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(54) **HUMIDIFYING ELEMENT AND HUMIDIFIER**

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Description

Field

5 **[0001]** The present invention relates to a humidifying element and a humidifying apparatus.

Background

10 **[0002]** As an apparatus that generates the air of a humidifying atmosphere, there are a natural evaporation type, an electric heating type, a water spray type, an ultrasound type, and the like. In the natural evaporation type apparatus, a humidifying ability tends to be small compared with the other types. In the electric heating type apparatus, running cost tends to be high compared with the other types. In the water spray type apparatus, humidifying efficiency tends to be low and the apparatus tends to be large compared with the other types. In the ultrasound type apparatus, initial cost tends to be high compared with the other types. In addition, the life of the apparatus tends to be short and germs in water and fine powder of calcium carbonate tend to scatter.

15 **[0003]** Under such circumstances, in a natural evaporation type humidifier, running cost is easily reduced compared with the other types. Therefore, the natural evaporation type humidifier is useful for use, in particular, in a place where the natural evaporation type humidifier is operated for a long time. The humidifying ability described as the problem above is being improved.

20 **[0004]** There are various forms of the natural evaporation type humidifier. Among the forms, there is a "dripping type" as a humidifying system suitable for use for a long time. The humidifier of the dripping type tends to be used in humidifying apparatuses for business use such as an air conditioner.

25 **[0005]** As the humidifying apparatus of the dripping type, for example, Patent Literature 1 discloses a method of dropping water from an upper part of a humidifying element through a porous member and a configuration in which the bottom surface of a water tank is formed of the porous member.

[0006] Patent Literature 2 discloses an upper tray including a large number of water injection holes on the bottom surface of a water tank and a configuration in which a sponge-like porous material is provided between the upper tray and a humidifying filter to wash the humidifying filter.

JP S62 176629 U discloses a humidifying element according to the preamble of claim 1.

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Citation List

Patent Literature

35 **[0007]**

Patent Literature 1: Japanese Patent Publication No. S60-8637

Patent Literature 2: Japanese Patent Application Laid-Open No. 2009-180434

40 Summary

Technical Problem

45 **[0008]** However, in the configuration disclosed in Patent Literature 1, because the bottom surface is formed of the porous member, hard components included in tap water and vaporization residues such as silica and iron rust deposit on the entire bottom surface. The porous member is clogged according to the elapse of time and a water passage amount decreases. Therefore, there is a problem in that a humidifying ability is deteriorated.

50 **[0009]** In the configuration disclosed in Patent Literature 2, because the water injection holes are in contact with the sponge-like porous material, gas dissolved in water in the water tank adheres to the sponge-like porous material as air bubbles. Hard components included in tap water and vaporization residues such as silica and iron rust adhere to and deposit on the water injection holes and the water injection holes are clogged, whereby a water passage amount of the sponge-like porous material decreases. Therefore, there is a problem in that a humidifying ability is deteriorated.

55 **[0010]** The present invention has been devised in view of the above and an object of the present invention is to obtain a humidifying element that can achieve uniform supply of water to a plurality of humidifying bodies and stable water supply for a long period.

Solution to Problem

[0011] In order to solve the above problem, and in order to attain the above object, a humidifying element of the present invention includes a plurality of humidifying bodies arranged along a first direction to provide gaps among the humidifying bodies, a diffusing member that extends along the first direction and is in contact with the plurality of humidifying bodies, and a casing that houses the plurality of humidifying bodies and the diffusing member on an inside. A water storing section provided above the humidifying bodies to store water is formed in the casing, a plurality of water injection holes are formed on a bottom surface of the water storing section, a cylindrical wall surface extending downward from the water injection hole portion is formed on an outer side of the bottom surface of the water storing section, a distal end of the cylindrical wall surface and the diffusing member are set in contact, and a communication port for causing an inside and an outside of the cylindrical wall surface to communicate is formed in the cylindrical wall surface.

Advantageous Effects of Invention

[0012] According to the present invention, there is an effect that it is possible to obtain a humidifying element that can achieve uniform supply of water to a plurality of humidifying bodies and stable water supply for a long period.

Brief Description of Drawings

[0013]

FIG. 1 is a configuration diagram of a humidifying apparatus according to a first embodiment.
 FIG. 2 is an enlarged view of a humidifying element portion of the humidifying apparatus.
 FIG. 3 is a perspective view of the humidifying element.
 FIG. 4 is an exploded perspective view of the humidifying element.
 FIG. 5 is a front view of the humidifying element.
 FIG. 6 is an arrow sectional view taken along line X-X shown in FIG. 5.
 FIG. 7 is a bottom view of a water storing section viewed from below.
 FIG. 8 is a sectional view of a peripheral portion of the water storing section.
 FIG. 9 is a sectional view of a peripheral portion of a water storing section shown as a comparative example.
 FIG. 10 is a sectional view showing an example of the peripheral portion of the water storing section.
 FIG. 11 is a sectional view showing an example of the peripheral portion of the water storing section.
 FIG. 12 is a sectional view showing an example of the peripheral portion of the water storing section.
 FIG. 13 is a sectional view showing an example of the peripheral portion of the water storing section.
 FIG. 14 is a sectional view showing an example of the peripheral portion of the water storing section.
 FIG. 15 is a sectional view showing an example of the peripheral portion of the water storing section.
 FIG. 16 is an arrow sectional view taken along line Z-Z shown in FIG. 15.

Description of Embodiments

[0014] A humidifying element and a humidifying apparatus according to an embodiment of the present invention are explained in detail below with reference to the drawings. Note that the present invention is not limited by the embodiment.

First Embodiment.

[0015] FIG. 1 is a configuration diagram of a humidifying apparatus 1 according to a first embodiment. A humidifying element 2 is incorporated in the humidifying apparatus 1.

A blower 5 for feeding the air in a room into the humidifying element 2 and blowing out the air into the room is incorporated on a ventilation upstream side or a ventilation downstream side of the humidifying element 2.

[0016] The humidifying apparatus 1 includes the humidifying element 2, a water supply pipe 3 connected to a water supply source such as waterworks to feed water for humidification to the humidifying element 2, a water discharge pipe 4 for discharging the water remaining not used for the humidification by the humidifying element 2 to the outside, the blower 5 that allows an air flow to pass through the humidifying element 2, a control device 6 that performs, for example, control of the blower 5 and an electromagnetic valve of a water supply system (a water supply valve 3a), and a drain pan 7 that receives waste water and discharges the waste water to the outside.

[0017] FIG. 2 is an enlarged view of the portion of the humidifying element 2 of the humidifying apparatus 1. One or a plurality of humidifying elements 2 are directly set on the drain pan 7. Corner portions on both sides of top structures of the humidifying elements 2 are insertably and removably held by, for example, guide rails (not shown in the figure)

suspended on partition walls and a front side inner wall surface of a main body box body. A water supply system including the water supply valve 3a that supplies water for humidification and interrupts the supply is connected to the humidifying elements 2. The water discharge pipe 4 is connected to the drain pan 7.

[0018] The water supply system that feeds the water for humidification to the humidifying elements 2 is configured as a water channel including, besides the water supply valve 3a that adjusts the pressure and the flow rate of the water supplied to the humidifying element 2, a strainer that prevents intrusion of dust into the water supply system and the water supply pipe 3 for water feeding. All of connecting portions of the water supply system excluding a connecting portion to the water supply source side are desirably integrated in the drain pan 7.

[0019] FIG. 3 is a perspective view of the humidifying element 2. FIG. 4 is an exploded perspective view of the humidifying element 2. FIG. 5 is a front view of the humidifying element 2. FIG. 6 is an arrow sectional view taken along line X-X shown in FIG. 5. The humidifying element 2 includes a large number of flat humidifying bodies 20 arranged along a first direction (a direction indicated by an arrow Y in FIG. 5) to provide gaps among the humidifying bodies 20. A diffusing member (a diffusion plate) 30 is set in contact with upper parts of the humidifying bodies 20. The diffusing member 30 is formed to extend along the first direction. A plurality of humidifying bodies 20 are collectively in contact with one diffusing member 30.

[0020] A water storing section 12 that stores water to be supplied to the humidifying bodies 20 and a water supply port 11 for injecting water supplied from the water supply pipe 3 into the water storing section 12 are present above the humidifying bodies 20. A water discharge section 13 and a water discharge port 13a for receiving water remaining without being used for humidification from the humidifying bodies 20 and discharging the water are present below the humidifying bodies 20.

[0021] The humidifying bodies 20 are housed and fixed on the inside of the casing 10. The water supply port 11, the water storing section 12, and the water discharge section 13 are formed in the casing 10. In the casing 10, a structure wall 14 that connects the water storing section 12 serving as an upper structure and the water discharge section 13 serving as a lower structure is formed. Water accumulates in the water storing section 12 from the water supply port 11, penetrates into the diffusing member 30 and spreads to the humidifying bodies 20, and humidifies the air flowing in the gaps among the humidifying bodies 20. Excess water not evaporated in the humidifying bodies 20 flows out to the outside of the casing 10 from the water discharge section 13 in a lower part.

[0022] The casing 10 is formed by, for example, injection molding by thermoplastic such as ABS resin, PS resin, or PP resin. The casing 10 is divided into two components, that is, a casing 10a and a casing 10b. The casing 10a and the casing 10b are integrated by sandwiching the humidifying bodies 20 with the casing 10a and the casing 10b and joining engaging sections 15 of the casing 10a and the casing 10b.

