“joined” to the latter with a third component interposed therebetween.

[33] In the present specification, a front-rear direction, a left-right direction, and an up-down direction are referred to for convenience of description and may be directions perpendicular to each other. However, these directions are determined relative to a direction in which a gas cutting apparatus is disposed, and the up-down direction may not necessarily mean a vertical direction.

[34] Referring to FIG. 2, a fuel supply system 100 according to an embodiment of the present disclosure will be described. The fuel supply system 100 includes a fuel tank 10 in which a fuel gas is stored, the fuel tank 10 being capable of accommodating an evaporated gas of the fuel gas and a purge gas usable for a purging operation, a fuel supply line 340 for supplying a fuel from the fuel tank 10 to an engine, a purging gas generating unit 200 which generates a purging gas suitable for use in the purging operation using the evaporated gas and the purge gas accommodated in the fuel tank 10, a purging line 310 for purging the engine and a pipe with the purging gas generated by the purging gas generating unit 200, and a recovery line 320 which is connected to the purging line 310 and recovers the purging gas used in the purging operation to the fuel tank 10.

[35] The fuel gas may be used as a term encompassing all gas fuels that are generally stored in a liquid state, such as liquefied petroleum gas (LPG), ethylene, ammonia, methanol, and hydrogen, and a fuel which is not in a liquid state due to heating or pressing may also be expressed as the fuel gas for convenience. This may be applied to the evaporated gas in the same manner.

[36] An inert gas such as nitrogen or argon may be used as the purge gas, but the present disclosure is not limited thereto. The purging gas is used as a term distinguished from the purge gas in the specification. The purging gas refers to a gas that is actually used in the purging operation, is generated by the purging gas generating unit 200, and flows along the purging line 310. The purging gas may be a mixture gas of the evaporated gas and the purge gas or may be a pure purge gas. This may be changed depending on a treatment method of the purging gas generating unit 200, which will be described below.

[37] The fuel gas may be stored in the fuel tank 10, and the evaporated gas of the fuel gas and the purge gas that may be used for the purging operation may be accommodated together in an upper portion of the fuel tank 10. A purge gas supply line 330 may be connected to the fuel tank 10 to supply the purge gas to the fuel tank 10. This purge gas may also be used to prevent a decrease in a pressure inside the fuel tank 10. A regulator 12 for adjusting a flow rate of the purge gas may be provided in the purge gas supply line 330. When an amount of the purge gas for maintaining a pressure of the fuel tank 10 is insufficient, the regulator 12 may be automatically opened to additionally supply the purge gas through the purge gas supply line 330 in order to prevent structural damage to the fuel tank 10.

[38] In a purge system according to the present disclosure, a closed loop of the purge gas is configured, and thus when the purge gas is supplied to the fuel tank 10 through the purge gas supply line 330 once, subsequent resupply of the purge gas is not required.

[39] Further, since the resupply of the purge gas is not required, it is possible to solve a problem in which the pressure inside the fuel tank 10 is excessively increased due to continuous supply of the purge gas, and thus a toxic fuel gas (e.g., methanol or ammonia) together with the purge gas should be discharged frequently.

[40] The purging gas generating unit 200 generates the purging gas suitable for use in the purging operation using a mixture gas inside the fuel tank 10. The fuel liquefied or the evaporated gas separated by the purging gas generating unit 200 may be recovered to the fuel tank 10 through a drain line 350. A detailed configuration thereof will be described in detail with reference to FIGS. 3 to 6.

[41] Interiors of the engine and the pipe are purged using the purging gas generated by the purging gas generating unit 200. According to FIG. 2, the purging line 310 is illustrated as a line extending from the pipe connected to the purging gas generating unit 200 and passing through a partial pipe of the fuel supply line 340 and the interior of the engine 20 but may be understood as a line circulating through equipment and the pipe required for the purging operation. A supply valve 30 may be provided in the purging line 310 to adjust a flow rate of the purging gas.

[42] According to FIG. 2, a heat exchanger 16 and a fuel shut-off valve 18 may be illustrated in the fuel supply line 340, but may be replaced with other components depending on the fuel system. A fuel discharge line 332 for discharging the fuel when the engine is stopped may be provided in the fuel

supply line 340.

