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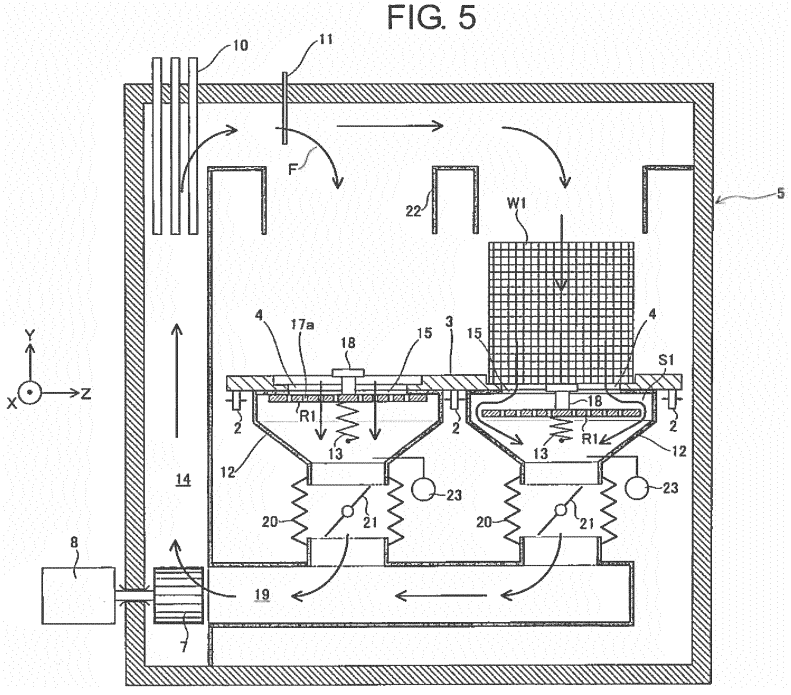
(54) DRYING APPARATUS

(57) A suction port 15 of a suction duct 12 corresponding to a tray vent hole 4 at a position, at which a drying target object W1 is not mounted, is covered with a first resistant lid R1 in which a first vent hole 17a is formed and hot air circulates through the first vent hole 17a. In the suction duct 12 corresponding to the tray vent hole 4 at a position at which a drying target object W1 is mounted, hot air flows through a first gap S1 formed between the first resistant lid R1 and the suction port 15, and does not pass through the first vent hole 17a of the first resistant lid R1. In other words, air resistance of the first vent hole 17a is set to be the same as air resistance of the drying target object W1, thereby it is possible for the same amount of hot air to pass through any one of the tray vent holes 4 and it is possible to perform the drying under the same condition as in a case where a drying process is performed on the maximum number of drying target objects.

FIG. 5



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a hot-air circulation type drying apparatus which thermally processes a drying target object having air permeability.

2. Description of the Related Art

[0002] A drying apparatus in the related art is configured as illustrated in FIG. 10.

[0003] In the apparatus, a plurality of drying target objects W are mounted on roller conveyor 31 and are loaded in drying chamber 32. While drying target objects W passes through drying chamber 32, hot air 33 supplied to drying chamber 32 is blown to drying target object W through passage 34. After air passes through drying target object W, the air passes through regulating plate 35 and is suctioned from hot air outlet 36. Then, a part of the air is exhausted and the rest is circulated.

Citation List

Patent Literature

[0004] PTL 1: Japanese Patent Unexamined Publication No. 1998-306977

SUMMARY OF THE INVENTION

[0005] However, in the configuration in the related art, a drying process may be appropriately performed in a state in which the plurality of drying target objects W are fully mounted on roller conveyor 31 to an arrangement limit. However, in a case where the drying process is performed in a state in which some drying target objects W are not mounted on roller conveyor 31 or in a state in which drying target objects W are not fully mounted with an empty position, the blown hot air passes through positions at which drying target object W is not mounted and which is empty and has low air resistance. Therefore, a small amount of hot air passes through drying target object W, and thus a problem arises in that a longer period of drying time is required, compared to a state in which drying target objects W are fully mounted to the arrangement limit.

[0006] An object of the present invention is to provide a drying apparatus in which, even when the number of drying target objects, on which a drying process is performed at once, varies, it is possible to shorten a period of drying time.

[0007] In a drying apparatus according to the present invention, a plurality of drying target objects having air permeability are mounted on a tray and a drying process is performed on the drying target object using a drying medium which penetrates through the tray. The drying apparatus includes: a tray in which a tray vent hole, through which the drying medium passes, is formed at respective mounting positions of the drying target object; a suction duct which is provided on the under surface side of the tray and suctions the drying medium from the tray vent hole; and a first resistant lid that opens and closes a suction port of the suction duct and has a first vent hole through which the drying medium passes in a state in which the suction port is closed in response to regulating of passing resistance of the drying medium. In the suction duct corresponding to the tray vent hole on which the drying target object is mounted, of the respective mounting positions of the tray, the drying medium is circulated passing through a first gap formed between the first resistant lid and the suction port of the suction duct. In the suction duct corresponding to the tray vent hole on which a drying target object is not mounted, of the respective mounting positions of the tray, the drying medium is circulated passing through the first vent hole formed in the first resistant lid.

[0008] In this configuration, the first resistant lid enables the drying medium to flow with the same air-flow resistance even at the drying position, at which the drying target object is not set, as that at the drying position at which the drying target object is set. Even when the number of drying target objects, on which the drying process is performed at once, varies, it is possible to shorten a period of drying time.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

FIGS. 1(a) and 1(b) are views illustrating a drying apparatus according to Exemplary Embodiment 1 of the present invention, FIG. 1(a) is a longitudinal sectional view thereof, and FIG. 1(b) is a horizontal sectional view thereof,

FIG. 2 is a sectional view taken along line I-I in FIG. 1;

FIG. 3 is a sectional view taken along line II-II in FIG. 1;

FIG. 4 is a sectional view illustrating a state in which a tray, on which drying target objects are mounted, reaches a drying position and a drying process is performed;

FIG. 5 is a sectional view illustrating a case where the tray has a place at which a drying target object is set and a place at which no drying target object is set;

FIG. 6 is a sectional view illustrating a main part of a drying position of a drying apparatus according to Exemplary Embodiment 2 of the present invention;

FIGS. 7(a) and 7(b) are views illustrating a tray loaded at the drying position according to Exemplary Embodiment 2 of the present invention, FIG. 7(a) is a plan view thereof, and FIG. 7(b) is a sectional view thereof taken along line III-III;

FIG. 8(a) is a sectional view illustrating a state of a place, at which a drying target object is set, reaching the drying position, FIG. 8(b) is a sectional view illustrating a state of a place, at which no drying target object is set, reaching the drying position, and FIG. 8(c) is a sectional view illustrating a state of a place, at which a drying target object having low air-flow resistance is set, reaching the drying position, according to Exemplary Embodiment 2 of the present invention;

FIG. 9 is a sectional view illustrating a main part of Exemplary Embodiment 3 of the present invention; and

FIG. 10 is a view illustrating a configuration of a drying apparatus in the related art.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] Hereinafter, respective exemplary embodiments of the present invention will be described with reference to the drawings.

[0011] In the following description, the same reference signs are assigned to components having the same operation.

EMBODIMENT 1

[0012] FIG. 1(a) to FIG. 5 illustrate a drying apparatus of Exemplary Embodiment 1 of the present invention.

[0013] The drying apparatus repeats drying processes in which a plurality of drying target objects having air permeability are processed at once. A specific example of the drying target object includes a diesel exhaust gas purifying catalyst diesel particulate filter (DPF) which decreases particulate matters (PM) in a diesel engine exhaust gas. The apparatus can be used in drying of a ceramic honeycomb structure or the like.

[0014] As illustrated in FIG. 1(a) and 1(b), the drying apparatus has chain 2, as a transport device, which is laid from a loading port to an unloading port of main body 1. X represents a transport direction, Y represents a height direction of main body 1, and Z represents a width direction of main body 1.

