CLAIMS

1. An exhaust gas cleaning system for cleaning exhaust gas discharged from an exhaust gas generating device installed in a ship, the exhaust gas cleaning system comprising:

a desulfurization tower defining therein a gas-liquid contact part for bringing the exhaust gas into contact with a scrubbing liquid;

an intake part for taking outboard water from an outside of a hull;

a supply passage connecting the intake part and the desulfurization tower;

a discharge passage for draining the scrubbing liquid discharged from the desulfurization tower to the outside of the hull;

a circulation passage for returning the scrubbing liquid discharged from the desulfurization tower to the supply passage as a circulation liquid, the circulating passage joining the supply passage at a junction part;

a supply-side switch device for switching a supply source of the scrubbing liquid supplied to the desulfurization tower to either one of the outboard water taken by the intake part or the circulation liquid returned to the supply passage via the circulation passage; ~~and~~

a discharge-side switch device for switching an outlet of the scrubbing liquid discharged from the desulfurization tower to either one of the discharge passage or the circulation passage~~.~~;~~-~~

a water feed pump disposed downstream of the junction part on the supply passage;

a storage tank disposed on the circulation passage and capable of storing the circulation liquid;

a storage amount acquisition device capable of acquiring a storage amount of the circulation liquid in the storage tank;

an outboard water feed device capable of feeding the outboard water to the storage tank;

a control part configured to control a feed amount of the outboard water to the storage tank by the outboard water feed device, in accordance with the storage amount acquired by the storage amount acquisition device;

a circulation liquid treatment device capable of removing an impurity from the circulation liquid;

a treatment liquid passage for supplying the circulation liquid to the circulation liquid treatment device as a liquid to be treated by the circulation liquid treatment device;

a treatment-liquid-flow-rate control valve capable of controlling a flow rate of the liquid to be treated in the treatment liquid passage; and

a treatment liquid storage tank disposed on the treatment liquid passage and capable of storing the liquid to be treated.

2. The exhaust gas cleaning system according to claim 1, further comprising:

~~a water feed pump disposed downstream of the junction part on the supply passage; and~~

~~a storage tank disposed on the circulation passage and capable of storing the circulation liquid.~~

a pH detection device capable of detecting a pH of the circulation liquid in the storage tank; and

a neutralizer addition device capable of adding a neutralizer to the storage tank,

wherein the control part is configured to control an addition amount of the neutralizer by the neutralizer addition device, in accordance with the pH detected by the pH detection device.

3. The exhaust gas cleaning system according to claim 1 or 2, further comprising:

~~a storage amount acquisition device capable of acquiring a storage amount of the circulation liquid in the storage tank~~;

~~an outboard water feed device capable of feeding the outboard water to the storage tank; and~~

~~a control part configured to control a feed amount of the outboard water to the storage tank by the outboard water feed device, in accordance with the storage amount acquired by the storage amount acquisition device.~~

a specific gravity detection device capable of detecting a specific gravity of the scrubbing liquid after cleaning the exhaust gas,

wherein the control part is configured to control an opening degree of the treatment-liquid-flow-rate control valve, in accordance with the specific gravity of the scrubbing liquid after cleaning the exhaust gas detected by the specific gravity detection device.

4. ~~The~~ An exhaust gas cleaning system ~~according to claim 3, further~~ for cleaning exhaust gas discharged from an exhaust gas generating device installed in a ship, the exhaust gas cleaning system comprising:

~~a pH detection device capable of detecting a pH of the circulation liquid in the storage tank; and~~

~~a neutralizer addition device capable of adding a neutralizer to the storage tank,~~

