

DESCRIPTION

Title of Invention

5 MAIN MODULE, UTILITY MODULE, MODULE UNIT AND
MODULE SYSTEM

Technical Field

[0001] The present invention relates to a main module, a utility module, a module unit, and a module system.

Background Art

10 [0002] Patent Literature 1 discloses a modular unit for pharmaceutical production. The modular unit is moved to an area to be arranged by being pushed on air bearings, castors, or pallets. The modular unit is connected to a power source and water supply.

Citation List

15 Patent Literature

[0003] Patent Literature 1: Japanese Unexamined Patent Publication No. 2014-98545

Summary of Invention

Technical Problem

20 [0004] In some cases, modification such as partial changes becomes necessary in pharmaceutical facilities; however, the above-described technology is insufficient for handling such modification including partial changes in facilities, hence improvements are desired.

[0005] Here, an object of the invention is to provide a main module, a utility module, a module unit, and a module system, which are capable of improving the flexibility of pharmaceutical facilities.

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Solution to Problem

[0006] An aspect of the invention is a main module including a ceiling module which includes a ceiling panel capable of changing a height in a vertical direction; a floor module which is integrated with the ceiling module at a position below the ceiling module and includes a floor panel; and an under-floor module which is integrated with the floor module at a position below the floor module and includes a moving device moveable along a floor surface. The main module is connected to another main module, and a space between the ceiling panel of the ceiling module and the floor panel of the floor module of the main modules connected to each other can be kept airtight.

[0007] According to this configuration, in the ceiling module of the main module, it is possible to change the height in the vertical direction of the ceiling panel, and in the floor module which is integrated with the ceiling module at a position below the ceiling module and which includes the floor panel, it is possible to flexibly change the height of the space between the ceiling panel of the ceiling module and the floor panel. Further, since the under-floor module, which is integrated with the floor module at a position below the floor module, is moved along the floor surface by the moving device and the main module is connected to another main module so as to keep the airtightness of the space between the ceiling panel of the ceiling module and the floor panel of the floor module of the main modules connected to each other, it is possible to flexibly expand, reduce, and modify the space between the ceiling panel and the floor panel in the vertical direction and the horizontal direction depending on the situation of pharmaceutical

facilities to improve the flexibility of pharmaceutical facilities.

[0008] In this case, a partition wall, which keeps airtightness in a boundary of the main modules connected to each other, may be selectively disposed or not in the space between the ceiling panel of the ceiling module and the floor panel of the floor module of the main modules connected to each other.

[0009] According to this configuration, since it is possible to select whether to dispose or not the partition wall, which keeps the boundary of the main modules connected to each other airtight, in the space between the ceiling panel of the ceiling module and the floor panel of the floor module of the main modules connected to each other, the space between the ceiling panel and the floor panel can be flexibly defined depending on the situation of pharmaceutical facilities to further improve the flexibility of pharmaceutical facilities.

[0010] Further, a partition wall which airtightly defines a part of the space between the ceiling panel of the ceiling module and the floor panel of the floor module of the one main module may be selectively disposed or not.

[0011] According to this configuration, since it is possible to select whether to dispose or not the partition wall which airtightly defines a part of the space between the ceiling panel of the ceiling module and the floor panel of the floor module of the one main module, the space between the ceiling panel and the floor panel can be finely defined depending on the situation of pharmaceutical facilities to further improve the flexibility of pharmaceutical facilities.

[0012] Further, another aspect of the invention is a utility module

including a utility part which supplies or receives any of gas, liquid, electric power, and a signal to or from a main module movable along a floor surface; and a moving device which moves the utility part along the floor surface.

5 [0013] According to this configuration, since the utility part, which supplies or receives any of gas, liquid, electric power, and a signal to or from the main module configured to move along the floor surface, can be moved along the floor surface by the moving device in the utility module it is possible to improve the flexibility of the path supplying gas
10 and the like to the main module to improve the flexibility of pharmaceutical facilities.

[0014] Further, another aspect of the invention is a module unit including the main module of the invention and the utility module of the invention.

15 [0015] Further, another aspect of the invention is a module system including the module unit of the invention provided in an enclosed area partitioned from the outside.

Advantageous Effects of Invention

20 [0016] According to the main module, the utility module, the module unit, and the module system of the aspects of the invention, the flexibility of pharmaceutical facilities can be improved.

Brief Description of Drawings

[0017] FIG. 1 is a plan view illustrating a module system according to an embodiment.

25 FIG. 2 is an enlarged view of a range indicated by X of FIG. 1.

FIG. 3 is a perspective view schematically illustrating a main

module of an embodiment.

FIG. 4 is a perspective view illustrating a state in which the main module of an embodiment is separated into a ceiling module, a floor module, and an under-floor module.

5 FIGS. 5(A) and 5(B) are diagrams illustrating an operation of a moving device.

FIG. 6(A) is a diagram illustrating a connection between the main module and a utility module and FIG. 6(B) is a diagram illustrating a detail of FIG. 6(A).

10 FIG. 7 is a perspective view schematically illustrating the utility module of an embodiment.

FIG. 8 is a perspective view illustrating a connection between the main module and a clean corridor.

15 FIGS. 9(A), 9(B), 9(C), 9(D), 9(E), and 9(F) are plan views illustrating exemplary changes in arrangement of the main modules of an embodiment.