[0015] A plurality of drying target objects W1 are set on tray 3, are mounted on chain 2, and are transported toward the unloading port. Drying target object W1 is formed of, for example, ceramic to have a cylindrical shape and, in size, has a diameter of about 250 mm and a height of about 250 mm, and has a weight of 10 kg. In the present embodiment, four tray vent holes 4 are formed in tray 3 and four drying target objects can be set on one tray 3 at the maximum. There is no difference between weights of the four drying target objects. In the following description, the four drying target objects have the same air resistance as passing resistance.

[0016] Drying chamber 5, which supplies hot air as a drying medium to tray 3 which has arrived and suctions the hot air, is provided in a draying area at an intermediate position of main body 1. Drying chamber 5 has a box shape to form an airtight space and is enclosed with an insulating material such as glass wool.

[0017] FIG. 2 is a sectional view taken along line I-I in FIG. 1 and illustrates a state of transporting tray 3 toward drying chamber 5. First step portion 6a, in which drying target object W1 is set, is formed on the top surface of the tray 3 at a periphery of tray vent hole 4.

[0018] FIG. 3 is a sectional view taken along line II-II in FIG. 1, in a state in which tray 3 has yet to reach drying chamber 5. In addition to fan 7, motor 8, and shaft 9 for circulate air, drying chamber 5 includes heater 10, temperature sensor 11, suction duct 12, first resistant lid R1, compression spring 13, or the like. For example, fan 7 is sirocco fan or turbofan. Wind generated by fan 7 rises through first passage 14 along the inner side of a side wall of drying chamber 5. Heater 10 is disposed on a corner of first passage 14 in the vicinity of the ceiling. Hot air warmed by heater 10 is fed to the inside of drying chamber 5 in the vicinity of the ceiling as shown by arrow F.

[0019] Suction ducts 12 are arranged on the bottom of drying chamber 5, and chain 2 passing through drying chamber 5 is interposed between suction ducts 12 and tray 3, and suction duct 12 is provided for each of tray vent holes 4 of tray 3 which has arrived at the drying position. Suction duct 12 is attached to drying chamber 5 to be freely lifted and lowered with respect to a passage of chain 2. In FIG. 3 illustrating a state before tray 3 reaches drying chamber 5, suction duct 12 is positioned at a lowered position. Suction port 15 of suction duct 12 in this state is blocked by first resistant lid R1 biased upward by compression spring 13. Specifically, an outer circumferential portion of the top surface of first resistant lid R1 comes into contact with a periphery of suction port 15 on the inner side of suction duct 12. Reference sign 16 represents a support point of compression spring 13 in suction duct 12. Multiple first vent holes 17a are formed in an inner periphery of first resistant lid R1. Projecting portion 18 is formed at the center of the top surface of first resistant lid R1.

[0020] An outlet of suction duct 12 is connected, through bellows-shaped duct 20, to second passage 19 communicating with first passage 14 near a suction port of fan 7. In addition, motorized damper 21 is provided in the vicinity of a connection portion between the outlet of suction duct 12 and duct 20. Reference sign 22 represents a partition wall and reference sign 23 represents a pressure sensor. Reference sign 24 represents an operation controller and operation controller 24 performs current applying control to heater 10, opening regulation of damper 21, and operation control of chain 2.

[0021] Next, a configuration of operation controller 24 will be described on the basis of a drying operation.

[0022] Operation controller 24 operates motor 8 and causes a wind to circulate in drying chamber 5 as shown by arrow F regardless of whether tray 3 reaches drying

chamber 5 or not, and is operated such that a detected temperature by temperature sensor 11 becomes approximately a set temperature. For example, control of power supplied to heater 10 through a relay circuit is performed through PID control. The set temperature is set to a temperature of about 150°C to 200°C as a drying temperature of a solvent impregnated with drying target object W1.

[0023] Since, until tray 3 reaches drying chamber 5, the periphery of suction port 15 of suction duct 12 is brought into close contact with and is closed with first resistant lid R1 as illustrated in FIG. 3, a circulation route of hot air in drying chamber 5 is formed to circulate the hot air through first vent holes 17a of first resistant lid R1. Multiple first vent holes 17a of first resistant lid R1 are regulated to have a size and the number thereof such that air resistance through first vent holes 17a of first resistant lid R1 becomes the same as air resistance through drying target object W1. The air resistance is, for example, 500 Pa.

[0024] Operation controller 24 can change an opening degree of damper 21 such that differences between values of pressure detected by pressure sensor 23 which detects pressure of respective suction ducts 12 are decreased and a constant amount of air is caused to flow through respective suction ducts 12.

[0025] When tray 3 reaches drying chamber 5, operation controller 24 causes suction duct 12 to be lifted as illustrated in FIG. 4. First, a case, where four drying target objects W1 are set, at the maximum, on tray 3 which has arrived, is described in the following.

[0026] Respective suction ducts 12 are driven to a lifted position, and thereby suction ports 15 of respective suction ducts 12 come into close contact with the under surface of tray 3. First resistant lids R1 provided in respective suction ducts 12 are lifted along with suction ducts 12 at an initial lifting of suction ducts 12, but, after projecting portion 18 of first resistant lid R1 comes into contact with drying target object W1 due to the lifting, entire first resistant lid R1 is pushed downward due to a weight of drying target object W1 in resistance to the biasing force of compression spring 13. Accordingly, first gap S1 is formed between suction duct 12 and first resistant lid R1. Since air resistance through first gap S1 is less than air resistance through first vent hole 17a of first resistant lid R1 and is, for example, about 10 Pa, the hot air in drying chamber 5 circulates through first gap S1 without passing through first vent hole 17a of first resistant lid R1. Even at this time, operation controller 24 can change the opening degree of damper 21 such that differences between values of pressure detected by respective pressure sensors 23 are decreased, and a constant amount of air is caused to flow through respective suction ducts 12.

[0027] In this state, when operation controller 24 detects that the drying process of four drying target objects W1 is completed, then all of suction ducts 12 are lowered, chain 2 is operated, tray 3 is unloaded from drying chamber 5, and next tray 3 is loaded in drying chamber 5.

[0028] The case, in which the drying process is performed on four drying target objects W1 at the same time, is described above; however, in a case of a partially mounted state having an empty place at which drying target object W1 is not set, such as a state in which only three drying target objects W1 are set on tray 3, operation controller 24, which detects that tray 3 has arrived, causes suction ducts 12 to be lifted, then first gap S1 is formed between suction ducts 12 and first resistant lid R1 in the same way as in the case in FIG. 4, at the drying position at which drying target objects W1 of tray 3 are set as illustrated on the right side in FIG. 5, and the hot air in drying chamber 5 circulates through first gap S1 without passing through first vent hole 17a of first resistant lid R1.

[0029] Since first resistant lid R1 is not pushed downward in resistance to the biasing force of compression spring 13 as illustrated on the left side in FIG. 5, at the drying position at which drying target objects W1 of tray 3 are not set, even when suction ducts 12 are lifted, the hot air circulates through first vent hole 17a of first resistant lid R1 in the same way as in the case in FIG. 3.

[0030] Even at this time, operation controller 24 can change the opening degree of damper 21 such that differences between values of pressure detected by respective pressure sensors 23 are decreased, and a constant amount of air is caused to flow through respective suction ducts 12. Therefore, it is possible to perform the drying process for the same time as in the case where four drying target objects W1 are set on tray 3.

[0031] When operation controller 24 detects that the drying process is completed, then all of suction ducts 12 are lowered, chain 2 is operated, and tray 3 is unloaded from drying chamber 5.

[0032] Damper 21 and control of damper 21 by operation controller 24 are not essential configurational conditions. Even when suction port 15 of suction damper 21 is only opened or closed by first resistant lid R1 without control of the opening degree of damper 21, and even when the number of drying target objects, on which the drying process is performed at once, varies, it is possible to shorten a period of drying time.

[0033] In a case of avoiding prolonging of period of drying time due to variations in the number of drying target objects only by the control of the opening degree of damper 21 without using first resistant lid R1, flowing of the hot air in the inside of drying chamber 5 is not stabilized in a short time, and thus a delay occurs until the flowing of the hot air is stabilized. Therefore, in order to rapidly start the drying process, with an appropriate amount of hot air, on the respective drying target objects which are mounted on tray 3 and are loaded in drying chamber 5, it is most preferable that first resistant lid R1 and regulation by damper 21 are combined.

