

GAS MIXING SUPPLY DEVICE, SUPPLY SYSTEM, AND GAS MIXING SUPPLY METHOD

BACKGROUND

5 1. Field of the Invention

The present disclosure relates to a gas mixing supply device, a supply system, and a gas mixing supply method, and more particularly, to a gas mixing supply device, a supply system, and a gas mixing supply method for supplying a supply gas to a gas-based apparatus at an appropriate concentration.

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2. Discussion of Related Art

In general, apparatuses using a gas are made to use a supply gas suitable for every purpose, and it is required to satisfy a certain concentration and pressure according to every purpose and the types of supply gases.

15 In particular, in the case of a gas supply device that supplies the gas to a gas-based apparatus in which precise work is performed, such as a semiconductor processing apparatus, it is required that the concentration, the pressure, the temperature, and the like satisfy a precise error range.

20 FIG. 1 illustrates a gas supply device that supplies a gas to a semiconductor processing apparatus according to an embodiment of the related art.

Referring to FIG. 1, the gas supply device according to the related art includes a mixing system 1 that mixes a plurality of types of gases, a tank 2 that stores a mixed gas supplied from the mixing system 1, and a supply system 3 that supplies the gas stored in the tank to a gas-based apparatus S that is the
25 semiconductor processing apparatus.

The mixing system 1 includes a plurality of source gas supply lines 11 and 21 which are connected to a plurality of source gas supply tanks 10 and 20 in which different types of source gases are stored and to which a plurality of types of source gases are supplied, a mixing unit 30 in which the plurality of types of source gases supplied from the plurality of source gas supply lines 11 and 21 are mixed, and a mixing gas supply line 31 through which the gas mixed in the mixing unit 30 flows to the tank 2.

The plurality of source gas supply lines 11 and 21 are provided with pressure relief valves (PRVs) 12 and 22 and mass flow controllers (MFCs) 13 and 23 that control the pressure and the flow rate of the source gas supplied along respective flow paths, and source gas valves 14 and 24 that open or close the respective flow paths.

A controller (not illustrated) controls the PRVs 12 and 22, the MFCs 13 and 23, and the source gas valve 14 and 24 to adjust the pressure and the flow rate of the source gas supplied along the respective flow paths and whether the source gas is supplied so as to adjust the concentration and the pressure of the supply gas.

The supply system 3 includes a tank gas supply line 40 through which the gas stored in the tank 2 flows to the gas-based apparatus S and a tank gas supply line valve 41 that opens or closes the tank gas supply line 40.

When the supply gas is supplied to the gas-based apparatus S, the controller opens the tank gas supply line valve 41 to supply the gas stored in the tank 2 to the gas-based apparatus S.

In the related art as described above, in an initial step of supplying the supply gas to the tank 2 through the mixing system 1, a flow rate hunting phenomenon occurs due to the structural limitation of the mixing system 1, and thus

the concentration of the gas stored in the tank 2 becomes irregular.

Further, in the initial step of supplying the supply gas to the tank 2 through the mixing system 1, as the gas remaining in the mixing gas supply line 31 is introduced and stored in the tank 2 together with the gas newly supplied through the mixing unit 30, the concentration of the gas inside the tank 2 does not satisfy the concentration range of the gas required by the gas-based apparatus S.

Further, when a time has elapsed after the mixed gas is stored in the tank 2, a change in the atmosphere inside the tank 2 such as separation of the mixed gas inside the tank 2 into a plurality of types of gas layers or reaction and precipitation of the plurality of types of gases with each other may occur. Thus, the concentration of the gas supplied from the tank 2 to the gas-based apparatus S through the supply system does not satisfy the concentration range of the gas required by the gas-based apparatus S.

Accordingly, discussions on a gas supply device and a gas supply method for stably supplying a gas satisfying a certain concentration range to the gas-based apparatus S are being actively conducted.

Korean Patent No. 10-1659200 is an example of the related art for the gas supply device described above.

SUMMARY OF THE INVENTION

The present disclosure is conceived to solve the above problems, and the purpose of the present disclosure is to provide a gas mixing supply device, a supply system, and a gas mixing supply method for supplying a supply gas to a gas-based apparatus while maintaining the concentration of the supply gas to be constant.

According to an aspect of the present disclosure, there is provided a gas

mixing supply device including a mixing system configured to mix a plurality of types of gases and supply the mixed gas to a tank, a supply system configured to supply a supply gas stored in the tank to a gas-based apparatus, and a controller configured to control driving of the mixing system, the tank, and the supply system.

5 The supply system may include a tank gas concentration analysis unit configured to measure a concentration of the supply gas flowing through a tank gas supply line connecting the tank and the gas-based apparatus, and the controller may determine whether the supply gas supplied to the gas-based apparatus is appropriate by comparing the concentration of the supply gas measured by the tank gas
10 concentration analysis unit with a preset reference concentration range.

 The supply system may include a tank gas supply line valve that opens or closes the tank gas supply line, the controller may open the tank gas supply line valve when the concentration of the supply gas measured by the tank gas concentration analysis unit satisfies the reference concentration range, and the
15 controller may close the tank gas supply line valve when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the reference concentration range.

 The supply system may include a tank gas vent line branched off from the tank gas supply line and connected to an external unit and a tank gas vent line valve
20 that opens or closes the tank gas vent line, the controller may close the tank gas vent line valve when the concentration of the supply gas measured by the tank gas concentration analysis unit satisfies the reference concentration range, and the controller may open the tank gas vent line valve when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the
25 reference concentration range.

The mixing system may include a plurality of source gas supply lines, a mixing unit in which a plurality of different types of source gases supplied from the plurality of source gas supply lines are mixed to form the supply gas, and a mixing gas supply line connecting the mixing unit and the tank, wherein the plurality of
5 different types of source gases are each supplied to one of the plurality of source gas supply lines.

When the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the preset reference concentration range, the controller may calculate a concentration correction value so that the
10 concentration of the supply gas flowing through the tank gas supply line satisfies the reference concentration range, and then the controller may correct the concentration of the supply gas supplied to the tank through the mixing system by applying the concentration correction value to the mixing system.

The plurality of source gas supply lines may include at least one pressure
15 relief valve configured to adjust supply pressures of the plurality of different types of source gases and at least one mass flow controller configured to adjust supply flow rates of the plurality of different types of source gases, and when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the preset reference concentration range, the controller may adjust the pressure relief
20 valve and the mass flow controller according to the concentration correction value to adjust a ratio of each of the source gases mixed in the mixing unit so as to correct the concentration of the supply gas supplied to the tank through the mixing gas supply line.

The mixing system may include a mixing gas supply line valve that opens or
25 closes the mixing gas supply line, a mixing gas vent line branched off from the

mixing gas supply line and connected to an external unit, and a mixing gas vent line valve that opens or closes the mixing gas vent line.

The mixing system may further include a mixing gas concentration analysis unit configured to measure the concentration of the supply gas flowing through the mixing gas supply line, the controller may open the mixing gas supply line valve and close the mixing gas vent line valve when the concentration of the supply gas measured by the mixing gas concentration analysis unit satisfies the preset reference concentration range, and the controller may close the mixing gas supply line valve and open the mixing gas vent line valve when the concentration of the supply gas measured by the mixing gas concentration analysis unit does not satisfy the preset reference concentration range.