[43] A vent line 360 may be connected to the fuel tank 10 to discharge the mixture gas inside the fuel tank 10. A relief valve 14 may be provided in the vent line 360, and therefore, a pressure inside the fuel tank 10 may be prevented from being overpressure.

[44] The recovery line 320 is a line which is connected to the purging line 310 and recovers the purging gas used in the purging operation to the fuel tank 10. In the recovery line 320, residual fuel may be recovered together with the purging gas used in the purging operation. Thus, the purge gas flows along the fuel tank 10, the purging gas generating unit 200, the purging line 310, and the recovery line 320, and is then recovered back to the fuel tank 10. FIG. 2 illustrates closed loop flow of the purge gas. Since the purge gas flows along the closed loop, the purging operation may be performed without loss (by reuse) of the purge gas. A pressure reducing valve 50 for reducing a pressure of the purging gas used in the purging operation may be provided in the recovery line 320.

[45] <First Embodiment>

[46] FIG. 3 illustrates the purging gas generating unit 200 according to a first embodiment. The purging gas generating unit 200 may include a compressor 210 which compresses the mixture gas stored in the fuel tank 10 and a buffer tank 220 which is provided at a rear end of the compressor 210 and temporarily stores the mixture gas compressed by the compressor 210.

[47] The compressor 210 compresses the mixture gas of the evaporated gas

and the purge gas. The high-pressure mixture gas may be used as the purging gas, may flow along the purging line 310 and the recovery line 320, and may then be recovered back to the fuel tank 10. The high-pressure mixture gas may contain a portion of the evaporated gas of the fuel gas, but when a mixing ratio is lower than an allowable reference value (e.g., 5% or less in the case of methanol), the purging operation may be performed even with the mixture gas including the evaporated gas of the fuel gas.

[48] The buffer tank 220 serves to temporarily store the high-pressure purging gas. An amount of the purging gas used for the purging operation is small compared to a total amount of the purge gas included the fuel tank 10, and thus the purging gas may be sufficiently accommodated in the buffer tank 220. A mass (e.g., at least 440 kg) of the purge gas that may be accommodated in the fuel tank 10 is four times or more a mass (e.g., up to 110 kg) of the purging gas used for a single purging operation. In the related art, the purging gas (e.g., 110 kg) is supplied through the purge gas supply line 330 whenever the purging operation is performed. However, in the present embodiment, the purging gas may be initially supplied to the fuel tank 10 through the purge gas supply line 330 once and then may be stored and purged in the buffer tank 220. Thereafter, the purge gas recovered to the fuel tank 10 and stored in the buffer tank 220 may recirculate. The numerical values such as 440 kg and 110 kg are by way of example, and the present disclosure is not limited thereto.

[49] Since the high-pressure purging gas is temporarily stored in the buffer tank 220, a capacity of the compressor 210 may be reduced. That is, the high-

pressure purging gas is stored in advance in the buffer tank 220, the high-pressure purging gas is additionally generated by the compressor 210 during the purging operation, and thus the high-pressure purging gas is discharged together. Thus, the buffer tank 220 is provided, and thus even when the capacity of the compressor 210 is reduced, a sufficient pressure of the purging gas may be maintained.

[50] When the compressor 210 is operated for a long time, a large amount of the gas inside the fuel tank 10 is stored in the buffer tank 220, the amount of the gas inside the fuel tank 10 is decreased, and thus the pressure of the fuel tank 10 is reduced. Further, when the compressor 210 is operated for a short time, a small amount of the gas inside the fuel tank 10 is stored in the buffer tank 220, there is no significant change in the amount of the gas inside the fuel tank 10, and thus the pressure of the fuel tank 10 may be maintained. In this way, the pressure inside the fuel tank 10 may be adjusted by adjusting use of the compressor 210.

[51] <Second Embodiment>

[52] FIGS. 4 to 6 illustrate the purging gas generating unit 200 according to a second embodiment. The purging gas generating unit 200 includes the compressor 210 which compresses the mixture gas stored in the fuel tank 10 and a purging gas purifier 230 which is provided at a rear end of the compressor 210 and separates the evaporated gas from the compressed mixture gas. The evaporated gas may be separated by the purging gas purifier 230, the purity of the purge gas may be increased, and thus an allowable