[0034] The case, where four drying target objects W1 are set at the maximum on tray 3, is described as an example; however, cases where three or less drying target objects or five or more drying target objects are set on tray 3 can be implemented in the same way as above.

EMBODIMENT 2

[0035] FIG. 6 to FIG. 8 illustrate Exemplary Embodiment 2 of the present invention.

[0036] In Exemplary Embodiment 1, the plurality of drying target objects as air permeable cylindrical bodies have the same weight; however, in Exemplary Embodiment 2, even in a case where there are variations in weights of the plurality of drying target objects, on which the drying process is performed at once, it is possible to perform the drying process in the same time as in the case where there is no variation in the weights.

[0037] FIG. 6 illustrates a main part of the drying apparatus according to Exemplary Embodiment 2 of the present invention. The other parts are the same as Exemplary Embodiment 1.

[0038] In Exemplary Embodiment 2, drying conditions include a case where the maximum number of drying target objects are set on a tray and the drying process is performed, a case where less than the maximum number of drying target objects are set on a tray and the drying process is performed, and a case where drying target objects which are set on the tray have weight differences thereamong.

[0039] In tray 3, second step portion 6b on which second resistant lid R2 is set, apart from first step portion 6a on which drying target object W is set, is formed. Second resistant lid R2 has a diameter smaller than that of first resistant lid R1.

[0040] FIG. 7(a) illustrates a case where first step portion 6a and second step portion 6b are formed at any one of six mounting positions P1 to P6 on tray 3 on which six drying target objects are set at the maximum. The drying target objects are set at the mounting positions P1, P3, and P5 of tray 3. Height of drying target object W2 set at mounting position P3 is half of a height of drying target objects W1 set at mounting positions P1 and P5. In other words, air resistance of drying target object W2 is half of the air resistance of drying target object W1. FIG. 7(b) illustrates a cross section of mounting positions P1 to P3 of tray 3.

[0041] As illustrated in FIG. 7(b), tray 3 is loaded into drying chamber 5 in a state in which second resistant lid R2 is set in second step portion 6b at mounting positions P2, P4, and P6 at which the drying target object is not set.

[0042] Since, until tray 3 reaches drying chamber 5, the periphery of suction port 15 of suction duct 12 is brought into close contact with and is closed with first resistant lid R1 as illustrated in FIG. 3, a circulation route of hot air in drying chamber 5 is formed to circulate the hot air through first vent holes 17a of first resistant lid R1. Multiple first vent holes 17a of first resistant lid R1 are regulated to have a size and the number thereof such that air resistance through first resistant lid R1 becomes the same as air resistance through drying target object W1. The air resistance is, for example, 500 Pa which is the same as drying target object W1.

[0043] Operation controller 24 can change an opening degree of damper 21 such that difference between values of pressure detected by pressure sensor 23 which detects pressure of respective suction ducts 12 are decreased and a constant amount of air is caused to flow through respective suction ducts 12.

[0044] When tray 3 reaches drying chamber 5, operation controller 24 causes suction duct 12 to be lifted. Suction ports 15 of respective lifted suction ducts 12 come into close contact with the under surface of tray 3. FIGS. 8(a), 8(b), and 8(c) illustrate states of suction ducts 12 corresponding to mounting positions P1, P2, and P3, respectively.

[0045] First resistant lid R1 provided in suction duct 12 at mounting position P1 is lifted along with suction duct 12 at an initial lifting of suction duct 12, but, after projecting portion 18 comes into contact with drying target object W1 due to the lifting, entire first resistant lid R1 is pushed downward due to drying target object W1 in resistance to the biasing force of compression spring 13. Accordingly, first gap S1 is formed between suction duct 12 and first resistant lid R1. Since air resistance through first gap S1 is less than air resistance through first resistant lid R1 and is, for example, about 10 Pa, the hot air in drying chamber 5 circulates through first gap S1 without passing through first vent hole 17a of first resistant lid R1. Even at this time, operation controller 24 can change the opening degree of damper 21 such that differences between values of pressure detected by respective pressure sensors 23 are decreased, and a constant amount of air is caused to flow through respective suction ducts 12.

[0046] First resistant lid R1 provided in suction duct 12 at mounting position P2 is lifted along with suction duct 12 in response to lifting of suction duct 12, and suction port 15 of lifted suction duct 12 comes into close contact with the under surface of tray 3. In addition, projecting portion 18 of first resistant lid R1 is provided to come into contact with second resistant lid R2 which is set at mounting position P2, due to the lifting. The biasing force of compression spring 13, which biases first resistant lid R1 upward, is greater than the weight of second resistant lid R2. Therefore, after projecting portion 18 of first resistant lid R1 comes into contact with second resistant lid R2, second resistant lid R2 is lifted from second step portion 6b of tray 3 in response to the lifting of suction duct 12 such that second gap S2 is formed between tray 3 and second resistant lid R2. Since the hot air has air resistance through second gap S2 smaller than air resistance through multiple second vent holes 17b which are formed in second resistant lid R2 and is, for example, about 10 Pa, the hot air in drying chamber 5 circulates through second gap S2 without passing through second vent hole 17b of second resistant lid R2, and further through first vent hole 17a of first resistant lid R1, in which the air resistance is 500 Pa. Even at this time, operation controller 24 can change the opening degree of damper 21 such that differences between values of pressure detected by respective pressure sensors 23 are decreased, and a constant amount of air is caused to flow through

respective suction ducts 12.

[0047] Second resistant lid R2 and drying target object W2 are set at mounting position P3. First resistant lid R1 provided in suction duct 12 at mounting position P3 is lifted along with suction duct 12 at the initial lifting of suction duct 12, but, after projecting portion 18 comes into contact with second resistant lid R2 due to the lifting, entire first resistant lid R1 is pushed downward due to drying target object W2 in resistance to the biasing force of compression spring 13. Accordingly, first gap S1 is formed between suction duct 12 and first resistant lid R1. Air resistance through first gap S1 is less than air resistance through first resistant lid R1 and is, for example, about 10 Pa. The hot air in drying chamber 5, which has passed through drying target object W2 and further has passed through second resistant lid R2 circulates through second gap S2 without passing through first vent hole 17a of first resistant lid R1. Even at this time, operation controller 24 can change the opening degree of damper 21 such that differences between values of pressure detected by respective pressure sensors 23 are decreased, and a constant amount of air is caused to flow through respective suction ducts 12. In other words, in a case where the air resistance of drying target object W2 is 250 Pa, and the air resistance of second resistant lid R2 is 250 Pa, and thereby total air resistance becomes 500 Pa. In this manner, it is possible to perform the drying under the same condition as drying target object W1.

[0048] Mounting positions P4, and P6 at which second resistant lid R2 is set without a drying target object is the same as the case of mounting position P2. A case, where drying target object W1 is set at mounting position P5, is the same as the case of mounting position P1. A case, where drying target object W2 and second resistant lid R2 are set at mounting position P5, is the same as the case of mounting position P3.

[0049] In this manner, even in a case where partially unmounted positions at which drying target objects W1 and W2 are not set on tray 3 or various types of drying target objects are dried at the same time, first and second resistant lids R1 and R2 are provided, and thereby a plurality of works can be dried even using a single system of fan 7 and heater 10.

EMBODIMENT 3

[0050] FIG. 9 illustrates Exemplary Embodiment 3 of the present invention.

[0051] In Exemplary Embodiment 2, suction duct 12 is lifted and suction port 15 of suction duct 12 comes into contact with the under surface of tray 3; however, sealing between suction duct 12 and tray 3 is not described. However, gasket 25 illustrated in FIG. 9 is actually provided. More specifically, gasket 25 is provided on an end surface, which is in contact with tray 3, of suction duct 12 so as to surround suction port 15 of suction duct 12. Furthermore, in the suction duct 12, spacer 26, which is processed to have a height of a minimum interval between suction duct 12 and tray 3, is provided on the inner circumferential side of gasket 25 such that gasket 25 is not excessively deformed.

