

DESCRIPTION

Title of Invention

STORAGE SHELF

Technical Field

5 [0001] One aspect of the present invention relates to a storage shelf.

Background Art

[0002] Storage shelves are known that store containers such as reticle pods or Front Opening Unified Pods (FOUPs) in which items to be stored such as semiconductor wafers or glass substrates are stored. Such storage shelves may be provided with a storage shelf including a purging facility configured to supply purge gas, such as inert gas or clean dry air, to containers in order to maintain the cleanliness of the items to be stored. For example, Patent Document 1 discloses a shelf module including three shelves, in each of which a supply nozzle configured to supply purge gas is disposed. Each of a plurality of the shelf modules is configured to be supplied with the purge gas through a sub pipe branched from a main pipe.

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Citation List

Patent Literature

[0003] [Patent Document 1] Japanese Unexamined Patent Publication No. 2015-533026

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Summary of Invention

Technical Problem

[0004] In such storage shelves, components that are provided in a shelf module (e.g., a mass flow controller and a supply nozzle) may be replaced, or the shelf module itself may be replaced. Hereafter in the present application specification, these replacements are collectively referred to

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simply as "shelf module replacement". In this case, an operator closes a valve leading to a purge gas supply source to shut off distribution of purge gas flowing in the main pipe, and then removes the sub pipe from a branch. After removing the sub pipe, the operator seals a removal
5 portion to prevent impurities from entering the main pipe from the removal portion.

[0005] Furthermore, after replacement work of a component is completed, it is necessary to allow purge gas to flow for a while to discharge impurities that may have been mixed in from the removal
10 portion during the replacement (aging). In this case, the impurities may be discharged not only from a replaced shelf module but also from a supply nozzle of another shelf module, and thus the operator needs to perform a task of removing a container placed on the other shelf module. Thus, in the above-described conventional devices, the operator has
15 heavy workload when replacing components that are provided in the shelf modules.

[0006] Therefore, an object of one aspect of the present invention is to provide a storage shelf that can reduce the workload the operator has when replacing components that are provided in the shelf module.

20 **Solution to Problem**

[0007] A storage shelf according to one aspect of the present invention includes: a main frame; a plurality of shelf modules each having a base plate detachably provided on the main frame, and a supply nozzle provided on the base plate; a main pipe through which purge gas supplied
25 from a supply source flows, and a first branch that is provided in the main pipe and branches a flow path from the main pipe, in which the shelf

modules are each provided with a mass flow controller configured to adjust the flow rate of the purge gas supplied to the supply nozzle, the first branch is connected to a module pipe via an open/close valve for opening/closing the flow path, and the mass flow controller is connected to the module pipe.

[0008] In a storage shelf with this configuration, when replacing any one of the shelf modules, the operator does not need to shut off purge gas flowing through the main pipe or seal a removal portion, but only needs to remove the module pipe from the open/close valve after performing a simple task of closing the open/close valve. In addition, the storage shelf with this configuration prevents foreign matter from entering the main pipe when the open/close valve is closed before the module pipe is removed. Therefore, the operator does not need to perform aging for the main pipe, which was performed in the conventional storage shelf described above, but only needs to perform aging for the module pipe. This means that the operator does not need to remove containers disposed in other shelf modules during the aging, and after connecting the module pipe, but only needs to open the open/close valve and leave it open for a while. Thus, the storage shelf with this configuration can reduce the workload the operator has when replacing the components that are provided in the shelf modules.

[0009] In the storage shelf according to the one aspect of the present invention, the shelf module may be provided with a plurality of the supply nozzles and a plurality of the mass flow controllers corresponding to the respective supply nozzles, the storage shelf may further include a second branch that is provided in the module pipe and branches the flow path

from the module pipe, and each of the mass flow controllers may be connected to the module pipe via the second branch.

[0010] In this configuration, even when each of the shelf modules is provided with the supply nozzles and the mass flow controllers, the operator only needs to disconnect the module pipe from the open/close valve after performing the simple task of closing the open/close valve, and after connecting the module pipe, only needs to open the open/close valve to simply leave it open for a while. Thus, the storage shelf with this configuration can reduce the workload the operator has when replacing the components that are provided in the shelf modules.

[0011] In the storage shelf according to the one aspect of the present invention, the module pipe and/or the open/close valve may be supported by the main frame. In this configuration, the operator can easily remove only the shelf module because the module pipe and/or the open/close valve remains in the main frame after removing the connection between the module pipe and the open/close valve.