FIGS. 10(A), 10(B), 10(C), 10(D), 10(E), and 10(F) are plan views illustrating exemplary changes in arrangement of the main modules of an embodiment.

20 FIGS. 11(A), 11(B), and 11(C) are plan views illustrating other exemplary arrangements of the main module of an embodiment.

FIG. 12 is a plan view illustrating another example of the main module, the utility module, and the module unit of an embodiment.

25 FIGS. 13(A), 13(B), 13(C), 13(D), and 13(E) are perspective views illustrating another example of the main module of the embodiment.

Description of Embodiments

[0018] Hereinafter, embodiments of the invention will be described in detail with reference to the drawings. A main module, a utility module, a module unit, and a module system according to the
5 embodiments of the invention to be described below are designed for use as pharmaceutical facilities for producing, researching, testing, and experimenting a drug including a facility for producing biopharmaceuticals.

[0019] As illustrated in FIG. 1, a module system 1 of the embodiment
10 includes a module unit 1000 provided in an enclosed area 5 separated from the outside by, for example, an outer wall 2, a ceiling, and a floor of a building. As illustrated in FIG. 1, the module system 1 may include an inner wall 3 that defines a machine room 4 of the building and a clean corridor 6 that crosses the inside of the building, in addition
15 to the outer wall 2 of the building. Additionally, the enclosed area 5 may be separated from the outside by the outer wall 2 and the inner wall 3 of the building as illustrated in FIG. 1. Further, the enclosed area 5 may be an area surrounded by the inner wall 3 inside an area surrounded by the outer wall 2 of the building.

[0020] As illustrated in FIGS. 1 and 2, the module unit 1000 includes
20 main modules 100A to 100T and utility modules 200 and 300. As will be described later, the main modules 100A to 100T and the utility modules 200 and 300 of the module unit 1000 are respectively movable, connectable, and separable to and from each other, and each are flexible
25 in arrangement.

[0021] The plurality of main modules 100A to 100T each having a

rectangular shape in plan view are arranged in the enclosed area 5. Each of the plurality of main modules 100A to 100T is connected at a respective long side portion of a rectangular shape. A corridor contact wall 101 which is one short side portion of the rectangular shape of each of the plurality of main modules 100A to 100T is connected to the clean corridor 6. The main modules 100A to 100T are configured to accommodate, for example, biopharmaceutical production equipment as will be described later.

[0022] A utility module connection wall 102 which is the other short side portion of the rectangular shape of each of the plurality of main modules 100A to 100T is connected to one long side portion of the rectangular shape of the utility module 200 substantially having the same size and shape as those of the main modules 100A to 100T in plan view. The other long side portion of the rectangular shape of the utility module 200 is connected to the long side portion of the rectangular shape of the utility module 300 substantially having the same size and shape as those of the utility module 200 in plan view. As will be described later, the utility modules 200 and 300 supply or receive any of gas, liquid, electric power, and a signal to or from the main modules 100A to 100T.

[0023] The length ratio between the short side and the long side of the rectangular shape of the main modules 100A to 100T and the utility modules 200 and 300 is an integer ratio of 1:5. Thus, as illustrated in FIG. 2, in the main modules 100A to 100T and the utility modules 200 and 300, the length obtained by combining the utility module connection walls 102 of the short side portions of five main modules

100P to 100T connected to each other at their long side portions is standardized so as to match the length of the long side portion of one utility module 200.

[0024] For example, the length of one long side portion of the rectangular shape of the main modules 100A to 100T and the utility modules 200 and 300 is 11700 mm or less, the length of short side portion is 2200 mm or less, and the height is 2370 mm or less to allow them to be transported by a high cube container of a marine container. Additionally, a ratio between the short side and the long side of the rectangular shape of the main modules 100A to 100T and the utility modules 200 and 300 may be an integer ratio other than 1:5. Further, a ratio between the short side and the long side of the rectangular shape of the main modules 100A to 100T and the utility modules 200 and 300 may be other than an integer ratio when the length obtained by combining the short side portions of the plurality of main modules 100A to 100T does not need to match the length of the long side portion of one utility module 200.

[0025] Ducts 140 and branch pipes leading to the utility module connection walls 102 of the main modules 100A to 100T and ducts 240 and main pipes leading to one long side portions of the utility modules 200 are provided at predetermined positions and are standardized to be connected to each other. The ducts 240 leading to the other long side portions of the utility modules 200 and ducts of air handling units 361 and exhaust fans 362 leading to one long side portions of the utility modules 300 are provided at predetermined positions and are standardized so as to be connected to each other.

[0026] As illustrated in FIGS. 1 and 2, the outermost main modules 100A and 100T among the main modules 100A to 100T connected to each other include side walls 103 which keep airtightness of the outermost long side portions of the main modules 100A to 100T connected to each other. A space surrounded by the corridor contact wall 101, the utility module connection wall 102, and the side wall 103 in the main modules 100A to 100T is kept airtight and controlled to keep cleanliness.

[0027] Further, as illustrated in FIG. 2, the side wall 103 which is a partition wall for keeping airtightness is disposed in a boundary of the main modules 100Q and 100R connected to each other and a boundary of the main modules 100S and 100T. Further, a partition wall 104 for keeping airtightness which defines a part of a space of one main module 100P is disposed.