[0052] Here, Exemplary Embodiment 2 is described as an example; however, it is preferable that gasket 25 and spacer 26 are also provided in Exemplary Embodiment 1, similar to Exemplary Embodiment 2.

INDUSTRIAL APPLICABILITY

[0053] The present invention contributes to minimizing of an installment space of various manufacturing lines in which a drying process is performed on consecutive drying target objects, in addition to a drying process for air permeable cylindrical body or the like.

REFERENCE MARKS IN THE DRAWINGS

[0054]

W1: drying target object
W2: drying target object
R1: first resistant lid
R2: second resistant lid
S1: first gap
S2: second gap
X: transport direction
Y: height direction of main body 1
Z: width direction of main body 1
1: main body
2: chain
3: tray
4: tray vent hole
5: drying chamber
6a: first step portion
6b: second step portion
7: fan
8: motor
9: shaft
10: heater
11: temperature sensor
12: suction duct
13: compression spring
14: first passage
15: suction port of suction duct 12
16: support point of compression spring 13
17a: first vent hole
17b: second vent hole
18: projecting portion
19: second passage
20: duct
21: damper
22: partition wall
23: pressure sensor
24: operation controller
25: gasket
26:spacer
P1 to P6: mounting position

Claims

1. A drying apparatus for drying a plurality of drying target objects having air permeability and mounted on a tray by using a drying medium penetrating through the tray, the drying apparatus comprising:

   a tray (3) having a tray vent hole (4) for the drying medium passing therethrough at respective mounting positions of the drying target objects (W1);
   a suction duct (12) provided on an under surface side of the tray (3) for sucking the drying medium from the tray vent hole (4); and
   a first resistant lid (R1) for regulating of passing resistance of the drying medium by opening and closing a suction port (15) of the suction duct (12), the lid having a first vent hole (17a) for the drying medium passing therethrough with the suction port (15) closed,
   wherein, in the suction duct (12) corresponding to the tray vent hole (4), on which the drying target object (W1) is mounted, of the respective mounting positions of the tray (3), the drying medium is circulated passing through a first gap (S1) formed between the first resistant lid (R1) and the suction port (15) of the suction duct (12), and
   wherein, in the suction duct (12) corresponding to the tray vent hole (4), on which a drying target object (W1) is not mounted, of the respective mounting positions of the tray (3), the drying medium is circulated passing through the first vent hole (17a) formed in the first resistant lid (R1).

2. The drying apparatus according to claim 1,
   wherein the tray (3) has a first step portion that engages with the drying target object (W1) at a periphery of the tray vent hole (4) on a top surface of the tray (3).

3. The drying apparatus according to claim 1, further comprising:

   a spring for biasing the first resistant lid (R1) in a direction in which the suction port (15) of the suction duct (12) is closed,
   wherein the first resistant lid (R1) is caused to move in a direction, such that the passing resistance of the drying medium is lowered, against the bias, due to weight of the drying target object (W1), for forming the first gap (S1).

4. The drying apparatus according to claim 1,
   wherein a damper is provided in the suction duct (12).

5. The drying apparatus according to claim 1,
   wherein a gasket is provided to the suction duct (12) at an end surface which is in contact with the tray (3), and a spacer is provided at an inner circumferential side of the gasket.

6. The drying apparatus according to claim 1, further comprising:

   a second resistant lid (R2) having a second vent hole, through which the drying medium is passed, mounted on the tray (3) so as to cover the tray vent hole (4),
   wherein, in the suction duct (12) corresponding to the tray vent hole (4), on which the second resistant lid (R2) is mounted and a drying target object (W1) is not mounted, of the respective mounting positions of the tray (3), the drying medium is circulated through a second gap formed between the tray (3) and the second resistant lid (R2) which is pushed upward from the tray (3) in a state in which the suction port (15) of the suction duct (12) is closed with the first resistant lid (R1), and the first vent hole (17a) of the first resistant lid (R1, and
   wherein, in the suction duct (12) corresponding to the tray vent hole (4), on which the second resistant lid (R2) and the drying target object (W1) are mounted, of the respective mounting positions of the tray (3), the drying medium is circulated through the second vent hole of the second resistant lid (R2) and the first gap (S1) formed between the first resistant lid (R1) and the suction port (15) of the suction duct (12).

7. The drying apparatus according to claim 6, further comprising:

   a spring for biasing the first resistant lid (R1) in a direction in which the suction port (15) of the suction duct (12) is closed,
   wherein, in a state in which the suction port (15) of the suction duct (12) is blocked by the first resistant lid (R1) due to the bias, the second gap is formed by pushing the second resistant lid (R2) upward with the first resistant lid (R1) interposed.

8. The drying apparatus according to claim 6,
   wherein the tray (3) has a first step portion that engages with the drying target object (W1) at a periphery of the tray vent hole (4) on a top surface of the tray (3), and has a second step portion that accommodates the second resistant lid (R2) between the tray vent hole (4) of the tray (3) and the first step portion.