[0012] In the storage shelf according to the one aspect of the present invention, the main frame may be a suspended member that is suspended from a ceiling or from a member fixed to the ceiling and be arranged in one direction, the base plate may be bridged over the main frame arranged in the one direction, and the module pipe and/or the open/close valve may be supported by a straddle member that is a different member from the base plate and that is bridged over the main frame arranged in the one direction. In this configuration, the operator can easily remove only the shelf module because the module pipe and/or the open/close valve remains in the main frame after removing the connection between the

module pipe and the open/close valve.

[0013] The storage shelf according to the one aspect of the present invention may further include: a main wiring that is connected to a main controller or a power supply; a module wiring that is connected to the mass flow controller or the supply nozzle provided in the shelf module and that is connected to a detection sensor configured to detect a container; and a third branch that is provided in the main wiring, electrically branches from the main wiring, and detachably connects the module wiring. In this configuration, the operator can easily remove the shelf module by a simple task of removing the module wiring from the third branch.

Advantageous Effects of Invention

[0014] According to the one aspect of the present invention, it is possible to reduce the workload the operator has when replacing the components that are provided in the shelf module.

Brief Description of Drawings

[0015] [FIG. 1] FIG. 1 is a perspective view illustrating a storage shelf according to one embodiment.

[FIG. 2] FIG. 2 is a configuration schematic diagram of shelf modules included in the storage shelf in FIG. 1.

[FIG. 3] FIG. 3 is a perspective view illustrating the shelf module bridged over the main unit.

[FIG. 4] FIG. 4 is a perspective view illustrating a state in which the shelf module bridged over the main unit is removed.

Description of Embodiments

[0016] One suitable embodiment of the one aspect of the present

invention will be described in detail below with reference to the drawings. It should be noted that, like or equivalent elements are designated by like reference signs in the description of the drawings, and duplicate description is omitted. Terms "X-direction," "Y-direction," and "Z-direction" are for convenience based on illustrated directions. It should be noted that, in FIG. 1, a purge gas supply facility 60 and a wiring facility 70 are omitted.

[0017] A storage shelf 1 illustrated in FIG. 1 is disposed along a track 5 of an overhead traveling car 3 that constitutes a semiconductor transfer system in a semiconductor manufacturing plant, for example. The storage shelf 1 temporarily stores a container F such as FOUPs or reticle pods in which items to be stored such as semiconductor wafers or glass substrates are stored. The storage shelf 1 includes a main frame 10, first shelf modules 30, second shelf modules (shelf modules) 40, the purge gas supply facility 60 (refer to FIG. 2), and the wiring facility 70 (refer to FIG. 4).

[0018] As illustrated in FIG. 1 and FIG. 3, the main frame 10 is a member that suspends the first shelf module 30 and the second shelf module 40 from a ceiling. A plurality of the main frames 10 are arranged at equal intervals along the extension direction (X direction) of the track 5.

[0019] The main frame 10 has a pair of first suspending sections 11, 11, a first shelf support 13, a first connection 15, a pair of second suspending sections 12, 12, second shelf supports 14, second connections 16, and fall prevention fences 18.

[0020] The pair of first suspending sections 11, 11 are suspension members that extend from a fixed portion such as the ceiling. The first

shelf support 13 connects lower ends of the pair of first suspending sections 11, 11. The first shelf support 13 extends along a short direction (Y direction) of the first shelf module 30 and supports the first shelf module 30 from below. The first connection 15 is connected at both ends thereof to the pair of first suspending sections 11, 11 and extends parallel (in the Y direction) to the first shelf support 13.

[0021] The pair of second suspending sections 12, 12 are suspension members that extend from a fixed portion such as the ceiling. The pair of second suspending sections 12, 12 are disposed to sandwich the pair of first suspending sections 11, 11 in the opposite direction of the first suspending sections 11, 11. The second shelf support 14 connects one of the pair of first suspending sections 11, 11 to a lower end of one of the pair of second suspending sections 12, 12. The second shelf support 14 extends along the short direction (Y direction) of the second shelf module 40 and supports the second shelf module 40 from below. The second connection 16 is connected to the first suspending section 11 at one end thereof and to the second suspending section 12 at the other end thereof, and extends parallel (Y direction) to the second shelf support 14.

[0022] The fall prevention fence 18 is a flat, straddle member that is hung between adjacent ones of the first suspending sections 11, 11 or between adjacent ones of the second suspending sections 12, 12. The fall prevention fences 18 are disposed to sandwich the container F placed on the first shelf module 30 or the second shelf module 40 from sides of the container F (Y direction). In other words, the fall prevention fences 18 are disposed to prevent the container F placed on the first shelf module 30 or the second shelf module 40 from falling from the first shelf module

30 or the second shelf module 40.

