CLAIMS

{Claim 1}

A control device of a multi-stage supercharging system which includes a first supercharger of a low-pressure side, a cooling means that cools air discharged from the first supercharger, and a second supercharger of a high-pressure side that compresses the discharged air after cooling and which supplies, to an internal-combustion engine, air compressed in at least two stages, comprising:

an information acquisition means that acquires, as input information, a sucked air temperature, a sucked air humidity, a sucked air pressure, and a discharge pressure of the first supercharger;

a water vapor partial pressure calculation means that calculates a water vapor partial pressure of the discharged air of the first supercharger by using the sucked air temperature, the sucked air humidity, the sucked air pressure, and the discharge pressure of the first supercharger as parameters;

a target temperature setting means that sets, as a target temperature, a temperature at which the water vapor partial pressure calculated by the water vapor partial pressure

calculation means reaches a saturated water vapor pressure; and

a cooling control means that controls the cooling means such that a sucked air temperature of the second supercharger reaches equal to or higher than the target temperature;

wherein,

the information acquisition means further acquires, as the input information, a rotation speed or an air flow rate of the first supercharger, and

the target temperature setting means uses the water vapor partial pressure calculated by the water vapor partial pressure calculation means and the sucked air temperature, the sucked air pressure, the discharge pressure, and the rotation speed or the air flow rate of the first supercharger to set, as the target temperature, such a sucked air temperature of the second supercharger that a condensed water amount contained in air sucked into the second supercharger reaches a predetermined allowable condensed water amount determined by a characteristic of the second supercharger.

{Claim 2}

A control device of a multi-stage supercharging system which includes a first supercharger of a low-pressure side, a

cooling means that cools air discharged from the first supercharger, and a second supercharger of a high-pressure side that compresses the discharged air after cooling and which supplies, to an internal-combustion engine, air compressed in at least two stages, comprising:

an information acquisition means that acquires, as input information, a sucked air temperature, a sucked air humidity, a sucked air pressure, and a discharge pressure of the first supercharger;

a water vapor partial pressure calculation means that calculates a water vapor partial pressure of the discharged air of the first supercharger by using the sucked air temperature, the sucked air humidity, the sucked air pressure, and the discharge pressure of the first supercharger as parameters;

a target temperature setting means that sets, as a target temperature, a temperature at which the water vapor partial pressure calculated by the water vapor partial pressure calculation means reaches a saturated water vapor pressure; and,

a cooling control means that controls the cooling means such that a sucked air temperature of the second supercharger reaches equal to or higher than the target temperature;

wherein the target temperature setting means

uses, as an unknown value, a water vapor partial pressure in the sucked air of the second supercharger to set an expression indicating the condensed water amount contained in the sucked air of the second supercharger,

obtains the water vapor partial pressure when the expression is equal to the allowable condensed water amount, and

sets, as the target temperature, a temperature at which the water vapor partial pressure reaches the saturated water vapor pressure.

{Claim 3}

The control device of a multi-stage supercharging system according to claim 1, wherein

the target temperature setting means

uses, as an unknown value, a water vapor partial pressure in the sucked air of the second supercharger to set an expression indicating the condensed water amount contained in the sucked air of the second supercharger,

obtains the water vapor partial pressure when the expression is equal to the allowable condensed water amount, and

sets, as the target temperature, a temperature at

which the water vapor partial pressure reaches the saturated water vapor pressure.

{Claim 4}

A multi-stage supercharging system comprising:

a first supercharger of a low-pressure side;

a cooling means that cools air discharged from the first supercharger;

a second supercharger of a high-pressure side that compresses the discharged air after cooling; and

the control device of a multi-stage supercharging system according to claim 1 or 2,

wherein air compressed in at least two stages is supplied to an internal-combustion engine.

{Claim 5}

A method for controlling a multi-stage supercharging system which includes a first supercharger of a low-pressure side, a cooling means that cools air discharged from the first supercharger, and a second supercharger of a high-pressure side that compresses the discharged air after cooling and which supplies, to an internal-combustion engine, air

compressed in at least two stages, comprising:

an information acquiring step of acquiring, as input information, a sucked air temperature, a sucked air humidity, a sucked air pressure, and a discharge pressure of the first supercharger;

a water vapor partial pressure calculating step of calculating a water vapor partial pressure of the discharged air of the first supercharger by using the sucked air temperature, the sucked air humidity, the sucked air pressure, and the discharge pressure of the first supercharger as parameters;

a target temperature setting step of setting, as a target temperature, a temperature at which the water vapor partial pressure calculated at the water vapor partial pressure calculating step reaches a saturated water vapor pressure; and

a cooling control step of controlling the cooling means such that a sucked air temperature of the second supercharger reaches equal to or higher than the target temperature;

wherein,

at the information acquiring step, a rotation speed or an air flow rate of the first supercharger is further acquired as the input information, and

at the target temperature setting step, the water vapor partial pressure calculated at the water vapor partial

pressure calculating step and the sucked air temperature, the sucked air pressure, the discharge pressure, and the rotation speed or the air flow rate of the first supercharger are used to set, as the target temperature, such a sucked air temperature of the second supercharger that a condensed water amount contained in air sucked into the second supercharger reaches a predetermined allowable condensed water amount determined by a characteristic of the second supercharger.

{Claim 6}

A method for controlling a multi-stage supercharging system which includes a first supercharger of a low-pressure side, a cooling means that cools air discharged from the first supercharger, and a second supercharger of a high-pressure side that compresses the discharged air after cooling and which supplies, to an internal-combustion engine, air compressed in at least two stages, comprising:

an information acquiring step of acquiring, as input information, a sucked air temperature, a sucked air humidity, a sucked air pressure, and a discharge pressure of the first supercharger;

a water vapor partial pressure calculating step of calculating a water vapor partial pressure of the discharged

air of the first supercharger by using the sucked air temperature, the sucked air humidity, the sucked air pressure, and the discharge pressure of the first supercharger as parameters;

a target temperature setting step of setting, as a target temperature, a temperature at which the water vapor partial pressure calculated at the water vapor partial pressure calculating step reaches a saturated water vapor pressure; and

a cooling control step of controlling the cooling means such that a sucked air temperature of the second supercharger reaches equal to or higher than the target temperature;

wherein,

at the target temperature setting step,

a water vapor partial pressure in the sucked air of the second supercharger is used as an unknown value to set an expression indicating the condensed water amount contained in the sucked air of the second supercharger,

the water vapor partial pressure is obtained when the expression is equal to the allowable condensed water amount, and

a temperature at which the water vapor partial pressure reaches the saturated water vapor pressure is set as the target temperature

{Claim 7}

The method for controlling a multi-stage supercharging system according to claim 5, wherein

at the target temperature setting step,

a water vapor partial pressure in the sucked air of the second supercharger is used as an unknown value to set an expression indicating the condensed water amount contained in the sucked air of the second supercharger,

the water vapor partial pressure is obtained when the expression is equal to the allowable condensed water amount, and

a temperature at which the water vapor partial pressure reaches the saturated water vapor pressure is set as the target temperature.