[0023] In the casing 10a and the casing 10b, portions formed as the water storing section 12, portions formed as the water discharge port 13a, and opening sections 10c for introducing humidified air into the humidifying bodies 20 are respectively provided. The water supply port 11 for supplying water to the water storing section 12 is provided in the casing 10b. On the inner side of the casing 10, a housing space for housing the humidifying bodies 20 is provided.

[0024] Positioning protrusions 17 for regulating the positions of the humidifying bodies 20 are provided in portions of the casing 10 in contact with the humidifying bodies 20. As the humidifying bodies 20, there are some humidifying bodies that soften when containing water and are deformed by the weight of water. Therefore, by regulating the positions of the humidifying bodies 20 in the outer peripheral portions of the humidifying bodies 20 in contact with the casing 10, it is possible to secure dimensions of channels among the humidifying bodies 20 and allow the air to uniformly flow.

[0025] Consequently, a pressure loss of the humidifying element 2 is reduced. The entire surfaces of the humidifying bodies 20 are effectively used as humidifying surfaces. Therefore, an effect that a humidifying amount increases compared with when the humidifying bodies 20 are distorted can be expected. Note that the water storing section 12 can be formed integrally with the diffusing member 30 and housed in the casing 10.

[0026] The water supply pipe 3 is connected to the water supply port 11 to supply water to the water storing section 12. Therefore, the water supply port 11 is provided further on the upper surface side than the humidifying bodies 20 in an upper part of the humidifying element 2. The shape of the water supply port 11 is a shape matching the water supply pipe 3. For example, a convex band (a fold back) can be formed over the circumferential length of the water supply port 11 or the water supply port 11 can be bound by a hose band to prevent the water supply pipe 3 from easily come off.

[0027] When a water supply amount is too excessive with respect to a humidifying amount, an amount of water flowing from the water discharge section 13 without being used for humidification is large and a useless water amount increases. Therefore, it is desirable to provide a mechanism for reducing a water amount (e.g., an orifice 21 shown in FIGS. 3, 4 and 6) and adjust a flow rate. In the flow rate adjustment, it is necessary to make it possible to supply a flow rate larger than a maximum humidifying amount of the humidifying element 2. The position and the like of the water supply port 11 are not limited as long as the water supply port 11 can supply water from upper parts of the humidifying bodies 20. However, when, for example, occurrence of a water leak or the like from a joint of the water supply pipe 3 and the water supply port 11 is taken into account, by disposing the water supply port 11 on an upstream side of the air to be humidified, water scattered to the upstream side by a flow of an air current is guided to a downstream side, that is, the humidifying

element 2 side. It is possible to reduce a scattering distance of the water to the periphery.

[0028] The water storing section 12 is provided above the humidifying bodies 20. A plurality of water injection holes 12a are formed on the bottom surface of the water storing section 12. A cylindrical wall surface 12b extending downward from the water injection hole 12a portion is formed on the outer side of the water storing section 12. A cutout (a communication port) 12c is formed at the distal end of the cylindrical wall surface 12b. The distal end of the cylindrical wall surface 12b is in contact with the diffusing member 30. On the inner side of the water storing section 12, a cylindrical water guide pipe 100 extending up and down is formed in a position avoiding the water injection hole 12a. In the water guide pipe 100, an inflow port for causing water to flow into the inside of the water guide pipe 100 is formed in a position lower than the upper end of the water storing section 12. In this embodiment, the upper end of the water guide pipe 100 is in a position lower than the upper end of an outer wall of the water storing section 12. An opening on the upper end side is the inflow port. When the upper end of the water guide pipe 100 is higher than the upper end of the outer wall of the water storing section 12, an opening only has to be provided in a position lower than the outer wall of the water storing section 12 and formed as the inflow port.

[0029] A tabular water guide member 110 is held between the water storing section 12 and the diffusing member 30. The water storing section 12 and the diffusing member 30 are integrally combined. An integral component of the water storing section 12 and the diffusing member 30 is sandwiched and held between the casing 10a and the casing 10b. A water level sensor 8 for detecting a water level of the water storing section 12 can be set in the water storing section 12. The detected water level can be fed back to control opening and closing of the water supply valve 3a with the control device 6.

[0030] The diffusing member 30 is formed of a porous tabular material. To penetrate water and supply the water to the humidifying bodies 20, the surface of the material is desirably hydrophilic. Permeability is improved by the hydrophilicity and a water supply amount increases.

Because the diffusing member 30 comes into contact with water, the diffusing member 30 is desirably formed of a material less easily deteriorated by the water, for example, a porous material made of resin including polyester such as PET resin or PP resin, cellulose, or metal including titanium, copper, or stainless steel. Hydrophilic treatment can be applied to the porous material to increase a hydrophilicity degree of the surface of the material.

[0031] Like the diffusing member 30, the humidifying bodies 20 are formed of a porous tabular material. Suitable conditions for the humidifying bodies 20 are the same as the conditions for the diffusing member 30. Projecting sections 40 are provided on the surfaces of the humidifying bodies 20. Intervals among the humidifying bodies 20 are maintained by the projecting sections 40. The projecting sections 40 are formed by, for example pressing a jig or the like against the humidifying bodies 20 and plastically deforming pressed portions of the humidifying bodies 20. When two kinds of the humidifying bodies 20, on which arrayed positions of the projecting sections 40 are different, are alternately arrayed, the humidifying bodies 20 have a function of keeping the intervals of the humidifying bodies fixed. The intervals of the humidifying bodies only have to be kept. Combs having cutouts equivalent to the humidifying body thickness can be engaged with the humidifying bodies at fixed intervals to maintain the intervals or a structure for keeping intervals by stacking a plurality of wavy humidifying bodies in a honeycomb shape has no problem functionally.

[0032] The lower end of the diffusing member 30 and the upper ends of the humidifying bodies 20 are set partially in contact with each other. If the diffusing member 30 and the humidifying bodies 20 are in contact, water smoothly flows down with the action of surface tension. However, the lower end of the diffusing member 30 and the upper end of the humidifying bodies 20 can be inserted into each other and coupled taking into account the influence of fluctuation during assembly and vibration during transportation.

[0033] A flow of water from the water supply port 11 to the humidifying bodies 20 is explained. The water supplied from the water supply port 11 flows into the water storing section 12. The water flowed into the water storing section 12 flows from the water injection holes 12a on the bottom surface of the water storing section 12 and runs on the cylindrical wall surface 12b having the cutout 12c to be absorbed by the diffusing member 30. The water flows down while spreading to the inside of the diffusing member 30 and reaches the lower end of the diffusing member 30.

[0034] Because the lower end of the diffusing member 30 and the upper ends of the humidifying bodies 20 are in contact, the flowed-down water runs from sections of the contact to the humidifying bodies 20 and flows down with the action of the surface tension. The water flows down while spreading to the insides of the humidifying bodies 20 and being contained in the entire humidifying bodies 20 and drips from the lower ends of the humidifying bodies 20. At this point, moisture is taken from the surface of the humidifying bodies 20 by the air ventilated among the humidifying bodies 20. The air is discharged from the humidifying element 2 as humidified air. Therefore, a water amount dripped and discharged from the lower ends of the humidifying bodies 20 is a water amount obtained by subtracting a water amount taken from the humidifying bodies 20 as the humidified air from a water amount supplied from the water supply port 11.

[0035] In the series of flow of the water, a relation between the water level of the water stored in the water storing section 12 and the water injection hole 12a is explained. When the water is fed to the water injection hole 12a, flowing water resistance is present. Briefly, there is a relation of the following expression between a flow rate Q1 of the water passing the water injection hole 12a and a water level h of the water stored in the water storing section 12.

$$Q_1 = ah + b \quad (1)$$

where, a and b represent constants related to flowing water resistance due to the dimensions of the water injection hole 12a.

[0036] For example, when hard components included in the supply water and vaporization residues such as silica and iron rust deposit in the water injection hole 12a, a and b decrease and the flow rate Q_1 of the water flowing in the water injection hole 12a decreases. Further, a water supply amount Q of the water supplied from the water supply port 11, time t from a start of the water supply, and a water level change $h(t)$ have the following relation.

$$h(t) = (Q - b) / a \times (1 - \exp(-a/A \times t)) \quad (2)$$

where, A represents the bottom area of the water storing section 12.

[0037] In a state in which a sufficient time elapses after the water supply, t is replaced with ∞ in Expression (2) and the following expression is obtained:

$$h = (Q - b) / a \quad (3)$$

[0038] Further, when Expression (3) is substituted in Expression (1), the following relation is obtained:

$$Q_1 = ah + b = a \times (Q - b) / a + b = Q \quad (4)$$

[0039] That is, the water level h of the water stored in the water storing section 12 is determined such that the flow rate Q_1 of the water passing through the water injection hole 12a is equal to the water supply amount Q from the water supply port 11. Therefore, when hard components of the supply water and vaporization residues such as silica and iron rust deposit in the water injection hole 12a as time elapses, a and b decrease. Because the water level h of the water storing section 12 rises according to Expression (3), the flow rate Q_1 , that is, a humidifying amount is controlled to be fixed.

[0040] In this way, the humidifying element 2 that supplies the water from the water storing section 12 provided above the humidifying bodies 20 via the water injection hole 12a and the diffusing member 30 has a function of controlling the humidifying amount to be fixed even when time elapses. However, an allowable upper limit value of a water level rise is present according to the dimensions of the water storing section 12 or the casing 10. From Expression (2), time until the water level reaches a state of a fixed water level increases when a decreases. Therefore, time is required from the start of the water supply until the humidifying amount stabilizes. Such a state is undesirable in the humidifying apparatus. Therefore, it is necessary to prevent the vaporization residues from depositing in the water injection hole 12a as much as possible even when time elapses.

