

DESCRIPTION

PLANT CULTIVATION DEVICE

5 TECHNICAL FIELD

[0001]

The present disclosure relates to a plant cultivation device which cultivates a plant by emitting artificial light and ejecting gas to the plant.

10 BACKGROUND ART

[0002]

In recent years, a plant factory which engages in agriculture such as vegetable cultivation in an industrial process has been operated on a practical scale. In the plant factory, all processes in a range from raising seedling and
15 farming to harvesting are carried out for a cultivation target plant under a controlled environment using artificial light. The plant factory aims to carry out plant cultivation with high productivity without being affected by a climate or a season. Therefore, a plant cultivation device is used which has a lighting unit for emitting the artificial light for photosynthesis to the cultivation target
20 plant, and an air conditioner for circulating air by supplying air to the plant or by suctioning the air around the plant so as to obtain a desired growth atmosphere (for example, refer to PTLs 1 and 2).

[0003]

In the related art disclosed in PTL 1, a configuration is disclosed which
25 includes an air conditioner for adjusting temperature and humidity to a predetermined value in a sealed chamber in which pyramidal panels supporting plants are arranged in a plurality of parallel rows and lighting

equipment for emitting light of predetermined illuminance to the plants. According to this configuration, an advantageous effect can be obtained in that tipburn as a physiological disorder of the plants can be prevented without decreasing a growth rate of the plants. In addition, in the related art disclosed
5 in PTL 2, the following configuration is disclosed. In a plant cultivation device having a form in which a plurality of plant bodies are arranged on multi-stage cultivation shelves, the air inside an air intake region defined as a region including the plurality of plant bodies adjacent to one another is fetched by an air intake pipe and is discharged outward. According to this configuration,
10 even in a case where the plants are densely cultivated, the humidity around the plant bodies can be efficiently reduced. In this manner, it is possible to prevent a defect such as disease damage from occurring due to a high humid atmosphere.

15 Citation List

Patent Literature

[0004]

PTL 1: Japanese Patent Unexamined Publication No. 2002-142585

PTL 2: Japanese Patent Unexamined Publication No. 2013-255439

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SUMMARY OF THE INVENTION

[0005]

A plant cultivation device has a rack, a lighting unit, an air blower pipe, and a gas supplier. The rack has shelves for arranging a plurality of plants.
25 The lighting unit emits artificial light to the plurality of plants from above. The air blower pipe has a plurality of ejection openings. The gas supplier

ejects gas to the plants through the plurality of ejection openings by applying static pressure into the air blower pipe.

BRIEF DESCRIPTION OF DRAWINGS

5 [0006]

FIG. 1 is a front view of a plant cultivation device according to the present embodiment.

FIG. 2A is a plan view of a lighting unit used for the plant cultivation device according to the present embodiment.

10 FIG. 2B is a sectional view taken along line 2B-2B in FIG. 2A.

FIG. 3 is a partially enlarged sectional view of the lighting unit used for the plant cultivation device according to the present embodiment.

DESCRIPTION OF EMBODIMENT

15 [0007]

Before the present embodiment is described, problems in the plant cultivation device in the related art will be briefly described. In the plant cultivation device which aims to carry out plant cultivation with high productivity, the above-described air conditioner needs to satisfy various conditions from various viewpoints. For example, in order to prevent the above-described tipburn and to ensure product quality, it is an effective way to supply air to a growth point of the plant. However, in order to maintain a growth rate by improving cultivation efficiency, it is desirable to promote transpiration for all of the plants by ejecting the air as uniformly as possible without localizing an air supply position.

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[0008]

Furthermore, in the plant cultivation device, the lighting unit for emitting the artificial light is incorporated into the device together with the air conditioner. Accordingly, a construction of the air conditioner needs to be simple and space-saving. However, in the related art including the above-described patent literature, it is difficult to realize the plant cultivation device having the air conditioner satisfying these various conditions.

[0009]

Next, the present embodiment will be described with reference to the drawing. First, a configuration of plant cultivation device 1 will be described with reference to FIG. 1. Plant cultivation device 1 is located indoor in a plant factory, and has a function of cultivating plants by emitting artificial light to the plants and ejecting gas to the plants.

[0010]

In Fig. 1, the plant cultivation device 1 mainly includes rack 2 having horizontal shelves 3 provided with a plurality of stages (three stages in this case) in which cultivation target plants are placed. A top of shelf 3 on an uppermost stage is covered by top board 4, and vertical posts 5 is connected to both end portions of shelf 3 and top board 4. Caster 5a is installed in a lower end portion of post 5, thereby enabling rack 2 to move on a floor inside the plant factory.

[0011]

A plurality of trays 6 accommodating a plurality of (two in this case) pots 7 are placed on each of shelves 3, and plants 8 such as leafy vegetables are planted in each of pots 7. Lighting unit 10 is horizontally located above each of the shelves 3 having tray 6 placed thereon, while both end portions of lighting unit 10 are held by lighting unit holder 11.