The mixing system may further include a mixing gas pressure measurement unit configured to measure a pressure of the supply gas flowing through the mixing gas supply line, the controller may open the mixing gas supply line valve and close the mixing gas vent line valve when a pressure of the supply gas measured by the mixing gas pressure measurement unit is larger than or equal to a gas pressure inside the tank, and the controller may close the mixing gas supply line valve and open the mixing gas vent line valve when the pressure of the supply gas measured by the mixing gas pressure measurement unit is smaller than the gas pressure inside the tank.

The mixing system may further include a mixing gas vent mass flow controller configured to adjust an opening degree of the mixing gas vent line to adjust a discharge amount of the supply gas discharged through the mixing gas vent line.

The tank may be a batch-type tank.

The supply system may include a tank gas concentration analysis line branched off from the tank gas supply line and a tank gas concentration analysis line valve that opens or closes the tank gas concentration analysis line, and the tank gas concentration analysis unit may measure the concentration of the supply gas flowing
5 through the tank gas concentration analysis line when the tank gas concentration analysis line valve is opened by the control of the controller.

The mixing system may include a mixing gas concentration analysis line branched off from the mixing gas supply line and a mixing gas concentration analysis line valve that opens or closes the mixing gas concentration analysis line,
10 and the mixing gas concentration analysis unit may measure the concentration of the supply gas flowing through the tank gas concentration analysis line when the mixing gas concentration analysis line valve is opened by control of the controller.

The mixing system may include a mixing gas pressure measurement line branched off from the mixing gas supply line and a mixing gas pressure
15 measurement line valve that opens or closes the mixing gas pressure measurement line, and the mixing gas pressure measurement unit may measure the pressure of the supply gas flowing through the mixing gas pressure measurement line when the mixing gas pressure measurement line valve is opened by control of the controller.

According to another aspect of the present disclosure, there is provided a gas
20 mixing supply method in which a controller controls a supply system configured to supply a supply gas stored in a tank to a gas-based apparatus so as to supply the supply gas stored in the tank to the gas-based apparatus, the method including the steps of a) measuring the concentration of the supply gas flowing through a tank gas supply line connecting the tank and the gas-based apparatus by a tank gas
25 concentration analysis unit of a supply system configured to supply the supply gas

stored in the tank to the gas-based apparatus, and b) determining, by a controller, whether the supply gas supplied to the gas-based apparatus is appropriate by comparing the concentration of the supply gas measured by the tank gas concentration analysis unit with a preset reference concentration range.

5 The controller may open a tank gas supply line valve that opens or closes the tank gas supply line when the concentration of the supply gas measured by the tank gas concentration analysis unit satisfies the reference concentration range, and the controller may close the tank gas supply line valve when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the
10 reference concentration range.

 The controller may close a tank gas vent line valve that opens or closes a tank gas vent line branched off from the tank gas supply line and connected to an external unit when the concentration of the supply gas measured by the tank gas concentration analysis unit satisfies the reference concentration range, and the
15 controller may open the tank gas vent line valve when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the reference concentration range.

 Prior to step a), a mixing gas supply step of mixing a plurality of types of gases through a mixing system and supplying the mixed gas to the tank may be
20 performed, and when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the reference concentration range, step c) discharging the supply gas flowing from the tank to the tank gas supply line to the outside by closing the tank gas supply line valve that opens or closes the tank gas supply line and by opening a tank gas vent line valve that opens or closes a tank gas
25 vent line branched off from the tank gas supply line and connected to an external unit

may be further performed, and then the mixing gas supply step may be performed again.

Prior to step a), a mixing gas supply step of mixing a plurality of types of gases through a mixing system and supplying the mixed gas to the tank may be performed, step b) may further include calculating, by a controller, a concentration correction value so that the concentration of the supply gas flowing through the tank gas supply line satisfies the reference concentration range, and when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the reference concentration range, the controller may apply the concentration correction value to the mixing system to correct the concentration of the supply gas supplied to the tank through the mixing system.

The method may further include, when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the reference concentration range, the steps of c) discharging the supply gas flowing from the tank to the tank gas supply line to the outside by closing the tank gas supply line valve that opens or closes the tank gas supply line and by opening a tank gas vent line valve that opens or closes a tank gas vent line branched off from the tank gas supply line and connected to an external unit, and d) performing the mixing gas supply step again, and correcting the concentration of the supply gas supplied to the tank through the mixing system by applying the concentration correction value to the mixing system.

The mixing system may include a plurality of source gas supply lines, a mixing unit in which a plurality of different types of source gases supplied from the plurality of source gas supply lines are mixed to form the supply gas, and a mixing gas supply line connecting the mixing unit and the tank, wherein the plurality of

different types of source gases are each supplied to one of the plurality of source gas supply lines, the plurality of source gas supply lines may include at least one pressure relief valve configured to adjust supply pressures of the plurality of different types of source gases and at least one mass flow controller configured to adjust supply flow rates of the plurality of different types of source gases, and step d) may include correcting the concentration of the supply gas supplied to the tank through the mixing gas supply line by adjusting a ratio of each of the source gases mixed in the mixing unit by adjusting the pressure relief valve and the mass flow controller according to the concentration correction value.

10 The mixing system may include a mixing gas vent line branched off from the mixing gas supply line and connected to an external unit, and a mixing gas vent line valve that opens or closes the mixing gas vent line, and the controller may control driving of the mixing gas vent line valve to control whether to discharge the supply gas flowing through the mixing gas supply line.

15 The mixing system further includes a mixing gas concentration analysis unit configured to measure the concentration of the supply gas flowing through the mixing gas supply line, and when the supply gas is supplied to the tank through the mixing system, the controller may open the mixing gas supply line valve and close the mixing gas vent line valve when the concentration of the supply gas measured by
20 the mixing gas concentration analysis unit satisfies the preset reference concentration range, and the controller may close the mixing gas supply line valve and open the mixing gas vent line valve when the concentration of the supply gas measured by the mixing gas concentration analysis unit does not satisfy the preset reference concentration range.

25 The mixing system may further include a mixing gas pressure measurement

unit configured to measure the pressure of the supply gas flowing through the mixing gas supply line, and when the supply gas is supplied to the tank through the mixing system, the controller may close the mixing gas supply line valve and open the mixing gas vent line valve when the pressure of the supply gas measured by the mixing gas pressure measurement unit is lower than a gas pressure inside the tank, and the controller may open the mixing gas supply line valve and close the mixing gas vent line valve when the pressure of the supply gas measured by the mixing gas pressure measurement unit is higher than or equal to the gas pressure inside the tank.

The mixing system may further include a mixing gas vent mass flow controller configured to adjust an opening degree of the mixing gas vent line, and when the mixing gas vent line valve is opened, and thus the supply gas is discharged to the outside through the mixing gas vent line, the controller may adjust the mixing gas vent mass flow controller to adjust a discharge amount of the supply gas discharged through the mixing gas vent line.