[0041] FIG. 7 is a bottom view of the water storing section 12 viewed from below. FIG. 8 is a sectional view of a peripheral portion of the water storing section 12. FIG. 9 is a sectional view of a peripheral portion of a water storing section 112 shown as a comparative example. In the comparative example shown in FIG. 9, a cylindrical wall surface 112b obtained by extending the inner surface of a water injection hole 112a downward is formed at the lower end of the water injection hole 112a. A cutout is not formed at the distal end of the cylindrical wall surface 112b.

[0042] Gas components such as oxygen and nitrogen are dissolved in the supplied water. In particular, in winter when humidification is necessary, a dissolved gas amount is large because underwater temperature is low. The water is often in an oversaturated state exceeding the solubility of the gas. In this case, the gas separates from the water and air bubbles 91 are easily generated. However, the air bubbles 91 are generated on a surface part having unevenness. In FIG. 9, because the distal end of the cylindrical wall surface 112b is in contact with the diffusing member 30, the air bubbles 91 easily adhere to a part where the diffusing member 30 is in contact with the water. The generated air bubbles 91 gradually increase volume and soon cover the surface of the diffusing member 30, which is a water feed path. The water passage amount of the diffusing member 30 decreases. Therefore, the humidifying amount decrease.

[0043] On the other hand, in FIG. 8, the cylindrical wall surface 12b including the cutout 12c opened in a part of the side surface is formed. The inside of the cylindrical wall surface 12b is opened to the atmosphere through the cutout 12c. Therefore, even when the air bubbles 91 adhere to the diffusing member 30, the air bubbles 91 touch the atmosphere. Therefore, the air bubbles 91 quickly disappear. As a satisfactory water passage state is easily maintained. It is possible to secure a stable humidifying amount.

[0044] Above the water storing section 12, a communication port 18 that causes the outside of the casing 10 and the

water storing section 12 to communicate is formed. Therefore, the water storing section 12 is opened to the atmosphere. Further, because the communication port 18 is provided above the water supply port 11, the inside of the space of the water storing section 12 is always kept at the atmospheric pressure. The water pressure in the bottom surface portion of the water storing section 12 is the water-gage pressure of the water level. Therefore, it is possible to reduce the influence of fluctuation in supply pressure and secure a fixed humidifying amount.

[0045] A stop of the humidifying operation at the time when humidification is unnecessary such as night is explained. For example, when nobody is in a room and humidification is unnecessary, for example, at night, the humidifying operation of the humidifying apparatus 1 is sometimes stopped. In this case, it is undesirable in terms of sanitation to leave the humidifying element 2 untouched for a long time in a wet state. When bacteria and mold in the air adhere to a wet portion and propagate, there is concern that the bacteria and mold spores are conveyed by ventilated air passing the surface of the humidifying element 2 and discharged into the room when the humidifying operation is resumed. As a method of suppressing the propagation of the bacteria and the mold, it is effective to dry the humidifying element 2 as soon as possible.

[0046] From such a view point, when the humidifying apparatus 1 is stopped, it is desirable to operate the blower 5 after closing the water supply valve 3a according to control from the control device 6 and perform control for drying the humidifying element 2. To reduce a drying time for the humidifying element 2, it is necessary to dry the water storing section 12 early. However, because the water storing section 12 has a water tank shape, it is difficult to ventilate and dry the water storing section 12. Therefore, after the water supply valve 3a is closed, it is important to cause the water in the water storing section 12 to quickly flow out toward the diffusing member 30.

[0047] FIG. 10 is a sectional view showing an example of a peripheral portion of the water storing section 12. In FIG. 10, the bottom surface of the water storing section 12 inclines to be the lowest in the water injection hole 12a portion. Therefore, after the water supply valve 3a is closed, the water in the water storing section 12 smoothly flows down toward the water injection hole 12a. Therefore, the water in the water storing section 12 easily flows out to the outside through the water injection hole 12a. It is possible to achieve early drying in the water storing section 12.

[0048] FIG. 11 is a sectional view showing an example of the peripheral portion of the water storing section 12. In FIG. 11, the bottom surface of the water storing section 12 is formed by a curved surface and inclined to be the bottom in the water injection hole 12a. Note that the bottom surface of the water storing section 12 can be formed by a plane and a curved surface.

[0049] The material of the water storing section 12 can be a water repellent material such as PP or PTFE or, even if the water repellent material is not used, water repellent treatment can be applied to the surface of the water storing section 12 such that the water less easily stay in the water storing section 12. Further, from the viewpoint of hygiene, antibacterial treatment or mold prevention treatment can be applied to the water storing section 12, the diffusing member 30, the humidifying bodies 20, and the casing 10.

[0050] Another example for suppressing a decrease in a humidifying amount due to vaporization residues caused in the water storing section 12 is explained. FIG. 12 is a sectional view showing an example of the peripheral portion of the water storing section 12. FIG. 13 is a sectional view showing an example of the peripheral portion of the water storing section 12. In FIG. 12, a projecting section 70 is provided in the bottom of the water storing section 12 to surround the water injection hole 12a. In FIG. 13, a recessed section 80 is provided in the bottom of the water storing section 12 to surround the water injection hole 12a.

[0051] The vaporization residues 16 accumulate and deposit on the bottom surface of the water storing section 12 because the vaporization residues 16 have specific weight larger than the specific weight of water. When the water in the water storing section 12 flows toward the diffusing member 30 (the water injection hole 12a), the vaporization residues 16 deposited on the bottom surface also flow toward the diffusing member 30. Because the projecting section 70 is provided in the bottom of the water storing section 12 to surround the water injection hole 12a, the vaporization residues 16 are dammed by the projecting section 70 and suppressed from intruding into the diffusing member 30.

[0052] Note that, to improve drainage of the bottom surface and achieve improvement of hygiene, it is desirable to fragment a part of the projecting section 70 to allow the water to flow from a fragmented portion. When the recessed section 80 is provided as shown in FIG. 13, the vaporization residues 16 having the specific weight larger than the specific weight of the water enter the recessed section 80. Therefore, intrusion into the diffusing member 30 is suppressed and the drainage is secured. Note that a part of the recessed section 80 can be fragmented to provide a fragmented portion.

[0053] FIG. 14 is a sectional view showing an example of the peripheral portion of the water storing section 12. In FIG. 14, a capturing member 90 serving as a core of the vaporization residues 16 is provided on the bottom surface of the water storing section 12. In a state in which water is immersed in the water storing section 12, the vaporization residues 16 in the water grow using components of the capturing member 90 as cores and precipitate and fix on the surface of the capturing member 90. Therefore, it is possible to suppress intrusion of the vaporization residues 16 into the diffusing member 30.

[0054] The capturing member 90 is formed of a material serving as a core of growth of calcium carbide, silica, iron, and the like included in supplied water. For example, a substance containing calcium carbide such as calcite or aragonite

is suitable for the calcium carbide, a silica compound such as quartz is suitable for the silica, and a copper material is suitable for the iron.

[0055] As the capturing member 90, the respective components can be separately disposed in the water storing section 12 or can be changed to a powder state, mixed, and equalized and thereafter solidified by a binder or the like and used. Further, the material of the water storing section 12 can be a water repellent material such as PP or PTFE or, even if the water repellent material is not used, water repellent treatment can be applied to the surface of the water storing section 12 such that the water less easily stay in the water storing section 12. Further, from the viewpoint of hygiene, antibacterial treatment or mold prevention treatment is desirably applied to the water storing section 12, the diffusing member 30, the humidifying bodies 20, and the casing 10.

[0056] The inclination of the bottom surface of the water storing section 12 explained above and the configuration in which the projecting section 70, the recessed section 80, or the capturing member 90 is provided on the bottom surface of the water storing section 12 can be combined as appropriate.

[0057] FIG. 15 is a sectional view showing an example of the peripheral portion of the water storing section 12. FIG. 16 is an arrow sectional view taken along line Z-Z shown in FIG. 15. In FIG. 16, the water guide pipe 100 is indicated by a broken line. On the inner side of the water storing section 12, the cylindrical water guide pipe 100 extending up and down avoiding the water injection holes 12a is formed. At the lower end of the water guide pipe 100, a water-guide-pipe open hole 12d piercing through the bottom surface of the water storing section 12 is formed. On the outer side of the bottom surface of the water storing section 12, a surrounding wall 12e projecting downward to surround the circumference of the water-guide-pipe open hole 12d and the cylindrical wall surfaces 12b is formed. A projection amount of the cylindrical wall surfaces 12b and a projection amount of the surrounding wall 12e are equal. The distal ends of both of the cylindrical wall surfaces 12b and the surrounding wall 12e are in contact with the diffusing member 30.

[0058] A tabular water guide member 110 formed in size fit in the inner side of the surrounding wall 12e is provided between the water storing section 12 and the diffusing member 30. In the water guide member 110, through-holes 110a larger than the outer diameter of the cylindrical wall surfaces 12b are formed in positions corresponding to the water injection holes 12a (positions overlapping the water injection holes 12a in plan view). The water guide member 110 is in contact with the diffusing member 30.