[0023] The first shelf module 30 is a member on which the container F is placed. The first shelf module 30 is a unit that does not have any purge function, i.e., a unit that does not have any function to supply gas to the container F to be placed on the first shelf module 30. The first shelf module 30 is hung between adjacent ones of the first shelf supports 13, 13 or between adjacent ones of the second shelf supports 14, 14.

[0024] The first shelf module 30 has a first shelf frame 31 and a first shelf plate 33. The first shelf frame 31 is hung between adjacent ones of the first shelf supports 13, 13 or between adjacent ones of the second shelf supports 14, 14 in the X direction. The first shelf frame 31 is a substantially rectangular plate-shaped member in plan view from the Z direction. The first shelf frame 31 is fixed to the first shelf support 13 or the second shelf support 14 by screws inserted from below into insertion holes in the first shelf support 13 or the second shelf support 14. Bolts and nuts may be used instead of the screws.

[0025] The first shelf plate 33 is supported on an upper surface of the first shelf frame 31 via an elastic body 37. The first shelf plate 33 is a substantially rectangular plate-shaped member in plan view from the Z direction. Examples of materials for the elastic body 37 include rubber material, silicone gel material, urethane gel, and a metal spring. The first shelf plate 33 has a mounting surface on which the container F is placed, and the mounting surface is provided with pins 35. Each of the pins 35 protrudes upward from the mounting surface of the first shelf plate 33. The pin 35 is disposed in a position corresponding to a positioning groove (not illustrated) on a bottom of the container F.

[0026] As illustrated in FIG. 1 to FIG. 3, the second shelf module 40 is a member on which the container F is placed. The second shelf module 40 is a unit with a purge function, i.e., a unit that supplies gas to the container F to be placed on the second shelf module 40. Examples of the gas include nitrogen gas, dry air, and the like. The second shelf module 40 is hung between adjacent ones of the second shelf supports 14, 14.

[0027] The second shelf module 40 has a second shelf frame (base plate) 41, a second shelf plate 43, and a purging facility 50. The second shelf frame 41 is hung between adjacent ones of the second shelf supports 14, 14 in the X direction. The second shelf frame 41 is a substantially rectangular plate-shaped member in plan view from the Z direction.

[0028] The second shelf plate 43 is supported on the upper surface of the second shelf frame 41 via an elastic body 47. Examples of materials for the elastic body 47 include rubber material, silicone gel material, urethane gel, and a metal spring. The second shelf plate 43 is a substantially rectangular plate-shaped member in plan view from the Z direction. The two second shelf plates 43 are arranged along the X direction on the second shelf frame 41. That is, the second shelf module 40 has a plurality of supply nozzles 51 and a plurality of mass flow controllers (MFCs) 55.

[0029] The second shelf plate 43 has a mounting surface on which the container F is placed, and three pins 45 are provided for the single mounting surface. Each of the pins 45 protrudes upward from the mounting surface of the second shelf plate 43. The pin 45 is disposed in a position corresponding to a positioning groove (not illustrated) on the

bottom of the container F.

[0030] The purging facility 50 has the supply nozzle 51, a first pipe 52, a filter section 53, a second pipe 54, the MFC 55, a third pipe 56, and a detection sensor 59.

5 [0031] The supply nozzle 51 is a nozzle that supplies gas to the interior of the container F. The supply nozzle 51 protrudes upward from the mounting surface of the second shelf plate 43 and is connected to an introduction hole on the bottom of the container F when the container F is placed on the supply nozzle 51. The first pipe 52 is a tubular member
10 that connects the supply nozzle 51 to the filter section 53. The filter section 53 is a member housing a filter that removes foreign matter contained in gas that passes through the filter section 53, removing foreign matter contained in gas supplied from a supply source of the gas through the main pipe 61. The filter section 53 is fixed to the second
15 shelf frame 41 by a suitable member. The second pipe 54 is a tubular member that connects the filter section 53 to the MFC 55.

[0032] The MFC 55 is a device that measures a flow rate of the gas supplied from the main pipe 61 and controls the flow rate. The MFC 55 is controlled by the main controller, which is not illustrated. The MFC
20 55 is provided on each of the second shelf plates 43. The MFC 55 is connected to a main wiring 71, which is connected to the main controller via a module wiring 73.