[0028] As illustrated in FIG. 1, a module unpacking room 7 for unpacking the utility modules 200, 300 and the main modules 100A to 100T carried from the outside of the module system 1 leads to the enclosed area 5 through an openable/closeable door. A product warehouse 15 is disposed in the periphery of the module unpacking room 7. A washing room 8, a cell bank room 9, changing rooms 10 and 11, a toilet 12, a control room 13, and a raw material storage 14 are adjacently located at one side of the clean corridor 6, which is opposing the side of the clean corridor 6 where the main modules 100A to 100T contact with the clean corridor 6.

[0029] The clean corridor 6, the washing room 8, the cell bank room 9, the changing rooms 10 and 11, and the raw material storage 14 are

controlled to keep cleanliness. In FIG. 1, the shaded area indicates clean rooms where cleanliness is kept, and cleanliness is not kept in the unshaded area. Additionally, the clean rooms are located in a defined area with cleanliness control which means that a space is controlled to limit airborne microparticles and airborne microorganisms in the air to be below a defined cleanliness level and to also keep the required cleanliness for any items supplied to the space including materials, chemicals, and water.

[0030] For example, the biopharmaceutical production processes are respectively assigned to the main modules 100A to 100T. A clean corridor 16 and a pass room 17 are assigned to the main module 100A. A seed culture room 18 and a weighing room 19 are assigned to the main modules 100B and 100C. A cell culture room 20 is assigned to the main modules 100D to 100G, and among them, the pass room 17 is assigned to the main modules 100D and 100G. A first purification room 21 is assigned to the main modules 100H to 100Q, and among them, the pass room 17 is assigned to the main modules 100P and 100Q. A second purification room 22 and a filling room 23 are assigned to the main modules 100R and 100S, and among them, the pass room 17 is assigned to a section of the filling room 23 of the main module 100S. The clean corridor 16 and the pass room 17 are assigned to the main module 100T.

[0031] Since the side wall 103 and the partition wall 104 defining each of the spaces of the main modules 100A to 100T while keeping airtightness can be flexibly arranged, removed, and moved, it is also possible to flexibly change the assignment thereto of pharmaceutical

production, research, test, and experiment processes such as biopharmaceutical production processes. Further, as will be described later, since the main modules 100A to 100T and the utility modules 200 and 300 are movable along the floor surface of the enclosed area 5, it is possible to flexibly expand, reduce, or modify according to the biopharmaceutical production processes.

[0032] Hereinafter, the main modules 100A to 100T of the embodiment will be described in detail. Since the main modules 100A to 100T have a similar structure, the main module 100E will be described as an exemplary main module. As illustrated in FIGS. 3 and 4, the main module 100E is configured to accommodate biopharmaceutical production equipment 150. The main module 100E includes a ceiling module 110, a floor module 120, and an under-floor module 130 which are stacked in three stages vertically. The ceiling module 110, the floor module 120, and the under-floor module 130 are connectable to and separable from each other, are respectively standardized, and can be partially replaced.

[0033] The ceiling module 110 is a module which forms a ceiling and an attic in the main module 100E. The ceiling module 110 includes a ceiling panel 111 capable of changing the height in the vertical direction. To include the ceiling panel 111 capable of changing the height in the vertical direction means, for example, that in the main module 100E, the height of the ceiling panel 111 can be changed by replacing the ceiling module 110 with the ceiling module 110 having the ceiling panel 111 of a different height in accordance with the required height. Further, to include the ceiling panel 111 capable of changing

the height in the vertical direction means, for example, that the height of the ceiling panel 111 can be changed by adjusting the height of the ceiling panel 111 in a state where the ceiling module 110 is connected to the floor module 120.

5 [0034] As illustrated in FIG. 4, the ceiling module 110 is provided with, for example, a High Efficiency Particulate Air Filter (HEPA filter) unit, lighting equipment, utility bulbs, and cables, along with the duct 140 connected to the duct 240 of the utility module 200 and the branch pipe 141 connected to the main pipe of the utility module 200. Further, the
10 ceiling module 110 includes the corridor contact wall 101 and the utility module connection wall 102 at least in the height range equal to the height of the ceiling panel and lower. When the floor module 120 includes the side wall 103 or the partition wall 104, the side wall 103 or the partition wall 104 is provided at least in the height range equal to the
15 height of the ceiling panel and lower.

[0035] As illustrated in FIGS. 3 and 4, in the main module 100E, the floor module 120 includes walls formed by the corridor contact wall 101 and the utility module connection wall 102, and a floor formed by a floor panel 121. The floor module 120 is integrated with the ceiling
20 module 110 at a position below the ceiling module 110, includes the floor panel 121, and is configured to accommodate, for example, the biopharmaceutical production equipment 150 in a space between the floor panel 121 and the ceiling panel 111 of the ceiling module 110.

[0036] Examples of the production equipment 150 are a bioreactor tank, a pump wagon, a medium preparation tank, a column, a chromatography device, and a buffer preparation tank. The production
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equipment 150 is single-use equipment and may or may not be fixed to the floor module 120. Further, in the production equipment 150, the one higher than the frame of the main module 100E is once removed and transported separately.

5 [0037] The floor module 120 may include the floor panel 121 capable of changing the height in the vertical direction. To include the floor panel 121 capable of changing the height in the vertical direction means, for example, that in the main module 100E, the height of the floor panel 121 can be changed by replacing the floor module 120 with the floor
10 module 120 having the floor panel 121 of a different height in accordance with the required height. Further, to include the floor panel 121 capable of changing the height in the vertical direction means, for example, that the height of the floor panel 121 can be changed by adjusting the height of the floor panel 121 in a state where the floor
15 module 120 is connected to any one of the ceiling module 110 and the under-floor module 130.