The supply system may include a tank gas concentration analysis line branched off from the tank gas supply line and a tank gas concentration analysis line valve that opens or closes the tank gas concentration analysis line, when the tank gas concentration analysis line valve is opened by control of the controller, the tank gas concentration analysis unit may measure the concentration of the supply gas flowing through the tank gas concentration analysis line, and step a) may include allowing the supply gas supplied from the tank to the tank gas supply line to flow to the tank gas concentration analysis line by opening, by a controller, the tank gas concentration analysis line.

Steps a) and b) may be performed in real time or at predetermined time intervals while the supply gas stored in the tank is supplied to the gas-based

apparatus.

The mixing system may include a mixing gas concentration analysis line branched off from the mixing gas supply line and a mixing gas concentration analysis line valve that opens or closes the mixing gas concentration analysis line, and the mixing gas concentration analysis unit may measure the concentration of the supply gas flowing through the tank gas concentration analysis line when the mixing gas concentration analysis line valve is opened by control of the controller.

The mixing gas concentration analysis unit may measure the concentration of the supply gas flowing through the mixing gas supply line in real time or at predetermined time intervals while the supply gas is supplied to the tank through the mixing system, and the controller may control the mixing gas vent line valve and the mixing gas supply line valve in real time according to the concentration of the supply gas measured by the mixing gas concentration analysis unit.

The mixing gas pressure measurement unit may measure the pressure of the supply gas flowing through the mixing gas supply line in real time or at predetermined time intervals while the supply gas is supplied to the tank through the mixing system, and the controller may control the mixing gas vent line valve and the mixing gas supply line valve in real time according to the pressure of the supply gas measured by the mixing gas pressure measurement unit.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present disclosure will become more apparent to those of ordinary skill in the art by describing exemplary embodiments thereof in detail with reference to the accompanying drawings, in which:

FIG. 1 is a schematic view illustrating a gas mixing supply device according to the related art;

FIG. 2 is a schematic view illustrating a gas mixing supply device and a supply system according to a first embodiment of the present disclosure;

5 FIG. 3 is a schematic view illustrating a gas mixing supply device and a supply system according to a second embodiment of the present disclosure; and

FIG. 4 is a flowchart illustrating a gas mixing supply method according to the present disclosure.

10 DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

Hereinafter, configurations and operations of a gas mixing supply device and a supply system according to the present disclosure will be described in detail with reference to the accompanying drawings.

15 Here, detailed descriptions of the contents described in the background art and overlapping contents will be omitted, and descriptions will be made focusing on components newly added to the present disclosure.

FIG. 2 illustrates a gas mixing supply device and a supply system according to a first embodiment of the present disclosure.

20 The gas mixing supply device according to the first embodiment of the present disclosure includes a mixing system 100 that mixes and supplies a plurality of types of gases, a tank 200 that stores a supply gas supplied from the mixing system 100, a supply system 300 that supplies the supply gas stored in the tank 2 to the gas-based apparatus S, and a controller (not illustrated) that controls driving of the mixing system 100, the tank 200, and the supply system 300.

25 The supply system 300 includes a tank gas supply line 320 that connects the

tank 200 and the gas-based apparatus S and a tank gas concentration analysis unit 310 that measures the concentration of the supply gas flowing in the tank gas supply line 320.

5 The controller determines whether the supply gas supplied to the gas-based apparatus S is appropriate by comparing the concentration of the supply gas measured by the tank gas concentration analysis unit 310 with a preset reference concentration range.

The mixing system 100, the tank 200, and the supply system 300 may be connected to each other to constitute the gas mixing supply device.

10 Further, the mixing system 100, the tank 200, and the supply system 300 may be formed as separate devices but may be coupled to each other to constitute the gas mixing supply device.

The supply system 300 may further include a tank gas supply line valve 321 that opens or closes the tank gas supply line 320.

15 The controller controls the driving of the tank gas supply line valve 321 to control whether the supply gas is supplied to the gas-based apparatus S.

When the concentration of the supply gas measured by the tank gas concentration analysis unit 310 satisfies the reference concentration range, the controller may control the tank gas supply line valve 321 to be opened to supply the
20 supply gas stored in the tank 200 to the gas-based apparatus S.

Further, when the concentration of the supply gas measured by the tank gas concentration analysis unit 310 does not satisfy the reference concentration range, the controller may control the tank gas supply line valve 321 to be closed to block the supply of the supply gas to the gas-based apparatus S.

25 The supply system 300 may further include a tank gas vent line 330

branched off from the tank gas supply line 320 and connected to an external unit, and a tank gas vent line valve 331 that opens or closes the tank gas vent line 330.

The controller controls the driving of the tank gas supply line valve 321 to control whether the supply gas is discharged through the tank gas vent line 330.

5 When the concentration of the supply gas measured by the tank gas concentration analysis unit 310 satisfies the reference concentration range, the controller may control the tank gas vent line valve 331 to be closed so as to allow the supply gas supplied from the tank 200 to flow to the gas-based apparatus S along the tank gas supply line 320 without being discharged to the outside.

10 Further, when the concentration of the supply gas measured by the tank gas concentration analysis unit 310 does not satisfy the reference concentration range, the controller may control the tank gas supply line valve 321 to be opened so as to allow the supply gas supplied from the tank 200 to be discharged to the outside through the tank gas vent line 330.

15 When the tank gas supply line valve 321 or the tank gas vent line valve 331 is opened by the control of the controller, the tank gas concentration analysis unit 310 may be configured to measure the concentration of the supply gas supplied from the tank 200.

20 Further, when the concentration of the supply gas measured by the tank gas concentration analysis unit 310 does not satisfy the preset reference concentration range, the controller may calculate a concentration correction value so that the concentration of the supply gas flowing through the tank gas supply line 320 satisfies the reference concentration range.

25 The concentration correction value may be formed by the amount, the concentration, the pressure or the like of at least one source gas of the plurality of

source gases supplied through the plurality of source gas supply lines 110 and 120 and mixed in the mixing unit 130 and may be formed by an increase value or a decrease value based on a setting value of the amount, the concentration, the pressure or the like of each source gas, which is preset in the mixing system 100.

5 The controller may apply the calculated concentration correction value to the mixing system 100 and correct the concentration of the supply gas supplied to the tank 200 through the mixing system 100 according to the concentration correction value to perform control so that the concentration of the supply gas supplied to the gas-based apparatus S from the tank 200 satisfies an appropriate range.

10 The mixing system 100 may include the plurality of source gas supply lines 110 and 120 to which the plurality of different types of source gases are respectively supplied, the mixing unit 130 in which the plurality of different types of source gases supplied from the plurality of source gas supply lines 110 and 120 are mixed to form the supply gas, and a mixing gas supply line 140 that connects the mixing unit 130
15 and the tank 200.

 The source gas supply lines 110 and 120 may be connected to source gas supply tanks 101 and 102 configured to supply the source gases.

 The source gas supply lines 110 and 120 may include one or more pressure relief valves 111 and 121 configured to adjust the supply pressures of the plurality of
20 different types of source gases and one or more mass flow controllers 112 and 122 configured to adjust the supply flow rates of the plurality of different types of source gases and may include source gas valves 113 and 123 configured to respectively open or close the source gas supply lines 110 and 120 so as to control whether each source gas is supplied.