[0059] When the vaporization residues 16 intrude into the water injection holes 12a or the vaporization residue components adhere to and deposit on the inner surfaces of the water injection holes 12a, a water injection amount decreases. In this case, the water level h rises as explained above. Because the upper end of the water guide pipe 100 is lower than the outer wall of the water storing section 12, when the water level h rises, the water flows into the water guide pipe 100 without overflowing from the water storing section 12.

[0060] The supply water flowed into the water guide pipe 100 flows on the water guide member 110 and flows down from the through-holes 110a to the diffusing member 30. If the through-holes 110a are adjusted to a proper hole diameter, the supply water is evenly distributed to the through-holes 110a and flows down to the diffusing member 30. According to this action, even when the water injection amount from the water injection holes 12a decreases and the water level h substantially rises, the supply water does not overflow from the water storing section 12. It is possible to uniformly supply the water to the diffusing member 30. When the water guide member 110 is not provided, a lot of the supply water penetrates the diffusing member 30 from a portion right under the water-guide-pipe open hole 12d. Therefore, it is difficult to uniformly supply the water. However, in this embodiment, it is possible to cause, with the water guide member 110, the supply water to flow down to the positions corresponding to the water injection holes 12a and realize uniform water supply. By surrounding the water-guide-pipe open hole 12d with the surrounding wall 12e, the supply water less easily leaks to the outside.

[0061] Note that, in this embodiment, the water guide pipe 100 is formed near the outer wall of the water storing section 12. More specifically, the outer wall is formed to be included in a part of the water guide pipe 100. However, the water guide pipe 100 can be formed in a position away from the outer wall.

[0062] The cutout 12c functioning as the communication port formed at the distal end of the cylindrical wall surface 12b only has to be capable of causing the inside of the cylindrical wall surface 12b to communicate with the outside and allow the air bubbles to escape. Therefore, the communication port can be formed as a hole rather than the cutout. However, because the air bubbles is easily generated on the surface of the diffusing member 30, it is possible to more easily allow the air bubbles to escape by forming the communication port further on the distal end side.

[0063] With the humidifying element 2 and the humidifying apparatus 1 configured as explained, it is possible to achieve uniform supply of water to the plurality of humidifying bodies 20. It is possible to achieve stable water supply to the humidifying bodies 20 for a long period. It is possible to simplify the configuration of the humidifying element 2 and achieve facilitation of assemblability. It is possible to achieve an increase in the humidifying amount by the humidifying element 2. It is possible to achieve improvement of hygiene.

Reference Signs List

[0064]

5	1	humidifying apparatus
	2	humidifying element
	3	water supply pipe
	3a	water supply valve
	4	water discharge pipe
10	5	blower
	6	control device
	7	drain pan
	8	water level sensor
	10, 10a, 10b	casing
15	10c	opening section
	11	water supply port
	12	water storing section
	12a	water injection hole
	12b	cylindrical wall surface
20	12c	cutout (communication port)
	12d	water-guide-pipe opening hole
	12e	surrounding wall
	13	water discharge section
	13a	water discharge port
25	14	structure wall
	15	engaging section
	16	vaporization residue
	17	positioning protrusion
	20	humidifying body
30	30	diffusing member (diffusion plate)
	40	projecting section
	70	projecting section
	80	recessed section
	90	capturing member
35	91	air bubble
	100	water guide pipe
	110	water guide member
	112	water storing section
	112a	water injection hole
40	112b	cylindrical wall surface

Claims

- 45 1. A humidifying element (2) comprising:
- a plurality of humidifying bodies (20) arranged along a first direction to provide gaps between the humidifying bodies (20); and
- a casing (10) that houses the plurality of humidifying bodies (20) on an inside, wherein
- 50 a water storing section (12) provided above the humidifying bodies (20) to store water is formed in the casing (10),
- a plurality of water injection holes (12a) are formed on a bottom surface of the water storing section (12),
- a cylindrical wall surface (12b) extending downward from the water injection hole (12a) portion is formed on an outer side of the bottom surface of the water storing section (12),
- a distal end of the cylindrical wall surface (12b) and the diffusing member (30) are set in contact, and
- 55 a communication port (12c) for causing an inside and an outside of the cylindrical wall surface (12b) to communicate is formed in the cylindrical wall surface (12b), the humidifying element being **characterized in that** it comprises a diffusing member (30) which is housed on the inside of the casing (10) and which extends along the first direction and is in contact with the plurality of humidifying bodies (20),

and being further **characterized in that** a distal end of the cylindrical wall surface (12b) and the diffusing member (30) are set in contact.

2. The humidifying element according to claim 1, wherein the communication port (12c) is a cutout formed at the distal end of the cylindrical wall surface (12b).

3. A humidifying apparatus (1) comprising:

the humidifying element (2) according to claim 1 or 2; and
a blower (5) that allows air to pass among the humidifying bodies (20).

Patentansprüche

1. Befeuchtungselement (2), umfassend:

eine Vielzahl von Befeuchungskörpern (20), die entlang einer ersten Richtung angeordnet sind, um Zwischenräume zwischen den Befeuchungskörpern (20) bereitzustellen; und
ein Gehäuse (10), in dem die Vielzahl von Befeuchungskörpern (20) auf einer Innenseite untergebracht sind, wobei

ein Wasserlagerungsabschnitt (12), der oberhalb der Befeuchungskörper (20) bereitgestellt ist, um Wasser zu lagern, in dem Gehäuse (10) gebildet ist,

eine Vielzahl von Wassereinspritzlöchern (12a) auf einer Bodenoberfläche des Wasserlagerungsabschnitts (12) ausgebildet sind,

eine zylindrische Wandoberfläche (12b), die sich von dem Abschnitt des Wassereinspritzlochs (12a) nach unten erstreckt, auf einer äußeren Seite der Bodenoberfläche des Wasserlagerungsabschnitts (12) ausgebildet ist, ein distales Ende der zylindrischen Wandoberfläche (12b) und das Diffusionselement (30) in Kontakt gebracht sind, und

eine Kommunikationsöffnung (12c) zum Veranlassen einer Innenseite und einer Außenseite der zylindrischen Wandoberfläche (12b), zu kommunizieren, in der zylindrischen Wandoberfläche (12b) ausgebildet ist, wobei das Befeuchtungselement **dadurch gekennzeichnet ist, dass** es ein Diffusionselement (30) umfasst, das auf der Innenseite des Gehäuses (10) untergebracht ist und sich entlang der ersten Richtung erstreckt und mit der Vielzahl von Befeuchungskörpern (20) in Kontakt ist,

und ferner **dadurch gekennzeichnet ist, dass** ein distales Ende der zylindrischen Wandoberfläche (12b) und das Diffusionselement (30) in Kontakt gebracht sind.

2. Befeuchtungselement nach Anspruch 1, wobei die Kommunikationsöffnung (12c) ein Ausschnitt ist, der am distalen Ende der zylindrischen Wandoberfläche (12b) ausgebildet ist.

3. Befeuchtungsvorrichtung (1), umfassend:

das Befeuchtungselement (2) nach Anspruch 1 oder 2;

und

ein Gebläse (5), das Luft zwischen den Befeuchungskörpern (20) passieren lässt.

Revendications

1. Élément humidifiant (2) comprenant :

une pluralité de corps humidifiants (20) agencés le long d'une première direction de façon à fournir des espaces entre les corps humidifiants (20) ; et

une enveloppe (10) qui reçoit à l'intérieur la pluralité de corps humidifiants (20) ;

dans lequel :

une section stockage d'eau (12), disposée au-dessus des corps humidifiants (20) de façon à stocker de l'eau, est formée dans l'enveloppe (10);

une pluralité de trous d'injection de l'eau (12a) sont formés dans une surface inférieure de la section

stockage d'eau (12) ;

une surface de paroi cylindrique (12b) qui s'étend vers le bas à partir de la partie trous d'injection de l'eau (12a), est formée sur un côté extérieur de la surface inférieure de la section stockage d'eau (12) ;

une extrémité distale de la surface de paroi cylindrique (12b) et l'élément diffusant (30), sont mis en contact ;
et

un orifice de communication (12c) destiné à mettre en communication l'intérieur et l'extérieur de la surface de paroi cylindrique (12b), est formé dans la surface de paroi cylindrique (12b) ;

l'élément humidifiant :

étant **caractérisé en ce qu'il** comprend un élément diffusant (30) qui est logé à l'intérieur de l'enveloppe (10), et qui s'étend le long de la première direction, et est en contact avec la pluralité de corps humidifiants (20) ;

et étant **caractérisé en outre en ce qu'une** extrémité distale de la surface de paroi cylindrique (12b) et l'élément diffusant (30), sont mis en contact.

2. Élément humidifiant selon la revendication 1, dans lequel l'orifice de communication (12c) est formé selon une découpe au niveau de l'extrémité distale de la surface de paroi cylindrique (12b).

3. Appareil humidifiant (1) comprenant :

l'élément humidifiant (2) selon la revendication 1 ou la revendication 2 ; et
une soufflante (5) qui permet à l'air de passer parmi les corps humidifiants (20).

