

[DESCRIPTION]

[Invention Title]

CHEMICAL FILTER REPLACEMENT DEVICE AND REPLACEMENT METHOD

5 [Technical Field]

The present invention relates to a device and a method for replacing a chemical filter, and more particularly, to a device and a method for replacing a chemical filter in which a filter configured to filtrate impurities included in a chemical is simply replaceable.

10 [Background Art]

Generally, in all companies which use hazardous chemicals, such as companies for manufacturing semiconductor, semiconductor devices, liquid crystal displays (LCD), and organic light emitting devices (OLED), pharmaceutical companies, paint companies, and the like, a variety of types of chemicals are used.

15 Also, a variety of methods of safely supplying such chemicals are provided.

Such chemicals are supplied through a chemical filter to be used in a highly pure state with minimized impurities according to properties of a manufacturing process.

20 A shape and a replacement method of the chemical filter vary according to a type thereof, and a replacement cycle thereof varies according to a type of chemical and a reference for maintaining a necessary highly pure state.

Until now, a worker has worn a safety kit such as chemical-resistant clothes, a gas mask, and the like to minimize damage caused by chemicals and has manually replaced chemical filters one by one.

However, when the chemical filter is replaced manually by the worker, chemicals and fumes may leak outward, contamination, damage, and destruction of peripheral environments including manufacturing facilities may be caused, and other people in addition to the worker may be exposed to danger while the chemical filter is being replaced.

Also, when the worker makes a mistake in manipulating a valve, an accident in that a variety of toxic chemicals accommodated in the filter leak outward may occur.

Also, since the chemical filter is replaced manually, the number of operations required for replacing the filter increases.

An apparatus for fixing a chemical filter when the chemical filter is replaced manually has been disclosed in Korean Patent Publication No. 10.-2003-0043124 (published on June 02, 2003).

[Disclosure]

[Technical Problem]

The present invention is directed to providing a device and a method for replacing a chemical filter in which chemicals are blocked from leaking outward while the chemical filter is replaced, a risk of accidents that may occur when the chemical filter is replaced is minimized, a volume of the device is implemented to be compact, and the number of operations required for replacing the chemical filter is reducible.

[Technical Solution]

One aspect of the present invention provides a chemical filter replacement device (1) including a filter assembly holding portion (300) on which a filter assembly (2) comprising a first cartridge (10-1) to be used to filtrate chemicals or a

second cartridge (10-2) which has been used to filtrate chemicals, a filter housing (20) configured to accommodate the first cartridge (10-1) or the second cartridge (10-2) and vertically coupled, and a filter head (30) is mounted and cartridge replacement means configured to separate the filter housing (20) from the filter assembly (2) while the filter assembly (2) is placed on the filter assembly holding portion (300) and to couple the separated filter housing (20) to the filter assembly (2) when the second cartridge (10-2) is separated from the filter assembly (2) and the first cartridge (10-1) is coupled to the filter assembly (2) from which the second cartridge (10-2) is separated.

10 A first loading portion (210) on which the first cartridge (10-1) to be coupled to the filter assembly (2) may be mounted and a second loading portion (220) on which the second cartridge (10-2) separated from the filter assembly (2) is mounted.

 The first loading portion (210) comprises a first cartridge mount (211) on which the first cartridge (10-1) is mounted, and wherein the second loading portion
15 (220) comprises a second cartridge mount (221) on which the second cartridge (10-2) is mounted.

 A pair of such first loading portions (210), a pair of such filter assembly holding portions (300), and a pair of such second loading portions (220) may be provided at positions spaced apart bidirectionally.

20 A door (110) may be provided in front of the first loading portions (210), and wherein the first loading portions (210), the filter assembly holding portions (300), and the second loading portions (220) are sequentially arranged at positions spaced at certain intervals apart backward from the door (110).

The first loading portions (210) and the second loading portions (220) may be provided to be located within a range where a hand of a worker reaches on the basis of the door (110).

The filter head (30) is coupled to one open end of the filter housing (20) and
5 comprises a plurality of connection portions (31 to 34) formed to allow the chemicals to flow thereinto or discharged therefrom.

