# DESCRIPTION

## MOVING BODY

### Technical Field

[0001] The present invention relates to a moving body provided with a cooling device for cooling air to be supplied to a combustion means in a power generation system.

### Background Art

[0002] A combined cycle power generation system is a system in which upon supply of a combustion gas generated by a combustion means, a gas turbine is rotated, and a power generator generates power using the rotative force of the gas turbine, and a waste heat recovery boiler recovers heat remaining in an exhaust gas from the gas turbine to generate steam, a steam turbine is rotated by the generated steam, and a power generator generates power using the rotative force of the steam turbine.

[0003] This type of combined cycle power generation system is not only used in an onshore power generation plant but also recently considered to be used in applications other than the onshore application because it is a system that can achieve high power generation efficiency.

[0004] For example, Patent Document 1 discloses a ship power generation system that is installed on a ship to realize power generation on the ship. This ship power generation system is a power generation system installed on a ship such as an LNG ship, and has a configuration similar to the above-described combined cycle power generation system, i.e., a configuration in which upon supply of a combustion gas, a gas turbine generates rotative power, and a power generator generates power using the rotative force of the gas turbine, and heat is recovered from an exhausted gas discharged from the gas turbine so that steam is generated, and upon supply of the generated steam, a steam turbine generates rotative power, and a power generator generates power using the rotative force of the steam turbine.

### Prior Art Document

Patent Document

[0005] Patent Document 1: JP 2018-141381A

Disclosure of the Invention

Problem to be Solved by the Invention

[0006] Meanwhile, a gas turbine unit suctions and compresses air, mixes the air with a fuel gas and burns the air-fuel mixture using a combustion means, and drive and rotate a gas turbine with the generated combustion gas, so that a power generator generates power using the rotative force of the gas turbine. However, with an increase in the temperature of air to be supplied to the combustion means, the density of the air is reduced, and thus the mass of the air to be delivered to the combustion means is reduced, resulting in a state in which output is low (in other words, a state in which the amount of power generation is low).

[0007] Accordingly, in order to secure a required amount of power generation regardless of the temperature of air to be supplied to the combustion means, a measure is required such as increasing the number of installed gas turbine units.

[0008] However, increasing the number of installed gas turbine units will incur a problem of cost increase or the like. Particularly, in a power generation system such as the ship power generation system disclosed in Patent Document 1, which is installed on a moving body such as a ship, realizing space saving of the power generation system is required due to the space of the moving body, and thus not only the cost increase but also an increase in the installation space is very problematic.

[0009] On the other hand, as a method for improving a decrease in output from a gas turbine unit, a method for lowering the temperature of air to be supplied to a combustion means has been conventionally proposed. An example of such a method is a method in which mist is generated in an air intake room into which air is to be suctioned, and the air suctioned into the air intake room removes evaporative latent heat of the mist, so that the air to be supplied to a combustion means is cooled.

[0010] However, in the method that uses mist, only the amount of mist under the saturated vapor pressure that corresponds to an ambient air temperature can be evaporated, and thus if the power generation system is installed in a hot and humid tropical region, or if the power generation system is used in a hot and moist environment in summer, there is a problem that air to be

supplied to a combustion means cannot sufficiently be cooled, and the effect of restoring the output is unlikely to be realized.

[0011] Particularly, in a power generation system such as the ship power generation system disclosed in Patent Document 1, which is installed on a moving body such as a ship, the moving body often moves in a tropical region, and thus it is often the case where the effect of restoring the output cannot be realized sufficiently.

[0012] Also, as the method for lowering the temperature of air to be supplied to a combustion means, there is also a method in which by providing a chiller for producing cold water using, e.g., combustion heat of a fuel, and providing a heat exchanger that uses the cold water (cold heat source) produced by the chiller in an air intake room, air to be supplied to a combustion means is cooled by the cold water.

[0013] However, in the method that uses cold water from the chiller, if cold water that can sufficiently cool air to be supplied to the combustion means is to be produced by the chiller, there is a problem that the effect of restoring the output of a gas turbine unit is low with respect to the amounts of heat and electric power to be supplied to the chiller, and the energy efficiency of the power generation system as a whole is reduced. Also, if an increased amount of cold water is to be produced, there will be problems that a large chiller is unavoidable and the burden in terms of the cost is large. Therefore, particularly in a power generation system that is installed on a moving body, space saving is required as described above, and thus an increase in the installation space for the chiller is very problematic.

[0014] Accordingly, only with the above-described methods, there are the problems that the effect of restoring the output depends on the environment in which a power generation system is installed, and it is difficult to prevent a reduction in output of a gas turbine unit while preventing a reduction in energy efficiency of the power generation system as a whole and realizing space saving of the power generation system.

[0015] The present invention was made in view of the above-described circumstances, and an object thereof is to provide a moving body provided with a cooling device that can efficiently cool air to be supplied to a combustion means, and can prevent a reduction in output of a gas turbine unit.

Means for Solving Problem

[0016] A characteristic configuration of the moving body of the present invention to achieve the above-described object relates to a moving body provided with a cooling device that is used in a power generation system that comprises: a gas turbine unit in which a combustion means burns an air-fuel mixture of air and a fuel gas obtained by gasifying a liquid fuel to generate a combustion gas, and a gas turbine is driven to rotate with the combustion gas generated by the combustion means; and a first power generating means for generating power using a rotative force of the gas turbine, the cooling device being configured to cool air to be supplied to the combustion means,

wherein the cooling device includes

at least two cooling units, from among a first cooling unit that uses, as a cold heat source, a heating medium used to gasify the liquid fuel, a second cooling unit that uses, as a cold heat source, a heating medium from a chiller, and a third cooling unit that uses, as a cold heat source, marine water serving as a heating medium.

[0017] According to the above-described configuration, in at least two cooling units, from among the first cooling unit that uses, as a cold heat source, a heating medium used to gasify the liquid fuel, the second cooling unit that uses, as a cold heat source, a heating medium from a chiller, and the third cooling unit that uses, as a cold heat source, marine water serving as a heating medium, the air to be supplied to the combustion means is cooled.

[0018] For example, there is conventionally a problem that if only the cold heat of cold water (cold heat source) from the chiller is used, air cannot sufficiently be cooled only with the cold heat of the cold water from the chiller. Also, there is another inevitable problem that if cold water that can sufficiently cool air is to be produced, the energy efficiency of the power generation system as a whole is reduced, and if a large amount of cold water is to be produced, a large chiller is unavoidable. However, in the above-described characteristic configuration, air to be supplied to the combustion means is cooled in at least two cooling units, and thus it is possible to sufficiently cool the air to be supplied to the combustion means, while avoiding the above-described problems, compared to the case where only the cold heat of a cold heat source from a chiller is used. This makes it easy to realize the effect of restoring the output of the power generation system.

[0019] Also, since the present invention relates to the moving body provided with the above-described cooling device, it is possible to move the moving body

to a place where, for example, a combined cycle power generation system that does not include any cooling device is provided, and mount the cooling device to the combined cycle power generation system, thereby preventing a reduction in output of the gas turbine unit.

[0020] Also, a further characteristic configuration of the moving body of the present invention is such that the cooling device includes the first cooling unit and the second cooling unit.

[0021] According to the above-described characteristic configuration, in the first cooling unit, the air to be supplied to the combustion means is cooled by using, as a cold heat source, the heating medium used to gasify the liquid fuel, and in the second cooling unit, the air is cooled by using the heating medium from the chiller, as a cold heat source.

[0022] In a power generation system that performs power generation using a liquid fuel, when the liquid fuel is gasified, a heating medium that has removed the cold heat from the liquid fuel is naturally generated, and thus by using the heating medium that has removed the cold heat from the liquid fuel as a cold heat source for cooling air to be supplied to the combustion means, it is possible to efficiently use the cold heat of the liquid fuel.

Also, as described above, in contrast to a case where only the cold heat of a cold heat source from the chiller is used, the above-described characteristic configuration uses not only cooling with the cold heat of the cold heat source from the chiller but also cooling with the cold heat of the liquid fuel, and thus eliminates the need of cooling air only using the cold heat of cold water from the chiller. Accordingly, even if air to be supplied to the combustion means is sufficiently cooled, and the effect of restoring the output of the power generation system can be realized, it is possible to prevent a reduction in the energy efficiency of the power generation system as a whole, and avoid a large chiller, thus leading to a reduction in the cost burden and realizing space saving of the power generation system.

[0023] With this, according to the moving body having the above-described characteristic configuration, it is possible to cool air to be supplied to the combustion means while efficiently using the cold heat of a liquid fuel, and prevent a reduction in the energy efficiency of the power generation system as a whole. It is also possible to cool air to be supplied to the combustion means while reducing the cost burden and realizing space saving of the power generation system, thereby preventing a reduction in output of the gas turbine

unit.

[0024] A further characteristic configuration of the moving body of the present invention is such that in the cooling device, the first cooling unit and the second cooling unit are arranged so that the air to be supplied to the combustion means flows through the second cooling unit and the first cooling unit in this order.

[0025] The heating medium that is used as a cold heat source in the first cooling unit has been used to gasify the liquid fuel, and has a very low temperature due to having obtained considerable cold heat.

In contrast, the heating medium that is used as a cold heat source in the second cooling unit is cold water produced in the chiller, and tends to have a relatively high temperature compared to that of the heating medium that is used in the first cooling unit.

Accordingly, according to the above-described characteristic configuration, the air to be supplied to the combustion means is cooled in the second cooling unit, which uses a heating medium of a relatively high temperature, and then is cooled in the first cooling unit, which uses a heating medium of a relatively low temperature, and thus it is possible to cool the air without wasting the cold heat of the heating medium used in the two cooling units as much as possible.