25 Driving of the pressure relief valves 111 and 121, the mass flow controllers

112 and 122, and the source gas valves 113 and 123 may be controlled by the controller.

When the concentration of the supply gas measured by the tank gas concentration analysis unit 310 does not satisfy the preset reference concentration range, the controller may control the driving of the pressure relief valves 111 and 121, the mass flow controllers 112 and 122, and the source gas valves 113 and 123 to adjust the ratios of the source gases introduced into and mixed in the mixing unit 130 so as to correct the concentration of the supply gas supplied from the mixing unit 130 to the tank 200.

The mixing system 100 may further include a mixing gas supply line valve 141 that opens or closes the mixing gas supply line 140, and the controller may control driving of the mixing gas supply line valve 141 to control whether to supply the supply gas mixed and formed in the mixing unit 130 to the tank 200.

The mixing system 100 may further include a mixing gas vent line 150 branched off from the mixing gas supply line 140 and connected to an external unit, and a mixing gas vent line valve 151 that opens or closes the mixing gas vent line 150 and may further include a mixing gas vent mass flow controller 152 that adjusts the opening degree of the mixing gas vent line 150.

The controller may control driving of the mixing gas vent line valve 151 to control whether the supply gas flowing through the mixing gas supply line 140 is discharged and may adjust the mixing gas vent mass flow controller 152 to adjust the discharge amount of the supply gas discharged through the mixing gas vent line 150 so as to adjust the pressure of the supply gas flowing through the mixing gas supply line 140.

The mixing system 100 may further include a mixing gas concentration

analysis unit 160 that measures the concentration of the supply gas flowing through the mixing gas supply line 140, and a mixing gas pressure measurement unit 170 that measures the pressure of the supply gas flowing through the mixing gas supply line 140.

5 When the tank gas supply line valve 321 or the mixing gas vent line valve 151 is opened by the control of the controller, the mixing gas concentration analysis unit 160 and the mixing gas pressure measurement unit 170 may be configured to measure the concentration and the pressure, respectively, of the supply gas flowing through the mixing gas supply line 140.

10 When the concentration of the supply gas measured by the mixing gas concentration analysis unit 160 satisfies the present reference concentration range, the controller may control the mixing gas supply line valve 141 to be opened and the mixing gas vent line valve 151 to be closed so that the supply gas supplied from the mixing unit 130 flows to and is stored in the tank 200 along the mixing gas supply
15 line 140 without being discharged to the outside.

 Further, when the concentration of the supply gas measured by the mixing gas concentration analysis unit 160 does not satisfy the preset reference concentration range, the controller may control the mixing gas supply line valve 141 to be closed and the mixing gas vent line valve 151 to be opened so that the supply
20 gas flowing through the mixing gas supply line 140 is discharged to the outside, and at the same time, the supply of the supply gas to the tank 200 is blocked.

 Further, when the concentration of the supply gas measured by the mixing gas pressure measurement unit 170 is higher than or equal to the gas pressure inside the tank 200, the controller may control the mixing gas supply line valve 141 to be
25 opened and the mixing gas vent line valve 151 to be closed so that the supply gas

supplied from the mixing unit 130 flows to and is stored in the tank 200 along the mixing gas supply line 140 without being discharged to the outside.

Further, when the concentration of the supply gas measured by the mixing gas pressure measurement unit 170 is lower than the gas pressure inside the tank 200,
5 the controller may control the mixing gas supply line valve 141 to be closed and the mixing gas vent line valve 151 to be opened so that the supply gas flowing through the mixing gas supply line 140 is discharged to the outside, and at the same time, the supply of the supply gas to the gas-based apparatus S is blocked.

The tank 200 is made of a material having a predetermined thickness, high
10 stiffness, heat resistance, and pressure resistance so as to store high-temperature and high-pressure gas and is made of a material having chemical resistance and corrosion resistance so as not to cause a change in properties of the stored gas due to degeneration or corrosion in reaction to the gas.

A material satisfying the conditions is stainless steel (SUS). The SUS has
15 high rigidity, excellent heat resistance, excellent corrosion resistance, excellent chemical resistance, good accessibility, and economical advantages, and thus is one of the materials widely used in various fields.

The tank 200 may be a batch type tank in which an internal pressure is formed between an upper pressure limit and a lower pressure limit.

20 The tank 200 may be provided with a tank pressure measurement unit 210 that measures the internal gas pressure.

FIG. 3 illustrates a gas mixing supply device and a supply system according to a second embodiment of the present disclosure.

The gas mixing supply device according to the second embodiment of the
25 present disclosure follows the description in the first embodiment but is different

therefrom according to the first embodiment in that the supply system 300 further includes a tank gas concentration analysis line 340 branched off from the tank gas supply line 320 and a tank gas concentration analysis line valve 341 that opens or closes the tank gas concentration analysis line 340, and the tank gas concentration analysis unit 310 measures the concentration of the gas flowing along the tank gas concentration analysis line 340.

According to the second embodiment, when the tank gas concentration analysis line valve 341 is opened by the control of the controller, the tank gas concentration analysis unit 310 measures the concentration of the supply gas flowing from the tank 200 to the tank gas concentration analysis line 340.

The tank gas concentration analysis line 340 may be provided to have a smaller cross-sectional area than those of the tank gas supply line 320 and the tank gas vent line 330 and may allow the supply gas, which has a minimum flow rate required to measure the concentration of the gas, to flow due to the tank gas concentration analysis unit 310.

That is, the tank gas concentration analysis line 340 may be configured such that the supply gas having a significantly lower flow rate than those of the tank gas supply line 320 and the tank gas vent line 330 flows.

Accordingly, by measuring the concentration and the pressure in a state in which the supply gas flows to the tank gas concentration analysis line 340, the amount of consumed supply gas can be reduced and efficiency of the device can be increased as compared to a case in which the concentration and the pressure are measured in a state in which the supply gas flows to the tank gas supply line 320 or the tank gas vent line 330.

The controller may control driving of the tank gas concentration analysis line

valve 341 to control whether to measure the concentration of the supply gas supplied from the tank 200.

The tank gas concentration analysis line 340 may be connected to an external unit.

5 Further, in the gas mixing supply device according to the second embodiment of the present disclosure, the mixing system 100 includes a mixing gas concentration analysis line 180 branched off from the mixing gas supply line 140, and the mixing gas concentration analysis unit 160 is configured to measure the concentration of the supply gas flowing along the mixing gas concentration analysis
10 line 180.

The mixing system 100 may further include a mixing gas concentration analysis line valve 181 that opens or closes the mixing gas concentration analysis line 180.

The mixing gas concentration analysis unit 160 may measure the
15 concentration of the supply gas when the mixing gas concentration analysis line valve 181 is opened by the control of the controller and the supply gas flows from the mixing unit 130 to the mixing gas concentration analysis line 180.

Further, in the gas mixing supply device according to the second embodiment of the present disclosure, the mixing system 100 includes a mixing gas
20 pressure measurement line 190 branched off from the mixing gas supply line 140, and the mixing gas pressure measurement unit 170 is configured to measure the pressure of the supply gas flowing along the mixing gas pressure measurement line 190.