FIG. 1

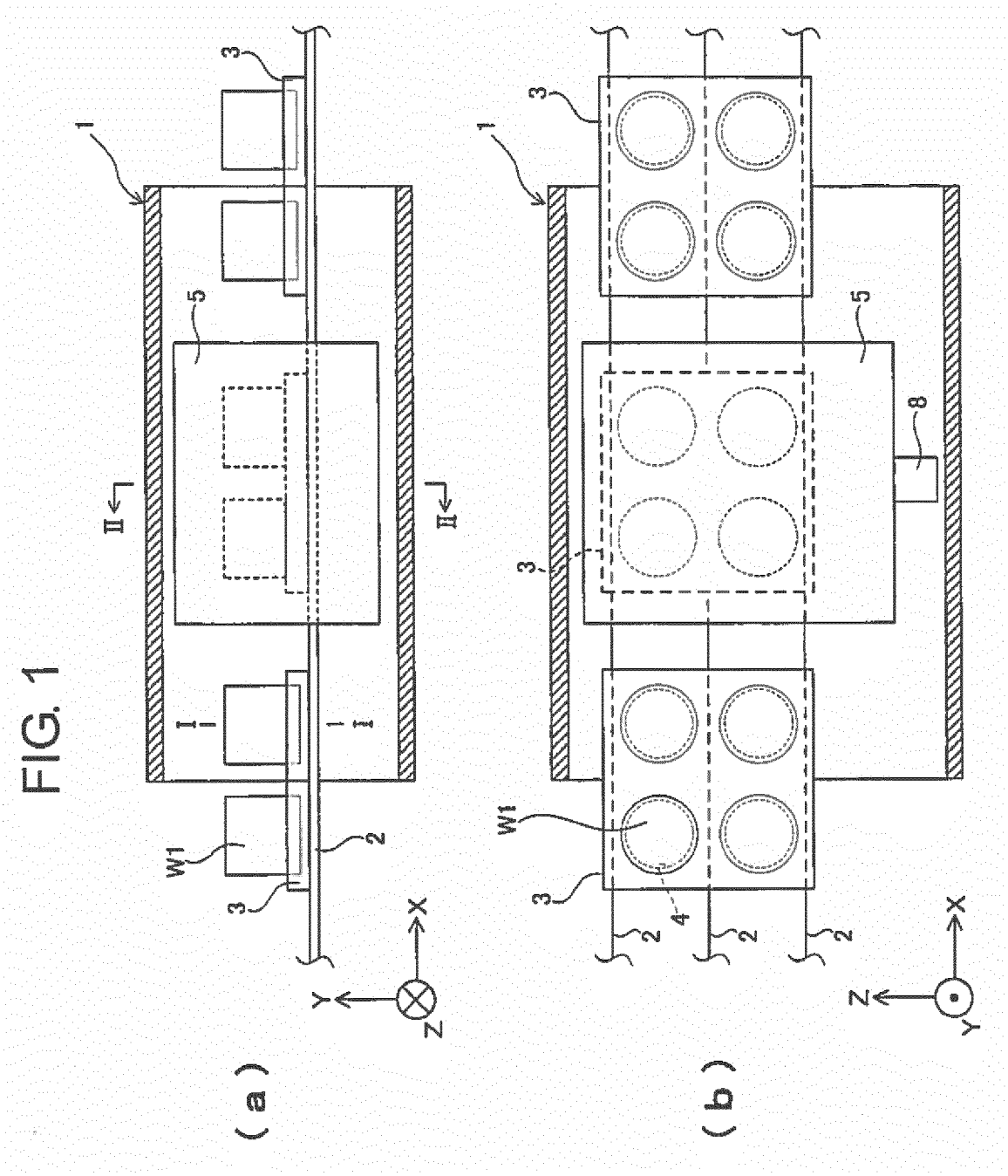


FIG. 2

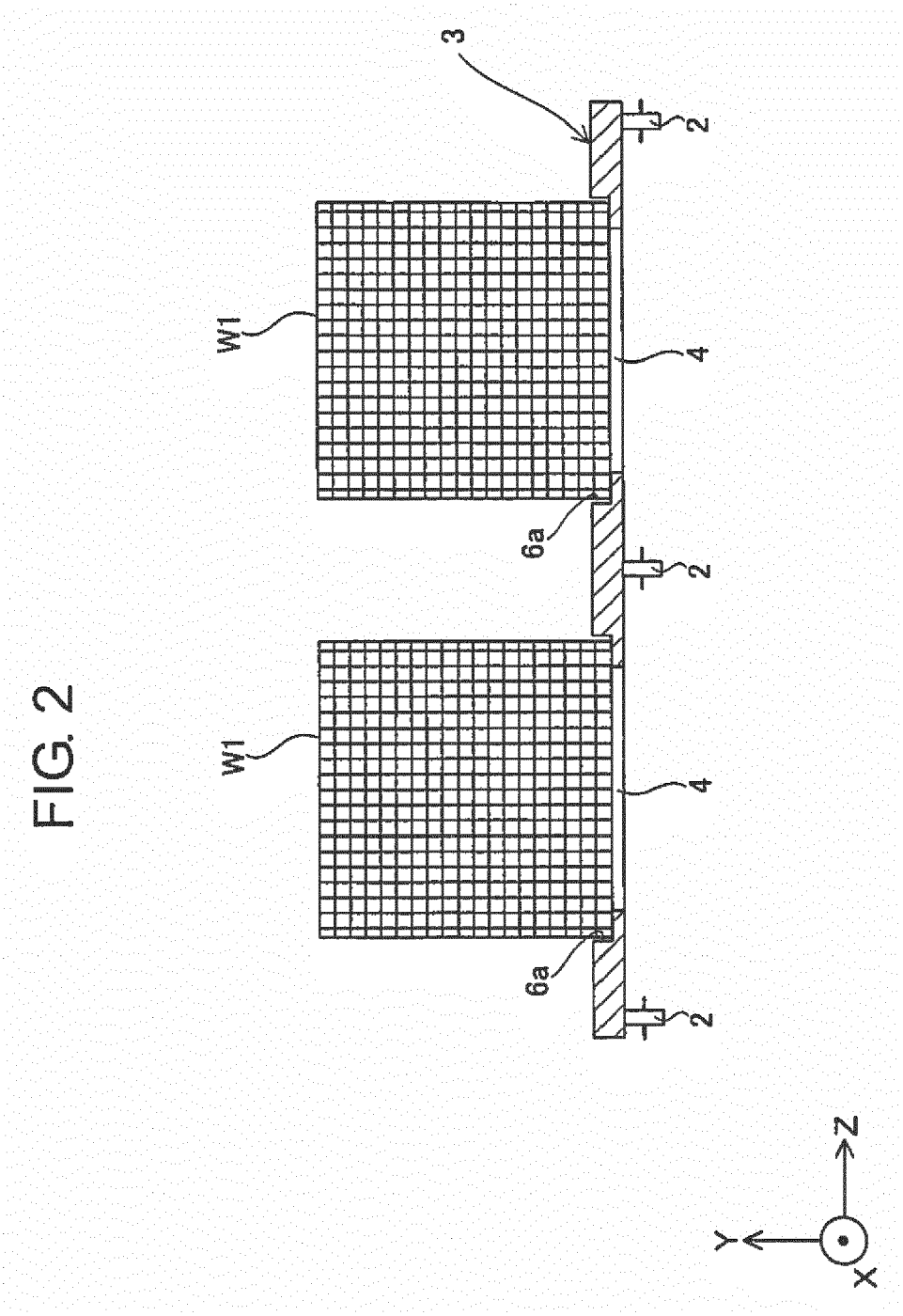


FIG. 3

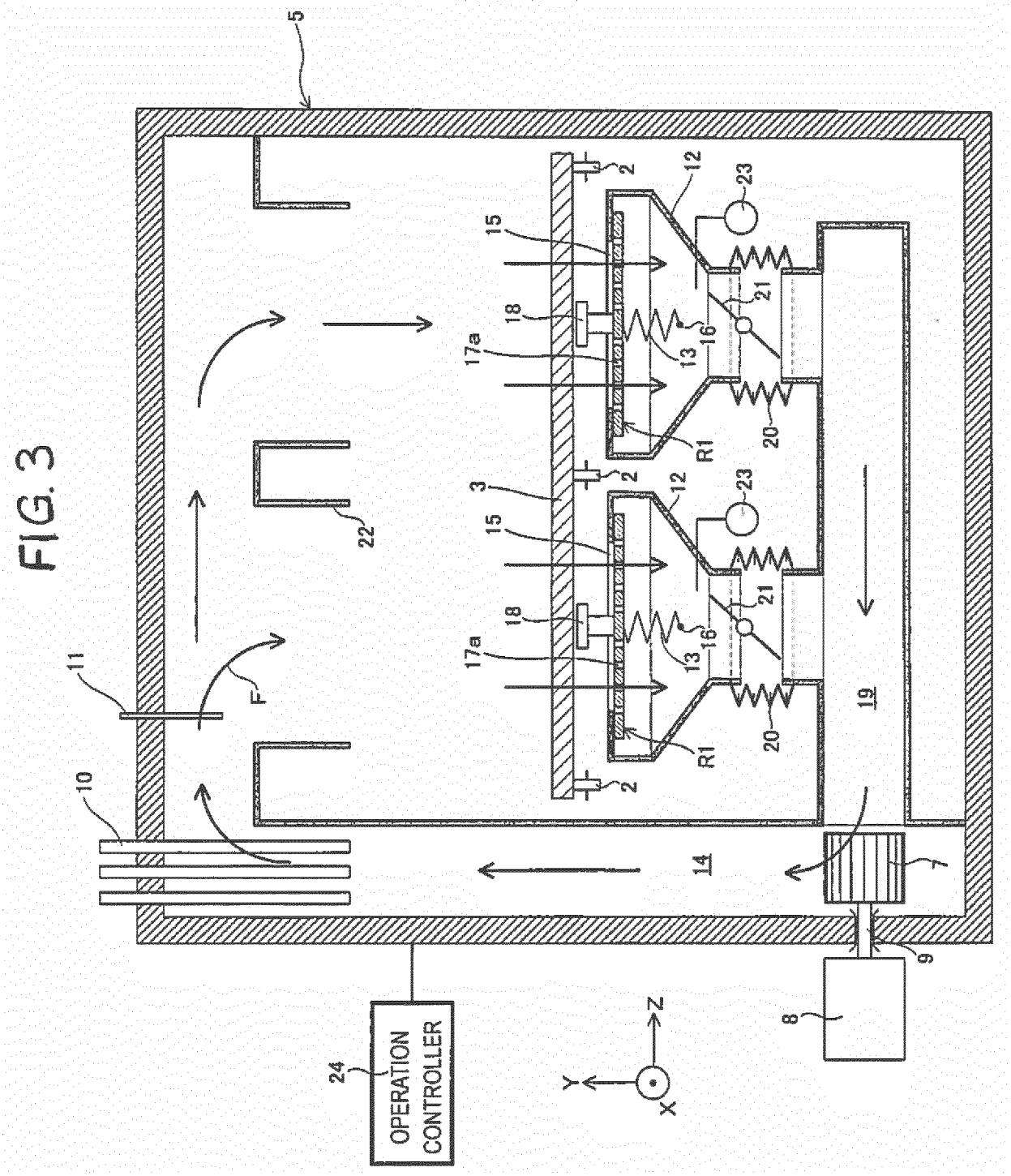