[0026] A further characteristic configuration of the moving body of the present invention is such that the cooling device includes the first cooling unit and the third cooling unit.

[0027] According to the above-described characteristic configuration, in the first cooling unit, the air to be supplied to the combustion means is cooled by using, as a cold heat source, the heating medium used to gasify the liquid fuel, and in the third cooling unit, the air is cooled by using the marine water serving as a heating medium, as a cold heat source.

[0028] Similar to the description above, the first cooling unit uses, as a cold heat source, the heating medium that has removed the cold heat naturally generated in the system for generating power using a liquid fuel, and thus it is possible to efficiently use the cold heat of the liquid fuel.

Also, even if only with the cold heat obtained by gasifying a liquid fuel that is consumed when the power generation system generates power, the temperature of air cannot be lowered to such a temperature that it is possible to suppress a reduction in output of the power generation system, the third

cooling unit can also cool air to be supplied to the combustion means using the cold heat of marine water, and lower the temperature. Accordingly, it is easy to suppress a reduction in output of the power generation system.

Furthermore, this characteristic configuration does not require any chiller, and thus can eliminate such a problem that a large chiller is unavoidable, making it possible to reduce the cost burden and realize space saving of the power generation system.

[0029] In this way, with this moving body having the above-described characteristic configuration, it is possible to cool the air to be supplied to the combustion means while efficiently using the cold heat of the liquid fuel, and prevent a reduction in the energy efficiency of the power generation system as a whole, and it is also possible to cool the air to be supplied to the combustion means while reducing the cost burden and realizing space saving of the power generation system, leading to a reduction in output of the gas turbine unit.

[0030] A further characteristic configuration of the moving body of the present invention is such that in the cooling device, the first cooling unit and the third cooling unit are arranged so that the air to be supplied to the combustion means flows through the third cooling unit and the first cooling unit in this order.

[0031] As described above, the heating medium that is used as a cold heat source in the first cooling unit has obtained considerable cold heat from the liquid fuel, and has a very low temperature.

In contrast, the marine water that is used as a cold heat source in the third cooling unit has a relatively high temperature compared to that of the heating medium that is used in the first cooling unit, depending on the depth from which the marine water is pumped.

Accordingly, according to the above-described characteristic configuration, the air to be supplied to the combustion means is cooled in the third cooling unit, which uses a heating medium of a relatively high temperature, and then is cooled in the first cooling unit, which uses a heating medium of a relatively low temperature, and thus it is possible to cool the air without wasting the cold heat of the heating medium used in the two cooling units as much as possible.

[0032] A further characteristic configuration of the moving body of the present invention is such that the cooling device includes the second cooling unit and the third cooling unit.

[0033] According to the above-described characteristic configuration, in the second cooling unit, the air to be supplied to the combustion means is cooled by using the heating medium from the chiller, as a cold heat source, and in the third cooling unit, the air is cooled by using the marine water serving as a heating medium, as a cold heat source.

[0034] As described above, in contrast to a case where only the cold heat of a cold heat source from the chiller is used, the above-described characteristic configuration uses not only cooling with the cold heat of the cold heat source from the chiller but also cooling with the cold heat of the marine water, and thus eliminates the need of cooling air only using the cold heat of the cold water from the chiller. Accordingly, even if air to be supplied to the combustion means is sufficiently cooled, and the effect of restoring the output of the power generation system can be realized, it is possible to prevent a reduction in the energy efficiency of the power generation system as a whole, and avoid a large chiller, thus leading to a reduction in the cost burden and realizing space saving of the power generation system.

[0035] With this, according to the moving body having the above-described characteristic configuration, it is possible to cool the air to be supplied to the combustion means while preventing a reduction in the energy efficiency of the power generation system as a whole, and realizing a reduction in the cost burden and space saving of the power generation system, thereby preventing a reduction in output of the gas turbine unit.

[0036] A further characteristic configuration of the moving body of the present invention is such that in the cooling device, the second cooling unit and the third cooling unit are arranged so that the air to be supplied to the combustion means flows through the third cooling unit and the second cooling unit in this order.

[0037] The temperature of the marine water that is used as a cold heat source in the third cooling unit tends to be relatively high, compared to that of the cold water from the chiller that is used as a cold heat source in the second cooling unit, depending on the depth from which the marine water is pumped.

Accordingly, according to the above-described characteristic configuration, the air to be supplied to the combustion means is cooled in the third cooling unit, which uses a heating medium of a relatively high temperature, and then is cooled in the second cooling unit, which uses a heating medium of a relatively low temperature, and thus it is possible to cool

the air without wasting the cold heat of the heating medium used in the two cooling units as much as possible.

[0038] A further characteristic configuration of the moving body of the present invention is such that the cooling device includes the first cooling unit, the second cooling unit, and the third cooling unit.

[0039] According to the above-described configuration, the air to be supplied to the combustion means is cooled in the first cooling unit that uses, as a cold heat source, a heating medium used to gasify the liquid fuel, the second cooling unit that uses, as a cold heat source, a heating medium from a chiller, as a cold heat source, and the third cooling unit that uses marine water as a cold heat source.

[0040] In this way, a configuration is adopted in which air to be supplied to the combustion means is cooled in the first, second, and third cooling units. Therefore, even if due to, for example, a lack of cold heat that is obtained by gasifying a liquid fuel that is consumed when the power generation system generates power, only with the cold heat of the heating medium used in two of the three cooling units, the temperature of air to be supplied to the combustion means cannot be lowered to such a temperature that it is possible to suppress a reduction in output of the power generation system, providing the three cooling units makes it possible to cool the air to be supplied to the combustion means and lower the temperature using the cold heat of the heating medium used in the three cooling units. Accordingly, it is possible to further suppress a reduction in output of the power generation system.

[0041] A further characteristic configuration of the moving body of the present invention is such that in the cooling device, the first cooling unit, the second cooling unit, and the third cooling unit are arranged so that the air to be supplied to the combustion means flows through the third cooling unit, the second cooling unit, and the first cooling unit in this order.

[0042] As described above, the marine water that is used as a cold heat source in the third cooling unit tends to have a relatively high temperature, compared to those of the heating medium that are used as cold heat sources in the first cooling unit and the second cooling unit, depending on the depth from which the marine water is pumped, and the heating medium that is used as a cold heat source in the second cooling unit tends to have a relatively high temperature, compared to that of the heating medium that is used in the first cooling unit.

Therefore, according to the above-described characteristic configuration, the air to be supplied to the combustion means is cooled in the cooling units in the ascending order of the relative temperature of the used heating medium, that is, the air is cooled in the third cooling unit, in the second cooling unit, and then in the first cooling unit, and thus it is possible to cool the air without wasting the cold heat of the heating medium used in the three cooling units as much as possible.

[0043] According to a further characteristic configuration, the moving body of the present invention includes:

a fuel tank in which the liquid fuel is stored;

a gasification unit configured to gasify the liquid fuel using, as a warm heat source, the heating medium to be used in the first cooling unit;

the gas turbine unit; and

the first power generating means.

[0044] According to the above-described characteristic configuration, the moving body is a moving body provided with the cooling device, the fuel tank, the gasification unit, the gas turbine unit, and the first power generating means, and in this moving body, the first power generating means generates power using the rotative force of a gas turbine of the gas turbine unit. According to the moving body having the above-described configuration due to the presence of the above cooling device, it is possible to cool the air to be supplied to the combustion means while preventing a reduction in the energy efficiency of the power generation system as a whole, and realizing a reduction in the cost burden and space saving of the power generation system. This makes it possible to prevent a reduction in output of the gas turbine unit, and efficiently generate power.

Also, in the moving body according to the present invention, even if the moving body is moved to or is stopped at a tropical region, cooling of air to be supplied to the combustion means is performed by the above-described cooling device, instead of using mist as in a conventional case, and thus it is possible to realize the effect of restoring the output of the power generation system.

[0045] According to a further characteristic configuration, the moving body of the present invention includes:

a waste heat recovery boiler unit configured to vaporize water using an exhaust gas from the gas turbine unit;

a steam turbine unit configured to drive and rotate a steam turbine

using steam obtained by the vaporization performed by the waste heat recovery boiler unit; and

a second power generating means for generating power using a rotative force of the steam turbine,

wherein the moving body is a ship.

[0046] According to the above-described characteristic configuration, the moving body is a ship (in other words, a ship with a combined cycle power generation system) that further includes the waste heat recovery boiler unit, the gas turbine unit, and the second power generating means, and in the ship serving as a moving body, the warm heat of the exhaust gas from the gas turbine unit is used to drive and rotate the steam turbine, and the second power generating means also generates power using the rotative force of the steam turbine. Accordingly, it is possible to effectively use the warm heat of the exhaust gas from the gas turbine unit and efficiently generate power.

Also, in the moving body according to the present invention, even if a ship serving as the moving body is often moved to or anchored at a tropical region, cooling of air to be supplied to the combustion means is performed by the above-described cooling device, instead of using mist as in a conventional case, and thus it is possible to realize the effect of restoring the output of the power generation system.

[0047] A further characteristic configuration of the moving body of the present invention is such that the cooling device includes the third cooling unit that uses marine water serving as a heating medium, as a cold heat source, and

the steam turbine unit includes:

a steam condenser configured to recover, as condensate, the steam used to drive and rotate the steam turbine; and

a condensate cooling unit configured to cool the inside of the steam condenser using, as a cold heat source, the marine water used in the third cooling unit.

[0048] According to the above-described characteristic configuration, the marine water that is used in the third cooling unit can be used as a cold heat source to cool the inside of the steam condenser in the condensate cooling unit, and steam discharged from the steam turbine is cooled inside the steam condenser and can be recovered as condensate.