[0038] Additionally, the height of the floor panel 121 of the floor module 120 may be changed by changing the height from the floor surface of the enclosed area 5 of the under-floor module 130 or by
20 connecting an under-floor module 130 having a different height from the floor surface of the enclosed area 5 to the floor module 120.

[0039] The floor module 120 is provided with, for example, an inlet, a Local Area Network (LAN), an outlet, a drain for equipment, and a drain plate in addition to the biopharmaceutical production equipment
25 150. Further, the floor module 120 includes the corridor contact wall 101 and the utility module connection wall 102 provided at least in the

height range equal to the height of the floor panel 121 and higher. Further, when the main module 100E is disposed on an outermost side among the main modules 100A to 100T connected to each other, the floor module 120 includes the side wall 103 which keeps airtightness provided at least in the height range equal to the height of the floor panel 121 and higher of the outermost long side portions of the main modules 100A to 100T connected to each other. Further, in the floor module 120, the side wall 103 corresponding to the partition wall keeping the airtightness in the boundary of the main modules 100A to 100T connected to each other is selectively disposed or not in the space between the ceiling panel 111 of the ceiling module 110 and the floor panel 121 of the floor module 120 of the main modules 100A to 100T connected to each other.

[0040] To selectively dispose the side wall 103 means that the side wall 103 is selectively disposed or not in the main module 100E by replacing the ceiling module 110 and the floor module 120 having the side wall 103 with the ceiling module 110 and the floor module 120 without the side wall 103. Further, to selectively dispose the side wall 103 means that the side wall 103 is selectively disposed or not in the main module 100E by installing or removing the side wall 103 in a state where the floor module 120 is connected to any one of the ceiling module 110 and the under-floor module 130.

[0041] Further, in the floor module 120, the partition wall 104 which airtightly defines a part of the space between the ceiling panel 111 of the ceiling module 110 and the floor panel 121 of the floor module 120 of one main module 100E is selectively disposed or not. To selectively

dispose the partition wall 104 means that the partition wall 104 is selectively disposed or not in the main module 100E by replacing the ceiling module 110 and the floor module 120 having the partition wall 104 with the ceiling module 110 and the floor module 120 without the partition wall 104. Further, to selectively dispose the partition wall 104 means that the partition wall 104 is selectively disposed or not in the main module 100E by installing or removing the partition wall 104 in a state where the floor module 120 is connected to any one of the ceiling module 110 and the under-floor module 130.

[0042] The under-floor module 130 is a module which forms an underfloor space in the main module 100E. As illustrated in FIGS. 4, 5(A), and 5(B), the under-floor module 130 is integrated with the floor module 120 at a position below the floor module 120 and the lower surface of the under-floor module 130 is provided with an attachment concave portion 131 to which a moving device 400 movable along the floor surface of the enclosed area 5 is to be attached.

[0043] As illustrated in FIG. 5(A), the moving device 400 includes an air introduction member 401 into which compressed air is introduced from the outside and an air caster member 402 which is configured to eject compressed air from a small hole provided to an outer wall of the air caster member 402 which is on the lower surface of the moving unit 400 while being inflated with the compressed air introduced from the air introduction member 401. As illustrated in FIG. 5(A), the air caster member 402 is contracted and the under-floor module 130 lands on the floor surface while the compressed air is not supplied to the air introduction member 401. As illustrated in FIG. 5(B), the air caster

member 402 is inflated and the air caster member 402 is fully filled with the compressed air while the compressed air is supplied to the air introduction member 401. The compressed air is ejected from the small hole of the outer wall of the air caster member 402 and leaks to the outside while forming a thin air film that is a slight gap between the air caster member 402 and the floor surface.

[0044] For this reason, the under-floor module 130 is manually movable along the floor surface of the enclosed area 5 while being connected to the ceiling module 110 and the floor module 120 in which the floor panel 121 is provided with the production equipment 150. Additionally, the moving device 400 is attachable to or detachable from the attachment concave portion 131 of the under-floor module 130 of the main module 100E. Thus, the moving device 400 may not be permanently attached to the attachment concave portion 131 of the under-floor module 130 of the main module 100E and may be temporarily attached to the attachment concave portion 131 of the under-floor module 130 of the main module 100E only when the main module 100E is moved. The moving device 400 may be moved by a vehicle wheel. Further, the moving device 400 may be movable along the floor surface of the enclosed area 5 by an electric motor, and an internal-combustion engine, instead of a manual operation.

[0045] As illustrated in FIG. 4, the under-floor module 130 may be provided with a drain pipe 132 and a ventilation pipe. The under-floor module 130 does not include the corridor contact wall 101, the utility module connection wall 102, and the side wall 103, but includes only the frame for supporting the floor module 120. Thus, the under-floor

module 130 is exposed to a space such as the enclosed area 5 and is disposed in a space without cleanliness control. Additionally, the under-floor module 130 may include only the frame without any pipes such as the drain pipe 132 and the ventilation pipe. In this case, necessary pipes may be provided in the floor module 120.

[0046] Additionally, any one of the space between the ceiling module 110 and the floor module 120 and the space between the floor module 120 and the under-floor module 130 may be permanently integrated and the main module 100E may be separated into only two stages in the vertical direction.