The filter assembly holding portion (300) comprises a head clamp (310) configured to clamp and couple the filter housing (20) and the filter head (30).

A head flange (36) formed along a perimeter of one end of the filter head (30)
10 and a housing flange (22) formed along a perimeter of one end of the filter housing (20) may be coupled to each other while mutually facing surfaces thereof come into contact with each other, and wherein the head clamp (310) pressurizes the facing surfaces of the head flange (36) and the housing flange (22) in a direction to be pressed against each other to perform clamping.

15 The head flange (36) and the housing flange (22) have tilted-wedge-shaped surfaces opposite the mutually facing surfaces thereof, and wherein the head clamp (310) comprises coupling grooves (311a), (312b) having tilted surfaces (311b), (312b), respectively, to be pressed against the tilted surfaces of the head flange (36) and the housing flange (22).

20 The head clamp (310) comprises a first clamp (311) and a second clamp (312) which are located on perimeters of the head flange (36) and the housing flange (22) to face each other, and wherein the head clamp (310) further comprises a clamp transfer portion (320) configured to transfer the first clamp (311) and the second clamp (312) in a direction to become closer to each other or in a direction to become
25 farther away from each other.

When the first clamp (311) and the second clamp (312) are transferred in the direction to become closer to each other, the head flange (36) and the housing flange (22) become a clamped state, and wherein when the first clamp (311) and the second clamp (312) are transferred in the direction to become farther away from each other, the head flange (36) and the housing flange (22) become released from the clamped state.

A clamp locking means configured to fix a position at which the head clamp (310) may be clamped to maintain a state in which the head flange (36) and the housing flange (22) are clamped.

10 A clamp transfer portion (320) configure to transfer the first clamp (311) and second clamp (312) in a direction to become closer to each other or in a direction to become farther away from each other, and wherein the clamp locking means comprises a clamp fixing portion (340) comprising a fixing groove (324) formed in the clamp transfer portion (320) and a fixing protrusion (341) inserted into the fixing
15 groove (324) while the head flange (36) and the housing flange (22) are clamped.

The clamp transfer portion (320) may be configured to be laterally movable back and forth, and wherein the clamp fixing portion (340) may be configured to be longitudinally movable back and forth.

The head flange (36) and the housing flange (22) are clamped, the clamp
20 fixing portion (340) is moved downward and the fixing protrusion (341) is inserted into the fixing groove (324) so that the head clamp (310) is clamped and locked, and wherein when the clamp fixing portion (340) is moved upward and the fixing protrusion (341) is located outside the fixing groove (324), the head clamp (310) is released from being clamped and locked.

The cartridge replacement means comprises at least one filter housing attachment/detachment module (400) configured to separate the filter housing (20) surrounding the second cartridge (10-2) from the filter assembly (2) or to couple the filter housing (20) separated from the filter assembly (2) to surround the first
5 cartridge (10-1).

The filter housing attachment/detachment module (400) comprises a housing fixing portion (410) to which the filter housing (20) is fixed and a housing transfer portion (420) configured to vertically move the housing fixing portion (410).

The filter housing attachment/detachment module (400) further comprises a
10 housing fixing portion height adjustment portion (430) configured to adjust a height of the housing fixing portion (410) according to a height specification of the filter housing (20).

The cartridge replacement means comprises a second cartridge transfer module (500) configured to transfer the second cartridge (10-2) placed on the filter
15 assembly holding portion (300) to the second loading portion (220).

The second loading portion (220) may be provided at a position spaced toward one side apart from a back of the filter assembly holding portion (300).

The second cartridge transfer module (500) comprises a rotation portion (520) configured to be rotatable between a first position at which the filter assembly
20 holding portion (300) is located and a second position at which the second loading portion (220) is located, a second lift-transfer portion (530) configured to vertically move a second lifting portion (540) upward or downward from the first position or the second position, and a second gripper (550) provided in the second lifting portion (540) to grip the second cartridge (10-2).