5
2
12
23
15
21
18
16
13
17a
20
R1
3
22
11
F
10
14
19
7
9
8
24
OPERATION CONTROLLER
Z
Y
X

FIG. 4

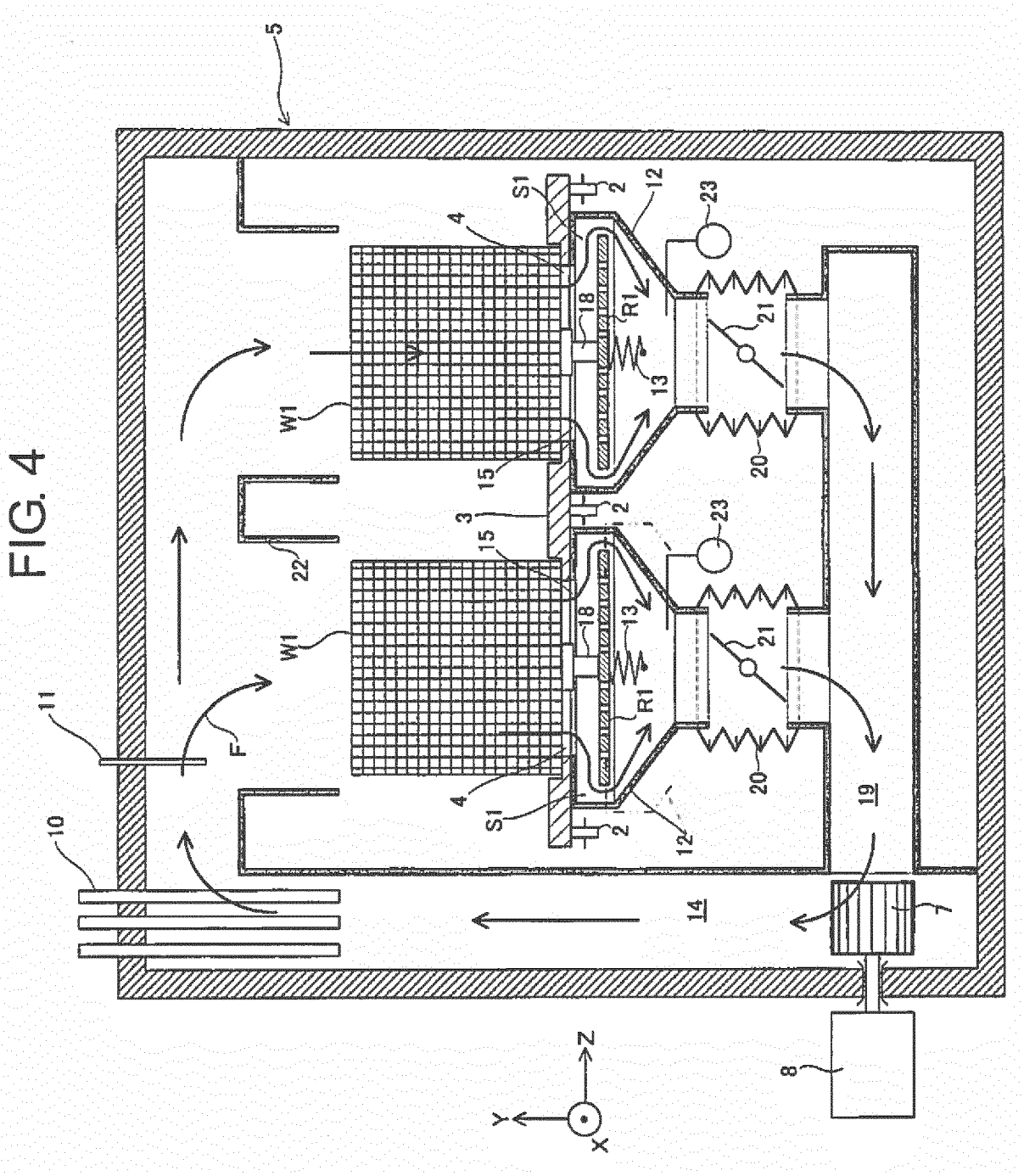