Further, the main module 100E may be permanently integrated as a whole and may not be separable. Alternatively, any one of the ceiling module 110, the floor module 120, and the under-floor module 130 can be further divided in the vertical direction and the main module 100E may be separable in four stages or more in the vertical direction.

[0047] The main modules 100A to 100T are connectable to or separable from other main modules 100A to 100T or the utility modules 200 and 300. The main modules 100A to 100T can keep the airtightness of the space between the ceiling panel 111 of the ceiling module 110 and the floor panel 121 of the floor module 120 of the main modules 100A to 100T connected to each other.

[0048] Further, the main modules 100A to 100T can keep the airtightness of the space defined by the ceiling panel 111, the floor panel 121, the side wall 103, and the partition wall 104 in the main modules 100A to 100T connected to each other. For example, the airtightness is secured by filling with a sealing material a joint of the ceiling panel 111,

the floor panel 121, the side wall 103, and the partition wall 104 after the ceiling panel 111, the floor panel 121, the side wall 103, and the partition wall 104 of the main modules 100A to 100T connected to each other are disposed at arbitrary positions. Hatches, doors, and the like may be provided to the corridor contact wall 101 as needed if the corridor contact wall 101 is connected to the clean corridor 6 through the clean corridor 16 or the pass room 17 in the main modules 100A to 100T.

[0049] As illustrated in FIGS. 6(A) and 6(B), the connection positions of the duct 140, the branch pipe 141, and the drain pipe 132 of the main module 100E with respect to the duct 240 and a main pipe 241 of the utility module 200 are standardized. For example, even when there are no ducts and the like to be connected to the main module 100E, the duct 240 and the main pipe 241 of the utility module 200 are disposed. A connection flexible pipe 500 for adjusting an installation error is provided if necessary for the connection of pipes such as the duct 140, the branch pipe 141, the drain pipe 132, and the ventilation pipe of the main module 100E with respect to the duct 240 and the main pipe 241 of the utility module 200. The main pipe 241 of the utility module 200 is disposed at a position lower than the drain pipe 132 of the main module 100E.

[0050] Hereinafter, the utility modules 200 and 300 of the embodiment will be described in detail. The utility modules 200 and 300 include utility parts 210 and 310 which supply or receive any of gas, liquid, power, and a signal to or from the main modules 100A to 100T configured to move along the floor surface of the enclosed area 5, and

include the moving device 400 which moves the utility parts along the floor surface of the enclosed area 5. The utility modules 200 and 300 are exposed to a space such as the enclosed area 5 and are disposed in an area without cleanliness control.

5 [0051] Further, in the embodiment, the utility module 200 corresponding to the first utility module and the utility module 300 corresponding to the second utility module are dividable. The utility module 200 and the utility module 300 are connectable to or separable from each other.

10 [0052] The utility module 200, which is the first utility module, includes the utility part 210 including a path part which is a path of any of gas, liquid, power, and a signal, and the moving device 400 which moves the path part along the floor surface of the enclosed area 5. The utility module 300, which is the second utility module, includes the
15 utility part 310 including a mechanical part which either supplies or receives any of gas, liquid, power, and a signal, and includes the moving device 400 to move a supply or receiving part along the floor surface of the enclosed area 5.

[0053] In the connection to the main modules 100A to 100T, the utility
20 module 300 which is the second utility module is disposed closer to the enclosed area 5 in relation to the utility module 200 which is the first utility module.

[0054] As illustrated in FIGS. 2 and 6(A), the utility module 200 includes the utility part 210 including the duct 240 and the main pipe
25 241 corresponding to a path part serving as a path for any of gas, liquid, power, and a signal to the main modules 100A to 100T configured to

move along the floor surface of the enclosed area 5 while accommodating the production equipment 150, and includes an attachment concave portion 231 to which the moving device 400 which moves the utility part 210 including the duct 240 and the main pipe 241 corresponding to the path part, along the floor surface of the enclosed area 5 is attached. The duct 240, the main pipe 241, and other pipes are unitized and integrated with the utility module 200, are carried into the enclosed area 5 along with the utility module 200, and are connected to the main modules 100A to 100T. Additionally, as illustrated in FIG. 2, the duct 240, the main pipe 241 and other pipes of the utility module may be connected to a permanent utility connection pipe 600 of the module system 1.

[0055] As illustrated in FIG. 7, the utility module 300 includes the utility part 310 that is a mechanical part including an air handling unit 361, an exhaust fan 362, a production power panel 363, and an automatic control panel 364 for supplying or receiving any of gas, liquid, power, and a signal to or from the main modules 100A to 100T through the utility module 200, the main modules 100A to 100T configured to move along the floor surface of the enclosed area 5 while accommodating the production equipment 150, and includes an attachment concave portion 331 to which the moving device 400, which moves the utility part 310 that is the mechanical part including the air handling unit 361 along the floor surface of the enclosed area 5, is attached. The cable connection to the mechanical part including the production power panel 363 is performed by simple cable connections.

[0056] Additionally, the utility module 200 corresponding to the first

utility module and the utility module 300 corresponding to the second utility module may not be connectable to or separable from each other and may be permanently integrated with each other.

