Claims

[Claim 1]

A state identification device identifying a combustion state of a combustion facility including a furnace main body defining a treatment space, a fire grate transporting an incineration object in a transport direction in the treatment space, and a feeder supplying the incineration object to the treatment space, the treatment space being partitioned into a plurality of sections in the transport direction, the combustion facility state identification device comprising:

an image acquisition unit acquiring a treatment image as an image of the feeder and the plurality of sections; and

a state identification unit identifying a combustion state of each of the feeder and the plurality of sections based on the treatment image, wherein

the image acquisition unit is configured to acquire the treatment image taken by a visible camera and an infrared camera where the image acquisition unit is installed at the downstream side of a flame,

the plurality of sections are partitioned into a drying stage, a combustion stage, and a post-combustion stage from an upstream in the transport direction,

the treatment image acquired from the infrared

camera is an image showing the feeder and the drying stage,

the treatment image acquired from the visible camera is an image showing the combustion stage and the post-combustion stage, and

the state identification unit identifies a combustion state of each of the feeder, the drying stage, the combustion stage, and the post-combustion stage.

[Claim 2]

The combustion facility state identification device according to Claim 1, further comprising:

a brightness identification unit identifying a brightness of an image associated with each of the feeder, the drying stage, the combustion stage, and the post-combustion stage based on the treatment image, wherein

the state identification unit identifies the combustion state based on the brightness.

[Claim 3]

The combustion facility state identification device according to Claim 2, further comprising:

a model storage unit storing a trained model trained by supervised learning using a data set of an input sample including the brightness of the drying stage and an output sample including the combustion state of the drying stage,

wherein

the state identification unit inputs the brightness to the trained model to identify the combustion state of the drying stage.

[Claim 4]

The combustion facility state identification device according to Claim 2 or 3, further comprising:

a point identification unit identifying a burnout point as a rear end in the transport direction of ~~a~~ the flame caused by combustion of the incineration object based on the brightness;

a temperature identification unit identifying a temperature of the post-combustion stage based on the treatment image; and

a recommended proposal unit proposing a recommended operation of the combustion facility based on the identified combustion state, burnout point, and temperature.

[Claim 5]

The combustion facility state identification device according to Claim 4, wherein

the combustion facility includes a wind box supplying air from below the fire grate, and

the recommended operation is an operation related to a speed of the fire grate or the amount of air supplied from the wind box.

[Claim 6]

The combustion facility state identification device according to any one of Claims 1 to 5, wherein the combustion state is a state indicating any of stable combustion, non-uniform combustion, early combustion, feeder combustion, a drying defect, a burnout defect, and a boundary defect.

[Claim 7]

A state identification method of a state identification device identifying a combustion state of a combustion facility including a furnace main body defining a treatment space, a fire grate transporting an incineration object in a transport direction in the treatment space, and a feeder supplying the incineration object to the treatment space, the treatment space being partitioned into a plurality of sections in the transport direction, the plurality of sections being partitioned into a drying stage, a combustion stage, and a post-combustion stage from an upstream in the transport direction,

the state identification method comprising:

a step of acquiring a treatment image acquired from an infrared camera and a treatment image acquired from an visible camera which are on the downstream side of a flame, wherein the treatment image acquired from the infrared camera is an image showing the feeder and the drying stage, and the treatment image acquired from the visible camera is an image showing the combustion stage and the post-combustion stage; and

a step of identifying a combustion state of each of the feeder and the plurality of sections based on the treatment image.

[Claim 8]

A program causing a computer of a state identification device identifying a combustion state of a combustion facility including a furnace main body defining a treatment space, a fire grate transporting an incineration object in a transport direction in the treatment space, and a feeder supplying the incineration object to the treatment space, the treatment space being partitioned into a plurality of sections in the transport direction, the plurality of sections being partitioned into a drying stage, a combustion stage, and a post-combustion stage from an upstream in the transport

direction, to execute:

a step of acquiring a treatment image acquired from an infrared camera and a treatment image acquired from an visible camera which are on the downstream side of a flame, wherein the treatment image acquired from the infrared camera is an image showing the feeder and the drying stage, and the treatment image acquired from the visible camera is an image showing the combustion stage and the post-combustion stage; and

a step of identifying a combustion state of each of the feeder and the plurality of sections based on the treatment image.