[0033] The main controller controls the MFC 55 to supply a predetermined flow rate of the gas to the container F when the container
25 F is detected by the detection sensor 59, and controls the MFC 55 not to supply the gas to the container F when the container F is not detected by

the detection sensor 59. The MFC 55 is fixed to an underside of the second shelf frame 41 by a suitable method.

[0034] The third pipe 56 is a tubular member that connects the MFC 55 to a second branch 65. An end of the third pipe 56 that is connected to the second branch 65 is provided with a pipe connector 65A that enables connection to the second branch 65, which is described in detail later.

[0035] The detection sensor 59 detects whether the container F is placed on the second shelf plate 43. The detection sensor 59 is provided on the mounting surface of the second shelf plate 43. The 59 detection sensor is controlled by the main controller, which is not illustrated. The detection sensor 59 is connected to the main wiring 71, which is connected to the main controller via the module wiring 73.

[0036] As illustrated in FIG. 2 and FIG. 3, the purge gas supply facility 60 has the main pipe 61, a first branch 62, a relay pipe 62A, a module pipe 63, an open/close valve 64, and the second branch 65.

[0037] The main pipe 61 is connected to the supply source of the gas to be supplied to the purging facility 50. The main pipe 61 is a tubular member formed from metal, such as stainless steel, or from resin, such as fluorocarbon resin. The main pipe 61 is attached, via a mounting member 18A, to the fall prevention fence 18, which is hung between adjacent ones of the second suspending sections 12, 12.

[0038] The first branch 62 is provided in the main pipe 61 to branch the flow path from the main pipe 61. In the present embodiment, the first branches 62 are provided, the number of which corresponds to the number of the second shelf modules 40 with the purging facilities 50. One end of the relay pipe 62A is connected to the first branch 62. The

other end of the relay pipe 62A is connected to the module pipe 63 via the open/close valve 64. The relay pipe 62A relays the purge gas flowing in the main pipe 61 to the module pipe 63.

[0039] The open/close valve 64 opens and closes the flow path from the relay pipe 62A to the module pipe 63. In other words, the module pipe 63 is connected to the first branch 62 via the open/close valve 64 that opens and closes the flow path. The module pipe 63 and the open/close valve 64 are supported by the fall prevention fence 18, which is hung between the adjacent ones of the second suspending sections 12, 12, via a bracket 18B.

[0040] The second branch 65 is provided in the module pipe 63 to branch the flow path from the module pipe 63. As described above, the second shelf module 40 is provided with the plurality of MFCs 55. Each of the MFCs 55 is connected to the module pipe 63 via the second branch 65. The end of the second branch 65, which is disposed at the most downstream section in the module pipe 63, is sealed so that the purge gas flows only to the MFC 55. In the present embodiment, the module pipe 63 is provided with the second branches 65, the number of which corresponds to the number of the MFCs 55. Each of the MFCs 55 is connected to the second branch 65 via the third pipe 56.

[0041] In the above-described embodiment, an example is described in which the second branches 65 are provided, the number of which corresponds to the number of MFCs 55, however, the second branches 65 the number of which is one less than the number of MFCs 55 may be disposed. In this case, the second branch 65, disposed at the most downstream section in the module pipe 63, is connected to the two MFCs

55 via the two third pipes 56.

[0042] As illustrated in FIG. 4, the wiring facility 70 has the main wiring 71, a third branch 72, and the module wiring 73.

[0043] The main wiring 71 is connected to the main controller that intensively controls the purging facilities 50. The main wiring 71 is supported by the fall prevention fence 18, which is hung between adjacent ones of the second suspending sections 12, 12, via the bracket 18B. The main controller may be fixed to part of the storage shelf 1, for example, or may be provided away from the storage shelf 1 via a relay device or the like.

[0044] The third branch 72 is provided in the main wiring 71, electrically branches from the main wiring 71, and detachably connects the module wiring 73. In the present embodiment, the third branches 72 are provided, the number of which is the same as the number of MFCs 55 (or the detection sensors 59) provided in the second shelf module 40. Each of the MFCs 55 (or the detection sensors 59) is connected to the module wiring 73 via the third branch 72.

[0045] The module wiring 73 connects the third branch 72 to the MFC 55 and also connects the third branch 72 to the detection sensor 59. The module wiring 73 is connected to the third branch 72 of the main wiring 71. At the end of the module wiring 73 that is connected to the third branch 72, a wiring connector 73A is provided that enables connection to the third branch 72. It should be noted that the main wiring 71 and the module wiring 73 have a function not only as communication lines for exchanging information, but also as power lines for exchanging power.

