devices of the gas supply system is large, it takes time to exhaust the processing gas remaining in the pipeline when replacing the processing gas flowing in the pipeline. Therefore, it is difficult to improve throughput in the processing apparatus which performs multiple processes while replacing the processing gases.

[0006] Furthermore, when replacing the processing gas at a high speed by opening or closing a valve, if the volume of the pipeline which connects the element devices of the gas supply system is large, the valve is opened before a pressure within the pipeline reaches a required level. In such a case, it is difficult to control the processing gas to have a required pressure.

SUMMARY

[0006a] According to a first aspect of the present invention, there is provided a gas supply system of supplying a gas into a processing apparatus, comprising:

a flow rate controller configured to control a flow rate of the gas;

an upstream valve whose upstream side is connected to a supply source of the gas and whose downstream side is connected to the flow rate controller in a direction along which the gas is flown;

a downstream valve whose upstream side is connected to the flow rate controller and whose downstream side is connected to the processing apparatus in the direction along which the gas is flown;

a first pipeline, configured to connect the upstream valve and the flow rate controller, through which the gas is flown;

a second pipeline, configured to connect the flow rate controller and the downstream valve, through which the gas is flown; and

a base,

wherein the flow rate controller is disposed on a first surface of the base,

the upstream valve and the downstream valve are disposed on a second surface of the base,

each of the first pipeline and the second pipeline has a straight line shape and penetrates the base,

the flow rate controller is a pressure type flow rate control device equipped with a control valve and an orifice, and

a volume V_1 of a flow path of the gas between the control valve and the orifice and a volume V_2 of a flow path of the gas between the orifice and the downstream valve satisfy a relationship of $V_1/V_2 \geq 9$.

[0006b] According to a second aspect of the present invention, there is provided a gas supply system of supplying a gas into a processing apparatus, comprising:

a flow rate controller configured to control a flow rate of the gas;

an upstream valve whose upstream side is connected to a supply source of the gas and whose downstream side is connected to the flow rate controller in a direction along which the gas is flown;

a downstream valve whose upstream side is connected to the flow rate controller and whose downstream side is connected to the processing apparatus in the direction along which the gas is flown;

a first pipeline, configured to connect the upstream valve and the flow rate controller, through which the gas is flown;

a second pipeline, configured to connect the flow rate controller and the downstream valve, through which the gas is flown; and

a base,

wherein the flow rate controller is disposed on a first surface of the base,

the upstream valve and the downstream valve are disposed on a second surface of the base,

each of the first pipeline and the second pipeline has a straight line shape and penetrates the base, and

the upstream valve is connected to a gas exhaust device via a gas exhaust valve.

[0006c] According to a third aspect of the present invention, there is provided a gas supply control method of controlling a supply of a gas into a processing apparatus in a gas supply system configured to supply the gas into the processing apparatus,

wherein the gas supply system comprises:

a flow rate controller configured to control a flow rate of the gas;

an upstream valve whose upstream side is connected to a supply source of the gas and whose downstream side is connected to the flow rate controller in a direction along which the gas is flown;

a downstream valve whose upstream side is connected to the flow rate controller and whose downstream side is connected to the processing apparatus in the direction along which the gas is flown;

a base on which the flow rate controller, the upstream valve and the downstream valve are disposed;

a first pipeline which is configured to connect the upstream valve and the flow rate controller and through which the gas is flown; and

a second pipeline which is configured to connect the flow rate controller and the downstream valve and through which the gas is flown,

wherein the flow rate controller is disposed on a first surface of the base,

the upstream valve and the downstream valve are disposed on a second surface of the base, which is opposite to the first surface of the base,

each of the first pipeline and the second pipeline has a straight line shape and penetrates the base,

the flow rate controller is a pressure type flow rate control device equipped with a control valve and an orifice,

a volume V_1 of a flow path of the gas between the control valve and the orifice and a volume V_2 of a flow path of the gas between the orifice and the downstream valve satisfy a relationship of $V_1/V_2 \geq 9$, and

wherein the gas supply control method comprises:

opening the upstream valve; and

controlling the supply of the gas into the processing apparatus by opening/closing the downstream valve while allowing a pressure P_1 of the flow path of the gas between the control valve and the orifice and a pressure P_2 of the flow path of the gas between the orifice and the downstream valve to satisfy a relationship of $P_1 > 2 \times P_2$.

[0006d] According to a fourth aspect of the present invention, there is provided a gas replacement method of replacing a gas within a gas supply system configured to supply the gas into a processing apparatus,

wherein the gas supply system comprises:

a flow rate controller configured to control a flow rate of the gas;

an upstream valve whose upstream side is connected to a supply source of the gas and whose downstream side is connected to the flow rate controller in a direction along which the gas is flown;

a downstream valve whose upstream side is connected to the flow rate controller and whose downstream side is connected to the processing apparatus in the direction along which the gas is flown;

a base on which the flow rate controller, the upstream valve and the downstream valve are disposed;

a first pipeline which is configured to connect the upstream valve and the flow rate controller and through which the gas is flown; and

a second pipeline which is configured to connect the flow rate controller and the downstream valve and through which the gas is flown,

wherein the flow rate controller is disposed on a first surface of the base,

the upstream valve and the downstream valve are disposed on a second surface of the base, which is opposite to the first surface of the base,

each of the first pipeline and the second pipeline has a straight line shape and penetrates the base,

the upstream valve is connected to a gas exhaust device via a gas exhaust valve, and

wherein the gas replacement method comprises:

opening the upstream valve and the gas exhaust valve; and

exhausting the gas within a flow path of the gas at an upstream side of the flow rate controller by the gas exhaust device.

