 30 and after the heating medium is heat-exchanged with the liquid, the heating medium is discharged from the heater 20 through the heating medium discharge line 40.

[0032] Meanwhile, the heater 20 may be provided with the second detector 25 and the second detector 25 may be at least any one of a pressure detector, a temperature detector, and a gas detector.

[0033] As illustrated in FIG. 2, according to the exemplary embodiment of the present invention, the heater 20 is provided with all of the pressure detector, the temperature detector, and the gas detector to enable the second detector 25 to primarily detect the leakage of natural gas from the evaporation tube 21.

[0034] By doing so, the controller shut-off the heating medium inlet shut-off valve 35 on the basis of the signal detected by the second detector 25 to stop the supply of the heating medium at the time of the leakage of natural gas, thereby preventing secondary accidents.

[0035] Meanwhile, according to the exemplary embodiment of the present invention, the heating medium discharge line 40 may be provided with the leakage gas accumulation tank 60 and the first detector 65.

[0036] As illustrated in FIG. 1, the leakage gas storage tank 60 is mounted at the heating medium discharge line 40 and thus stores the leaked natural gas and heating medium. In this case, the heating medium outlet shut-off valve 45 may be mounted at an outlet side of the leakage gas accumulation tank 60.

[0037] The leakage gas accumulation tank 60 is provided with the first detector 65 and the first detector 65 may be at least any one of the pressure detector, the temperature detector, the gas detector, and the water level detector.

[0038] According to the exemplary embodiment of the present invention, the leakage gas accumulation tank 60 is provided with all of the pressure detector, the temperature detector, the gas detector, and the water level detector.

[0039] By doing so, the first detector may more effectively monitor the leakage of natural gas and the heating medium discharge line 40 is provided with the leakage gas accumulation tank 60 to be able to temporarily store and treat the leaked natural gas and heating medium.

[0040] By the above configuration, as illustrated in FIG. 3, when the natural gas is leaked within the heater 20 through the evaporation tube 21, since the leaked natural gas affects the leakage gas accumulation tank 60 which is separately mounted outside the heater 20, the first detector 65 which is mounted at the leakage gas accumulation tank 60 detects the leaked natural gas and the controller shuts-off the heating medium inlet shut-off valve 35 on the basis of the signal detected by the first detector 65 to stop the supply of the heating medium at the time of the leakage of natural gas.

[0041] The heater 20 is connected to a first discharge line 90 which is provided with a first emergency discharge valve 91 for emergency discharge of the heating medium and a first pressure safety valve 92 for pressure control, respectively, the leakage gas accumulation tank 60 is connected to a second discharge line 95 which is provided with a second emergency discharge valve 96 for emergency discharge of the heating medium and a second pressure safety valve 97 for pressure control, respectively, and a third discharge line 98 is formed by putting the first discharge line 90 and the second discharge line 95 together.

[0042] Next, a leakage detection and prevention system for a liquid heater according to a second exemplary embodiment of the present invention is illustrated in FIG. 4.

[0043] Referring to FIG. 4, the leakage detection and prevention system for a liquid heater according to the second exemplary embodiment of the present invention is applied to the case in which the heating medium is steam and includes the high pressure pump 10, the heater 20, the heating medium introduction line 30, the heating medium inlet shut-off valve 35, the heating medium discharge line 40, the heating medium outlet shut-off valve 45, the second detector 25, the controller (not illustrated), the leakage gas accumulation tank 60, the first detector 65, a steam

trap 80, and a first detector 70.

[0044] In the second exemplary embodiment of the present invention, the same components as the first exemplary embodiment of the present invention are denoted by the same reference numerals and the detailed description of the same components as the first exemplary embodiment of the present invention will be omitted and therefore refers to the first exemplary embodiment of the present invention.

[0045] The steam trap 80 is mounted on the heating medium discharge line 40 and is mounted at an inlet side of the leakage gas accumulation tank 60 to store a condensate generated from the heater 20.

[0046] That is, the steam which is the heating medium is heat-exchanged with LNG to make the condensate and the steam trap 80 collecting the condensate is mounted on the heating medium discharge line 40.

[0047] Further, the heating medium discharge line 40 is provided with the first detector 70 and the first detector 70 according to the exemplary embodiment of the present invention is the water level detector and is mounted at an inlet side of the steam trap 80 to be able to detect the water level of the condensate.

[0048] That is, when the natural gas is leaked, the water level of the steam trap 80 is reduced and therefore the water level detector which is mounted on the heating

medium discharge line 40 may detect the leakage of natural gas.

[0049] The controller shuts-off the heating medium inlet shut-off valve 35 on the basis of the signal detected by the first detector 70.

[0050] In addition, the second detector 25 which is mounted at the heater 20 primarily detects the leakage of natural gas and the first detector 65 detects the leakage of natural gas even in the leakage gas accumulation tank 60 to make the controller shut-off the heating medium inlet shut-off valve 35, thereby stopping the supply of steam.

[0051] The steam mixed with the already leaked natural gas is stored in the leakage gas accumulation tank 60, thereby preventing the secondary risks.

[0052] As described above, although the present invention has been described with reference to exemplary embodiments and the accompanying drawings, it would be appreciated by those skilled in the art that the present invention is not limited thereto but various modifications and alterations might be made without departing from the scope defined in the claims and their equivalents

【CLAIMS】

【Claim 1】

A leakage detection and prevention system for a liquid heater, comprising:

a high pressure pump 10 configured to be supplied with a low-temperature, low-pressure liquid to increase a pressure;

a heater 20 configured to be supplied with a high pressure liquid from the high pressure pump 10 to increase temperature;

a heating medium outlet shut-off valve 45 configured to be mounted at a heat medium discharge line 40;

a leakage gas accumulation tank 60 configured to be mounted at the heating medium discharge line 40 to store leaked gas and a heating medium; and

a first detector 65 configured to have at least any one of a pressure detector, a temperature detector, a gas detector, and a water level detector which is mounted at the leakage gas accumulation tank 60.

【Claim 2】

The leakage detection and prevention system for a liquid heater of claim 1, further comprising:

a heating medium discharge line 40 configured to be connected to a heating medium outlet of the heater 20 to

discharge the heating medium from the heater 20;

a heating medium introduction line 30 configured to be connected to a heating medium inlet of the heater 20 to introduce the heating medium being heat-exchanged with the liquid into the heater 20;

a heating medium inlet shut-off valve 35 configured to be mounted at the heating medium introduction line 30;

a second detector 25 configured to have at least one of the pressure detector, the temperature detector, and the gas detector which are mounted at the heater 20; and

a controller configured to perform a control to shut-off the heating medium inlet shut-off valve 35 on the basis of a signal detected by the second detector 25,

wherein the controller performs a control to shut-off the heating medium inlet shut-off valve 35 on the basis of the signal detected by the first detector 65.

【Claim 3】

The leakage detection and prevention system for a liquid heater of claim 2, wherein the heating medium outlet shut-off valve 45 is disposed at an outlet side of the leakage gas accumulation tank 60.

【Claim 4】

The leakage detection and prevention system for a

liquid heater of claim 2 or 3, further comprising:

a steam trap 80 configured to be mounted at the heating medium discharge line 40 and disposed at an inlet side of the leakage gas accumulation tank 60 to store a condensate generated from the heater 20; and

a first detector 70 configured to include a water level detector which is mounted at the heating medium discharge line 40 and mounted at an inlet side of the steam trap 80 to detect a water level of the condensate,

wherein the heating medium is steam and the controller performs a control to shut-off the heating medium inlet shut-off valve 35 on the basis of a signal detected by the first detector 70.