The mixing system 100 may further include a mixing gas pressure
25 measurement line valve 191 that opens or closes the mixing gas pressure

measurement line 190.

The mixing gas pressure measurement unit 170 may measure the pressure of the supply gas when the mixing gas pressure measurement line valve 191 is opened by the control of the controller and the supply gas flows from the mixing unit 130 to the mixing gas pressure measurement line 190.

The mixing gas concentration analysis line 180 and the mixing gas concentration analysis line valve 181 may allow the gas to flow only as much as a flow rate required for the mixing gas concentration analysis unit 160 to measure the concentration of the gas, and the mixing gas pressure measurement line 190 and the mixing gas pressure measurement line valve 191 may allow the gas to flow only as much as a flow rate required for the mixing gas pressure measurement unit 170 to measure the pressure of the gas.

The mixing gas concentration analysis line 180 and the mixing gas pressure measurement line 190 may be provided to have a cross-sectional area smaller than that of the mixing gas vent line 150 and may allow the supply gas, which has a minimum flow rate required for the mixing gas concentration analysis unit 160 and the mixing gas pressure measurement unit 170 to measure the concentration and the pressure of the gas, to flow.

That is, the mixing gas concentration analysis line 180 and the mixing gas pressure measurement line 190 may be configured such that the supply gas having a significantly lower flow rate than those of the mixing gas supply line 140 and the mixing gas vent line 150 flows.

Accordingly, by measuring the concentration and the pressure in a state in which the supply gas flows to the mixing gas concentration analysis line 180 or the mixing gas pressure measurement line 190, the amount of consumed supply gas can

be reduced and efficiency of the device can be increased, as compared to a case in which the concentration and the pressure are measured in a state in which the supply gas flows to the mixing gas supply line 140 or the mixing gas vent line 150.

The controller may control driving of the mixing gas concentration analysis line valve 181 and the mixing gas pressure measurement line valve 191 to control whether to measure the concentration and the pressure of the supply gas supplied from the mixing unit 130.

The mixing gas concentration analysis line 180 and the mixing gas pressure measurement line 190 may be connected to an external unit.

Further, although not illustrated in the drawing, the mixing gas concentration analysis line 180 and the mixing gas pressure measurement line 190 may be configured as one analysis measurement line (not illustrated), and the mixing gas concentration analysis line valve 181 and the mixing gas pressure measurement line valve 191 may be configured as one analysis measurement valve (not illustrated) that opens or closes the analysis measurement line.

In this case, when the analysis measurement valve is opened by the control of the controller, the supply gas flows to the analysis measurement line. Using the same, the mixing gas concentration analysis unit 160 measures the concentration of the gas, and at the same time, the mixing gas pressure measurement unit 170 measures the pressure of the gas.

Hereinafter, a gas mixing supply method using the gas mixing supply device and the supply system of the present disclosure will be described with reference to FIG. 4.

Steps S10 to S40 are steps of supplying the supply gas to the tank 200 through the mixing system 100.

Step S10 is a step of mixing the plurality of source gases supplied through one or more source gas supply lines 110 and 120 in the mixing unit 130 to form the supply gas.

5 The controller opens the source gas valves 113 and 123 to allow the source gas to flow from the source gas supply tanks 101 and 102 to the source gas supply lines 110 and 120 and, at the same time, adjusts the pressure relief valves 111 and 121 and the mass flow controllers 112 and 122 to adjust the pressure and the flow rate of the source gas so as to adjust the concentration of the supply gas mixed in the mixing unit 130.

10 Step S20 is a step in which the controller determines whether to store the supply gas supplied from the mixing unit 130 to the mixing gas supply line 140 in the tank 200.

The controller determines whether to store the supply gas supplied from the mixing unit 130 to the mixing gas supply line 140 in the tank 200 by comparing the
15 concentration of the supply gas measured by the mixing gas concentration analysis unit 160 with the preset reference concentration range and comparing the pressure of the supply gas measured by the mixing gas pressure measurement unit 170 with the gas pressure inside the tank 200 measured by the tank pressure measurement unit 210.

20 To this end, the controller may open the mixing gas supply line valve 141 or the mixing gas vent line valve 151 to allow the supply gas supplied from the mixing unit 130 to the mixing gas supply line 140 to flow to the mixing gas supply line 140 (see FIG. 2).

Further, the controller may open the mixing gas concentration analysis line
25 valve 181 and the mixing gas pressure measurement line valve 191 to allow the

supply gas supplied from the mixing unit 130 to the mixing gas supply line 140 to flow to the mixing gas concentration analysis line 180 and the mixing gas pressure measurement line 190 (see FIG. 3).

When the concentration of the supply gas measured by the mixing gas concentration analysis unit 160 does not satisfy the preset reference concentration range or the pressure measured by the mixing gas pressure measurement unit 170 is lower than the pressure inside the tank 200, the controller determines that the supply gas is not stored in the tank 200 and performs step S30 which will be described below.

Further, when the concentration of the supply gas measured by the mixing gas concentration analysis unit 160 satisfies the preset reference concentration range or the pressure measured by the mixing gas pressure measurement unit 170 is higher than or equal to the pressure inside the tank 200, the controller determines that the supply gas is stored in the tank 200 and performs step S40 which will be described below.

Step S30 is a step of discharging the supply gas flowing through the mixing gas supply line 140 to the outside.

The controller closes the mixing gas supply line valve 141 and opens the mixing gas vent line valve 151 to control the supply gas supplied from the mixing unit 130 to be discharged to the outside through the mixing gas vent line 150 without flowing to the tank 200.

Accordingly, the supply gas that does not satisfy an appropriate concentration range can be prevented from being stored in the tank 200, and as the supply gas having a pressure lower than the pressure inside the tank 200 flows through the mixing gas supply line 140, occurrence of a gas back flow and a hunting

phenomenon can be prevented.

In this case, the mixing gas vent mass flow controller 152 may be provided to maintain a state of being adjusted to a predetermined opening degree.

Further, the controller may control the mixing gas vent mass flow controller
5 152 to adjust the opening degree of the mixing gas vent line 150 so as to adjust the pressure of the supply gas flowing through the mixing gas supply line 140.

Further, the mixing gas vent mass flow controller 152 may be provided to enable manual adjustment.

The controller performs step S30 until the concentration of the supply gas
10 measured by the mixing gas concentration analysis unit 160 satisfies the preset reference concentration range, and at the same time, the pressure of the supply gas measured by the mixing gas pressure measurement unit 170 satisfies a storage condition that satisfies the pressure inside the tank 200 measured by the tank pressure measurement unit 210 and performs S40 when the storage condition is satisfied.

15 Step S40 is a step of introducing and storing the supply gas flowing through the mixing gas supply line 140 in the tank 200.

The controller controls the mixing gas supply line valve 141 to be opened and the mixing gas vent line valve 151 to be closed so that the supply gas supplied from the mixing unit 130 flows to and is stored in the tank 200 through the mixing
20 gas supply line 140 without being discharged to the outside through the mixing gas vent line 150.

Further, the controller maintains the tank gas supply line valve 321 in a closed state while the supply gas is stored in the tank 200.