FIG.1

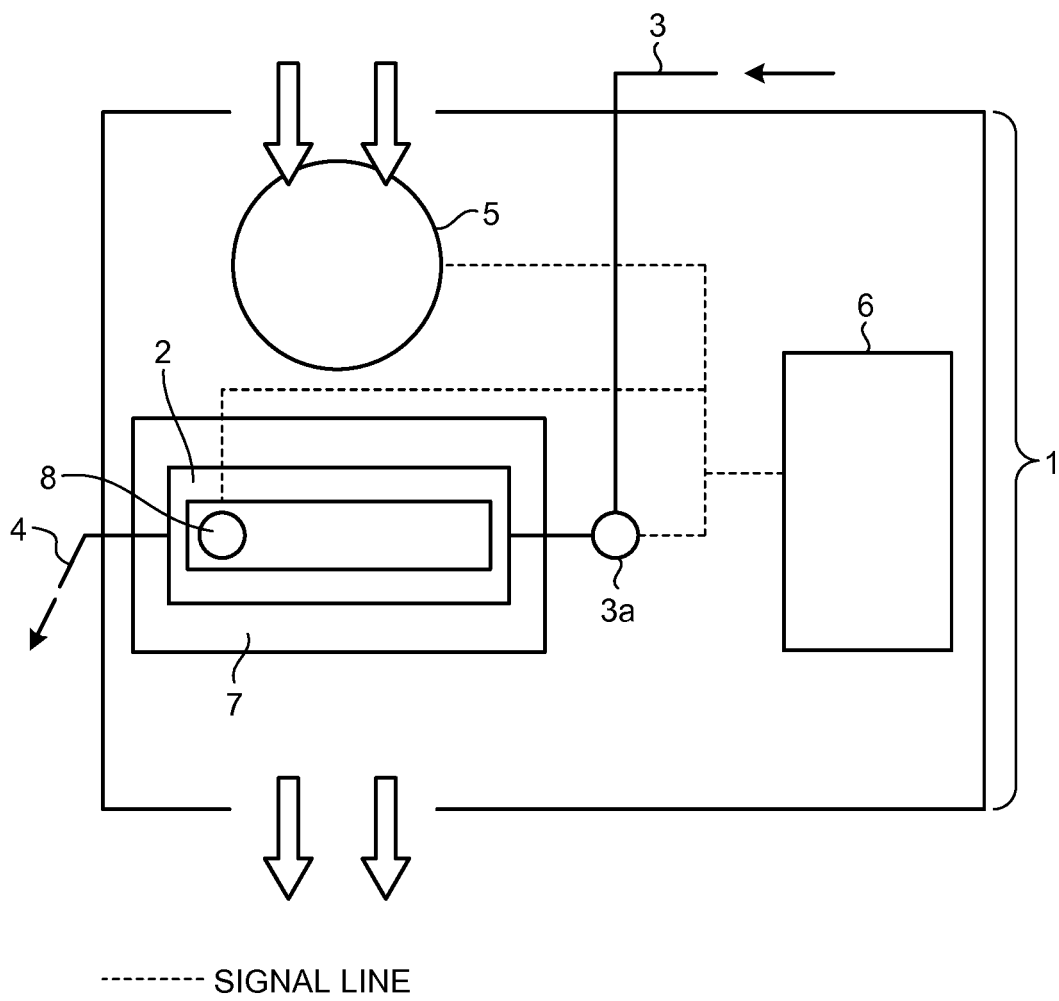


FIG.2

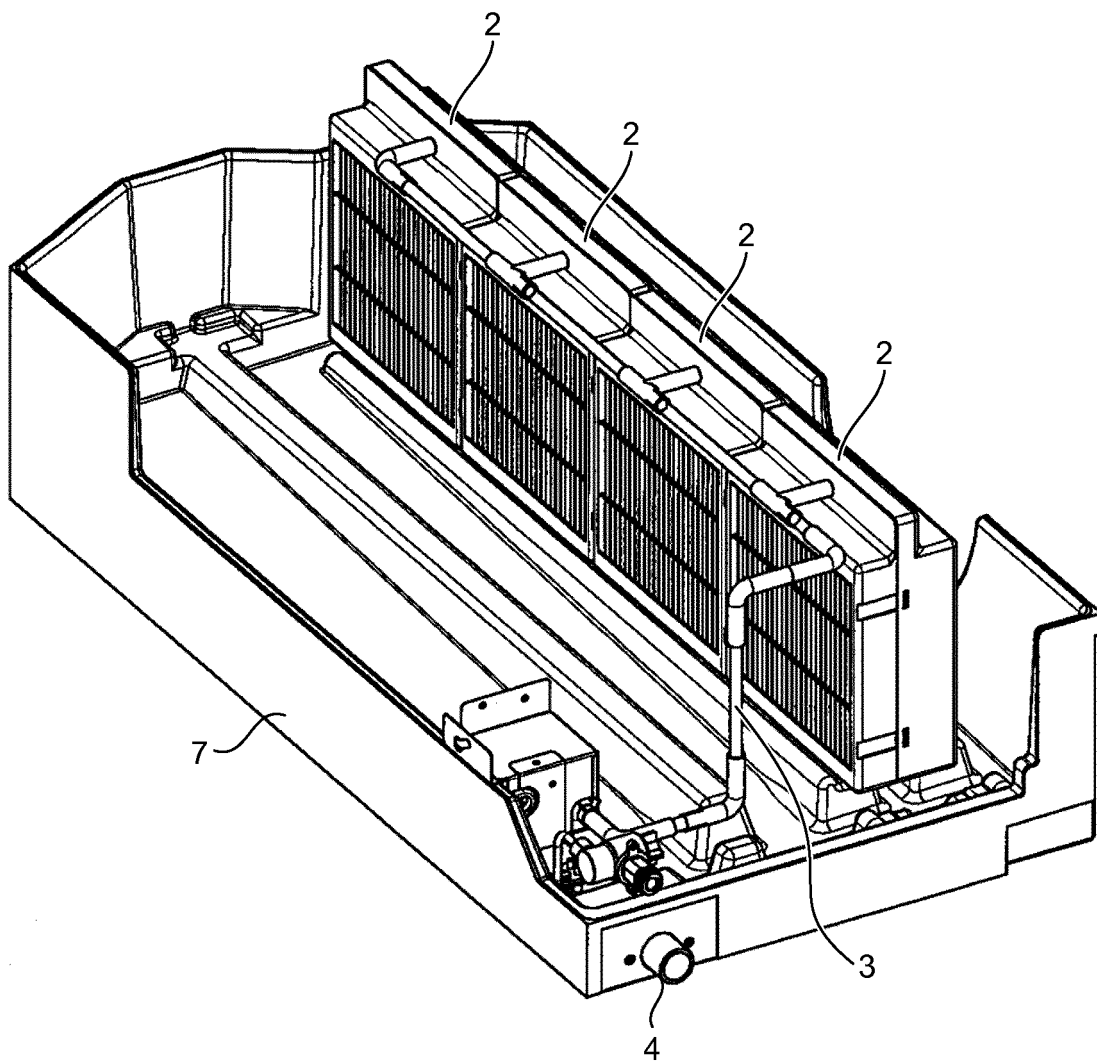


FIG.3

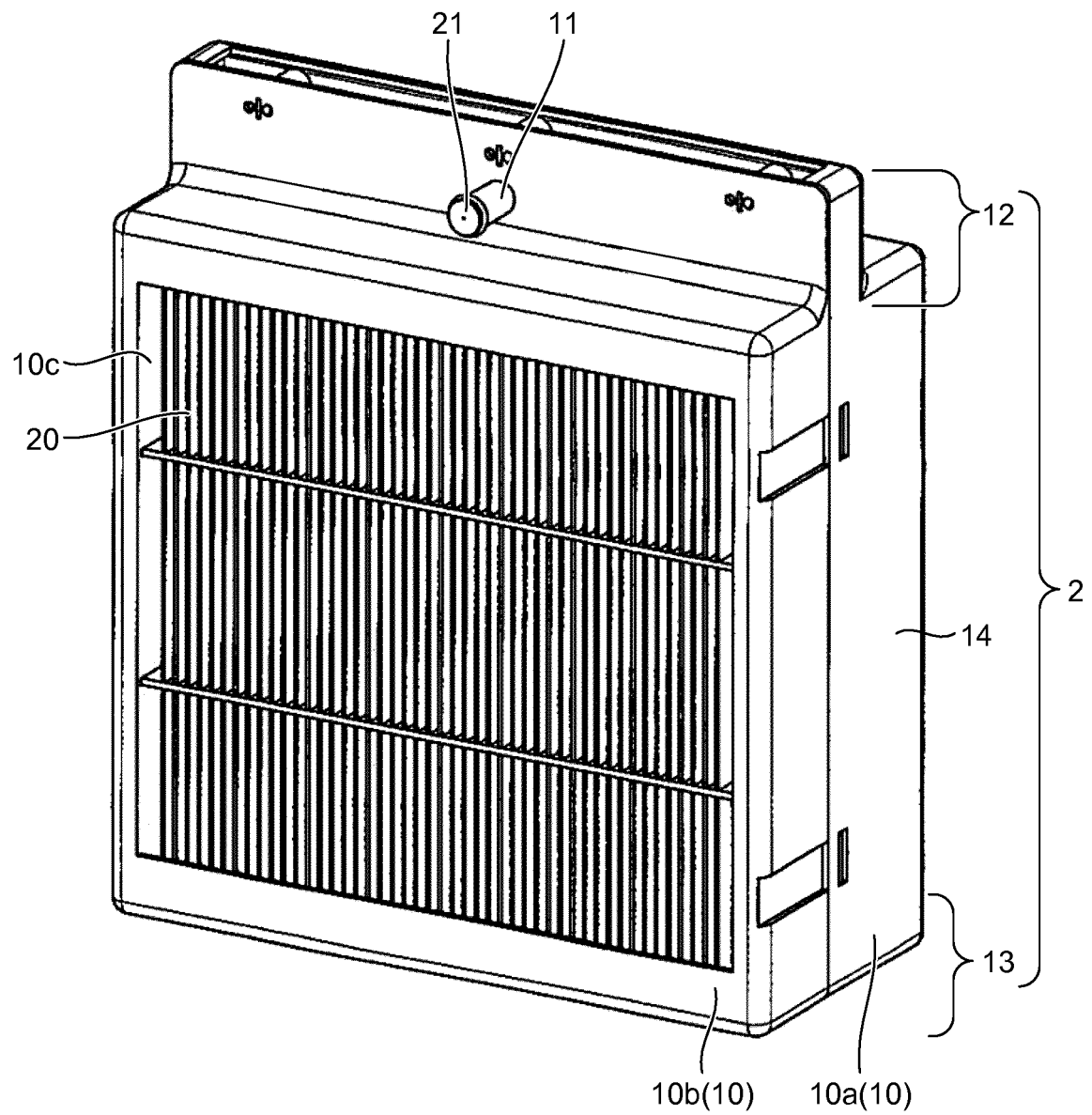


FIG.4

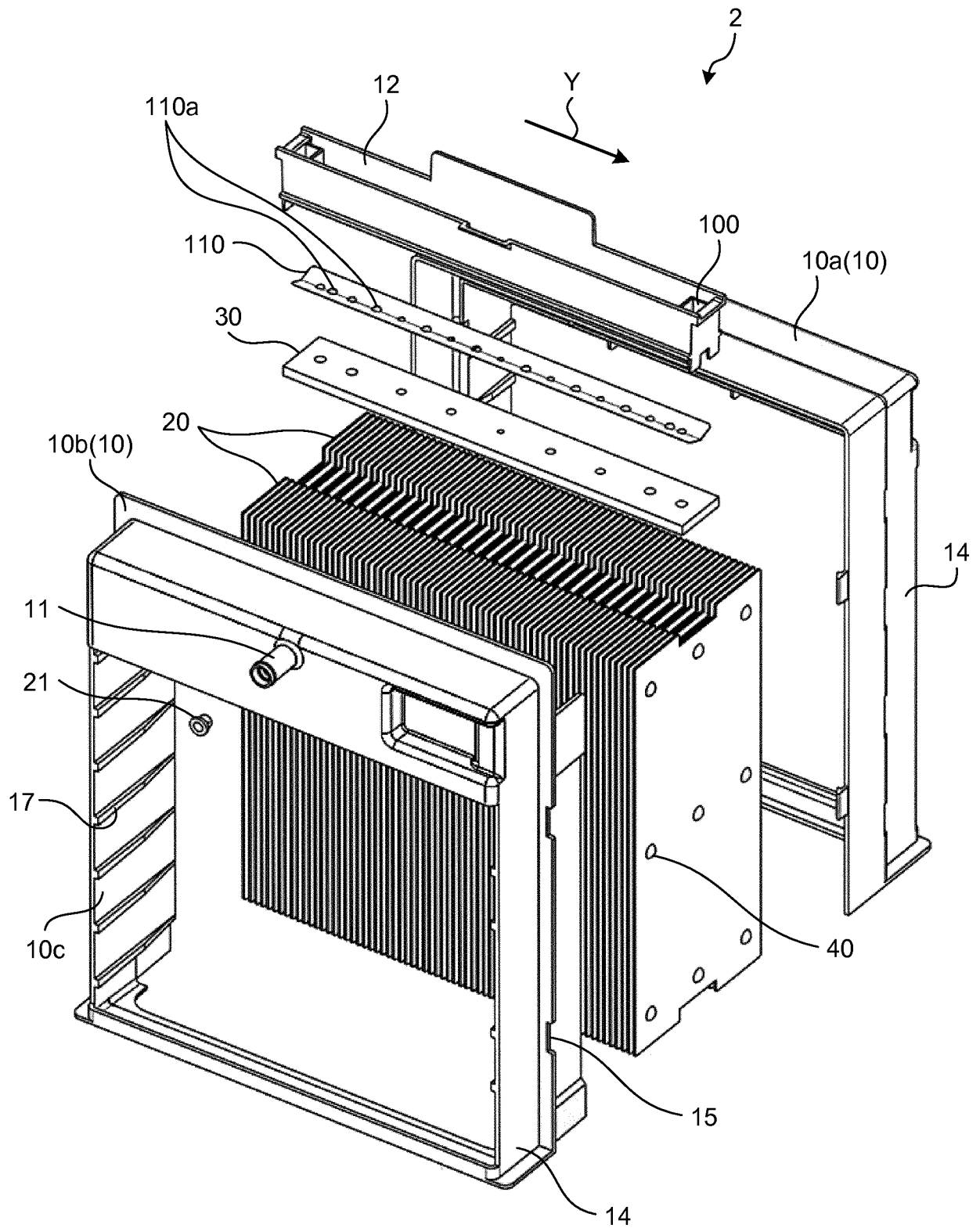


FIG.5