[0012]

Lighting unit 10 is located above shelves 3, and has a function to emit the artificial light for cultivation to plants 8 located on shelves 3. Lighting unit 10 may be configured so that air blower pipe 14 for ejecting the gas such as air to plants 8 located on shelves 3 is incorporated in lighting unit 10. Gas ejector 30 has a plurality of air blower pipes 14 whose tip portion is closed, and air blower 12 (gas supplier) which supplies the gas (air) to air blower pipe 14 via tube 13 so as to eject the gas. Since this configuration is adopted, lighting unit 10 as lighting means and air blower pipe 14 configuring the air conditioner are combined with each other inside a limited space in plant cultivation device

1. Accordingly, it is possible to realize a simple and space-saving configuration.

[0013]

According to the present embodiment, the static pressure is applied into air blower pipe 14 by air blower 12, thereby ejecting the air in a predetermined direction through ejection opening 14b (refer to FIG. 3) disposed in air blower pipe 14. Therefore, in this case, air blower 12 adopts a sirocco fan which can obtain high static pressure with a structure in which the air is pushed out using a centrifugal force by a rotary vane. In this manner, even in a case where horizontally long air blower pipe 14 which is located in a width direction in rack 2 is used as an air supply target, the air can be ejected as uniformly as possible through the plurality of ejection openings 14b disposed along a length direction of air blower pipe 14.

[0014]

Lighting unit holder 11 is suspended from top board 4 or shelf 3 on the upper stage, and each lighting unit holder 11 has a plurality of attachment holes 11a for fixing lighting unit 10 by using fixing means such as bolts. When lighting unit 10 is fixed, each position of attachment holes 11a is selected. In

this manner, an installation height of lighting unit 10 can be freely changed. That is, lighting unit holder 11 is configured so that a height of each of lighting unit 10 and air blower pipe 14 can be changed.

[0015]

5 In an example illustrated in FIG. 1, air blower 12 is fixedly located in a configuration member of rack 2, for example, post 5. Air blower 12 and air blower pipe 14 are connected to each other via flexible and elastic tube 13. In this manner, lighting unit 10 including air blower pipe 14 can be raised and lowered. In a case where a compact one such as the sirocco fan is used as air
10 blower 12, lighting unit 10 is incorporated in air blower pipe 14 in this way. In this manner, air blower pipe 14 may be raised and lowered together with lighting unit 10. That is, in this configuration example, air blower pipe 14 can be raised and lowered integrally with lighting unit 10.

[0016]

15 Next, a detailed configuration of lighting unit 10 will be described with reference to FIGS. 2A, 2B, and 3. FIG. 2A illustrates a state where lighting unit 10 is viewed in a plan view, and FIG. 2B illustrates a cross section taken along line 2B-2B in FIG. 2A. As illustrated in FIG. 2A, lighting unit 10 adopts a configuration in which a plurality of (five in this case) bar-shaped lighting
20 bodies 15 and a plurality of (four in this case) air blower pipes 14 are held in a longitudinal direction of shelves 3 illustrated in FIG. 1 by rectangular frame-shaped frame portion 16.

[0017]

As illustrated in FIG. 2A, lighting body 15 and air blower pipe 14 are
25 alternately arranged in parallel on frame portion 16 in a direction orthogonal to the longitudinal direction. Each of air blower pipes 14 is connected to air blower 12 via a manifold (not illustrated) for distribution. In a state where the

air supplied from air blower 12 is temporarily stored in the manifold serving as an air reservoir, the air is distributed to each of air blower pipes 14. According to this configuration, the air can be supplied to the plurality of air blower pipes 14 as uniformly as possible.

5 [0018]

FIG. 3 illustrates each sectional configuration of air blower pipe 14 and lighting body 15, and a structure fixedly attached to frame portion 16.

Air blower pipe 14 is formed from pipe member 14a made of metal or a hard resin, and is fixedly attached to frame portion 16 by U-shaped holding bracket
10 17. The plurality of ejection openings 14b are formed on a lower surface side of pipe member 14a along the longitudinal direction (paper surface direction in FIG. 3). In this case, an example has been described in which one ejection opening 14b is formed in a lower end portion of pipe member 14a. However, the plurality of ejection openings 14b may be formed in the same cross section.
15 Air blower 12 illustrated in FIG. 1 is connected to air blower pipe 14, and air blower 12 is operated so as to eject the air downward (in a direction of arrow a) through ejection opening 14b.

[0019]

Lighting body 15 has a sectional configuration in which board 20 having
20 light emitter 21 mounted thereon is sealed in transparent pipe 19 made of a transparent resin. Light emitter 21 is mounted on a lower surface of board 20. A plurality of light emitters 21 are arranged along the longitudinal direction of transparent pipe 19 inside transparent pipe 19. Lighting body 15 is fixedly attached to frame portion 16 via holding ring 18a for holding an outer
25 peripheral surface of transparent pipe 19 and holding bracket 18 coupled to holding ring 18a. Light emitter 21 is turned on to emit the light by a light emitting power source (not illustrated). In this manner, the artificial light for

cultivating plants 8 is emitted downward (in a direction of arrow b) after passing through transparent pipe 19.