[0046] Next, procedure for removing the second shelf module 40 from

the main frame 10 is described. The operator first closes the open/close valve 64 illustrated in FIG. 2 and FIG. 3. The operator then releases the bolts that fasten the second shelf frame 41, which is bridged over the second shelf support 14, and the second shelf support 14. The operator
5 then removes the module pipe 63 from the open/close valve 64 or removes the third pipe 56 from the second branch 65. This completes a process of removing the second shelf module 40 from the main frame 10.

[0047] Next, the procedure for attaching the second shelf module 40 of the present embodiment to the main frame 10 will be described. The
10 operator bridges the second shelf module 40 to the second shelf support 14, and connects the module pipe 63 to the open/close valve 64 or connects the third pipe 56 to the second branch 65. Next, the operator fastens the second shelf frame 41 to the second shelf support 14 with the bolts. The operator then opens the open/close valve 64 and leaves it
15 open for a while. This completes the aging of the second shelf module 40 that has been replaced. In other words, installation of the second shelf module 40 on the main frame 10 is completed.

[0048] Functional effects of the storage shelf 1 according to the above-described embodiment will be described. In the storage shelf 1 of the
20 above-described embodiment, when replacing the second shelf module 40, the operator does not need to shut off the purge gas flowing through the main pipe 61 or seal the removal portion (in the present embodiment, the open/close valve 64 from which the module pipe 63 is removed or the second branch 65 from which the third pipe 56 is removed), but only
25 needs to remove the module pipe 63 from the open/close valve 64 or remove the third pipe 56 from the second branch 65 after performing a

simple task of closing the open/close valve 64. Moreover, in the storage shelf 1 with this configuration, since the open/close valve 64 is closed to prevent foreign matter from entering the main pipe 61, the operator does not need to perform aging for the main pipe 61, which is performed in the above-described conventional storage shelf, but only needs to perform aging for the module pipe 63. This means that the operator does not need to remove the containers F disposed in the other second shelf module 40 during the aging, and after connecting the module pipe 63, only needs to open the open/close valve 64 and leave it open for a while. Thus, the storage shelf 1 with this configuration can reduce the workload the operator has when replacing the second shelf module 40 or the components that are provided in the second shelf module 40 (e.g., the supply nozzle 51 or the MFC 55, or the like).

[0049] In the configuration of the storage shelf 1 of the above-described embodiment, as illustrated in FIG. 2, even when each of the second shelf modules 40 is provided with a plurality of the supply nozzles 51 and the MFCs 55, the operator, after performing the simple task of closing the open/close valve 64, only needs to remove the module pipe 63 from the open/close valve 64 or remove the third pipe 56 from the second branch 65, and after connecting the module pipe 63, the operator only needs to open the open/close valve 64 to leave it open for a while. Thus, the storage shelf 1 with this configuration can reduce the workload the operator has when replacing the second shelf module 40 or the components that are provided in the second shelf module 40.

[0050] In the above-described configuration of the storage shelf 1, as illustrated in FIG. 3, the module pipe 63 and the open/close valve 64 are

supported by the fall prevention fence 18, which is hung between the adjacent ones of the second suspending sections 12, 12 of the main frame 10, via the bracket 18B. In this configuration, after disconnecting the connection between the module pipe 63 and the open/close valve 64, the open/close valve 64 remains on the bracket 18B provided on the fall prevention fence 18 of the main frame 10, and thus the operator can easily remove only the second shelf module 40. Moreover, in this configuration, after disconnecting the connection between the second branch 65 and the third pipe 56, the open/close valve 64 and the module pipe 63 remain on the bracket 18B provided on the fall prevention fence 18 of the main frame 10, and thus the operator can easily remove only the second shelf module 40.

[0051] In the configuration of the storage shelf 1 of the above-described embodiment, the operator can easily remove the second shelf module 40 by a simply task of removing the module wiring 73 from the third branch 72.

[0052] Although one embodiment has been described above, one aspect of the present invention is not necessarily limited to the above-described embodiment, and various modifications may be made without departing from the gist of the invention.

[0053] In the above-described embodiment, although an example is described in which the two second shelf plates 43 (i.e., a place to place the container F where the supply nozzle 51 and the MFC 55 are provided) are provided on the main frame 10 via the second shelf frame 41, the main frame 10 may have a configuration in which only the single second shelf plate 43 is provided on the main frame 10 via the second shelf frame 41.