~~wherein the control part is configured to control an addition amount of the neutralizer by the neutralizer addition device, in accordance with the pH detected by the pH detection device.~~

a desulfurization tower defining therein a gas-liquid contact part for bringing the exhaust gas into contact with a scrubbing liquid;

an intake part for taking outboard water from an outside of a hull;

a supply passage connecting the intake part and the desulfurization tower;

a discharge passage for draining the scrubbing liquid discharged from the desulfurization tower to the outside of the hull;

a circulation passage for returning the scrubbing liquid discharged from the desulfurization tower to the supply passage as a circulation liquid, the circulating passage joining the supply passage at a junction part;

a supply-side switch device for switching a supply source of the scrubbing liquid supplied to the desulfurization tower to either one of the outboard water taken by the intake part or the

circulation liquid returned to the supply passage via the circulation passage;

a discharge-side switch device for switching an outlet of the scrubbing liquid discharged from the desulfurization tower to either one of the discharge passage or the circulation passage;

a water feed pump disposed downstream of the junction part on the supply passage;

a storage tank disposed on the circulation passage and capable of storing the circulation liquid;

a storage amount acquisition device capable of acquiring a storage amount of the circulation liquid in the storage tank;

an outboard water feed device capable of feeding the outboard water to the storage tank;

a control part configured to control a feed amount of the outboard water to the storage tank by the outboard water feed device, in accordance with the storage amount acquired by the storage amount acquisition device;

a circulation liquid treatment device capable of removing an impurity from the circulation liquid;

a treatment liquid passage for supplying the circulation liquid to the circulation liquid treatment device as a liquid to be treated by the circulation liquid treatment device; and

a treatment-liquid-flow-rate control valve capable of controlling a flow rate of the liquid to be treated in the treatment liquid passage,

wherein the treatment liquid passage includes a first treatment liquid passage connecting a first branching part disposed downstream of the water feed pump on the supply passage to the circulation liquid treatment device, and

wherein the treatment-liquid-flow-rate control valve includes a first treatment-liquid-flow-rate control valve capable of controlling a flow rate of the liquid to be treated in the first treatment liquid passage.

5. The exhaust gas cleaning system according to claim ~~3 or~~ 4, further comprising:

~~a circulation liquid treatment device capable of removing an impurity from the circulation~~

~~liquid;~~

~~a treatment liquid passage for supplying the circulation liquid to the circulation liquid treatment device as a liquid to be treated by the circulation liquid treatment device; and~~

~~a treatment-liquid-flow-rate control valve capable of controlling a flow rate of the liquid to be treated in the treatment liquid passage.~~

a pH detection device capable of detecting a pH of the circulation liquid in the storage tank; and

a neutralizer addition device capable of adding a neutralizer to the storage tank,

wherein the control part is configured to control an addition amount of the neutralizer by the neutralizer addition device, in accordance with the pH detected by the pH detection device.

6. The exhaust gas cleaning system according to claim 4 or 5, further comprising:

a specific gravity detection device capable of detecting a specific gravity of the scrubbing liquid after cleaning the exhaust gas,

wherein the control part is configured to control an opening degree of the treatment-liquid-flow-rate control valve, in accordance with the specific gravity of the scrubbing liquid after cleaning the exhaust gas detected by the specific gravity detection device.

7. The exhaust gas cleaning system according to claim ~~5~~ 4 or 6, further comprising:

a treatment liquid storage tank disposed on the treatment liquid passage and capable of storing the liquid to be treated.

8. ~~The~~ An exhaust gas cleaning system ~~according to any one of claims 5 to 7,~~ for cleaning exhaust gas discharged from an exhaust gas generating device installed in a ship, the exhaust gas cleaning system comprising:

a desulfurization tower defining therein a gas-liquid contact part for bringing the exhaust gas into contact with a scrubbing liquid;

an intake part for taking outboard water from an outside of a hull;

a supply passage connecting the intake part and the desulfurization tower;

a discharge passage for draining the scrubbing liquid discharged from the desulfurization tower to the outside of the hull;

a circulation passage for returning the scrubbing liquid discharged from the desulfurization tower to the supply passage as a circulation liquid, the circulating passage joining the supply passage at a junction part;

a supply-side switch device for switching a supply source of the scrubbing liquid supplied to the desulfurization tower to either one of the outboard water taken by the intake part or the circulation liquid returned to the supply passage via the circulation passage;

a discharge-side switch device for switching an outlet of the scrubbing liquid discharged from the desulfurization tower to either one of the discharge passage or the circulation passage;