Accordingly, since parts of the marine water pipes through which marine water is supplied to the third cooling unit and the condensate cooling

unit, and through which marine water is recovered from these cooling units can be shared, it is possible to simplify the layout of the pipes, and reduce the number of pumps required to cause marine water to flow through the pipes.

[0049] According to a further characteristic configuration, the moving body of the present invention includes: a first marine water flow path through which the marine water to be supplied to the third cooling unit flows;

a second marine water flow path through which the marine water to be supplied from the third cooling unit to the condensate cooling unit flows;

a bypass flow path that connects the first marine water flow path and the second marine water flow path; and

an adjustment means for adjusting the amount of marine water that is to flow through the bypass flow path.

[0050] If a difference in temperature between marine water to be supplied to the third cooling unit, and ambient air suctioned so as to be supplied to the combustion means is small, the air-cooling effect hardly differs even if the amount of marine water to be supplied to the third cooling unit is low. However, if, even in such a case, the total amount of pumped marine water is always caused to flow to the condensate cooling unit through the third cooling unit, this will lead to an unnecessary increase in the pump output. Also, if the temperature of marine water is higher than the temperature of ambient air, supplying the marine water to the third cooling unit will rather lead to heating the air.

According to the above-described characteristic configuration, by providing the bypass flow path that connects the first marine water flow path and the second marine water flow path, and adjusting the amount of marine water flowing through the bypass flow path using the adjustment means, it is possible to adjust the amounts of marine water that is to flow to the condensate cooling unit via the third cooling unit, and marine water that is to flow to the condensate cooling unit through the bypass flow path without passing through the third cooling unit.

Accordingly, by adjusting the amount of marine water that is to flow through the bypass flow path based on the amount of marine water required by the third cooling unit, it is possible to prevent an unnecessary increase in the output of the pump. Also, in such a case where the temperature of marine water is higher than the temperature of ambient air, it is possible to prevent such a situation that air is heated by performing adjustment such that the total

amount of marine water pumped by a pump flows through the bypass flow path so that marine water is not supplied to the third cooling unit.

[0051] A further characteristic configuration of the moving body of the present invention is such that the number of gas turbine units to be operated is determined based on an electric demand and an operational state of the cooling device.

[0052] According to the above-described characteristic configuration, it is possible to operate the number of gas turbine units suited to the electric demand, without unnecessarily increasing the number of gas turbine units.

[0053] Note that the operational state of the cooling device is changed according to the degree of cooling of air to be supplied to the combustion means in each of the first cooling unit, the second cooling unit, and the third cooling unit, and by changing the degree of cooling of the air in each cooling unit, it is possible to appropriately change the operational state of the cooling device. Also, the degree of cooling of the air in each cooling unit can be changed by changing the temperature of the heating medium to be supplied to the cooling unit, or starting or stopping the supply of the heating medium to the cooling unit.

Also, in the context of the present application, the electric demand refers to an idea including electric power required by the moving body, electric power required by one or more facilities to which electric power is supplied from the moving body, as well as electric power to be generated by the power generation system to store the electric power.

[0054] A further characteristic configuration of the moving body of the present invention is such that the operational state of the cooling device is determined based on an electric demand and output characteristics of the gas turbine unit.

[0055] According to the above-described characteristic configuration, it is possible to operate the cooling device in the appropriate operational state suited to the electric demand, and prevent such a situation that the cooling device is loaded more than necessary.

[0056] According to a further characteristic configuration of the moving body of the present invention, the cooling device includes the first cooling unit, and at least one of the second cooling unit and the third cooling unit, and

in a state in which the air to be supplied to the combustion means is cooled by the first cooling unit, the operational state of the cooling device is determined by determining a degree of cooling of the air to be supplied to the

combustion means using the at least one of the second cooling unit and the third cooling unit based on the electric demand and the output characteristics of the gas turbine unit.

[0057] According to the above-described characteristic configuration, in a state in which the air is cooled by the first cooling unit, the degree of cooling of the air using at least one of the second cooling unit and the third cooling unit can be determined based on the electric demand and the output characteristics of the gas turbine unit, and the operational state of the cooling device can be determined. Accordingly, the operational state of the cooling device thus determined is an operational state in which the cold heat of a liquid fuel is effectively used.

[0058] Note that the above-described characteristic configuration includes determining the operational state of the cooling device, in a state in which the air to be supplied to the combustion means is cooled by the first cooling unit, by determining the degrees of cooling of the air to be supplied to the combustion means using the second cooling unit and the third cooling unit based on the electric demand and the output characteristics of the gas turbine unit, determining the operational state of the cooling device, in a state in which the air to be supplied to the combustion means is cooled by the first cooling unit, by determining the degree of cooling of the air to be supplied to the combustion means using the second cooling unit based on the electric demand and the output characteristics of the gas turbine unit, and determining the operational state of the cooling device, in a state in which the air to be supplied to the combustion means is cooled by the first cooling unit, by determining the degree of cooling of the air to be supplied to the combustion means using the third cooling unit based on the electric demand and the output characteristics of the gas turbine unit.

[0059] A further characteristic configuration of the moving body of the present invention is such that the cooling device includes the first cooling unit, the second cooling unit, and the third cooling unit, and

in a state in which the air to be supplied to the combustion means is cooled by the first cooling unit and the third cooling unit, the operational state of the cooling device is determined by determining a degree of cooling of the air to be supplied to the combustion means using the second cooling unit based on the electric demand and the output characteristics of the gas turbine unit.

[0060] According to the above-described characteristic configuration, in a

state in which the air is cooled by the first cooling unit and the third cooling unit, the degree of cooling of the air using the second cooling unit is determined based on the electric demand and the output characteristics of the gas turbine, and thus the operational state of the cooling device can be determined. Accordingly, the operational state of the cooling device thus determined is an operational state in which the cold heat of a liquid fuel is effectively used.

[0061] A further characteristic configuration of the moving body of the present invention is such that based on at least one of an ambient air state and a cooling device condition, the operational state of the cooling device is determined, and a degree of cooling of the air to be supplied to the combustion means using at least one of the first cooling unit, the second cooling unit, and the third cooling unit is determined.

[0062] According to the above-described characteristic configuration, based on the ambient air state, the operational state of the cooling device is determined, and then the degree of cooling of the air in each of the cooling units can be determined. Accordingly, for example, a state in which the air is not cooled using any one of the first to third cooling units is determined as an operational state of the cooling device, and then the degree of cooling of the air in the remaining cooling units can be determined, and thereafter the cooling device can be operated. Note that the ambient air state refers to an ambient air temperature, an atmospheric pressure, humidity, and the like, and the cooling device condition refers to presence or absence of a defect, the temperature of marine water to be used, the amount of use of LNG, and the like.

## Brief Description of the Drawings

[0063] FIG. 1 is a diagram illustrating a schematic configuration of a power generation system installed on a ship according to a first embodiment.

FIG. 2 is a diagram illustrating a schematic configuration of a chiller.

FIG. 3 is a diagram illustrating a schematic configuration of a power generation system installed on a ship according to a second embodiment.

FIG. 4 is a graph illustrating output characteristics of a gas turbine unit.

FIG. 5 is a graph illustrating efficiency characteristics of the gas turbine unit.

## Modes Of Embodying the Invention

[0064] [First Embodiment]

Hereinafter, a moving body according to a first embodiment of the present invention will be described with reference to the drawings. Note that in the present embodiment, a description will be made taking a case where the moving body is a ship as an example.

[0065] FIG. 1 is a diagram illustrating a schematic configuration of a power generation system E that is installed on a ship (LNG ship). As shown in FIG. 1, the power generation system E includes: a fuel tank 1 in which liquid natural gas (LNG) serving as a liquid fuel is stored; a gasifier 2 (gasification unit) that gasifies the LNG into a fuel gas using water serving as a heating medium; a gas turbine unit G in which a combustor 6 (combustion means) burns an air-fuel mixture of the fuel gas and air to generate a combustion gas, and a gas turbine 7 is driven to rotate by the combustion gas generated by the combustor 6; a chiller 10 that produces water serving as a cold heat source; a cooling device 20 that cools air to be supplied to the combustor 6; a waste heat recovery boiler unit 25 that vaporizes water to generate steam using warm heat of an exhaust gas discharged from the gas turbine unit G; a steam turbine unit S in which a steam turbine 30 is driven to rotate with the steam obtained by the vaporization using the exhaust gas from the gas turbine unit G; a first power generator 35 (first power generating means) that generates power using the rotative force of the gas turbine 7; and a second power generator 36 (second power generating means) that generates power using the rotative force of the steam turbine 30.

[0066] A fuel supply path L1 has one end connected to the fuel tank 1, and another end connected to the combustor 6 of the gas turbine unit G, and the fuel supply path L1 includes the gasifier 2. Also, the gasifier 2 is a heat exchanger to which a gasification medium supply path L2 through which water serving as a warm heat source flows, and a first cooling medium supply path L3 through which water that has obtained cold heat from LNG flows are connected, and LNG supplied from the fuel tank 1 is warmed and is gasified into a fuel gas in the gasifier 2 by warm heat of the water supplied through the gasification medium supply path L2, and the fuel gas is supplied to the combustor 6.