[0020]

According to plant cultivation device 1 having lighting unit 10
5 configured as described above, both the air ejected from air blower pipe 14 and the artificial light emitted from lighting body 15 are respectively ejected or emitted to a target of cultivation zone 22 in which plants arranged in shelves 3 located below are present. In this case, in the height of lighting unit 10 having air blower pipe 14 and lighting body 15 with respect to cultivation zone 22, a
10 proper height H is present in accordance with a growth degree of plants 8.

[0021]

According to plant cultivation device 1 described in the present embodiment, the height of lighting unit 10 into which air blower pipe 14 and lighting body 15 are incorporated as described above is configured to be
15 changeable by lighting unit holder 11. In other words, lighting unit holder 11 can change a distance from shelves 3 to lighting unit 10. In this manner, depending on the growth degree or an overgrowth state of plants 8, the air can be ejected to plants 8 by using a proper ejection height, and the artificial light can be emitted to plants 8 from a more proper emitting position.

20 [0022]

In lighting unit 10 configured as described above, the plurality of air blower pipes 14 having the plurality of ejection openings 14b are arranged, and furthermore, the plurality of lighting bodies 15 having the plurality of light emitters 21 are arranged. That is, ejection openings 14b and light emitters 21
25 are arranged in a predetermined two-dimensional array in lighting unit 10 located above cultivation zone 22 where plants 8 arranged on shelves 3 are present.

[0023]

In this manner, the air is supplied, and the artificial light for cultivation is emitted to plants 8 located in cultivation zone 22 evenly and uniformly. Therefore, product quality can be ensured by preventing the
5 tipburn as a physiological disorder of the plants, which is caused by defective air supply or lighting, and a growing rate can be improved by promoting the transpiration for all of the plants.

[0024]

As described above, the present disclosure relates to plant cultivation
10 device 1 which cultivates the plants by emitting the artificial light and ejecting the gas to plants 8. Plant cultivation device 1 has rack 2 that has shelf 3 for arranging the plurality of plants 8, lighting unit 10 that emits the artificial light to the plurality of plants from above, air blower pipe 14 that has the plurality of ejection openings, and air blower 12 (gas supplier) that ejects the
15 gas through the plurality of ejection openings 14b by applying the static pressure into air blower pipe 14 so as to eject the gas to the plurality of plants. In this manner, the air can be uniformly ejected to the plants with a simple configuration, and thus, product quality and productivity can be improved.

[0025]

20 According to the present disclosure, the air can be uniformly ejected to the plants with the simple configuration, and thus, the product quality and the productivity can be improved.

INDUSTRIAL APPLICABILITY

25 [0026]

The plant cultivation device according to the present disclosure has an advantageous effect in that the air can be uniformly ejected to the plants with

the simple configuration and the product quality and the productivity can be improved. Therefore, the present disclosure is effectively used in a plant cultivation field in which the cultivation is carried out by emitting the artificial light and ejecting the gas to the plants.

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REFERENCE MARKS IN THE DRAWINGS

[0027]

	1	PLANT CULTIVATION DEVICE
	2	RACK
10	3	SHELF
	4	TOP BOARD
	5	POST
	5a	CASTER
	6	TRAY
15	7	POT
	8	PLANT
	10	LIGHTING UNIT
	11	LIGHTING UNIT HOLDER
	11a	HOLE
20	12	AIR BLOWER
	13	TUBE
	14	AIR BLOWER PIPE
	14a	PIPE MEMBER
	14b	EJECTION OPENING
25	15	LIGHTING BODY
	16	FRAME PORTION
	17	HOLDING BRACKET

	18	HOLDING BRACKET
	18a	HOLDING RING
	19	TRANSPARENT PIPE
	20	BOARD
5	21	LIGHT EMITTER
	22	CULTIVATION ZONE
	30	GAS EJECTOR

CLAIMS

1. A plant cultivation device comprising:

a rack that has a shelf for arranging a plurality of plants;

5 a lighting unit that emits artificial light to the plurality of plants from above;

an air blower pipe that has a plurality of ejection openings; and

a gas supplier that ejects gas through the plurality of ejection openings by applying static pressure into the air blower pipe so as to eject the gas to the
10 plurality of plants.

2. The plant cultivation device of Claim 1,

wherein the plurality of air blower pipes are incorporated in the lighting unit.

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3. The plant cultivation device of Claim 2, further comprising:

a lighting unit holder that holds the lighting unit,

wherein the lighting unit holder is configured to be capable of changing a height of each of the lighting unit and the air blower pipe.

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4. The plant cultivation device of Claim 2,

wherein the lighting unit includes a plurality of bar-shaped lighting bodies,

wherein the air blower pipe is one of a plurality of air blower pipes, and

25 wherein the plurality of lighting bodies and the plurality of air blower pipes are alternately arranged in parallel.

5. The plant cultivation device of Claim 3,
wherein the lighting unit includes a plurality of bar-shaped lighting
bodies,

wherein the air blower pipe is one of a plurality of air blower pipes, and
5 wherein the plurality of lighting bodies and the plurality of air blower
pipes are alternately arranged in parallel.

6. The plant cultivation device of Claim 1,
wherein the air blower pipes is connected to the gas supplier with a
10 flexible tube.