[0057] Further, similarly to the main modules 100A to 100T, in the utility modules 200 and 300, the moving device 400 is attachable to or detachable from the attachment concave portions 231 and 331 of the utility modules 200 and 300. Thus, the moving device 400 may not be permanently attached to the attachment concave portions 231 and 331 of the utility modules 200 and 300, and may be temporarily attached to the attachment concave portions 231 and 331 of the utility modules 200 and 300 only when the utility modules 200 and 300 are moved.

[0058] Further, in the embodiment, the shapes and sizes of the utility modules 200 and 300 correspond to the shapes and sizes of the main modules 100A to 100T so as to be transported by a high cube container of a marine container. However, the sizes and shapes of the utility modules 200 and 300 may be different sizes and shapes not necessarily corresponding to the main modules 100A to 100T.

[0059] As illustrated in FIG. 8, the clean corridor 6 connected to the corridor contact wall 101 of the main modules 100A to 100T is provided with a frame 62 having an opening portion 63 opening to the enclosed area 5 in accordance with the sizes and shapes of the corridor contact walls 101 of the main modules 100A to 100T. The opening portion 63 of the frame 62 connected to the corridor contact walls 101 of the main modules 100A to 100T is blocked by the corridor contact walls 101. The opening portion 63 of the frame 62 not connected to the corridor contact walls 101 of the main modules 100A to 100T is blocked by the

panel 64. A floor 61 of the clean corridor 6 is raised to the height of the floor panel 121 of the main modules 100A to 100T.

[0060] Hereinafter, embodiments of the present invention will be described in terms of the vertical and horizontal expansion, reduction, and modification of pharmaceutical facilities such as a space for accommodating the production equipment 150. As illustrated in FIG. 9(A), when the main modules 100A to 100E connected to each other are arranged, the utility module 300 is disconnected from the utility module 200 and is moved along the floor surface of the enclosed area 5.

[0061] Additionally, in the operation to be described below, when a space for moving the main modules 100A to 100E and the utility modules 200 and 300 in the enclosed area 5 is not sufficient, the outer wall 2 is appropriately removed so that a space for moving the main modules 100A to 100E and the utility modules 200 and 300 can be supplemented.

[0062] As illustrated in FIG. 9(B), the utility module 200 is disconnected from the main modules 100A to 100E and is moved along the floor surface of the enclosed area 5. Additionally, the utility module 200 and the utility module 300 which are not separated from each other, but are integrated with each other may be disconnected from the main modules 100A to 100E and be moved along the floor surface of the enclosed area 5.

[0063] As illustrated in FIG. 9(C), the main module 100D of the main modules 100A to 100E connected to each other is disconnected from the main module 100C and is moved along the floor surface of the enclosed area 5 so that the main modules 100D and 100E are further shifted

outward. Accordingly, a gap into which a new main module 100X illustrated in FIG. 9(D) is inserted is formed between the main modules 100C and 100D.

[0064] As illustrated in FIG. 9(D), the new main module X which is unpacked in the module unpacking room 7 is moved along the floor surface of the enclosed area 5 and is inserted between the main modules 100D and 100E so as to be connected to the main modules 100D and 100E. Further, the utility modules 200 and 300 for the new main module X are prepared. As illustrated in FIG. 9(E), the utility modules 200 are connected to the main modules 100A to 100E and 100X and the utility modules 300 are connected to the utility modules 200. Accordingly, pharmaceutical facilities such as a space for accommodating the production equipment 150 are expanded in the horizontal direction.

[0065] The height of the ceiling panel 111 of the ceiling module 110 of the main modules 100A to 100E and 100X is appropriately changed. Further, the arrangement of the side wall 103 and the partition wall 104 of the ceiling module 110 of the main modules 100A to 100E and 100X is appropriately changed. Accordingly, pharmaceutical facilities such as a space for accommodating the production equipment 150 are expanded, reduced, and modified in the vertical direction and the horizontal direction.

[0066] Meanwhile, when pharmaceutical facilities such as a space for accommodating the production equipment 150 are reduced in the horizontal direction, for example, the main module 100C is disconnected from the main modules 100B and 100D and is moved

along the floor surface of the enclosed area 5 after performing the operations illustrated in FIGS. 9(A) and 9(B). The main module 100B and the main module 100D are moved closer to each other and the main module 100B and the main module 100D are connected to each other so as to fill a gap between the main modules 100B and 100D. Accordingly, pharmaceutical facilities such as a space for accommodating the production equipment 150 are reduced in the horizontal direction.

[0067] Further, after performing the operations illustrated in FIGS. 10(A) and 10(B) which are the operations similar to FIGS. 9(A) and 9(B), as illustrated in FIG. 10(C), the main module 100C may be disconnected from the main modules 100B and 100D and be moved along the floor surface of the enclosed area 5 to, for example, the module unpacking room 7. As illustrated in FIG. 10(D), a main module 100Y with the partition wall 104 dividing the space for accommodating the production equipment 150 is inserted in a direction parallel to the long side of the main module 100Y between the main modules 100B and 100D so as to be connected to the main modules 100B and 100D replacing the main module 100C. As illustrated in FIGS. 10(E) and 10(F), the utility modules 200 and 300 are connected again. Accordingly, adding a partition of the partition wall 104 allows modification of pharmaceutical facilities such as a space for accommodating the production equipment 150 and the assignment change for pharmaceutical production, research, test, and experiment processes.