A pair of such filter assembly holding portions (300) and a pair of such second loading portions (220) may be provided at positions spaced apart bidirectionally, and wherein the second cartridge transfer module (500) is provided as a single module and is configured to transfer the second cartridge (10-2) between
5 the filter assembly holding portions (300) and the second loading portions (220) which are located on both sides.

The second cartridge transfer module (500) transfers the second cartridge (10-2) from the filter assembly holding portion (300) to the second loading portion 220 and then returns to a standby position located in the middle of the second loading
10 portions (220) located on both sides.

The second cartridge transfer module (500) further comprises a second lifting portion height adjustment portion (560) configured to adjust a height of the second lifting portion (540) according to a height specification of the second cartridge (10-2).

The cartridge replacement means comprises a first cartridge transfer module
15 (600) configured to transfer the first cartridge (10-1) loaded on the first loading portion (210) to the filter assembly holding portion (300).

The first loading portion (210) and the filter assembly holding portion (300) may be provided at positions spaced in front or behind on a linear path.

The first cartridge transfer module (600) comprises a first lift-transfer portion
20 (610) configured to vertically move, upward or downward, a first lifting portion (620), a forward/backward transfer portion (630) provided below the first lifting portion (620) to move forward or backward, and a first gripper (640) provided on the forward/backward transfer portion (630) to grip the first cartridge (10-1).

The forward/backward transfer portion (630) comprises a first
25 forward/backward transfer portion (630-1) coupled to a bottom of the first lifting

portion (620) and moved forward or backward along the first lifting portion (620) and a second forward/backward transfer portion (630-2) coupled to a bottom of the first forward/backward transfer portion (630-1), moved forward or backward along the first forward/backward transfer portion (630-1), and having a bottom to which the
5 first gripper (640) is coupled.

The first cartridge transfer module (600) further comprises a first lifting portion height adjustment portion (650) configured to adjust a height of the first lifting portion (620) according to a height specification of the first cartridge (10-1).

The second loading portion (220) comprises a chemical support (230)
10 configured to accommodate chemicals dropped from the second cartridge (10-2) and to discharge the chemicals through one side when the second cartridge (10-2) is transferred or the worker opens the door (110) and manually unloads the second cartridge (10-2).

The cartridge replacement means comprises a second cartridge transfer
15 module (500-1) configured to transfer the second cartridge (10-2) placed on the filter assembly holding portion 300 to the second loading portion (220) and a first cartridge transfer module (600-1) configured to transfer the first cartridge (10-1) loaded on the first loading portion (210) to the filter assembly holding portion (300), and wherein the second cartridge transfer module (500-1) and the first cartridge
20 transfer module (600-1) are configured to be movable forward or backward and upward or downward.

A pair of loading portions (200) on which the first cartridge (10-1) and the second cartridge (10-2) are loaded and a pair of such filter assembly holding portions (300) are provided on both sides, the chemical filter replacement device comprising a
25 cartridge transfer module (600-2) configured to transfer the filter assembly (2)

between the loading portions (200) and the filter assembly holding portions (300), and wherein the cartridge transfer module (600-2) is configured to be rotatable bidirectionally and movable upward or downward to be used by the two filter assemblies (2) in common.

5 A pair of loading portions (200) on which the first cartridge (10-1) and the second cartridge (10-2) are loaded and a pair of such filter assembly holding portions (300) are provided on both sides, the chemical filter replacement device comprising a cartridge transfer module (600-3) configured to transfer the filter assembly (2) between the loading portions (200) and the filter assembly holding portions (300), and
10 wherein the cartridge transfer module (600-3) comprises a lift-transfer portion (610-3), a first linear transfer portion (620-3) configured to transfer the lift-transfer portion (610-3) in a front-rear direction between the loading portions (200) and the filter assembly holding portions (300), and a second linear transfer portion (630-3) configured to transfer the lift-transfer portion (610-3) and the first linear transfer
15 portion (620-3) in a right-left direction between the pair of loading portions (200) and the pair of filter assembly holding portions (300) which are provided on both sides.