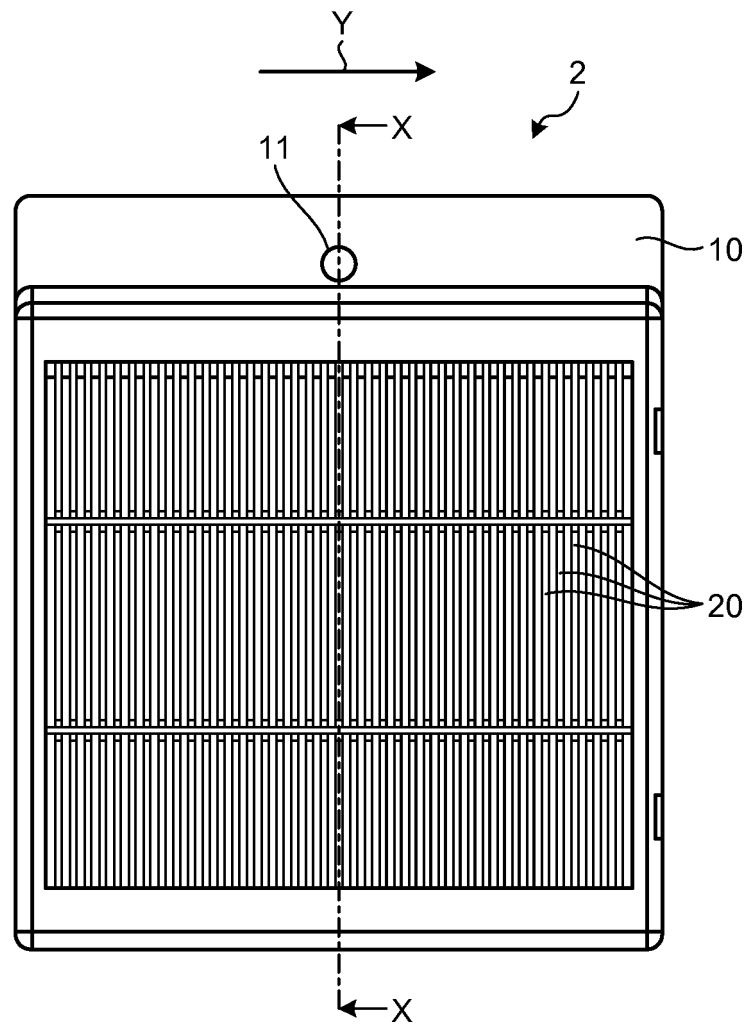


FIG.6

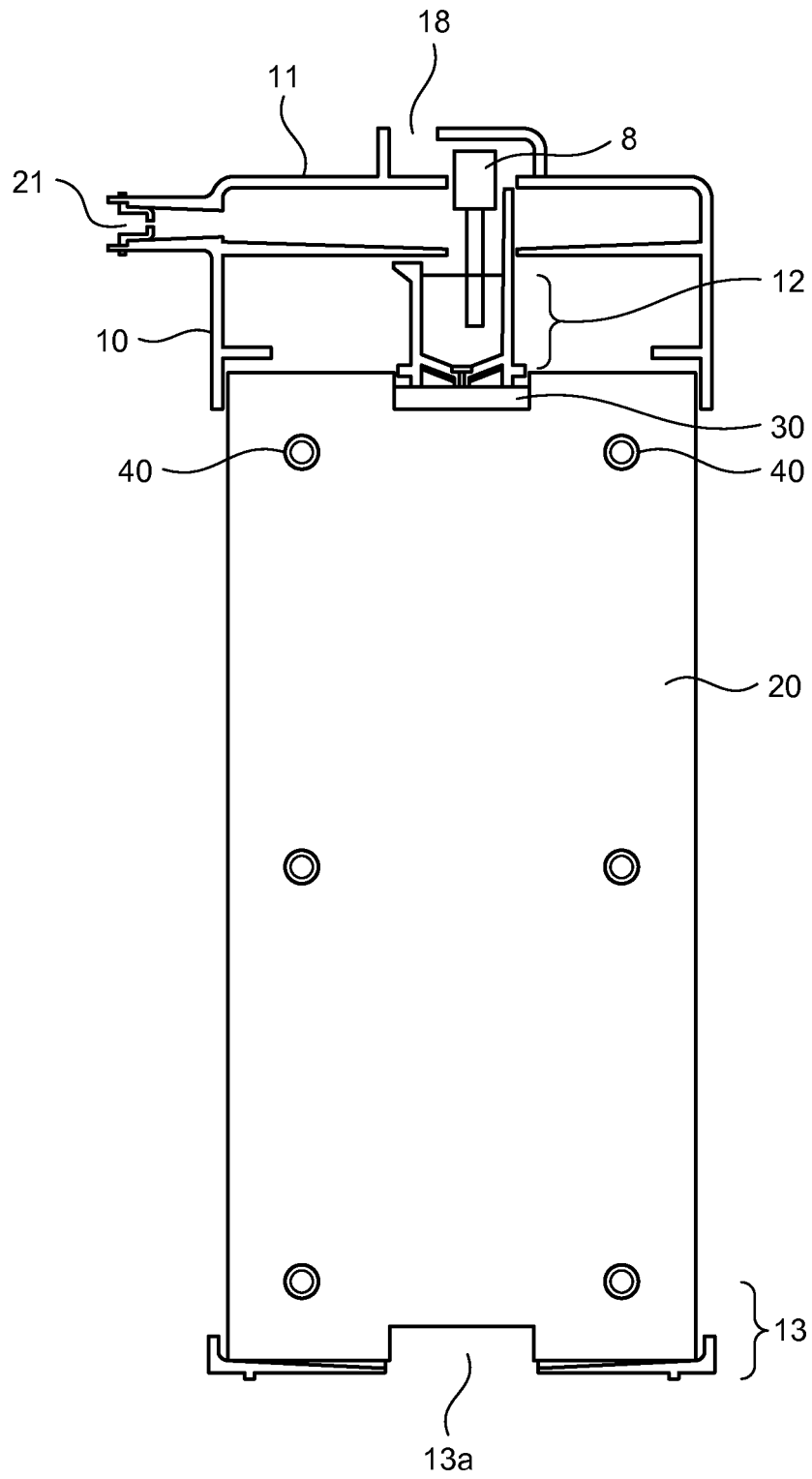


FIG.7

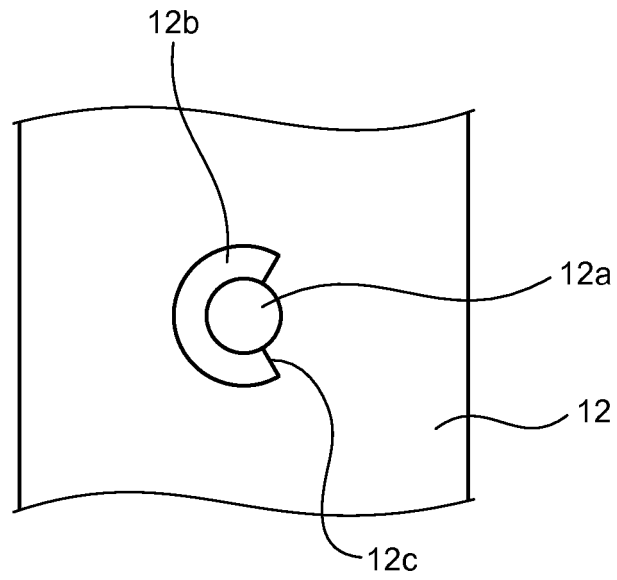


FIG.8

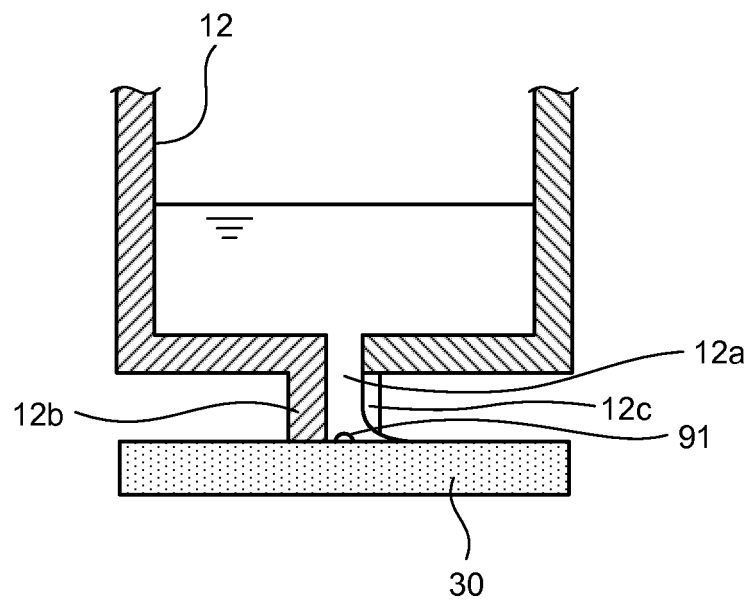


FIG.9

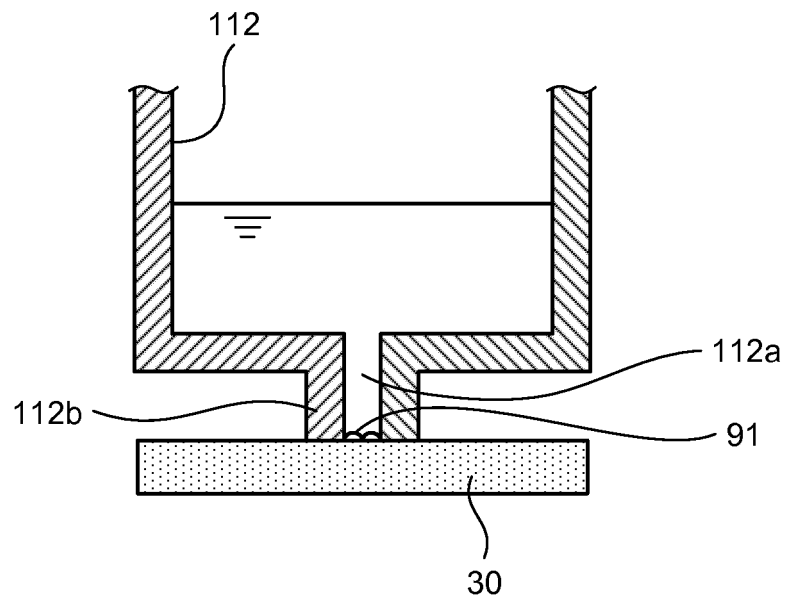