[0067] The gas turbine unit G includes a compressor 5, the combustor 6, and the gas turbine 7. The compressor 5 is driven to rotate by the gas turbine 7, and the compressor 5 is configured to be supplied with air cooled by a later-

described cooling device 20 through a first air supply path L10, compress the supplied air, and deliver the compressed air to the combustor 6. Also, the combustor 6 burns an air-fuel mixture of the fuel gas supplied through the fuel supply path L1 and the compressed air supplied from the compressor 5 through a second air supply path L11 to generate a combustion gas, and delivers the generated combustion gas to the gas turbine 7 through a combustion gas supply path L12. The gas turbine 7 is driven to rotate with the combustion gas delivered from the combustor 6, and the rotative force of the gas turbine 7 is transmitted to the compressor 5 and a first power generator 35. Also, the combustion gas provided to drive and rotate the gas turbine 7 is delivered to the later-described waste heat recovery boiler unit 25 through an exhaust gas supply path L13.

[0068] The chiller 10 of the present embodiment is a so-called absorption chiller, and includes an evaporator 11, an absorber 13, a regenerator 15, and a condenser 17, as shown in FIG. 2.

[0069] The evaporator 11 includes, inside thereof, a second cooling medium supply path L4 through which water to be supplied to a second cooling unit 22 of the later-described cooling device 20 as a cold heat source flows, and a cooling medium recovering path L5 that is coupled to this second cooling medium supply path L4 and through which water flows after the cold heat thereof was removed in the second cooling unit 22, and also includes a first spray means 12 that pumps water accumulated in the evaporator 11 using a pump (not shown) and sprays the water inside the evaporator 11. Also, the evaporator 11 is in communication with the absorber 13 via a pathway, and the pressures inside the evaporator 11 and the absorber 13 are reduced by a vacuum pump (not shown). The evaporator 11 evaporates the water sprayed by the first spray means 12 at a low temperature of about 5˚C under a reduced pressure, so as to cool the water flowing through the cooling medium recovering path L5, so that water that has a cold heat and is to be used in the second cooling unit 22 as a cold heat source is produced. Note that the water evaporated at a low temperature (that is to say, steam) is moved to the absorber 13 through the pathway.

[0070] Absorbing liquid (such as, for example, lithium bromide-water solution) is accumulated in the absorber 13, and the absorber 13 includes a second spray means 14 that sprays concentrated absorbing liquid heated in the later-described regenerator 15 into the absorber 13. In this absorber 13, the

concentrated absorbing liquid sprayed by the second spray means 14 is cooled by a cooling medium, and the steam generated in the evaporator 11 is absorbed by the cooled absorbing liquid.

[0071] The regenerator 15 is configured to be supplied with the absorbing liquid that was accumulated in the absorber 13 and was pumped by a pump (not shown), and the supplied absorbing liquid is heated by a heating means 16. Note that there is no particular limitation to the heating means 16 as long as it can heat absorbing liquid, and an example thereof may be a heating means that uses combustion heat of a fuel gas, heat of an electric heater, or the like. By heating the absorbing liquid supplied from the absorber 13, the regenerator 15 separates steam that was absorbed by the absorber 13 using the absorbing liquid. Note that the separated steam moves to the condenser 17 that is in communication with the regenerator 15 via a pathway.

[0072] The condenser 17 cools, using a cooling medium, the steam separated by the regenerator 15, and the condensed water is supplied to the evaporator 11. Note that the cold heat of a cooling medium (for example, water) appropriately supplied from the outside is used to cool the concentrated absorbing liquid in the absorber 13 and cool the steam in the condenser 17, and a cooling medium flow path La through which this cooling medium flows runs inside the absorber 13 and the condenser 17.

[0073] Note that water that is produced in the evaporator 11 of the chiller 10 and serves as a cold heat source may be used only by the second cooling unit 22, but may also be used for an air-conditioning device provided on the ship. That is to say, a configuration is also possible in which flow paths branched from the second cooling medium supply path L4 and the cooling medium recovering path L5 that are connected to the evaporator 11 are appropriately connected to the air-conditioning device, and water serving as a cold heat source is supplied to the air-conditioning device through the second cooling medium supply path L4, and water whose cold heat was removed in the air-conditioning device is recovered through the cooling medium recovering path L5.

[0074] The cooling device 20 is configured to cool air (air to be supplied to the combustor 6) that flows through the first air supply path L10. Specifically, in the present embodiment, this cooling device 20 includes a first cooling unit 21 that uses, as a cold heat source, water used as a heating medium to gasify the LNG, a second cooling unit 22 that uses, as a cold heat source, the water

produced by the chiller 10, and a third cooling unit 23 that uses marine water serving as a heating medium, as a cold heat source.

[0075] The first cooling unit 21 is a heat exchanger to which the gasification medium supply path L2 and the first cooling medium supply path L3 are connected, and water serving as a heating medium is circulated between the gasifier 2 and the first cooling unit 21 through the gasification medium supply path L2 and the first cooling medium supply path L3. This first cooling unit 21 cools the air to be supplied to the combustor 6 using the cold heat of the water (that is, water that has obtained the cold heat from LNG) supplied through the first cooling medium supply path L3.

[0076] The second cooling unit 22 is a heat exchanger to which the second cooling medium supply path L4 and the cooling medium recovering path L5 are connected, and water serving as a heating medium is circulated between the evaporator 11 of the chiller 10 and the second cooling unit 22 through the second cooling medium supply path L4 and the cooling medium recovering path L5. This second cooling unit 22 cools the air to be supplied to the combustor 6 using the cold heat of the water (that is, water that is produced by the chiller 10 and has a cold heat) supplied through the second cooling medium supply path L4.

[0077] The third cooling unit 23 is a heat exchanger to which a first marine water supply path L6 (first marine water flow path) through which marine water pumped by a pump P1 from the sea flows, and a second marine water supply path L7 (second marine water flow path) through which marine water to be supplied to a later-described condensate cooling unit 32 flows are connected. This third cooling unit 23 cools the air to be supplied to the combustor 6 using the cold heat of the marine water that serves as a cold heat source and is supplied through the first marine water supply path L6. Note that a bypass flow path L8 that connects the first marine water supply path L6 and the second marine water supply path L7 is connected to a position of the first marine water supply path L6 that is located between the pump P1 and the third cooling unit 23.

[0078] Also, an adjustment device 24 (adjustment means) is provided at the position of the first marine water supply path L6 at which the bypass flow path L8 is connected, and the adjustment device 24 can adjust the amount of marine water that is to flow through the bypass flow path L8.

[0079] Furthermore, in the present embodiment, the cooling units 21, 22, and

23 are arranged in the order of the third cooling unit 23, the second cooling unit 22, and the first cooling unit 21, from the upstream side in a flowing direction in which air flows to the combustor 6, so that air suctioned into the first air supply path L10 is cooled by the third cooling unit 23, the second cooling unit 22, and the first cooling unit 21 in this order.

[0080] The waste heat recovery boiler unit 25 is configured to recover the warm heat of an exhaust gas that is discharged from the gas turbine 7 after having used to drive and rotate the gas turbine 7. Specifically, in the present embodiment, the waste heat recovery boiler unit 25 warms and vaporizes water in a plurality of drums 26 using the warm heat of the exhaust gas from the gas turbine 7, and generates steam. Also, this steam is delivered to the steam turbine 30 of the steam turbine unit S through a steam supply path L14. Note that the exhaust gas from which the warm heat was recovered is discharged to the outside as appropriate.

[0081] The steam turbine unit S includes the steam turbine 30, a steam condenser 31, and the condensate cooling unit 32. The steam turbine 30 is driven to rotate with the steam delivered from the waste heat recovery boiler unit 25, and the rotative force thereof is transmitted to the second power generator 36. Also, the steam condenser 31 includes the condensate cooling unit 32 inside thereof, and the steam provided to drive and rotate the steam turbine 30 is condensed into water in this steam condenser 31 and is supplied to the drums 26 through a water supply path L15. The condensate cooling unit 32 is a heat exchanger to which the second marine water supply path L7 and a marine water discharge path L9 for discharging marine water to the sea are connected, and is configured to cool the inside of the steam condenser 31 using the cold heat of marine water supplied through the second marine water supply path L7, and the marine water that was used to cool the inside of the steam condenser 31 is discharged to the sea through the marine water discharge path L9. Note that in the present embodiment, if, in the condensate cooling unit 32, the temperature of marine water supplied through the second marine water supply path L7 is about 32˚C, the temperature of the marine water after having been used to cool the inside of the steam condenser 31 will be about 42˚C.

[0082] The first power generator 35 is driven by the gas turbine 7 to generate power, and the second power generator 36 is driven by the steam turbine 30 to generate power.

[0083] In the moving body having the above-described configurations, a fuel gas gasified by the gasifier 2 is supplied to the combustor 6, and air cooled by the cooling device 20 is supplied to the combustor 6, so that an air-fuel mixture of the fuel gas and the air is burned by the combustor 6, and the generated combustion gas is delivered to the gas turbine 7 to drive and rotate the gas turbine 7, and the first power generator 35 is driven to rotate by the rotative force of the gas turbine 7 to generate power.

[0084] Also, on the moving body, the combustion gas used to drive and rotate the gas turbine 7 is delivered to the waste heat recovery boiler unit 25 as an exhaust gas, and steam is generated by the waste heat recovery boiler unit 25 using the warm heat of the exhaust gas. This steam is delivered to the steam turbine 30 to drive and rotate the steam turbine 30, and the second power generator 36 is driven using the rotative force of the steam turbine 30 to generate power.

[0085] With the ship provided with the power generation system E according to the present embodiment, air to be supplied to the combustor 6 is cooled by the cooling device 20, and thus it is possible to prevent a reduction in output (in other words, a reduction in the amount of power generation) of the power generation system E. Also, in such a case where a plurality of gas turbine units G are installed on a ship, since providing the cooling device 20 can prevent a reduction in output of the power generation system E, it is possible to reduce the number of gas turbine units G required to obtain the same power, and realize reductions in the installation cost, the maintenance cost, and the installation spaces.