 The filter head (30) comprises a first connection portion (31) into which chemicals flow, a second connection portion (32) through which chemicals which
20 have passed through the first cartridge (10-1) or the second cartridge (10-2) are discharged, a third connection portion (33) configured to discharge chemicals remaining in a space (S2) between the first cartridge (10-1) or the second cartridge (10-2) and an inner surface of the filter housing (20), and a fourth connection portion (34) configured to discharge chemicals remaining in an internal space (S1) of the
25 first cartridge (10-1) or the second cartridge (10-2), and wherein the filter housing

(20) comprises a fifth connection portion (23) configured to supply dry air or cleaning water to an inside of the filter housing (20).

A pair of such filter assembly holding portions (300) are provided to be spaced apart on both sides, and wherein a dry air supply line (L6), a cleaning water
5 supply line (L7), and a common vent line (L8) configured to communicate with outside air are connected to the fifth connection portion (23) of the filter assembly (2) placed on each of the pair of filter assembly holding portions (300).

A bypass line (L9) configured to selectively supply chemicals to any one of a pair of such filter assemblies (2) is connected to the pair of filter assemblies (2).

10 A pressure sensor (P) configured to measure pressure inside the filter assembly (2) after replacement with the first cartridge (10-1) is connected to the filter assembly (2).

One aspect of the present invention provides a chemical filter replacement method including a) separating a filter housing (20) from a filter assembly (2); and b)
15 coupling, when a second cartridge (10-2) which has been used to filtrate chemicals inside the filter assembly (2) is separated from the filter assembly (2) and then a first cartridge (10-1) that is a new cartridge is coupled to the filter assembly (2) from which the second cartridge (10-2) is separated, the separated filter housing (20) to the filter assembly (2).

20 In operation b), the second cartridge (10-2) is separated from the filter assembly (2) by driving of a second cartridge transfer module (500), and wherein in operation b), the first cartridge (10-1) is coupled to the filter assembly (2), from which the second cartridge (10-2) is separated, by driving of a first cartridge transfer module module (600).

In operation b), the second cartridge (10-2) separated from the filter assembly (2) is transferred from the filter assembly holding portion (300) to the second loading portion (220), and wherein in operation b), the first cartridge (10-1) is transferred from the first loading portion (210) to the filter assembly holding portion (300).

5 The second cartridge transfer module (500) transfers the second cartridge (10-2) from the filter assembly holding portion (300) to the second loading portion (220) through upward or downward and rotational movement, and wherein the first cartridge transfer module (600) transfers the first cartridge (10-1) from the first loading portion (210) to the filter assembly holding portion (300) through upward or
10 downward and forward or backward movement.

The first cartridge (10-1) is manually loaded in the first loading portion (210), and wherein the second cartridge (10-2) loaded on the second loading portion (220) is manually unloaded.

Prior to operation a), draining chemicals inside the filter assembly (2) placed
15 on the filter assembly holding portion (300) and cleaning and drying the inside of the filter assembly (2).

After operation b), removing bubbles by repetitively supplying and draining to smoothly perform normal supplying of chemicals to the inside of the filter assembly (2) placed on the filter assembly holding portion (300).

20 After the removing of the bubbles, cleaning a pipe and a bottom of a chemical filter replacement device.

[Advantageous Effects]

According to the present invention, since it is possible to prevent chemicals and fumes from leaking while a chemical filter is replaced or to prevent a chemical

leaking accident caused by a mistake of a worker, the worker and other people may be prevented from being exposed to danger.

Also, chemicals may be prevented from leaking by firmly fixing a housing and a head of a filter assembly using a clamp, and a state in which the clamp is clamped may be firmly maintained including a clamp locking means so as to prevent chemicals from leaking.

Also, since a second cartridge which has been used for filtrating chemicals is automatically replaced with a new first cartridge using a mechanical device, the number of operations required for replacing the filter may be reduced.

Also, since chemicals placed on the used second cartridge may be effectively removed by automatically cleaning and drying the second cartridge at a filter assembly holding portion and an additional space for cleaning and drying is not necessary, a structure of the device may be simplified.

Also, since a state in which a filter housing is coupled to a filter housing attachment/detachment module is maintained and only a used cartridge is collected, an operation of separating the filter housing and the cartridge may be simplified and a time for separation may be reduced.