FIG. 5

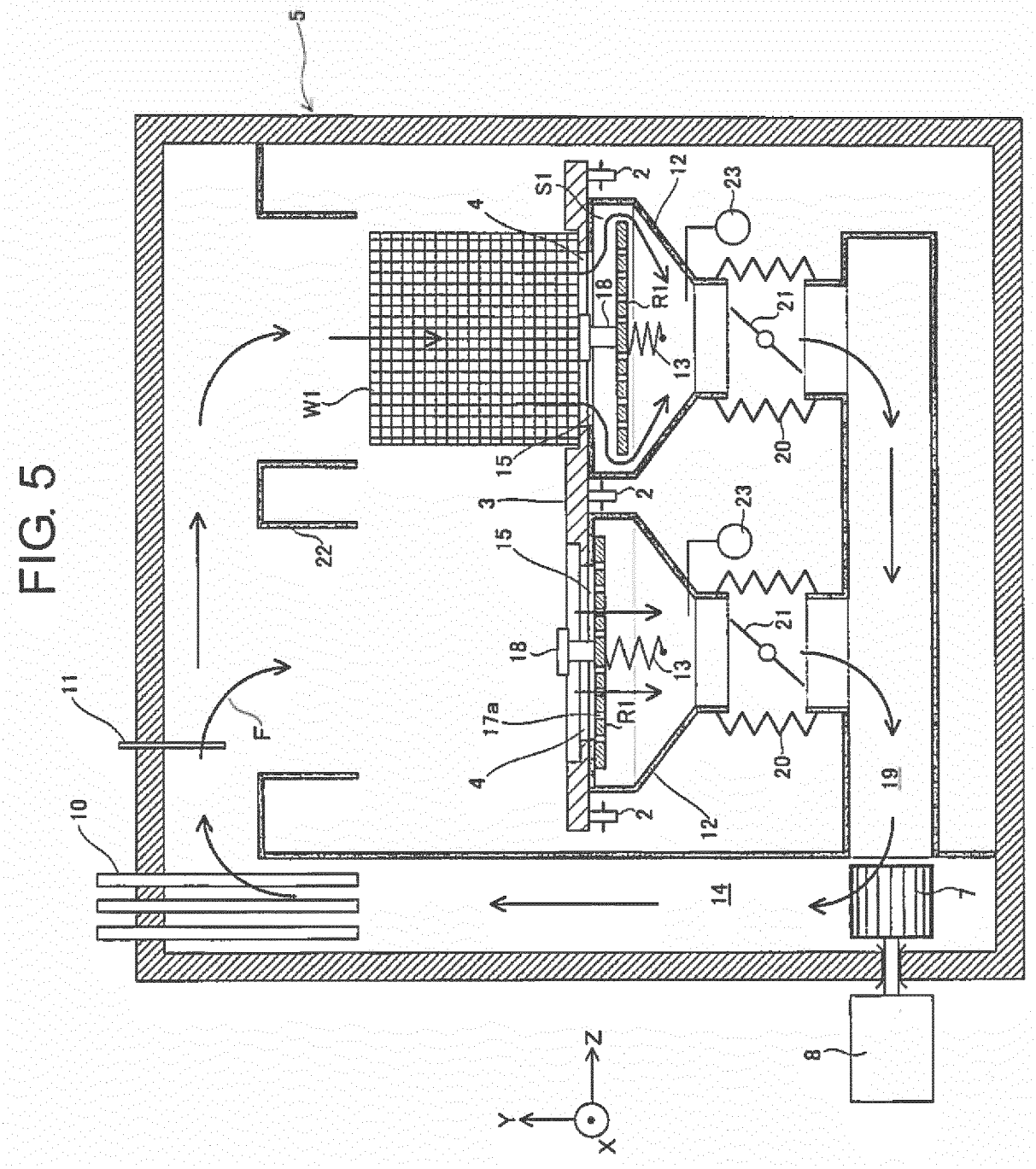


FIG. 6

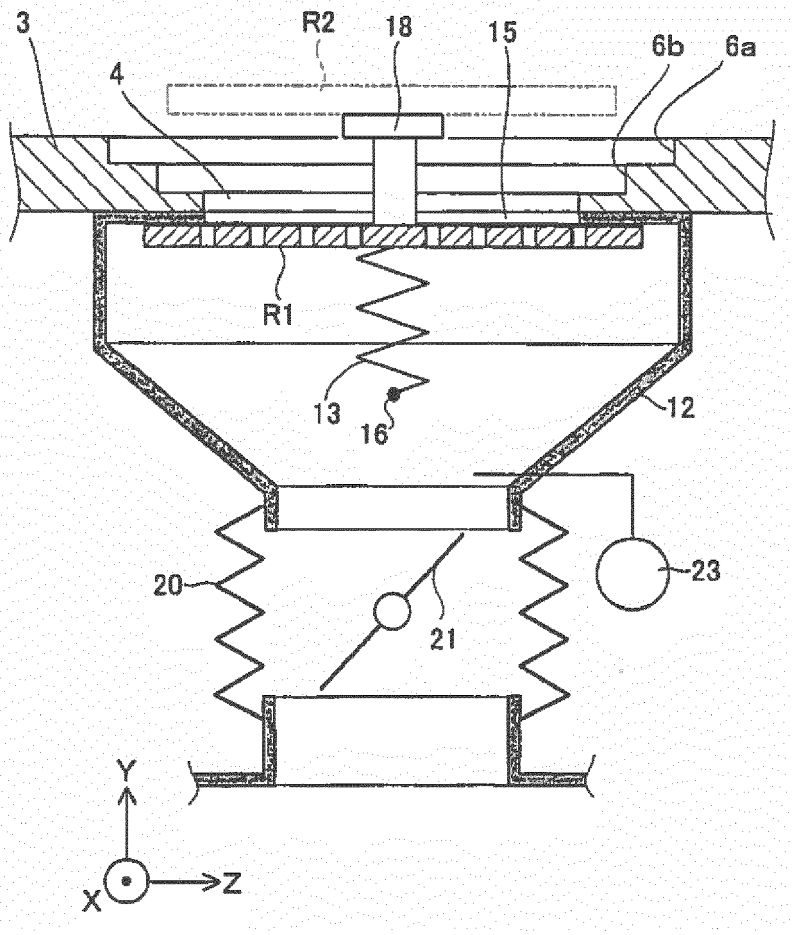
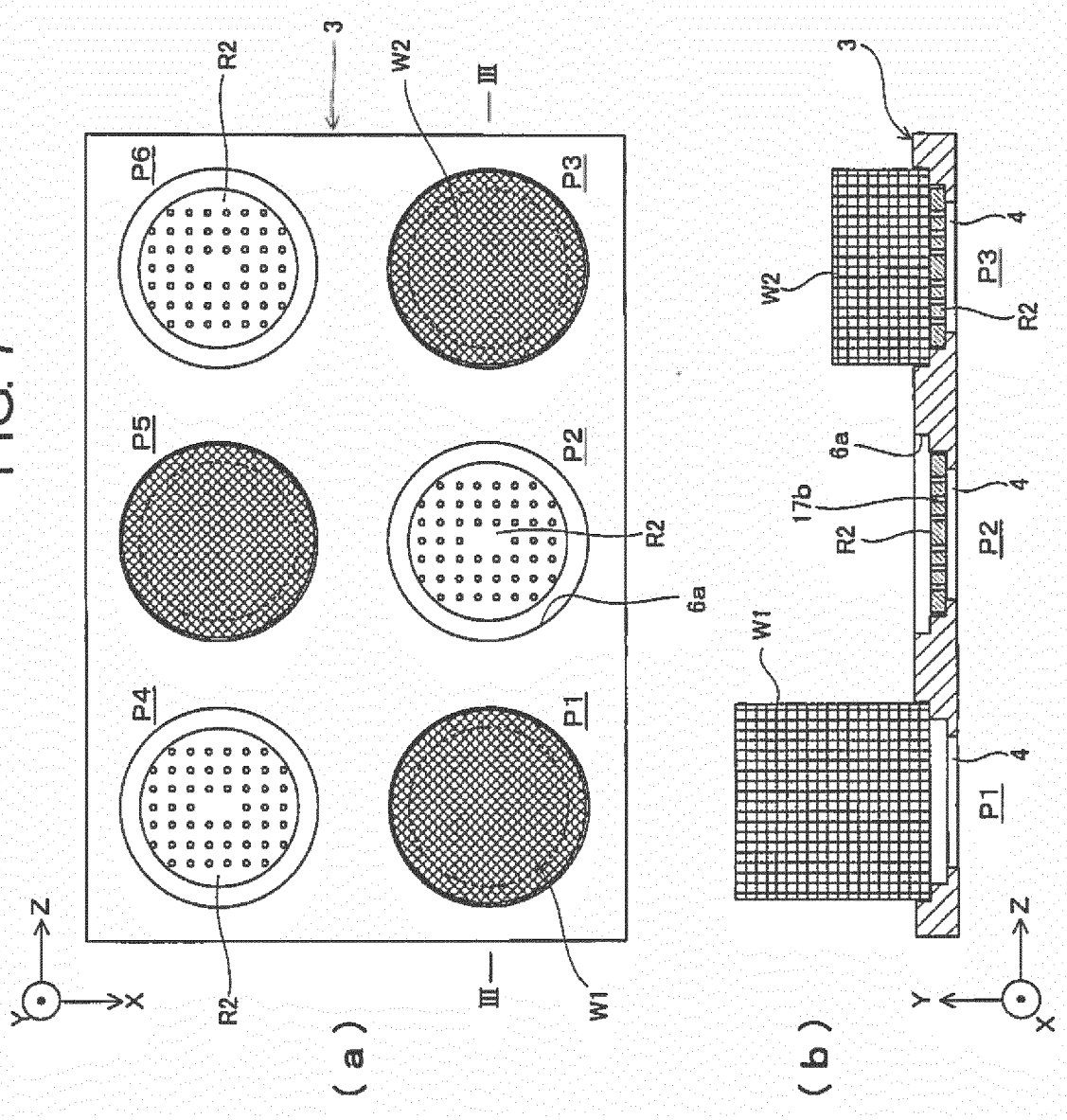