a water feed pump disposed downstream of the junction part on the supply passage;

a storage tank disposed on the circulation passage and capable of storing the circulation liquid;

a storage amount acquisition device capable of acquiring a storage amount of the circulation liquid in the storage tank;

an outboard water feed device capable of feeding the outboard water to the storage tank;

a control part configured to control a feed amount of the outboard water to the storage tank by the outboard water feed device, in accordance with the storage amount acquired by the storage amount acquisition device;

a circulation liquid treatment device capable of removing an impurity from the circulation liquid;

a treatment liquid passage for supplying the circulation liquid to the circulation liquid treatment device as a liquid to be treated by the circulation liquid treatment device; and

a treatment-liquid-flow-rate control valve capable of controlling a flow rate of the liquid to be treated in the treatment liquid passage,

wherein the treatment liquid passage includes a ~~first~~ second treatment liquid passage connecting ~~a first branching part disposed downstream of the water feed pump on the supply passage~~ the storage tank to the circulation liquid treatment device, ~~and~~

wherein the treatment-liquid-flow-rate control valve includes a ~~first~~ second treatment-liquid-flow-rate control valve capable of controlling a flow rate of the liquid to be treated in the ~~first~~ second treatment liquid passage~~.~~, and

wherein the control part is configured to perform control to open the second treatment-liquid-flow-rate control valve when the storage amount acquired by the storage amount acquisition device exceeds an upper threshold.

9. The exhaust gas cleaning system according to ~~any one of~~ claim~~s 5 to~~ 8, further comprising:

~~wherein the treatment liquid passage includes a second treatment liquid passage connecting the storage tank to the circulation liquid treatment device, and~~

~~wherein the treatment-liquid-flow-rate control valve includes a second treatment-liquid-flow-rate control valve capable of controlling a flow rate of the liquid to be treated in the second treatment liquid passage.~~

a pH detection device capable of detecting a pH of the circulation liquid in the storage tank; and

a neutralizer addition device capable of adding a neutralizer to the storage tank,

wherein the control part is configured to control an addition amount of the neutralizer by the neutralizer addition device, in accordance with the pH detected by the pH detection device.

10. The exhaust gas cleaning system according to claim 8 or 9, further comprising:

~~wherein the control part is configured to perform control to open the second treatment-liquid-flow-rate control valve when the storage amount acquired by the storage amount acquisition device exceeds an upper threshold.~~

a specific gravity detection device capable of detecting a specific gravity of the scrubbing liquid after cleaning the exhaust gas,

wherein the control part is configured to control an opening degree of the treatment-liquid-flow-rate control valve, in accordance with the specific gravity of the scrubbing liquid after cleaning the exhaust gas detected by the specific gravity detection device.

11. The exhaust gas cleaning system according to ~~any one of claims 3 to~~ 8 or 10, further comprising:

~~wherein the control part is configured to perform control to switch the supply source to the outboard water taken by the intake part through the supply-side switch device when the storage amount acquired by the storage amount acquisition device is less than a lower threshold.~~

a treatment liquid storage tank disposed on the treatment liquid passage and capable of storing the liquid to be treated.

12. The exhaust gas cleaning system according to any one of claims ~~2 to~~ 8, 10, 11,

wherein the ~~desulfurization tower further defines therein a liquid reservoir disposed below the gas-liquid contact part, and the storage tank disposed below the liquid reservoir.~~ treatment liquid passage includes a first treatment liquid passage connecting a first branching part disposed downstream of the water feed pump on the supply passage to the circulation liquid treatment device, and

wherein the treatment-liquid-flow-rate control valve includes a first treatment-liquid-flow-rate
control valve capable of controlling a flow rate of the liquid to be treated in the first treatment liquid passage.