In a configuration according to this modification, it is not necessary to provide the second branch 65 in the module pipe 63, and the module pipe 63 may be directly connected to the MFC 55. As in the above-described embodiment, the single second branch 65 may be provided in the module pipe 63 to connect one of the branches to the MFC 55 and the other of the branches may be sealed.

[0054] In the above-described embodiment and modifications, although an example is described in which each of the two second shelf plates 43 is provided with the supply nozzles 51 and the MFC 55, the purging facility 50 such as the supply nozzle 51 and the MFC 55 may be provided directly on the second shelf frame 41.

[0055] In the above-described embodiment and modifications, although the example is described in which the second shelf frame 41 that is bridged over the main frame 10, the second shelf plate 43 may be removed from the second shelf frame 41. Even in this case, the same effects as in the above-described embodiment and modifications can be obtained. The second shelf plate 43 in this case functions as a base plate attached to the main frame 10 via the second shelf frame 41.

[0056] In the above-described embodiment and modifications, although an example is described in which the second shelf module 40 is detachably provided in the second shelf support 14 that connects the first suspending section 11 to the lower end of the second suspending section 12, the second shelf module 40 may be detachably installed in the first shelf support 13.

[0057] The above-described embodiment and modifications, although an example is described in which an upper end of each of the first suspending

section 11 and the second suspending section 12 is fixed to a fixed part such as a ceiling, but the present invention is not limited thereto. For example, the respective upper ends of the first suspending section 11 and the second suspending section 12 may be fixed to a raceway or the like that allows each of the upper ends thereof to be able to slide by being unfastened.

[0058] In the above-described embodiment and modifications, although an example is described in which the module pipe 63 and the open/close valve 64 are supported by the fall prevention fence 18 of the main frame 10, they may be supported in a state of bridging over the first suspending section 11 or the second suspending section 12.

Reference Signs List

[0059] 1 ... Storage shelf

10 ... Main frame

18 ... Fall prevention fence (straddle member)

30 ... First shelf module

31 ... First shelf frame

33 ... First shelf plate

40 ... Second shelf module

41 ... Second shelf frame (base plate)

43 ... Second shelf plate

50 ... Purging facility

51 ... Supply nozzle

55 ... MFC (mass flow controller)

59 ... Detection sensor

60 ... Purge gas supply facility

	61 ...	Main pipe
	62 ...	First branch
	62A ...	Relay pipe
	63 ...	Module pipe
5	64 ...	Open/close valve
	65 ...	Second branch
	70 ...	Wiring facility
	71 ...	Main wiring
	72 ...	Third branch
10	73 ...	Module wiring
	F ...	Container.

CLAIMS

1. A storage shelf comprising:

a main frame;

5 a plurality of shelf modules each having a base plate detachably provided on the main frame, and a supply nozzle provided on the base plate;

a main pipe through which purge gas supplied from a supply source flows; and

10 a first branch that is provided in the main pipe and branches a flow path from the main pipe, wherein

the shelf modules are each provided with a mass flow controller configured to adjust the flow rate of the purge gas supplied to the supply nozzle,

15 the first branch is connected to a module pipe via an open/close valve for opening/closing the flow path

the module pipe is connected to the supply nozzle via the mass flow controller,

the supply nozzle is connected to the main pipe via the open/close valve and the mass flow controller, and

20 the module pipe is detachably provided on the main frame.

2. The storage shelf according to claim 1, wherein

25 the shelf module is provided with a plurality of the supply nozzles and a plurality of the mass flow controllers corresponding to the respective supply nozzles,

the storage shelf further includes a second branch that is provided in the module pipe and branches the flow path from the module pipe, and

each of the mass flow controllers is connected to the module pipe via the second branch.

3. The storage shelf according to claim 1 or 2, wherein the module pipe and/or the open/close valve is supported by the main frame.

4. The storage shelf according to any one of claims 1 to 3, wherein the main frame is a suspended member that is suspended from a ceiling or from a member fixed to the ceiling and is arranged in one direction,

the base plate is bridged over the main frame arranged in the one direction, and

the module pipe and/or the open/close valve is supported by a straddle member that is a different member from the base plate and that is bridged over the main frame arranged in the one direction.

5. The storage shelf according to any one of claims 1 to 4, further comprising;

a main wiring that is connected to a main controller or a power supply;

a module wiring that is connected to the mass flow controller or the supply nozzle provided in the shelf module and that is connected to a detection sensor configured to detect a container; and

a third branch that is provided in the main wiring, electrically branches from the main wiring, and detachably connects the module wiring.