[0007] In one exemplary embodiment, a gas supply system of supplying a gas into a processing apparatus includes a plurality of element devices which constitute the gas supply system and a base on which the plurality of element devices are disposed. Some of the element devices are disposed on a first surface of the base and the others of the element devices are disposed on a second surface of the base, which is opposite to the first surface of the base.

[0008] According to the exemplary embodiments, it is possible to improve the throughput of the processing and the accuracy of the pressure control over the processing gas.

The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

WE CLAIM

1. A gas supply system of supplying a gas into a processing apparatus, comprising:

a flow rate controller configured to control a flow rate of the gas;

an upstream valve whose upstream side is connected to a supply source of the gas and whose downstream side is connected to the flow rate controller in a direction along which the gas is flown;

a downstream valve whose upstream side is connected to the flow rate controller and whose downstream side is connected to the processing apparatus in the direction along which the gas is flown;

a first pipeline, configured to connect the upstream valve and the flow rate controller, through which the gas is flown;

a second pipeline, configured to connect the flow rate controller and the downstream valve, through which the gas is flown; and

a base,

wherein the flow rate controller is disposed on a first surface of the base,

the upstream valve and the downstream valve are disposed on a second surface of the base,

each of the first pipeline and the second pipeline has a straight line shape and penetrates the base,

the flow rate controller is a pressure type flow rate control device equipped with a control valve and an orifice, and

a volume V_1 of a flow path of the gas between the control valve and the orifice and a volume V_2 of a flow path of the gas between the orifice and the downstream valve satisfy a relationship of $V_1/V_2 \geq 9$.

2. The gas supply system of Claim 1,

wherein the volume V_1 of the flow path of the gas between the control valve and the orifice and the volume V_2 of the flow path of the gas between the orifice and the downstream valve satisfy a relationship of $V_1/V_2 \leq 200$.

3. A gas supply system of supplying a gas into a processing apparatus, comprising:

a flow rate controller configured to control a flow rate of the gas;

an upstream valve whose upstream side is connected to a supply source of the gas and whose downstream side is connected to the flow rate controller in a direction along which the gas is flown;

a downstream valve whose upstream side is connected to the flow rate controller and whose downstream side is connected to the processing apparatus in the direction along which the gas is flown;

a first pipeline, configured to connect the upstream valve and the flow rate controller, through which the gas is flown;

a second pipeline, configured to connect the flow rate controller and the downstream valve, through which the gas is flown; and

a base,

wherein the flow rate controller is disposed on a first surface of the base,

the upstream valve and the downstream valve are disposed on a second surface of the base,

each of the first pipeline and the second pipeline has a straight line shape and penetrates the base, and

the upstream valve is connected to a gas exhaust device via a gas exhaust valve.

4. A gas supply control method of controlling a supply of a gas into a processing apparatus in a gas supply system configured to supply the gas into the processing apparatus,

wherein the gas supply system comprises:

a flow rate controller configured to control a flow rate of the gas;

an upstream valve whose upstream side is connected to a supply source of the gas and whose downstream side is connected to the flow rate controller in a direction along which the gas is flown;

a downstream valve whose upstream side is connected to the flow rate controller and whose downstream side is connected to the processing apparatus in the direction along which the gas is flown;

a base on which the flow rate controller, the upstream valve and the downstream valve are disposed;

a first pipeline which is configured to connect the upstream valve and the flow rate controller and through which the gas is flown; and

a second pipeline which is configured to connect the flow rate controller and the downstream valve and through which the gas is flown,

wherein the flow rate controller is disposed on a first surface of the base,

the upstream valve and the downstream valve are disposed on a second surface of the base, which is opposite to the first surface of the base,

each of the first pipeline and the second pipeline has a straight line shape and penetrates the base,

the flow rate controller is a pressure type flow rate control device equipped with a control valve and an orifice,

a volume V_1 of a flow path of the gas between the control valve and the orifice and a volume V_2 of a flow path of the gas between the orifice and the downstream valve satisfy a relationship of $V_1/V_2 \geq 9$, and

wherein the gas supply control method comprises:

opening the upstream valve; and

controlling the supply of the gas into the processing apparatus by opening/closing the downstream valve while allowing a pressure P_1 of the flow path of the gas between the control valve and the orifice and a pressure P_2 of the flow path of the gas between the orifice and the downstream valve to satisfy a relationship of $P_1 > 2 \times P_2$.

5. A gas replacement method of replacing a gas within a gas supply system configured to supply the gas into a processing apparatus,

wherein the gas supply system comprises:

a flow rate controller configured to control a flow rate of the gas;

an upstream valve whose upstream side is connected to a supply source of the gas and whose downstream side is connected to the flow rate controller in a direction along which the gas is flown;

a downstream valve whose upstream side is connected to the flow rate controller and whose downstream side is connected to the processing apparatus in the direction along which the gas is flown;

a base on which the flow rate controller, the upstream valve and the downstream valve are disposed;

a first pipeline which is configured to connect the upstream valve and the flow rate controller and through which the gas is flown; and

a second pipeline which is configured to connect the flow rate controller and the downstream valve and through which the gas is flown,

wherein the flow rate controller is disposed on a first surface of the base,

the upstream valve and the downstream valve are disposed on a second surface of the base, which is opposite to the first surface of the base,

each of the first pipeline and the second pipeline has a straight line shape and penetrates the base,

the upstream valve is connected to a gas exhaust device via a gas exhaust valve, and

wherein the gas replacement method comprises:

opening the upstream valve and the gas exhaust valve; and

exhausting the gas within a flow path of the gas at an upstream side of the flow rate controller by the gas exhaust device.