[0086] Also, the cooling device 20 according to the present embodiment uses, as a cold heat source for cooling air to be supplied to the combustor 6, a heating medium that is naturally generated when LNG is gasified, and has removed the cold heat of the LNG, and thus the cold heat of the LNG can be efficiently used.

[0087] Furthermore, since air to be supplied to the combustor 6 is cooled by the three cooling units 21, 22, and 23, it is possible to sufficiently cool the air to be supplied to the combustor 6, while solving the problems that the energy efficiency of the power generation system E as a whole is reduced, that a large chiller 10 is unavoidable, and that the output of the power generation system E is reduced due to a lack of cold heat obtained by gasifying LNG consumed by the power generation system E when it generates power. This makes it

possible to prevent a reduction in output of the power generation system E.

[0088] Here, water that is used as a cold heat source in the first cooling unit 21 is water that was used to gasify LNG. In the present embodiment, as shown in FIG. 1, if the temperature of LNG is about -160˚C, when the LNG is gasified into a fuel gas of about 10˚C using water to be used in the first cooling unit 21, the water that is a heating medium will obtain considerable cold heat, and thus if the temperature of the water before obtaining the cold heat is about 13˚C, the temperature of the water after having obtained the cold heat will be about 5˚C.

[0089] In contrast, water that is used as a cold heat source in the second cooling unit 22 is water produced in the chiller 10, and tends to have a high temperature relative to that of the water used in the first cooling unit 21. In the present embodiment, as shown in FIG. 1, the temperature of the water at a point in time when the water is supplied to the second cooling unit 22 is about 7˚C, and the temperature of the water whose cold heat was removed by the air in the second cooling unit 22 is about 15˚C.

[0090] Also, the temperature of marine water that is used as a cold heat in the third cooling unit 23 is about 20 to 30˚C if it is pumped from the depth of 30 m to 70 m, and in the present embodiment, the temperature of the marine water is about 25˚C as shown in FIG. 1, and after the cold heat of the marine water was removed by air in the third cooling unit 23, the temperature of the marine water is about 32˚C.

[0091] In the present embodiment, since the third cooling unit 23, the second cooling unit 22, and the first cooling unit 21 are arranged in this order from the upstream side in the flowing direction in which air flows to the combustor 6, air (having 35˚C in the present embodiment) suctioned into the first air supply path L10 is cooled in the ascending order of the relative temperature of the used heating medium from the cooling units 21, 22, and 23. That is, the air to be supplied to the combustor 6 can be first cooled in the third cooling unit 23 so as to have the temperature of about 30˚C, then can be cooled in the second cooling unit 22 so as to have the temperature of about 20˚C, and then can be cooled in the first cooling unit 21 so as to ultimately have the temperature of about 15˚C, and thus it is possible to efficiently cool air without wasting the cold heat of the respective heating medium used in the three cooling units 21, 22, and 23 as much as possible.

[0092] Also, in the present embodiment, since the marine water pipes through

which marine water is supplied to the third cooling unit 23 and the condensate cooling unit 32, and through which marine water is recovered from these cooling units 23 and 32 have shared parts (that is to say, the first marine water supply path L6, the second marine water supply path L7, and the marine water discharge path L9), the layout of the pipes is simple, and only one pump P1 is required to cause marine water to flow.

[0093] Furthermore, in the present embodiment, by providing the bypass flow path L8, which connects the first marine water supply path L6 and the second marine water supply path L7, it is possible to adjust the amount of marine water that is to flow through the bypass flow path L8 using the adjustment device 24. Thus, the following advantages are realized.

[0094] For example, if a difference in temperature between air suctioned into the first air supply path L10 and marine water used in the third cooling unit 23 is small, the air-cooling effect hardly differs even if the amount of marine water to be supplied to the third cooling unit 23 is low. However, if, even in such a case, marine water is caused to flow to the condensate cooling unit 32 through the third cooling unit 23, this will lead to an unnecessary increase in the pump output. Also, if, for example, the temperature of suctioned air is higher than the temperature of marine water, supplying the marine water to the third cooling unit 23 will rather lead to heating the air.

[0095] However, according to the moving body of the present embodiment, by adjusting, using the adjustment device 24, the amount of marine water that is to flow through the bypass flow path L8 as needed, it is possible to prevent an unnecessary increase in the output of the pump P1. Also, according to the moving body of the present embodiment, even if the temperature of marine water is higher than the temperature of air, it is possible to avoid a situation in which the air is heated by the marine water, by performing adjustment of the adjustment device 24 such that the total amount of marine water pumped by the pump P1 flows through the bypass flow path L8.

[0096] [Second Embodiment]

The following will describe a moving body according to a second embodiment of the present invention. Note that also in the present embodiment, a description will be made taking a case where the moving body is a ship as an example. The same reference numerals are given to the same configurations as those in the first embodiment, and detailed descriptions

thereof are omitted.

[0097] FIG. 3 is a diagram illustrating a schematic configuration of a power generation system E1 that is installed on a ship (LNG ship). As shown in FIG. 3, the power generation system E1 includes the gasifier 2, a plurality of gas turbine units Ga and Gb, the chiller 10, a plurality of cooling devices 20a and 20b, a plurality of waste heat recovery boiler units 25a and 25b, and the steam turbine unit S. Also, this power generation system E1 includes a control device 40, and a temperature sensor Tb for detecting the ambient temperature. Note that, although illustration is omitted, the power generation system E1 of the moving body according to the second embodiment also includes a fuel tank in which liquid natural gas is stored, a first power generation means for generating power using the rotative forces of gas turbines 7a and 7b of the gas turbine units Ga and Gb, and a second power generating means for generating power using the rotative force of the steam turbine 30. Note that FIG. 3 shows a configuration in which two gas turbine units, two cooling devices, and two waste heat recovery boiler units are provided.

[0098] In the second embodiment, a fuel adjustment valve V1 is provided at a position of the fuel supply path L1 that is located between the fuel tank and the gasifier 2, and the open/close operation of this fuel adjustment valve V1 is controlled by the control device 40 based on the electric demand and the operational states of the gas turbine units.

[0099] In the second embodiment, the gasification medium supply path L2 connected to the gasifier 2 is branched into gasification medium supply paths L2a and L2b on the upstream side of the gasification medium supply path L2, and the first cooling medium supply path L3 also connected to the gasifier 2 is branched into first cooling medium supply paths L3a and L3b on the downstream side of the first cooling medium supply path L3. Also, the cooling medium supply path L3 includes a heat exchanger 37 and a buffer tank 38 in this order from the upstream side. The heat exchanger 37 is configured to perform heat exchange between water that has obtained the cold heat of LNG in the gasifier 2, and marine water suitably pumped from the sea, and the buffer tank 38 is configured to temporarily accumulate water to be supplied to the first cooling units 21a and 21b when the power generation system E1 is activated.

[0100] The two gas turbine units Ga and Gb have the same configuration as that of the gas turbine unit G of the first embodiment, and respectively include

compressors 5a and 5b and the gas turbines 7a and 7b. That is to say, in the present embodiment, air cooled by the cooling devices 20a and 20b is supplied to the compressors 5a and 5b through first air supply paths L10a and L10b. Also, the air supplied to the compressors 5a and 5b is mixed with a fuel gas and is burned by a not-shown combustor. Then, the combustion gas generated in the combustor is delivered to the gas turbines 7a and 7b to drive and rotate the gas turbines 7a and 7b, and then is delivered as an exhaust gas to the waste heat recovery boiler units 25a and 25b through exhaust gas supply paths L13a and L13b.

[0101] In the second embodiment, the second cooling medium supply path L4 connected to the chiller 10 is branched into second cooling medium supply paths L4a and L4b on the downstream side of the chiller 10, and the cooling medium recovering path L5 also connected to the chiller 10 is branched into cooling medium recovering paths L5a and L5b on the upstream side of the chiller 10. Furthermore, according to the second embodiment, a marine water temperature sensor Ta for measuring the temperature of marine water is provided on the cooling medium flow path La that runs through the absorber 13 and the condenser 17 of the chiller 10.

[0102] The gasification medium supply paths L2a and L2b, and the first cooling medium supply paths L3a and L3b are respectively connected to the first cooling units 21a and 21b of the cooling device 20a and 20b of the second embodiment. Also, the second cooling medium supply paths L4a and L4b, and the cooling medium recovering paths L5a and L5b are respectively connected to the second cooling units 22a and 22b.

[0103] Also, in the second embodiment, the first marine water supply path L6 is branched into first marine water supply paths L6a and L6b on the downstream side of the pump P1, and these first marine water supply paths L6a and L6b, and marine water discharge paths L9a and L9b are respectively connected to the third cooling units 23a and 23b of the cooling devices 20a and 20b, so that marine water supplied to the third cooling units 23a and 23b through the first marine water supply paths L6a and L6b is discarded to the sea through the marine water discharge paths L9a and L9b. Note that also in the cooling device 20a, 20b, the cooling units 21a, 21b, 22a, 22b, and 23a, 23b are arranged in the order of the third cooling unit 23a, 23b, the second cooling unit 22a, 22b, and the first cooling unit 21a, 21b from the upstream side of the first air supply path L10a, L10b.

[0104] The respective waste heat recovery boiler units 25a and 25b according to the second embodiment vaporize the water in a plurality of drums 26a and 26b using an exhaust gas delivered from the gas turbines 7a and 7b through the exhaust gas supply paths L13a and L13b, and generate steam. Also, this steam is delivered to the steam turbine 30 through the above-described supply paths L14a and L14b.