Further, while step S40 is performed, the controller may check whether the
25 supply gas having an appropriate concentration and an appropriate pressure is stored

in the tank 200 by receiving the concentration of the supply gas measured by the mixing gas concentration analysis unit 160 and the pressure of the supply gas measured by the mixing gas pressure measurement unit 170 in real time or at regular time intervals.

5 Further, while step S40 is performed, the controller may perform S30 when the concentration of the supply gas measured by the mixing gas concentration analysis unit 160 does not satisfy the preset reference concentration range or the pressure measured by the mixing gas pressure measurement unit 170 is lower than the pressure inside the tank 200.

10 That is, the controller may control the mixing gas vent line valve 151 and the mixing gas supply line valve 141 in real time according to the concentration of the supply gas measured by the mixing gas concentration analysis unit 160 and the pressure of the supply gas measured by the mixing gas pressure measurement unit 170 so as to store the supply gas having an appropriate concentration and an
15 appropriate pressure in the tank 200.

Step S40 may be performed until the pressure inside the tank 200 reaches a preset pressure upper limit value.

Steps S50 to S60 are steps of supplying the supply gas stored in the tank 200 to the gas-based apparatus S through the supply system 300.

20 Step S50 is a step in which the controller determines whether to supply the supply gas stored in the tank 200 to the gas-based apparatus S.

The controller determines whether to supply the supply gas supplied from the tank 200 to the tank gas supply line 320 to the gas-based apparatus S by comparing the concentration of the supply gas measured by the tank gas
25 concentration analysis unit 310 with the preset reference concentration range.

To this end, the controller may open the tank gas supply line valve 321 or the tank gas vent line valve 331 to allow the supply gas supplied from the tank 200 to flow to the mixing gas supply line 140 (see FIG. 2).

Further, the controller may open the mixing gas concentration analysis line valve 181 to allow the supply gas supplied from the tank 200 to the tank gas supply line 320 to flow to the tank gas concentration analysis line 340 (see FIG. 3).

When the concentration of the supply gas supplied from the tank 200 satisfies the preset reference concentration range, the controller determines that the supply gas is supplied to the gas-based apparatus S and performs step S60 which will be described below.

Further, when the concentration of the supply gas supplied from the tank 200 does not satisfy the preset reference concentration range, the controller determines that the supply gas is not supplied to the gas-based apparatus S and performs step S70 which will be described below.

Step S60 is a step of allowing the supply gas to flow and be supplied through the tank gas supply line 320 in the gas-based apparatus S.

The controller controls the tank gas supply line valve 321 to be opened and the tank gas vent line valve 331 to be closed so that the supply gas supplied from the tank 200 flows to and is consumed in the gas-based apparatus S through the tank gas supply line 320 without being discharged to the outside through the tank gas vent line 330.

Further, while step S60 is performed, the controller may check whether the supply gas having an appropriate concentration is supplied to the gas-based apparatus S by receiving the concentration of the supply gas measured by the tank gas concentration analysis unit 310 in real time or at regular time intervals.

Further, while step S60 is performed, the controller may perform S70, which will be described below, when the concentration of the supply gas measured by the tank gas concentration analysis unit 310 does not satisfy the preset reference concentration range.

5 That is, the controller may control the tank gas vent line valve 331 and the tank gas supply line valve 321 in real time according to the concentration of the supply gas measured by the tank gas concentration analysis unit 310 so that the supply gas having an appropriate concentration is supplied to the gas-based apparatus S.

10 Further, when the pressure inside the tank 200 reaches a lower pressure limit value as the supply gas stored in the tank 200 is supplied to the gas-based apparatus S, the controller may perform steps S10 to S40 again to fill the tank 200 with the supply gas.

 In this case, while a state, in which step S60 of supplying the supply gas to
15 the gas-based apparatus S is performed, is maintained, the controller may continuously supply the supply gas to the gas-based apparatus S by performing steps S10 to S40.

 Steps S70 to S80 are steps of correcting the concentration of the supply gas stored in the tank 200.

20 Step S70 is a step of discharging the supply gas flowing through the tank gas supply line 320 to the outside.

 The controller controls the tank gas supply line valve 321 to be closed and the tank gas vent line valve 331 to be opened so that the supply gas supplied from the tank 200 is discharged to the outside through the tank gas vent line 330 without being
25 supplied to the gas-based apparatus S through the tank gas supply line 320.

Accordingly, a function can be prevented from not being performed smoothly as the supply gas that does not satisfy an appropriate concentration range is supplied to the gas-based apparatus S.

Further, the controller maintains the mixing gas supply line valve 141 in a closed state while the supply gas stored in the tank 200 is discharged.

The controller performs step S70 until all of the supply gas stored in the tank 200 is discharged to the outside through the tank gas vent line 330, performs steps S10 to S40 again to store the supply gas in the tank 200, and then performs step S50 again to correct the concentration of the supply gas stored in the tank 200 to an appropriate concentration.

Further, the controller may correct the concentration of the supply gas stored in the tank 200 to an appropriate concentration by performing steps S10 to S50 again after performing step S80 which will be described below.

Step S80 is a step of correcting the concentration of the supply gas stored in the tank 200 by using a correction value calculated according to the concentration of the supply gas measured by the tank gas concentration analysis unit 310.

The controller may calculate the concentration correction value so that the concentration of the supply gas flowing through the tank gas supply line 320 measured by the tank gas concentration analysis unit 310 satisfies the reference concentration range and then may apply the concentration correction value to the mixing system 100.

Thereafter, as described above, by performing steps S10 to S50 again through the mixing system 100 to which the concentration correction value is applied, the concentration of the supply gas stored in the tank 200 may be corrected to an appropriate concentration.

Accordingly, a function can be prevented from not being performed smoothly as the supply gas that does not satisfy an appropriate concentration range is supplied to the gas-based apparatus S.

As described above, according to the gas mixing supply device, the supply
5 system, and the gas mixing supply method using the same according to the present disclosure, the supply gas may be supplied to the gas-based apparatus S while the concentration of the supply gas is maintained to be constant.

Further, the supply system 300 includes the tank gas concentration analysis
unit 310 to determine in real time whether the supply gas supplied from the tank 200
10 to the gas-based apparatus S is appropriate.

Further, the supply system 300 includes the tank gas vent line 330 and the
tank gas vent line valve 331 to selectively discharge the supply gas supplied from the
tank 200 to the gas-based apparatus S, thereby preventing the supply gas that does
not satisfy the preset reference concentration range from being supplied to the gas-
15 based apparatus S.

Further, the correction value is calculated according to the concentration of
the supply gas measured by the tank gas concentration analysis unit 310 and is
applied to the mixing system 100 to appropriately correct the concentration of the
supply gas newly stored in the tank 200, and thus the concentration of the supply gas
20 supplied to the gas-based apparatus S may be formed within an appropriate range.

According to a gas mixing supply device, a supply system, and a gas mixing
supply method according to the present disclosure, a supply gas can be supplied to a
gas-based apparatus while the concentration of the supply gas is maintained to be
constant.

25 Further, a supply system includes a concentration analysis unit and thus can

determine whether the supply gas supplied from a tank to the gas-based apparatus is appropriate.