[0068] Further, as illustrated in FIG. 11(A), in a state in which the main

module 100C of FIG. 10(C) is removed from a gap between the main modules 100B and 100D, the side wall 103 is added to the long side where the main module 100C is removed in the main modules 100B and 100D and the utility modules 200 and 300 may be connected again. That is, the main modules 100A to 100T may not be arranged in close contact.

[0069] Further, as illustrated in FIG. 11(B), pharmaceutical facilities such as a space for accommodating the production equipment 150 may be formed by a space surrounded by the corridor contact wall 101, the utility module connection wall 102, and the side wall 103 of the main module 100A, the corridor contact wall 101 and the utility module connection wall 102 of the main module 100B, and the inner wall 3 of a building; or a space surrounded by the corridor contact wall 101 and the utility module connection wall 102 of the main modules 100C and 100D, the corridor contact wall 101, the utility module connection wall 102, and the side wall 103 of the main module 100E, and the inner wall 3 of the building. That is, a space for accommodating the production equipment 150 may be formed by the inner wall 3 of the building in addition to the main modules 100A to 100T.

[0070] Further, as illustrated in FIG. 11(C), the enclosed area 5 surrounded by the outer wall 2 of the building may be divided into two or more sections by the inner wall 3 of the building and in the respective sections, pharmaceutical facilities such as a space for accommodating the production equipment 150 may be formed by the main modules 100A to 100T and the like. The main modules 100A to 100T and the utility modules 200 and 300 may be moved for each of the module units

1000 in which the main modules 100A to 100T are connected to the utility modules 200 and 300.

[0071] According to the embodiment, in the main modules 100A to 100T for accommodating the production equipment 150, since the height in the vertical direction of the ceiling panel 111 can be changed in the ceiling module, and the floor module 120 which is integrated with the ceiling module 110 at a position below the ceiling module 110 and includes the floor panel 121 can accommodate the production equipment 150 in the space between the ceiling panel 111 of the ceiling module 110 and the floor panel 121, it is possible to flexibly change the height of the space for accommodating the production equipment 150. Further, since the under-floor module 130 which is integrated with the floor module 120 at a position below the floor module 120 is moved along the floor surface by the moving device 400 and the main modules 100A to 100T are connected to other main modules 100A to 100T so as to keep airtightness of the space between the ceiling panel 111 of the ceiling module 110 and the floor panel 121 of the floor module 120 of the main modules 100A to 100T connected to each other, it is possible to flexibly expand, reduce, and modify the space for accommodating the production equipment 150 in the vertical direction and the horizontal direction depending on the situation of pharmaceutical facilities to improve the flexibility of pharmaceutical facilities. In the embodiment, it is possible to flexibly expand, reduce, and modify the space for accommodating the production equipment 150 in the vertical direction and the horizontal direction depending on the situation of biopharmaceutical production to improve the flexibility of use in, for

example biopharmaceutical production.

[0072] Further, according to the embodiment, since the side wall 103 corresponding to the partition wall keeping airtightness in the boundary of the main modules 100A to 100T connected to each other is selectively disposed or not in the space between the ceiling panel 111 of the ceiling module 110 and the floor panel 121 of the floor module 120 of the main modules 100A to 100T connected to each other, it is possible to flexibly define the space for accommodating the production equipment 150 depending on the situation of pharmaceutical facilities to further improve the flexibility of pharmaceutical facilities. In the embodiment, it is possible to flexibly define the space for accommodating the production equipment 150 in accordance with the situation of biopharmaceutical production and the like to improve the flexibility of use in, for example, biopharmaceutical production.

[0073] Further, according to the embodiment, since the partition wall 104 which airtightly defines a part of the space between the ceiling panel 111 of the ceiling module 110 and the floor panel 121 of the floor module 120 of one main module such as 100E is selectively disposed or not, it is possible to finely define the space for accommodating the production equipment 150 depending on the situation of pharmaceutical facilities to further improve the flexibility of pharmaceutical facilities. In the embodiment, it is possible to finely define the space for accommodating the production equipment 150 in accordance with the situation of biopharmaceutical production and the like to improve the flexibility of use in, for example, biopharmaceutical production.

[0074] Further, according to the embodiment, in the utility modules 200

and 300 including the utility part including the main pipe, the duct 240, and the air handling unit 361 supplying or receiving any of gas, liquid, power, and a signal to or from the main modules 100A to 100T configured to move along the floor surface of the enclosed area 5 while
5 accommodating the production equipment 150, since the utility part including the main pipe, the duct 240, and the air handling unit 361 is moved along the floor surface by the moving device 400, it is possible to provide improved flexibility regarding, for example, the path supplying gas to the main modules 100A to 100T to improve the
10 flexibility of pharmaceutical facilities. In the embodiment, it is possible to improve the flexibility of use in, for example, biopharmaceutical production.

[0075] Further, since the utility modules 200 and 300 are exposed to a space such as the enclosed area 5 and are disposed in an area without
15 cleanliness control, the utility modules 200 and 300 are easily managed, repaired, and maintained. Further, regarding the connection to the main modules 100A to 100T, since the utility module 300 corresponding to the second utility module is disposed so as to be located closer to the enclosed area 5 in relation to the utility module 200 corresponding to
20 the first utility module, the utility module 300 having a mechanical part with a necessity for maintenance rather than the utility module 200 having a path part with a less frequent necessity for maintenance can be separated and moved while keeping the connection of the utility module 200 and the main modules 100A to 100T. Accordingly, the utility
25 module 300 is easily managed, repaired, and maintained.