[0105] In the second embodiment, the second marine water supply path L7 branched from the first marine water supply path L6b, and a marine water discharge path L9c are connected to the condensate cooling unit 32 of the steam turbine unit S, so that marine water supplied through the second marine water supply path L7 is discarded to the sea through the marine water discharge path L9c. Also, the steam generated by the waste heat recovery boiler units 25a and 25b is condensed into water in the steam condenser 31, and the water is supplied to the drums 26a and 26b through water supply paths L15a and L15b.

[0106] The control device 40 is a device that performs various types of control regarding operations of the power generation system E1. This control device 40 can determine the number of gas turbine units Ga and Gb to be operated, based on the electric demand and the operational state of the cooling devices 20a and 20b. Note that the operational state of the cooling devices 20a and 20b may be predetermined, or may be suitably determined based on the electric demand and the output characteristics of the gas turbine units Ga and Gb. Also, the output characteristics of the gas turbine units Ga and Gb are predetermined based on the ambient temperature, atmospheric pressure, humidity, marine water temperature, and the like.

[0107] The following will describe an example of control of the operations of the power generation system that is performed by the control device 40, with reference to FIG. 4. Note that in the following description, the operational state of the cooling device 20a, 20b is changed by changing the degree of cooling of air using the second cooling unit 22a, 22b while setting the degrees of cooling of air using the first cooling unit 21a, 21b and the third cooling unit 23a, 23b as constant. Also, FIG. 4 is a graph illustrating output characteristics of the gas turbine units that are predetermined according to the ambient temperature. In FIG. 4, a dashed-dotted line X1 indicates a first output characteristic when one gas turbine unit is operated in an operational state of the cooling device such that air to be supplied to the combustor is 15˚C, and a

dashed-dotted line X2 indicates a second output characteristic when two gas turbine units are operated in the operational state of the cooling device such that air to be supplied to the combustor is 15˚C. Also, in FIG. 4, a dashed-two dotted line Y1 indicates a third output characteristic when one gas turbine unit is operated in an operational state of the cooling device such that air to be supplied to the combustor is 10˚C, and a dashed-two dotted line Y2 indicates a fourth output characteristic when two gas turbine units are operated in the operational state of the cooling device such that air to be supplied to the combustor is 10˚C.

[0108] First, the control device 40 determines the number of gas turbine units Ga and Gb that can satisfy the electric demand of 49.2 MW at the ambient temperature of 20˚C in predetermined operational state of the cooling devices 20a and 20b (operational state in which air to be supplied to the combustor is 15˚C) as two, and operates two gas turbine units Ga and Gb (state of a black circle (1) in FIG. 4).

[0109] Even if the ambient temperature increases to 35˚C from this state, and the electric demand is still in the state of 49.2 MW (state of a black circle (2) in FIG. 4), the state is located between the dashed-dotted line X1, which indicates the first output characteristic, and the dashed-dotted line X2, which indicates the second output characteristic, and thus it is possible to satisfy the electric demand without changing the operational state of the cooling devices 20a and 20b, and thus the state in which the two gas turbine units Ga and Gb are operated is maintained.

[0110] Also, if the state shifts to a state in which the electric demand is increased and is smaller than or equal to 82 MW (state of a black circle (3) in FIG. 4), this state is located at a position that does not exceed the dashed-dotted line X2, which indicates the second output characteristic. Accordingly, it is possible to satisfy the electric demand without changing the operational state of the cooling devices 20a and 20b, and thus the state in which the two gas turbine units Ga and Gb are operated is maintained.

[0111] On the other hand, if a state is realized in which the electric demand largely exceeds 82 MW (state of a white circle (3)' in FIG. 4), this state is located at a position that largely exceeds the dashed-dotted line X2, which indicates the second output characteristic, and the dashed-two dotted line Y2, which indicates the fourth output characteristic. Accordingly, even if the operational state of the cooling devices 20a and 20b is changed to an operational state in

which air to be supplied to the combustor is 10˚C, the electric demand cannot be satisfied, and thus the not-shown third gas turbine unit is operated so as to deal with this state.

[0112] Then, if a state is realized in which the ambient temperature is reduced to 27˚C and the electric demand is reduced to 42.6 MW (state of a black circle (4) in FIG. 4), this state is located at a position that exceeds the dashed-dotted line X1, which indicates the first output characteristic, but is located on the dashed-two dotted line Y1, which indicates the third output characteristic. Accordingly, by changing the operational state of the cooling devices 20a and 20b to the operational state in which air to be supplied to the combustor is 10˚C, it is possible to reduce the number of gas turbine units to be operated to one, and satisfy the electric demand. Therefore, in the second embodiment, by reducing the temperature of cold water to be supplied to the second cooling units from the chiller 10 (that is, increasing the degree of cooling of air using the second cooling units), the operational state of the cooling devices 20a and 20b is changed to the operational state in which air to be supplied to the combustor is 10˚C, and one of the two operating gas turbine units Ga and Gb is stopped.

[0113] In this way, in the moving body of the second embodiment, the operational state of the cooling devices 20a and 20b and the number of gas turbine units Ga and Gb to be operated can be determined based on the electric demand, and the cooling devices can be operated in the appropriate operational suited to the electric demand. Also, it is possible to operate the number of gas turbine units G suited to the electric demand, without unnecessarity increasing the number of the operated gas turbine units G.

[0114] Also, even if the gas turbine units Ga and Gb are operated such that when the gas turbine units Ga and Gb are rapidly operated or when the trips of the gas turbines 7a and 7b are stopped, the flow amount of LNG rapidly increases or the potential heat of water to be supplied to the gasifier 2 rapidly decreases, the control device 40 performs control such that a sufficient amount of water retained in the buffer tank 38 provided in the cooling medium supply path L3 is secured and water can be supplied rapidly. With this, it is possible to prevent the gasifier 2 from being damaged due to freezing caused by a lack of warm heat.

[0115] [Other Embodiments]

[1] In the above-described embodiments, a configuration is adopted in which the cooling device 20, 20a, 20b includes the first cooling unit 21, 21a, 21b, the second cooling unit 22, 22a, 22b, and the third cooling unit 23, 23a, 23b, but a configuration may also be adopted in which the cooling device includes at least two of the above-described three types of cooling units.

[0116] If a configuration is adopted in which the cooling device includes the first cooling unit 21, 21a, 21b, and the second cooling unit 22, 22a, 22b, it is possible to efficiently use the cold heat of LNG and cool air to be supplied to the combustor 6 using the first cooling unit 21, 21a, 21b, and the second cooling unit 22, 22a, 22b, while avoiding the problems that the energy efficiency of the power generation system as a whole is reduced, and that a large chiller is unavoidable. This makes it possible to prevent a reduction in output of the power generation system E, E1, as described above.

Note that in this case, in view of cooling air without wasting the cold heat of a heating medium as much as possible, it is preferable to arrange the two types of cooling units 21, 21a, 21b, and 22, 22a, 22b so that air to be supplied to the combustor 6 flows through the second cooling unit 22, 22a, 22b, and the first cooling unit 21, 21a, 21b in this order.

[0117] Also, even if a configuration is adopted in which the cooling device includes the first cooling unit 21, 21a, 21b, and the third cooling unit 23, 23a, 23b, it is possible to efficiently use the cold heat of LNG and cool air to be supplied to the combustor 6 using the first cooling unit 21, 21a, 21b, and the third cooling unit 23, 23a, 23b, while efficiently using the cold heat of LNG and avoiding the problems that the energy efficiency of the power generation system as a whole is reduced, and that a large chiller is unavoidable. This makes it possible to prevent a reduction in output of the power generation system E and E1, as described above.

Note that in this case, in view of cooling air without wasting the cold heat of a heating medium as much as possible, it is preferable to arrange the two types of cooling units 21, 21a, 21b, and 23, 23a, 23b so that air to be supplied to the combustor 6 flows through the third cooling unit 23, 23a, 23b, and the first cooling unit 21, 21a, 21b in this order. With this, it is possible to cool the air without wasting the cold heat of a heating medium as much as possible.

[0118] If a configuration is adopted in which the cooling device includes the second cooling unit 22, 22a, 22b, and the third cooling unit 23, 23a, 23b, it is

possible to cool air to be supplied to the combustor 6 using the second cooling unit 22, 22a, 22b, and the third cooling unit 23, 23a, 23b, while avoiding the problems that the energy efficiency of the power generation system as a whole is reduced, and that a large chiller is unavoidable. This makes it possible to prevent a reduction in output of the power generation system E, as described above.

Note that in this case, it is preferable to arrange the two types of cooling units 22, 22a, 22b, and 23, 23a, 23b so that air to be supplied to the combustor 6 flows through the third cooling unit 23, 23a, 23b, and the second cooling unit 22, 22a, 22b in this order.

[0119] [2] In the above-described embodiments, a configuration is adopted in which the first cooling unit 21, 21a, 21b, the second cooling unit 22, 22a, 22b, and the third cooling unit 23, 23a, 23b that constitute the cooling device 20, 20a, 20b are arranged in the order of the third cooling unit 23, 23a, 23b, the second cooling unit 22, 22a, 22b, and the first cooling unit 21, 21a, 21b from the upstream side in the flowing direction in which air flows to the combustor 6, but the present invention is not limited to this, and a suitable layout of these cooling units may be set.

[0120] [3] In the above-described embodiments, a case is exemplified in which the moving body is a ship provided with the fuel tank 1, the gasifier 2, the gas turbine unit G, the waste heat recovery boiler unit 25, the steam turbine unit S, and the power generators 35 and 36, but the present invention is not limited to this. Any moving body may be used as long as it is provided with at least the cooling device, and a moving body may also be used that is provided with, in addition to the cooling device, constituent components (the fuel tank, the gasifier, the gas turbine unit, and the first power generator) necessary for gas turbine power generation.