Further, the supply system may include a vent line and a vent line valve to selectively discharge the supply gas supplied from the tank to the gas-based apparatus, thereby preventing the supply gas that does not satisfy a preset reference concentration range from being supplied to the gas-based apparatus.

Further, a correction value is calculated according to the concentration of the supply gas measured by a concentration analysis unit and is applied to a mixing system to appropriately correct the concentration of the supply gas newly stored in the tank and thus the concentration of the supply gas supplied to the gas-based apparatus can be formed within an appropriate range.

The present disclosure is not limited to the above-described embodiments, obvious modifications could be made by those skilled in the art to which the present disclosure pertains without departing from the technical spirit of the present disclosure claimed by the appended claims, and the obvious modifications belong to the scope of the present disclosure.

CLAIMS:

1. A gas mixing supply device comprising:

5 a mixing system configured to mix a plurality of types of gases and supply the mixed gas to a tank;

a supply system configured to supply a supply gas stored in the tank to a gas-based apparatus; and

a controller configured to control driving of the mixing system, the tank, and the supply system,

10 wherein the supply system includes a tank gas supply line connecting the tank and the gas-based apparatus, a tank gas concentration analysis line branched off from the tank gas supply line and has a smaller cross-sectional area than that of the tank gas supply line, a tank gas concentration analysis line valve that opens or closes the tank gas concentration analysis line, and a tank gas concentration analysis unit
15 measures the concentration of the gas flowing along the tank gas supply line by measuring the concentration of the gas flowing along the tank gas concentration analysis line, and

wherein the tank gas concentration analysis unit measures the concentration of the supply gas flowing through the tank gas concentration analysis line when the
20 tank gas concentration analysis line valve is opened by control of the controller,

wherein the controller determines whether the supply gas supplied to the gas-based apparatus is appropriate by comparing the concentration of the supply gas measured by the tank gas concentration analysis unit with a preset reference concentration range.

25

2. The gas mixing supply device of claim 1, wherein the supply system includes a tank gas supply line valve that opens or closes the tank gas supply line, and

wherein the controller opens the tank gas supply line valve when the
5 concentration of the supply gas measured by the tank gas concentration analysis unit satisfies the reference concentration range, and the controller closes the tank gas supply line valve when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the reference concentration range.

10 3. The gas mixing supply device of claim 1, wherein the supply system includes a tank gas vent line branched off from the tank gas supply line and connected to an external unit and a tank gas vent line valve that opens or closes the tank gas vent line, and

wherein the controller closes the tank gas vent line valve when the
15 concentration of the supply gas measured by the tank gas concentration analysis unit satisfies the reference concentration range, and the controller opens the tank gas vent line valve when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the reference concentration range.

20 4. The gas mixing supply device of claim 1, wherein the mixing system includes a plurality of source gas supply lines, a mixing unit in which a plurality of different types of source gases supplied from the plurality of source gas supply lines are mixed to form the supply gas, and a mixing gas supply line connecting the mixing unit and the tank, wherein the plurality of different types of source gases are
25 each supplied to one of the plurality of source gas supply lines.

5. The gas mixing supply device of claim 4, wherein, when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the preset reference concentration range, the controller calculates a concentration correction value so that the concentration of the supply gas flowing through the tank gas supply line satisfies the reference concentration range, and then the controller corrects the concentration of the supply gas supplied to the tank through the mixing system by applying the concentration correction value to the mixing system.

10

6. The gas mixing supply device of claim 5, wherein the plurality of source gas supply lines include at least one pressure relief valve configured to adjust supply pressures of the plurality of different types of source gases and at least one mass flow controller configured to adjust supply flow rates of the plurality of different types of source gases, and

wherein, when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the preset reference concentration range, the controller adjusts the pressure relief valve and the mass flow controller according to the concentration correction value to adjust a ratio of each of the source gases mixed in the mixing unit so as to correct the concentration of the supply gas supplied to the tank through the mixing gas supply line.

7. The gas mixing supply device of claim 4, wherein the mixing system includes a mixing gas supply line valve that opens or closes the mixing gas supply line, a mixing gas vent line branched off from the mixing gas supply line and

connected to an external unit, and a mixing gas vent line valve that opens or closes the mixing gas vent line.

8. The gas mixing supply device of claim 7, wherein the mixing system
5 further includes a mixing gas concentration analysis unit configured to measure the concentration of the supply gas flowing through the mixing gas supply line, and

wherein the controller opens the mixing gas supply line valve and closes the mixing gas vent line valve when the concentration of the supply gas measured by the mixing gas concentration analysis unit satisfies the preset reference concentration
10 range, and the controller closes the mixing gas supply line valve and opens the mixing gas vent line valve when the concentration of the supply gas measured by the mixing gas concentration analysis unit does not satisfy the preset reference concentration range.

15 9. The gas mixing supply device of claim 7, wherein the mixing system further includes a mixing gas pressure measurement unit configured to measure a pressure of the supply gas flowing through the mixing gas supply line, and

wherein the controller opens the mixing gas supply line valve and closes the mixing gas vent line valve when the pressure of the supply gas measured by the
20 mixing gas pressure measurement unit is larger than or equal to a gas pressure inside the tank, and the controller closes the mixing gas supply line valve and opens the mixing gas vent line valve when the pressure of the supply gas measured by the mixing gas pressure measurement unit is smaller than the gas pressure inside the tank.

25

10. The gas mixing supply device of claim 7, wherein the mixing system further includes a mixing gas vent mass flow controller configured to adjust an opening degree of the mixing gas vent line to adjust a discharge amount of the supply gas discharged through the mixing gas vent line.

5

11. The gas mixing supply device of claim 1, wherein the tank is a batch-type tank.

12. The gas mixing supply device of claim 8, wherein the mixing system
10 includes a mixing gas concentration analysis line branched off from the mixing gas supply line and a mixing gas concentration analysis line valve that opens or closes the mixing gas concentration analysis line, and

wherein the mixing gas concentration analysis unit measures the concentration of the supply gas flowing through the mixing gas concentration
15 analysis line when the mixing gas concentration analysis line valve is opened by control of the controller.

13. The gas mixing supply device of claim 9, wherein the mixing system includes a mixing gas pressure measurement line branched off from the mixing gas
20 supply line and a mixing gas pressure measurement line valve that opens or closes the mixing gas pressure measurement line, and

wherein the mixing gas pressure measurement unit measures the pressure of the supply gas flowing through the mixing gas pressure measurement line when the mixing gas pressure measurement line valve is opened by control of the controller.

25

14. A gas mixing supply method comprising the steps of:

a) Supply gas is formed by mixing a plurality of different types of source gases supplied from a plurality of source gas supply lines in a mixing unit and supply
5 the supply gas to a tank, and measuring a concentration of the supply gas flowing through a tank gas supply line connecting the tank and a gas-based apparatus by a tank gas concentration analysis unit of a supply system configured to supply the supply gas stored in the tank to the gas-based apparatus by measuring a concentration of a supply gas flowing through a tank gas concentration analysis line branched off
10 from the tank gas supply line and has a smaller cross-sectional area than that of the tank gas supply line; and

b) determining, by a controller, whether the supply gas supplied to the gas-based apparatus is appropriate by comparing the concentration of the supply gas measured by the tank gas concentration analysis unit with a preset reference
15 concentration range,

wherein the supply system includes a tank gas concentration analysis line valve that opens or closes the tank gas concentration analysis line,

wherein, when the tank gas concentration analysis line valve is opened by control of the controller, the tank gas concentration analysis unit measures the
20 concentration of the supply gas flowing through the tank gas concentration analysis line, and

wherein step a) includes allowing the supply gas supplied from the tank to the tank gas supply line to flow to the tank gas concentration analysis line by opening, by the controller, the tank gas concentration analysis line.