~~13. A method for operating an exhaust gas cleaning system for cleaning exhaust gas discharged from an exhaust gas generating device installed in a ship,~~

~~the exhaust gas cleaning system comprising:~~

~~a desulfurization tower defining therein a gas-liquid contact part for bringing the exhaust gas into contact with a scrubbing liquid;~~

~~an intake part for taking outboard water from an outside of a hull;~~

~~a supply passage connecting the intake part and the desulfurization tower;~~

~~a discharge passage for draining the scrubbing liquid discharged from the desulfurization tower to the outside of the hull;~~

~~a circulation passage for returning the scrubbing liquid discharged from the desulfurization tower to the supply passage as a circulation liquid, the circulating passage joining the supply passage at a junction part;~~

~~a water feed pump disposed downstream of the junction part on the supply passage;~~

~~a supply-side switch device for switching a supply source of the scrubbing liquid supplied to the desulfurization tower to either one of the outboard water taken by the intake part or the circulation liquid returned to the supply passage via the circulation passage; and~~

~~a discharge-side switch device for switching an outlet of the scrubbing liquid discharged from the desulfurization tower to either one of the discharge passage or the circulation passage,~~

~~the method comprising:~~

~~a first supply source switching step of switching the supply source of the scrubbing liquid by the supply-side switch device from the outboard water taken by the intake part to the circulation liquid returned to the supply passage via the circulation passage; and~~

a first outlet switching step of switching the outlet of the scrubbing liquid by the discharge-side switch device from the discharge passage to the circulation passage.

14. The method for operating the exhaust gas cleaning system according to claim 13,

wherein the exhaust gas cleaning system further comprises:

a storage tank disposed on the circulation passage and capable of storing the circulation liquid; and

a storage amount acquisition device capable of acquiring a storage amount of the circulation liquid in the storage tank,

wherein the method further comprises

a storage amount acquisition step of acquiring the storage amount of the circulation liquid by the storage amount acquisition device, and

wherein the first supply source switching step is performed after the first outlet switching step is performed and the storage amount acquired by the storage amount acquisition step exceeds a predetermined amount.

15. A method for operating an exhaust gas cleaning system for cleaning exhaust gas discharged from an exhaust gas generating device installed in a ship,

the exhaust gas cleaning system comprising:

a desulfurization tower defining therein a gas-liquid contact part for bringing the exhaust gas into contact with a scrubbing liquid;

an intake part for taking outboard water from an outside of a hull;

a supply passage connecting the intake part and the desulfurization tower;

a discharge passage for draining the scrubbing liquid discharged from the desulfurization tower to the outside of the hull;

a circulation passage for returning the scrubbing liquid discharged from the desulfurization tower to the supply passage as a circulation liquid, the circulating passage joining the supply passage at a junction part;

a water feed pump disposed downstream of the junction part on the supply passage;

a supply-side switch device for switching a supply source of the scrubbing liquid supplied to the desulfurization tower to either one of the outboard water taken by the intake part or the circulation liquid returned to the supply passage via the circulation passage; and

a discharge-side switch device for switching an outlet of the scrubbing liquid discharged from the desulfurization tower to either one of the discharge passage or the circulation passage,

the method comprising:

a second supply source switching step of switching the supply source of the scrubbing liquid by the supply-side switch device from the circulation liquid returned to the supply passage via the circulation passage to the outboard water taken by the intake part; and

a second outlet switching step of switching the outlet of the scrubbing liquid by the discharge-side switch device from the circulation passage to the discharge passage.

16. The method for operating the exhaust gas cleaning system according to claim 15,

wherein the exhaust gas cleaning system further comprises:

a storage tank disposed on the circulation passage and capable of storing the circulation liquid;

a circulation liquid treatment device capable of removing an impurity from the circulation liquid;

a treatment liquid passage for supplying the circulation liquid to the circulation liquid treatment device as a liquid to be treated by the circulation liquid treatment device, the treatment liquid passage connecting the storage tank to the circulation liquid treatment device; and

a treatment-liquid flow-rate control valve capable of controlling a flow rate of the liquid to be treated in the treatment liquid passage,

wherein the method further comprises a circulation liquid discharge step of, after the second supply source switching step and the second outlet switching step, opening the

~~treatment liquid flow rate control valve to transfer the circulation liquid stored in the storage tank to the circulation liquid treatment device.~~