FIG. 7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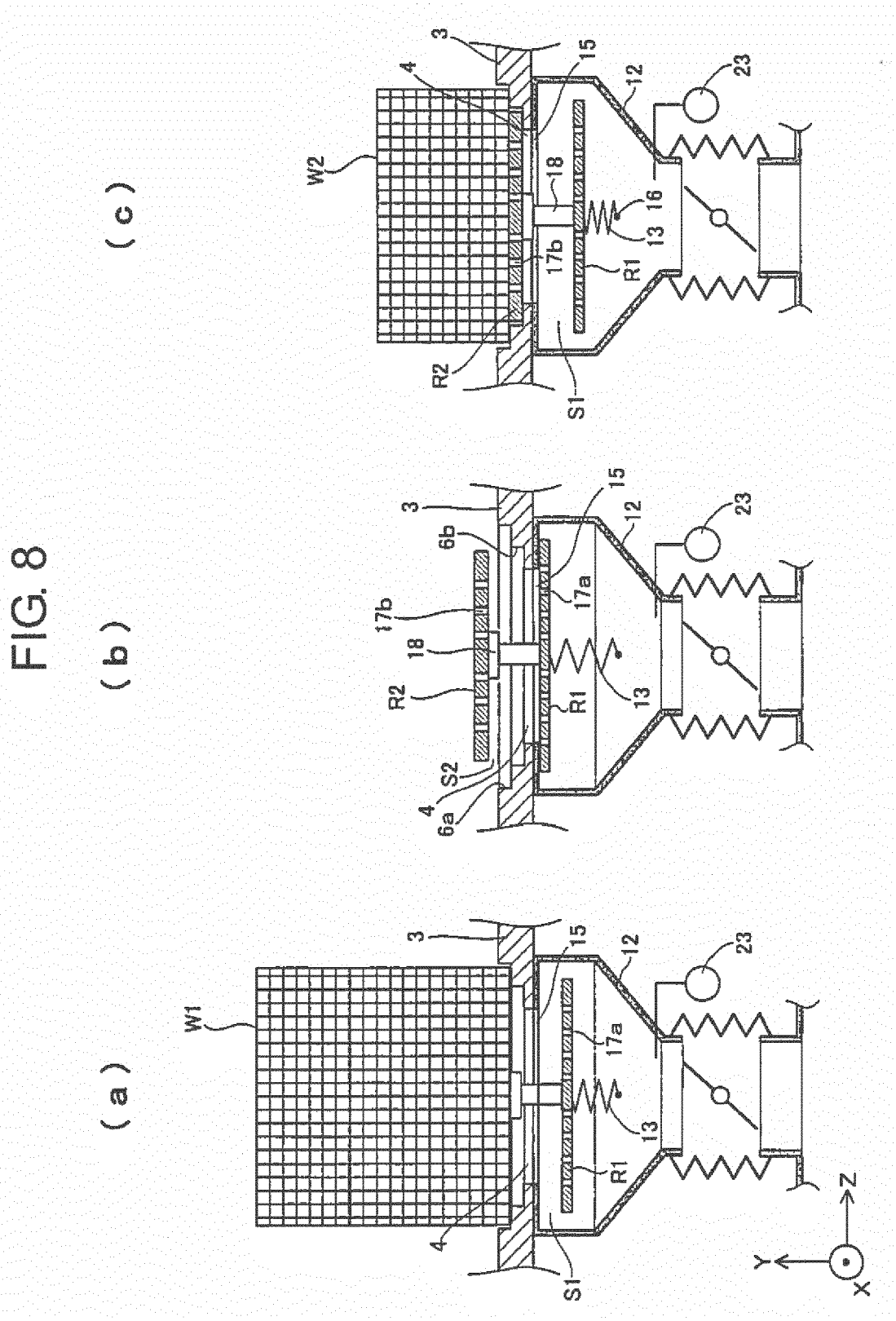
R2
W2
III
P6
P3
P5
P2
R2
6a
P4
P1
R2
III
W1
Z
Y
X
(a)
3
W2
P3
4
R2
6a
17b
4
R2
P2
W1
4
P1
Z
Y
X
(b)

FIG. 8


(a)
W1
3
4
15
12
23
17a
13
R1
S1
Z
Y
X
(b)
3
6b
15
12
23
17b
17a
18
R2
R1
13
S2
4
6a
(c)
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4
15
12
23
W2
18
16
13
17b
R1
R2
S1

FIG. 9

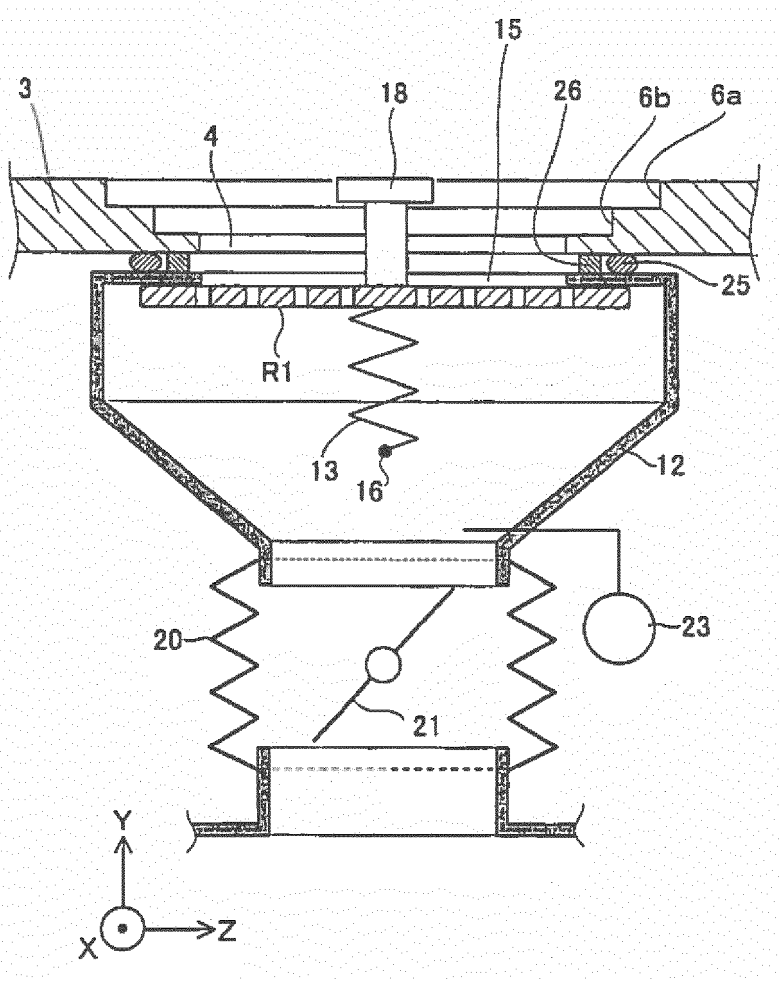
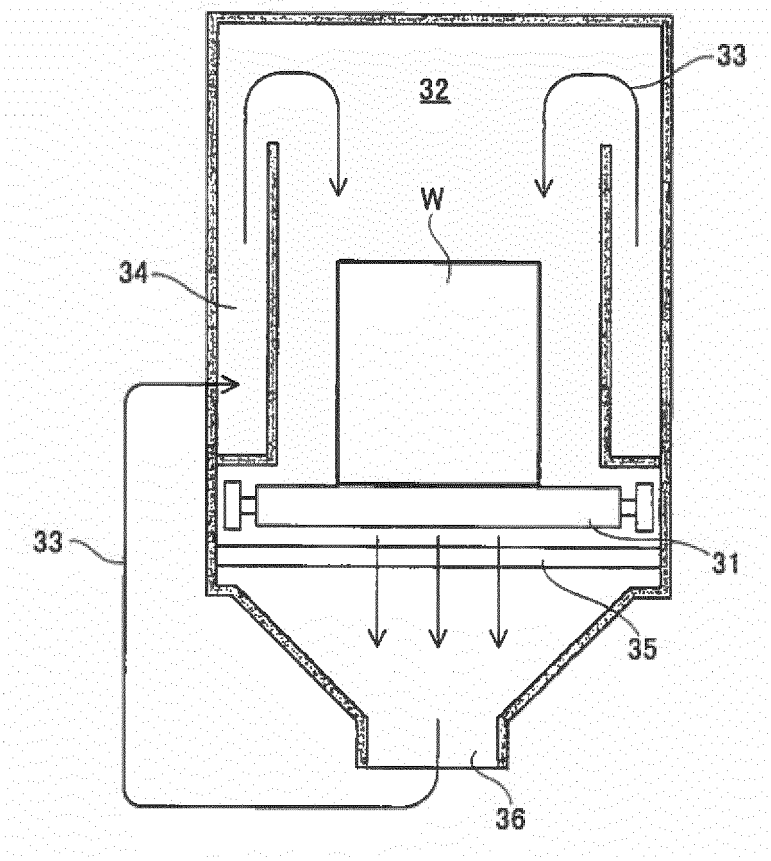


FIG. 10



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EUROPEAN SEARCH REPORT

Application Number
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A	JP 3 432388 B2 (OTSUKA GIKEN KOGYO KK) 4 August 2003 (2003-08-04) * figures 1-2 * * abstract * -----	1-8	INV. F26B15/14 F26B21/04 F26B21/12 F26B25/18
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Place of search	Date of completion of the search	Examiner
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