25

15. The gas mixing supply method of claim 14, wherein the controller opens a tank gas supply line valve that opens or closes the tank gas supply line when the concentration of the supply gas measured by the tank gas concentration analysis unit satisfies the reference concentration range, and the controller closes the tank gas supply line valve when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the reference concentration range.

16. The gas mixing supply method of claim 14, wherein the controller closes a tank gas vent line valve that opens or closes a tank gas vent line branched off from the tank gas supply line and connected to an external unit when the concentration of the supply gas measured by the tank gas concentration analysis unit satisfies the reference concentration range, and the controller opens the tank gas vent line valve when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the reference concentration range.

15

17. The gas mixing supply method of claim 14, wherein, prior to step a), a mixing gas supply step of mixing a plurality of types of gases through a mixing system and supplying the mixed gas to the tank is performed, and

wherein, when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the reference concentration range, step c) discharging the supply gas flowing from the tank to the tank gas supply line to the outside by closing the tank gas supply line valve that opens or closes the tank gas supply line and by opening a tank gas vent line valve that opens or closes a tank gas vent line branched off from the tank gas supply line and connected to an external unit is further performed, and then the mixing gas supply step is performed again.

18. The gas mixing supply method of claim 14, wherein, prior to step a), a mixing gas supply step of mixing a plurality of types of gases through a mixing system and supplying the mixed gas to the tank is performed,

5 wherein step b) further includes calculating, by the controller, a concentration correction value so that the concentration of the supply gas flowing through the tank gas supply line satisfies the reference concentration range, and

wherein, when the concentration of the supply gas measured by the tank gas concentration analysis unit does not satisfy the reference concentration range, the
10 controller applies the concentration correction value to the mixing system to correct the concentration of the supply gas supplied to the tank through the mixing system.

19. The gas mixing supply method of claim 18, further comprising, when the concentration of the supply gas measured by the tank gas concentration analysis
15 unit does not satisfy the reference concentration range, the steps of:

c) discharging the supply gas flowing from the tank to the tank gas supply line to the outside by closing the tank gas supply line valve that opens or closes the tank gas supply line and by opening a tank gas vent line valve that opens or closes a tank gas vent line branched off from the tank gas supply line and connected to an
20 external unit; and

d) performing the mixing gas supply step again and correcting the concentration of the supply gas supplied to the tank through the mixing system by applying the concentration correction value to the mixing system.

25 20. The gas mixing supply method of claim 17 or 18, wherein the mixing

system includes a plurality of source gas supply lines, a mixing unit in which a plurality of different types of source gases supplied from the plurality of source gas supply lines are mixed to form the supply gas, and a mixing gas supply line connecting the mixing unit and the tank, wherein the plurality of different types of source gases are each supplied to one of the plurality of source gas supply lines,

wherein the plurality of source gas supply lines include at least one pressure relief valve configured to adjust supply pressures of the plurality of different types of source gases and at least one mass flow controller configured to adjust supply flow rates of the plurality of different types of source gases, and

wherein step d) includes correcting the concentration of the supply gas supplied to the tank through the mixing gas supply line by adjusting a ratio of each of the source gases mixed in the mixing unit by adjusting the pressure relief valve and the mass flow controller according to the concentration correction value.

21. The gas mixing supply method of claim 20, wherein the mixing system includes a mixing gas vent line branched off from the mixing gas supply line and connected to an external unit, and a mixing gas vent line valve that opens or closes the mixing gas vent line, and

wherein the controller controls driving of the mixing gas vent line valve to control whether to discharge the supply gas flowing through the mixing gas supply line.

22. The gas mixing supply method of claim 21, wherein the mixing system further includes a mixing gas concentration analysis unit configured to measure the concentration of the supply gas flowing through the mixing gas supply line, and

wherein, when the supply gas is supplied to the tank through the mixing system, the controller opens the mixing gas supply line valve and closes the mixing gas vent line valve when the concentration of the supply gas measured by the mixing gas concentration analysis unit satisfies the preset reference concentration range, and
5 the controller closes the mixing gas supply line valve and opens the mixing gas vent line valve when the concentration of the supply gas measured by the mixing gas concentration analysis unit does not satisfy the preset reference concentration range.

23. The gas mixing supply method of claim 21, wherein the mixing system
10 further includes a mixing gas pressure measurement unit configured to measure a pressure of the supply gas flowing through the mixing gas supply line, and

wherein, when the supply gas is supplied to the tank through the mixing system, the controller closes the mixing gas supply line valve and opens the mixing gas vent line valve when the pressure of the supply gas measured by the mixing gas
15 pressure measurement unit is lower than a gas pressure inside the tank, and the controller opens the mixing gas supply line valve and closes the mixing gas vent line valve when the pressure of the supply gas measured by the mixing gas pressure measurement unit is higher than or equal to the gas pressure inside the tank.

20 24. The gas mixing supply method of claim 21, wherein the mixing system further includes a mixing gas vent mass flow controller configured to adjust an opening degree of the mixing gas vent line, and

wherein, when the mixing gas vent line valve is opened, and thus the supply gas is discharged to the outside through the mixing gas vent line, the controller
25 adjusts the mixing gas vent mass flow controller to adjust a discharge amount of the

supply gas discharged through the mixing gas vent line.

25. The gas mixing supply method of claim 14, wherein steps a) and b) are performed in real time or at predetermined time intervals while the supply gas stored
5 in the tank is supplied to the gas-based apparatus.

26. The gas mixing supply method of claim 22, wherein the mixing system includes a mixing gas concentration analysis line branched off from the mixing gas supply line and a mixing gas concentration analysis line valve that opens or closes
10 the mixing gas concentration analysis line, and

wherein the mixing gas concentration analysis unit measures the concentration of the supply gas flowing through the mixing gas concentration analysis line when the mixing gas concentration analysis line valve is opened by control of the controller.

15

27. The gas mixing supply method of claim 22, wherein the mixing gas concentration analysis unit measures the concentration of the supply gas flowing through the mixing gas supply line in real time or at predetermined time intervals while the supply gas is supplied to the tank through the mixing system, and

20 wherein the controller controls the mixing gas vent line valve and the mixing gas supply line valve in real time according to the concentration of the supply gas measured by the mixing gas concentration analysis unit.

28. The gas mixing supply method of claim 23, wherein the mixing gas
25 pressure measurement unit measures the pressure of the supply gas flowing through

the mixing gas supply line in real time or at predetermined time intervals while the supply gas is supplied to the tank through the mixing system, and

wherein the controller controls the mixing gas vent line valve and the mixing gas supply line valve in real time according to the pressure of the supply gas

5 measured by the mixing gas pressure measurement unit.