With the moving body provided with the cooling device, if, for example, the moving body is moved to a facility or the like in which a combined cycle power generation system that does not include any cooling device is provided, the cooling device of the moving body can cool air to be supplied to the combustor of this power generation system, making it possible to prevent a reduction in output of the gas turbine unit.

Also, the present invention is applicable and implemented to a relatively small moving body, as long as the cooling device, and the constituent components necessary for gas turbine power generation are installed.

Note that examples of the moving body include, in addition to an LNG ship, an LPG ship, an ethylene ship, an ammonia ship, a liquid hydrogen transport ship, a large tuna ship, a freezing container ship, and a floating ship, but the present invention is not limited to these. The examples may also include: a floating structure that is constructed or modified in a shipyard and is towed to a place at which it is to be used, and is anchored during a trial period or substantially permanently; and other types of land transport means (such as a truck or a dory).

[0121] [4] In the first embodiment, a configuration is adopted in which the marine water pipes through which marine water is supplied to the third cooling unit 23 and the condensate cooling unit 32, and through which marine water is recovered from these cooling units 23 and 32 have shared parts (that is to say, the first marine water supply path L6, the second marine water supply path L7, and the marine water discharge path L9), and marine water used in the third cooling unit 23 is used as a cold heat source in the condensate cooling unit 32, but the present invention is not limited to this. For example, a configuration is also possible in which a pipe for supplying marine water to the third cooling unit 23 or recovering the marine water, and a pipe for supplying marine water to the condensate cooling unit 32 or recovering the marine water are separately provided, and marine water supplied from a pipe different from the pipe for supplying marine water to be used in the third cooling unit 23 may be used in the condensate cooling unit 32.

[0122] [5] In the first embodiment, a configuration is adopted in which the bypass flow path L8 that connects the first marine water supply path L6 and the second marine water supply path L7 is provided, and the adjustment device 24 for adjusting the amount of marine water that is to flow through the bypass flow path L8 is provided, but the present invention is not limited to this configuration, and a configuration is also possible in which there are no bypass flow path and no adjustment device.

Also, the second embodiment does not employ an aspect in which the amount of marine water that is to flow through the second marine water supply path L7 is adjusted, but similar to the first embodiment, a configuration is also possible in which an adjustment device is suitably provided, so that the amount of marine water that is to flow through the second marine water supply path L7 is adjusted.

[0123] [6] In the above-described embodiments, water is used as a heating

medium used in the gasifier 2 and the first cooling unit 21, 21a, 21b, but instead of water, anti-freezing fluid such as ethylene glycol may also be used. With the use of anti-freezing fluid, the gasifier 2 gasifies LNG into a fuel gas using heat exchange with the anti-freezing fluid, so that the temperature of the anti-freezing fluid is reduced relative to the temperature of water (reduced to 0°C, for example). Therefore, when the anti-freezing fluid that has obtained the cold heat of LNG is used in the first cooling unit 21 to cool air to be supplied to the combustor 6, it is possible to cool the air to about 10°C.

[0124] [7] In the above-described embodiments, a so-called absorption chiller is employed as the chiller 10, but the present invention is not limited to this, and an electric turbo chiller may also be used.

[0125] [8] In the above-described embodiments, an aspect is adopted in which the cold heat of a cooling medium appropriately supplied from the outside is used to cool the concentrated absorbing liquid in the absorber 13 of the chiller 10, and to cool the steam in the condenser 17 thereof, but the present invention is not limited to this aspect. For example, if the cooling medium flow path La is branched from the first marine water supply paths L6 and L6a and is connected to the second marine water supply path L7 through the absorber 13 and the condenser 17, parts of the marine water pipes can be shared and used as flow paths through which marine water is to be supplied not only to the third cooling unit 23, 23a, 23b and the condensate cooling unit 32 but also to the absorber 13 and the condenser 17 of the chiller, making it possible to further simplify the layout of the pipes. Also, if an electric turbo chiller is used as the chiller 10, when a flow path for cooled water to be used in the condenser of the electric turbo chiller is branched from the first marine water supply paths L6 and L6a, and is provided to run through the condenser and connect to the second marine water supply path L7, parts of the marine water pipes can be shared, making it possible to further simply the layout of the pipes, as described above. Note that the pipes through which marine water flows is preferably made of stainless steel or titanium taking into consideration rusting and the like.

[0126] [9] In the above-described embodiments, an example has been given in which marine water to be used as a cold heat source is pumped from the depth of 30 m to 70 m, but the present invention is not limited to this. For example, deep-sea water may be used as a cold heat source.

[0127] [10] Although FIG. 1 does not show configurations that correspond to

the heat exchanger 37 and the buffer tank 38 of the second embodiment, but also in the power generation system E installed in a ship according to the first embodiment, it is preferable to provide a heat exchanger and a buffer tank in the first cooling medium supply path L3.

[0128] [11] In the second embodiment, a configuration is adopted in which steam generated by the plurality of waste heat recovery boiler units 25a and 25b is delivered to the common steam turbine 30, but the present invention is not limited to this, and a plurality of steam turbine units S may also be provided.

[0129] [12] In the second embodiment, output characteristics predetermined based on the ambient temperature are used as the output characteristics of the gas turbine units Ga and Gb for determining the operational state of the cooling devices 20a and 20b, but output characteristics predetermined based on the atmospheric pressure, humidity, and marine water temperature may also be used.

[0130] [13] The second embodiment has an aspect in which the number of gas turbine units Ga and Gb to be operated is determined so as to be able to satisfy a predetermined electric demand under a predetermined ambient temperature, the gas turbine units Ga and Gb are operated in predetermined operational state of the cooling devices 20a and 20b, and then the operational state of the cooling devices 20a and 20b and the number of gas turbine units Ga and Gb to be operated are appropriately changed in accordance with a change in the electric demand or the ambient temperature. But the present invention is not limited to this aspect.

A configuration is also possible in which the operational state of the cooling devices 20a and 20b is first determined based on the electric demand and the output characteristics of the gas turbine units Ga and Gb, and the number of gas turbine units Ga and Gb to be operated is further determined based on the determined operational state and the electric demand, and then the gas turbine units Ga and Gb are operated.

Also, in such a case where a change in the ambient temperature in a day or a change in electric demand in a day is known in advance, it is also possible to determine in advance the operational state of the cooling devices 20a and 20b and the number of gas turbine units Ga and Gb to be operated, based on a state in which the ambient temperature is highest or a state in which the electric demand is highest.

[0131] [14] In the second embodiment, as a case where the operational state of the cooling devices 20a and 20b is changed, a case has been described in which the temperature of air to be supplied to the second cooling unit from the chiller 10 is reduced (that is to say, a case where the degree of cooling of the air using the second cooling units 22a and 22b is increased), but the present invention is not limited to this.

By changing the degree of cooling of the air using any one type of the first cooling unit 21a, 21b, the second cooling unit 22a, 22b, and the third cooling unit 23a, 23b, the operational state of the cooling device 20a, 20b can be changed.

For example, there is a case where the temperature of marine water measured by the marine water temperature sensor Ta is high, and it is considered that cooling air using the third cooling units 23a and 23b is not effective. In this case, it is also possible to close adjustment valves that are suitably provided in the first marine water supply paths L6a and L6b, and change the operational state of the cooling devices 20a and 20b from the operational state in which air is cooled by three types of cooling units 21a, 21b, 22a, 22b, and 23a, 23b to the operational state in which air is cooled by the first cooling units 21a and 21b, and the second cooling units 22a and 22b, and air is not cooled by the third cooling units 23a and 23b (in other words, the operational state in which the degrees of cooling of air by the first cooling units 21a and 21b, and the second cooling units 22a and 22b are not changed, and the degree of cooling of air by the third cooling units 23a and 23b is reduced).

[0132] [15] In the second embodiment, by determining the degrees of cooling of air by the first cooling units 21a and 21b, the second cooling units 22a and 22b, and the third cooling units 23a and 23b based on the electric demand and the output characteristics of the gas turbine units, the operational state of the cooling devices 20a and 20b is determined, but the present invention is not limited to this.

It is also possible to determine the operational state of the cooling devices 20a and 20b based on the ambient air state (such as the ambient temperature, atmospheric pressure, and humidity), and determine the degrees of cooling of the air using the first cooling units 21a and 21b, the second cooling units 22a and 22b, and the third cooling units 23a and 23b.

For example, if the ambient temperature is low (about 20 to 30˚C), the operational state of the cooling devices 20a and 20b is determined as a state in

which the cooling devices 20a and 20b can be operated with such a cooling ability that the low temperature air can be cooled to a predetermined temperature, and the degrees of cooling of the air using the cooling units 21a, 21b, 22a, 22b, 23a, and 23b may be determined so that such an operational state is realized.

[0133] [16] In the second embodiment, when the operational state of the cooling devices 20a and 20b and the number of gas turbine units Ga and Gb to be operated are determined, the output characteristics of the gas turbine units Ga and Gb are taken into consideration, but the present invention is not limited to this, and control of operations of the power generation system may be performed taking into consideration efficiency characteristics of the gas turbine units Ga and Gb. The following will describe an example of the control of operations of the power generation system taking into consideration efficiency characteristics of the gas turbine units Ga and Gb with reference to FIG. 5.

Note that FIG. 5 is a graph showing efficiency characteristics of a gas turbine unit, and in FIG. 5, a dashed-dotted line Z1 indicates an efficiency characteristic (first efficiency characteristic) per one gas turbine unit when the cooling device is operated so that air to be supplied to the combustor has the temperature of 15˚C and the loading factor is 60%, and a dashed-dotted line Z2 indicates an efficiency characteristic (second efficiency characteristic) per one gas turbine unit when the cooling device is operated so that air to be supplied to the combustor has the temperature of 15˚C and the loading factor is 100%, and a dashed two-dotted line Z3 indicates an efficiency characteristic (third efficiency characteristic) per one gas turbine unit when the cooling device is operated so that air to be supplied to the combustor has the temperature of 10˚C and the loading factor is 100%.