FIG.10

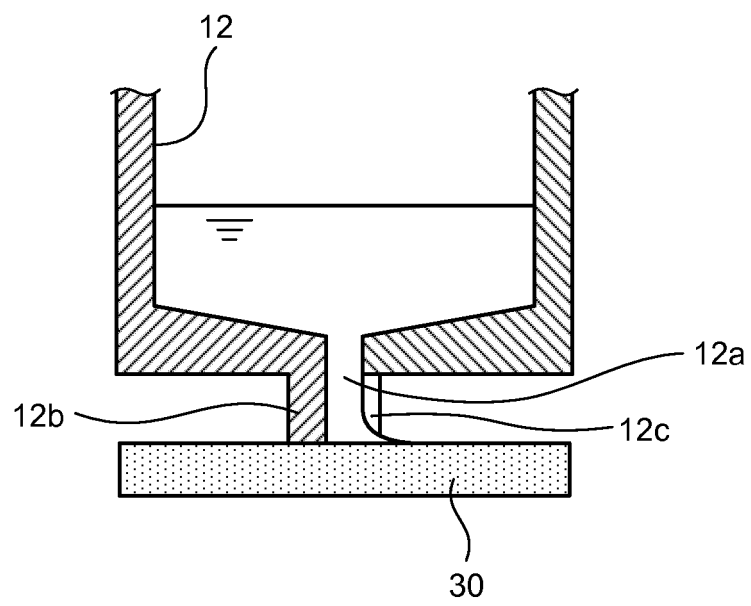


FIG.11

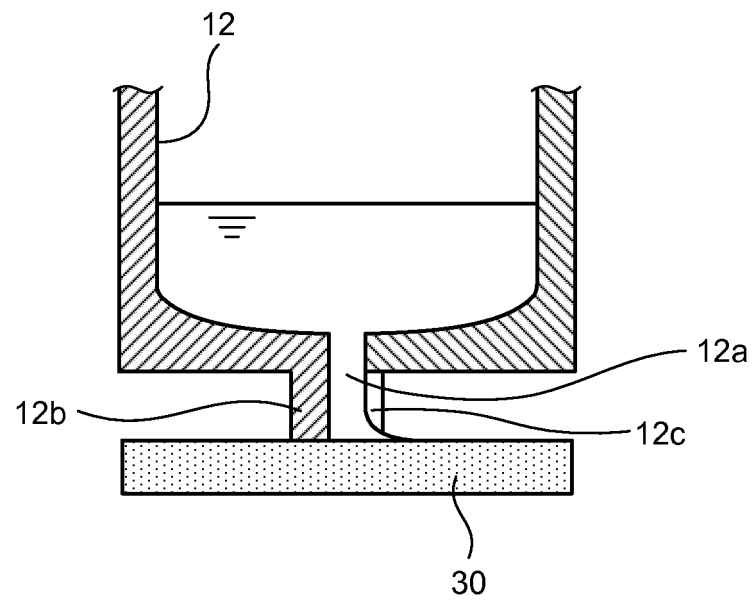


FIG.12

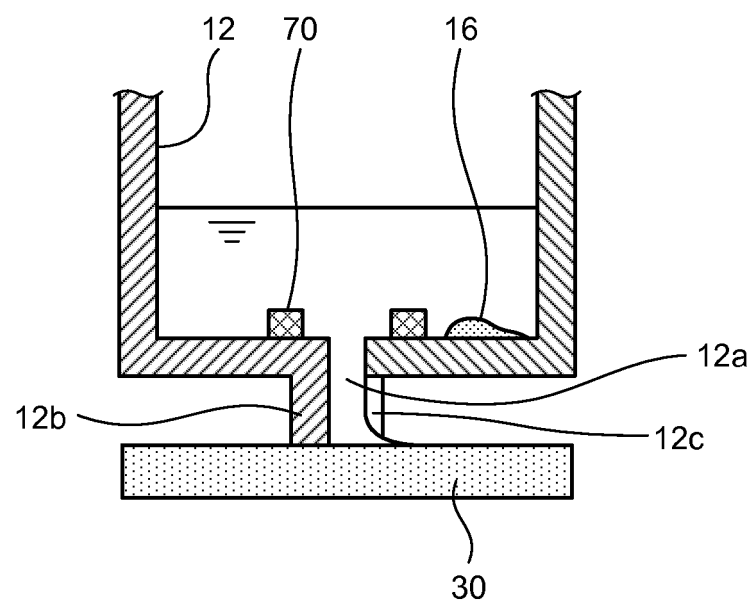


FIG.13

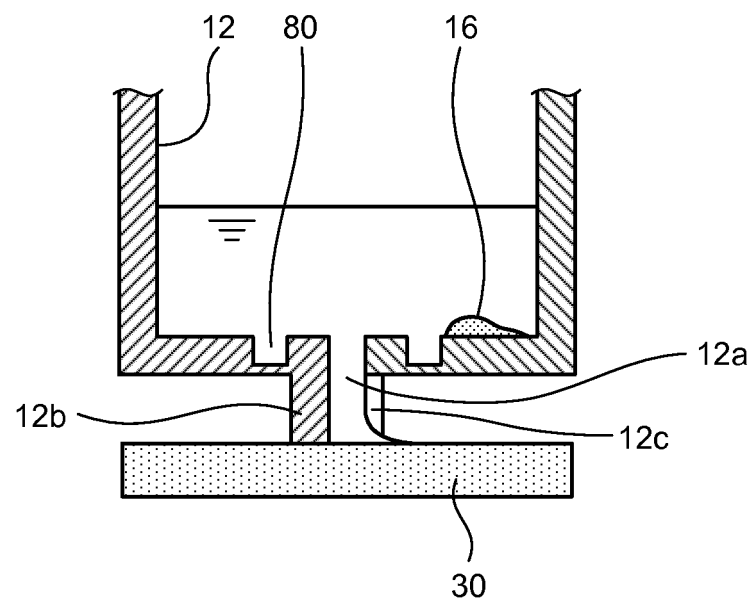


FIG.14