[0076] While the embodiments of the invention have been described

above, the invention is not limited to the above-described embodiments and is implemented in various forms. For example, the main modules 100A to 100T may not be used to accommodate the production equipment 150 and can be also applied to a different application other than the production. The production equipment 150 accommodated in the main modules 100A to 100T is not limited to the application for producing biopharmaceuticals, but may be applied to the production, research, test, and experiment applications for other pharmaceuticals allowing airtightness to be kept.

[0077] Further, the main modules 100A to 100T and the utility modules 200 and 300 may be divided in, for example, the direction of the long side. For example, in the situation illustrated in FIG. 9(E), the utility module 200 which is divided into 1/5 length in the direction of the long side may be connected to the main module 100E. Further, in the situation illustrated in FIG. 9(F), the utility module 300 which is divided into 1/5 length in the direction of the long side may be connected to the utility module 200 which is divided into 1/5 length in the direction of the long side. Accordingly, even when the main modules 100A to 100T in multiples of 5 are connected to each other, the length obtained by combining the utility module connection walls 102 on the short side of the main modules 100A to 100T connected to each other may match the length obtained by combining the long sides of the utility modules 200 and 300.

[0078] Further, as illustrated in FIG. 12, for example, the module unit 1000 of the embodiment may include a main module 100 α and utility modules 200 α and 300 α which are set such that a ratio between the

short side and the long side of the rectangular shape is an integer ratio of 1:3 in plan view and a main module 100 β and utility modules 200 β and 300 β which are set such that a ratio between the short side and the long side of the rectangular shape is an integer ratio of 1:2 in plan view. For example, in the module unit 1000 of the embodiment, the short side and the long side of each of the main modules 100 α and 100 β may be connected to each other. Further, the short side of each of the main modules 100 α and 100 β may be connected to each of the short side of the utility modules 200 α , 200 β , 300 α , and 300 β .

[0079] Further, as illustrated in FIG. 13(A), the main module 100 α or 100 β may not include the side wall 103. Further, as illustrated in FIG. 13(B), the main module 100 α or 100 β may include the side walls 103 only on the long sides. Further, as illustrated in FIG. 13(C), the main module 100 α or 100 β may include the side walls 103 only on the short sides. Further, as illustrated in FIG. 13(D), the main module 100 α or 100 β may include the side walls 103 on the short sides and the long sides. Further, as illustrated in FIG. 13(E), the main module 100 α or 100 β may include the side walls 103 on the short sides and the long sides and a space defined by the side walls may be further defined by the partition wall 104.

Reference Signs List

[0080] 1: module system, 2: outer wall, 3: inner wall, 4: machine room, 5: enclosed area, 6: clean corridor, 7: module unpacking room, 8: washing room, 9: cell bank room, 10, 11: changing room, 12: toilet, 13: control room, 14: raw material storage, 15: product warehouse, 16: clean corridor, 17: pass room, 18: seed culture room, 19: weighing

room, 20: cell culture room, 21: first purification room, 22: second
 purification room, 23: filling room, 61: floor, 62: frame, 63: opening
 portion, 64: panel, 100A to 100T, 100X, 100Y: main module, 100 α ,
 100 β : main module, 101: corridor contact wall, 102: utility module
 5 connection wall, 103: side wall, 104: partition wall, 110: ceiling module,
 111: ceiling panel, 120: floor module, 121: floor panel, 130: under-floor
 module, 131: attachment concave portion, 132: drain pipe, 140: duct,
 141: branch pipe, 150: production equipment, 200: utility module, 200 α ,
 200 β : utility module, 210: utility part, 231: attachment concave
 10 portion, 240: duct, 241: main pipe, 300: utility module, 300 α , 300 β :
 utility module, 310: utility part, 331: attachment concave portion, 361:
 air handling unit, 362: exhaust fan, 363: production power panel, 364:
 automatic control panel, 400: moving device, 401: air introduction
 member, 402: air caster member, 500: connection flexible pipe, 600:
 15 utility connection pipe, 1000: module unit.

CLAIMS

1. A main module comprising:
a ceiling module which includes a ceiling panel capable of changing a height in a vertical direction;

5 a floor module which is integrated with the ceiling module at a position below the ceiling module and includes a floor panel; and

an under-floor module which is integrated with the floor module at a position below the floor module and includes a moving device movable along a floor surface,

10 wherein the main module is connected to another main module and a space between the ceiling panel of the ceiling module and the floor panel of the floor module of the main modules connected to each other is kept airtight.

2. The main module according to claim 1,

15 wherein a partition wall which keeps airtightness in a boundary of the main modules connected to each other is selectively disposed or not in the space between the ceiling panel of the ceiling module and the floor panel of the floor module of the main modules connected to each other.

20 3. The main module according to claim 1 or 2,

wherein a partition wall which airtightly defines a part of the space between the ceiling panel of the ceiling module and the floor panel of the floor module of the one main module is selectively disposed or not.

25 4. A utility module comprising:

a utility part which supplies or receives any of gas, liquid,

electric power, and a signal to or from a main module moving along a floor surface; and

a moving device which moves the utility part along the floor surface.

- 5 5. A module unit comprising:
- the main module according to any one of claims 1 to 3; and
- the utility module according to claim 4.
6. A module system comprising:
- the module unit according to claim 5 provided in an enclosed
- 10 area partitioned from the outside.