When a state in which the cooling device is operated at the ambient temperature of 20˚C so that the temperature of air to be supplied to the combustor is changed to 15˚C with the loading factor of 60%, and two gas turbine units are operated (state of a black circle (1) in FIG. 5) is shifted to a state in which the ambient temperature is increased to 35˚C with the number of gas turbine units to be operated and the degree of cooling of air unchanged (state of a black circle (2) in FIG. 5), the efficiency per one gas turbine unit is reduced. By bringing this state (state of the black circle (2) in FIG. 5) into a state in which the output of the gas turbine and the cooling device are operated

so that the temperature of the air to be supplied to the combustor is changed to 15˚C with the loading factor of 100% (state of a black circle (3) in FIG. 5), it is possible to improve the efficiency per one gas turbine unit. Then, if a state is realized in which the ambient temperature is reduced to 27˚C, the electric demand is also reduced, and the efficiency per one gas turbine unit is reduced (state of a black circle (4) in FIG. 5), by using a method for lowering the temperature of cooled water to be supplied from the chiller as long as the electric demand can be satisfied, a state is realized in which the cooling device is operated so that the temperature of the air to be supplied to the combustor is changed to 10˚C, and the number of gas turbine units to be operated is reduced to one (state of the black circle (5) in FIG. 5). With this, in terms of increasing the cooling capacity using the cooling device, the efficiency per one gas turbine unit is slightly reduced, but the number of gas turbine units to be operated is reduced to one, and thus the efficiency per one gas turbine unit is ultimately improved.

Accordingly, by performing control of operations of the power generation system taking into consideration the efficiency characteristics of the gas turbine units, it is possible to efficiently operate the gas turbine units.

[0134] [17] The configurations disclosed in the above-described embodiments (including the other embodiments) can be applied in combination with configurations disclosed in other embodiments so long as no contradiction is incurred, the embodiments disclosed in the present specification are mere examples, and embodiments of the present invention are not limited to those disclosed in the present specification and can be modified as appropriate without departing from the object of the present invention.

## Industrial Applicability

[0135] The present invention is applicable to a moving body provided with a cooling device that can efficiently cool air to be supplied to a combustion means, and can prevent a reduction in output of a gas turbine unit.

## Description of Reference Signs

[0136]

1 Fuel tank
2 Gasifier (gasification unit)
6 Combustor (combustion means)

7, 7a, 7b Gas turbine
10 Chiller
20, 20a, 20b Cooling device
21, 21a, 21b First cooling unit
22, 22a, 22b Second cooling unit
23, 23a, 23b Third cooling unit
24 Adjustment device (adjustment means)
25, 25a, 25b Waste heat recovery boiler unit
30 Steam turbine
31 Steam condenser
32 Condensate cooling unit
35 First power generator (first power generating means)
36 Second power generator (second power generating means)
L6, L6a, L6b First marine water supply path (first marine water flow path)
L7 Second marine water supply path (second marine water flow path)
L8 Bypass flow path
G, Ga, Gb Gas turbine unit
S Steam turbine unit
E, E1 Power generation system

CLAIMS

1. A moving body provided with a cooling device that is used in a power generation system that comprises: a gas turbine unit in which a combustion means burns an air-fuel mixture of air and a fuel gas obtained by gasifying a liquid fuel to generate a combustion gas, and a gas turbine is driven to rotate with the combustion gas generated by the combustion means; and a first power generating means for generating power using a rotative force of the gas turbine, the cooling device being configured to cool air to be supplied to the combustion means,

wherein the cooling device includes

from among a first cooling unit that uses, as a cold heat source, a heating medium used to gasify the liquid fuel, a second cooling unit that uses, as a cold heat source, a heating medium from a chiller, and a third cooling unit that uses, as a cold heat source, marine water serving as a heating medium, at least the first cooling unit and the third cooling unit or at least the second cooling unit and the third cooling unit,

the moving body comprising:

a fuel tank in which the liquid fuel is stored;

a gasification unit configured to gasify the liquid fuel;

the gas turbine unit;

the first power generating means;

a waste heat recovery boiler unit configured to vaporize water using an exhaust gas from the gas turbine unit;

a steam turbine unit configured to drive and rotate a steam turbine using steam obtained by the vaporization performed by the waste heat recovery boiler unit; and

a second power generating means for generating power using a rotative force of the steam turbine,

the steam turbine unit includes:

a steam condenser configured to recover, as condensate, the steam used to drive and rotate the steam turbine; and

a condensate cooling unit configured to cool the inside of the steam condenser using, as a cold heat source, the marine water used in the third cooling unit.

2. The moving body according to claim 1,

wherein in the cooling device, the first cooling unit and the third cooling unit are arranged so that the air to be supplied to the combustion means flows through the third cooling unit and the first cooling unit in this order, or the second cooling unit and the third

cooling unit are arranged so that the air to be supplied to the combustion means flows through the third cooling unit and the second cooling unit in this order.

3. The moving body according to claim 1 or 2,

wherein the operational state of the cooling device is determined based on an electric demand and output characteristics of the gas turbine unit.

4. The moving body according to claim 3,

wherein the cooling device includes the first cooling unit and the third cooling unit, and

in a state in which the air to be supplied to the combustion means is cooled by the first cooling unit, the operational state of the cooling device is determined by determining a degree of cooling of the air to be supplied to the combustion means using the third cooling unit based on the electric demand and the output characteristics of the gas turbine unit.

5. The moving body according to claim 1,

wherein the cooling device includes the first cooling unit, the second cooling unit, and the third cooling unit.

6. The moving body according to claim 5,

wherein in the cooling device, the first cooling unit, the second cooling unit, and the third cooling unit are arranged so that the air to be supplied to the combustion means flows through the third cooling unit, the second cooling unit, and the first cooling unit in this order.

7. The moving body according to claim 5 or 6,

wherein the operational state of the cooling device is determined based on an electric demand and output characteristics of the gas turbine unit.

8. The moving body according to claim 7,

wherein in a state in which the air to be supplied to the combustion means is cooled by the first cooling unit and the third cooling unit, the operational state of the cooling device is determined by determining a degree of cooling of the air to be supplied to the combustion means using the second cooling unit based on the electric demand and the output characteristics of the gas turbine unit.

9. The moving body according to any one of claims 1 to 8,

wherein the moving body is one of a ship, a floating structure, and a land transport means.

10. The moving body according to any one of claims 1 to 9, comprising:

a first marine water flow path through which the marine water to be supplied to the third cooling unit flows;

a second marine water flow path through which the marine water to be supplied from the third cooling unit to the condensate cooling unit flows;

a bypass flow path that connects the first marine water flow path and the second marine water flow path; and

an adjustment means for adjusting the amount of marine water that is to flow through the bypass flow path.

11. The moving body according to any one of claims 1 to 10,

wherein based on at least one of an ambient air state and a cooling device condition, the operational state of the cooling device is determined, and a degree of cooling of the air to be supplied to the combustion means using at least one of the first cooling unit, the second cooling unit, and the third cooling unit is determined.

12. The moving body according to any one of claims 1 to 11,

wherein the gasification unit is configured to gasify the liquid fuel using, as a warm heat source, the heating medium to be used in the first cooling unit.

13. A moving body provided with a cooling device that is used in a power generation system that comprises: a gas turbine unit in which a combustion means burns an air-fuel mixture of air and a fuel gas obtained by gasifying a liquid fuel to generate a combustion gas, and a gas turbine is driven to rotate with the combustion gas generated by the combustion means; and a first power generating means for generating power using a rotative force of the gas turbine, the cooling device being configured to cool air to be supplied to the combustion means,

wherein the cooling device includes

a first cooling unit that uses, as a cold heat source, a heating medium used to gasify the liquid fuel,

a second cooling unit that uses, as a cold heat source, a heating medium

from a chiller, and

a third cooling unit that uses, as a cold heat source, marine water serving as a heating medium, and

in a state in which the air to be supplied to the combustion means is cooled by the first cooling unit and the third cooling unit, the operational state of the cooling device is determined by determining a degree of cooling of the air to be supplied to the combustion means using the second cooling unit based on an electric demand and output characteristics of the gas turbine unit.

14. The moving body according to any one of claims 1 to 13,

wherein the number of gas turbine units to be operated is determined based on an electric demand and an operational state of the cooling device.

15. A moving body provided with a cooling device that is used in a power generation system that comprises: a gas turbine unit in which a combustion means burns an air-fuel mixture of air and a fuel gas obtained by gasifying a liquid fuel to generate a combustion gas, and a gas turbine is driven to rotate with the combustion gas generated by the combustion means; and a first power generating means for generating power using a rotative force of the gas turbine, the cooling device being configured to cool air to be supplied to the combustion means,

wherein the cooling device includes:

a first cooling unit that uses, as a cold heat source, a heating medium used to gasify the liquid fuel; and

at least one of a second cooling unit that uses, as a cold heat source, a heating medium from a chiller and a third cooling unit that uses, as a cold heat source, marine water serving as a heating medium,

in a state in which the air to be supplied to the combustion means is cooled by the first cooling unit, the operational state of the cooling device is determined by determining a degree of cooling of the air to be supplied to the combustion means using the at least one of the second cooling unit and the third cooling unit based on an electric demand and output characteristics of the gas turbine unit, and

the number of gas turbine units to be operated is determined based on the electric demand and an operational state of the cooling device.