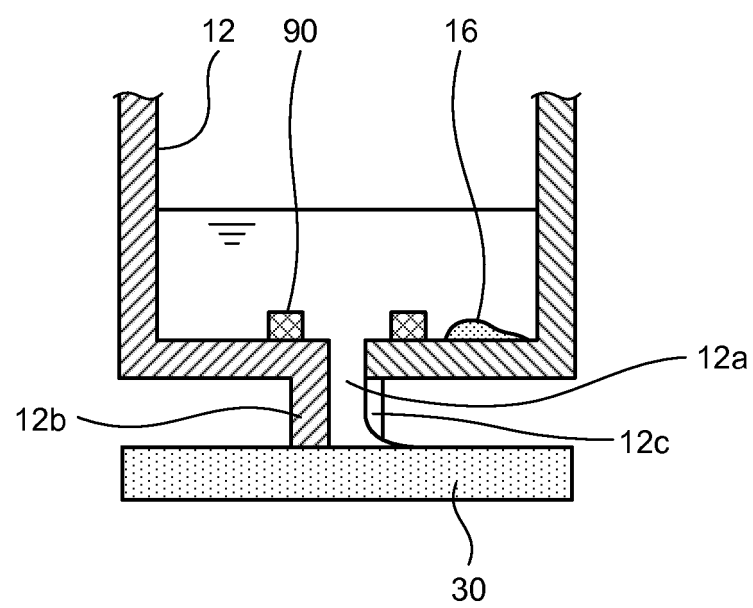


FIG.15

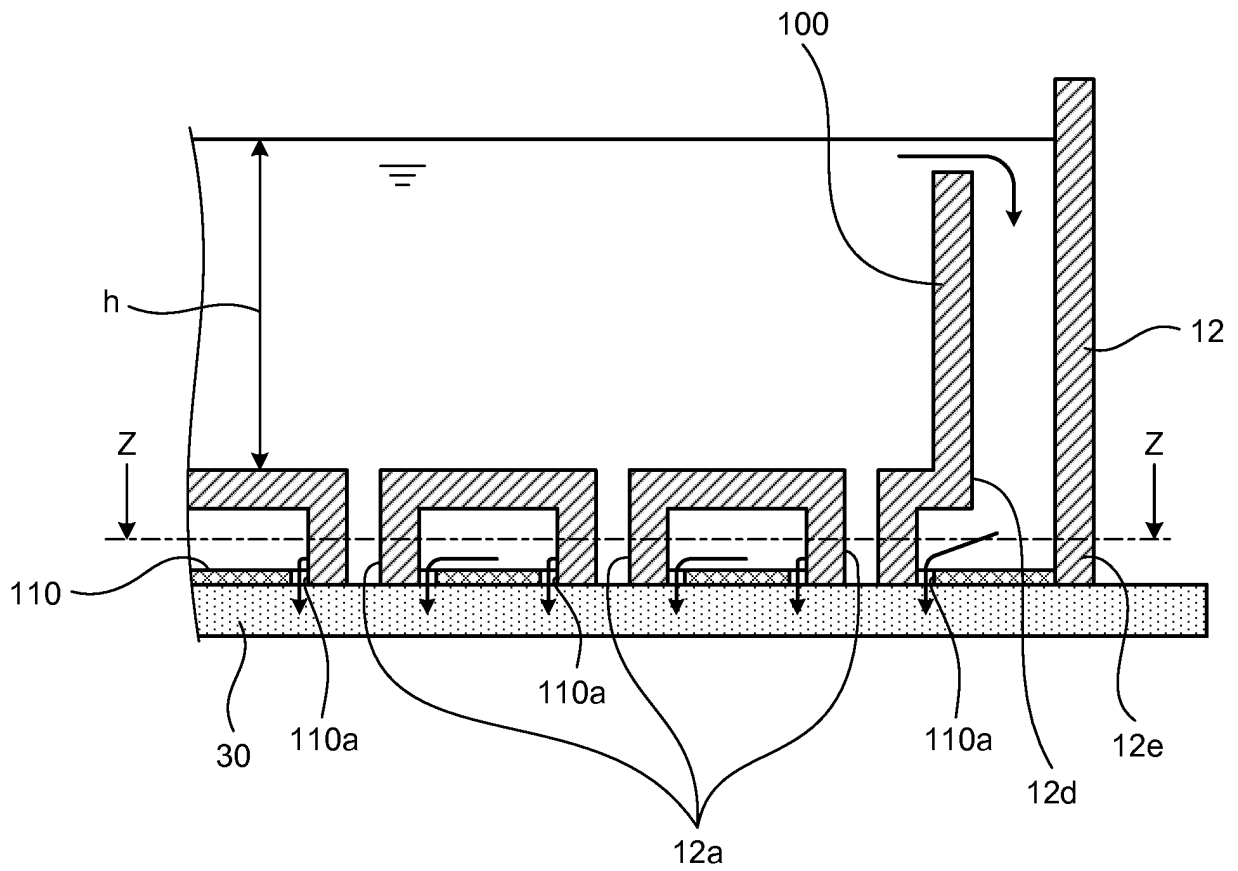
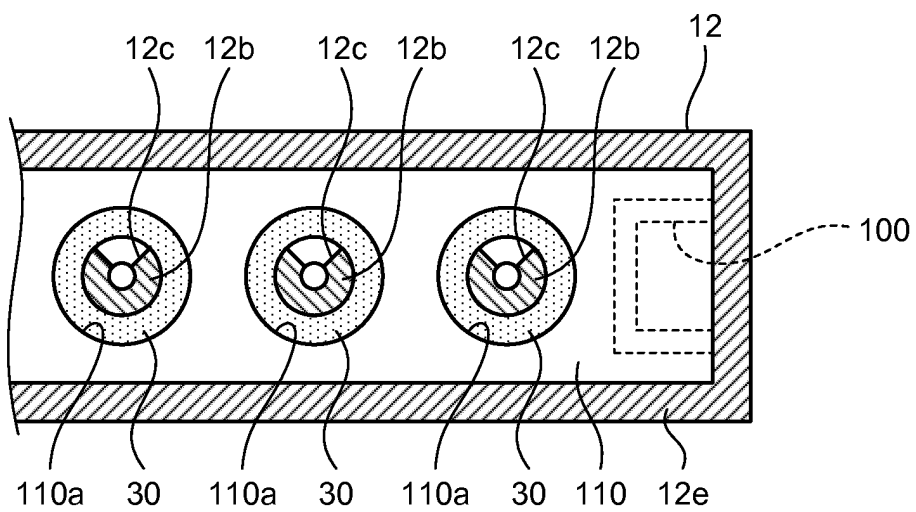


FIG.16



REFERENCES CITED IN THE DESCRIPTION

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