Also, since a second cartridge transfer module configured to transfer the used second cartridge and a first cartridge transfer module configured to transfer the new first cartridge are separately provided, contact between the second cartridge and the first cartridge may be blocked so as to prevent the first cartridge from being contaminated.

Also, since the second cartridge transfer module is configured to transfer the second cartridge through lifting and rotation and the first cartridge transfer module is configured to transfer the first cartridge through lifting and forward and backward

movement, movement paths of the second cartridge transfer module and the first cartridge transfer module may be reduced and a volume of the device may be reduced so as to be miniaturized.

Also, the second cartridge transfer module is configured to be usable in
5 common when the second cartridge is transferred between the filter assembly holding portions and second loading portions which are provided on both sides as one pairs so as to further simplify the structure of the device.

Also, a first loading portion on which the first cartridge is loaded and the second loading portion on which the second cartridge is loaded may be configured to
10 be located within a range which a hand of the worker reaches on the basis of a door so as to simply load the first cartridge and simply unload the second cartridge.

Also, a cartridge replacement means may be configured to have a height adjustable according to a height specification of the filter assembly so as to perform filter replacement of a variety of sized filter assemblies.

15 Also, since chemicals may be prevented from being dropped while a cartridge is transferred, it is possible to prevent a bottom of the device from being contaminated by the chemicals.

[Description of Drawings]

FIG. 1 is a perspective view of a chemical filter replacement device according
20 to the present invention when viewed from the front;

FIG. 2 is a perspective view of the chemical filter replacement device according to the present invention when viewed from the back;

FIG. 3 is a front view of the chemical filter replacement device according to the present invention;

FIG. 4 is a plan view illustrating a structure in which a door, first loading portions, filter assembly mounting portions, and second loading portions, which are provided on both sides as one pairs, of the chemical filter replacement device according to the present invention are arranged;

5 FIG. 5 is a view illustrating a chemical filter and a pipe and a valve connected thereto according to one embodiment of the present invention;

FIG. 6 is a process piping and instrument diagram of the chemical filter replacement device according to the present invention;

FIG. 7 is a perspective view illustrating a state in which a filter assembly is
10 clamped to a clamp and the clamp is locked at a filter assembly holding portion according to the present invention;

FIG. 8 is a cross-sectional view illustrating a state in which the filter assembly is clamped to the clamp according to the present invention;

FIG. 9 is a perspective view illustrating a state in which the filter assembly is
15 clamped to a clamp and the clamp is released on the filter assembly holding portion according to the present invention;

FIG. 10 is a perspective view illustrating a state in which the clamp is released and the filter assembly is released from the clamp on the filter assembly holding portion according to the present invention;

20 FIG. 11 is a cross-sectional view illustrating a state in which the filter assembly is released from the clamp according to the present invention;

FIG. 12 is a perspective view illustrating a state in which a filter housing has been moved downward by a filter housing attachment/detachment module according to the present invention;

FIG. 13 is a perspective view illustrating a state in which the filter housing has been moved upward by the filter housing attachment/detachment module according to the present invention;

FIGS. 14A and 14B are side views illustrating a state in which a height of a housing fixing portion is adjusted according to a height specification of the filter housing according to the present invention;

FIG. 15 is a perspective view illustrating a state in which a second cartridge transfer module is at a standby position according to the present invention;

FIG. 16 is a perspective view illustrating a state in which the second cartridge transfer module is at a first position located above the filter assembly holding portion according to the present invention;

FIG. 17 is a perspective view illustrating a state in which the second cartridge transfer module has been moved downward from the first position according to the present invention;

FIG. 18 is a perspective view illustrating a state in which the second cartridge transfer module is at a second position located above the second loading portion according to the present invention;

FIG. 19 is a plan view illustrating a path in which the second cartridge transfer module circulates the standby position, the first position, and the second position according to the present invention;

FIGS. 20A and 20B are side views illustrating a state in which a height of a second lifting portion is adjusted according to a height specification of a second cartridge according to the present invention;

FIG. 21 is a perspective view illustrating a state in which the first cartridge transfer module is at a forward position located above the first loading portion according to the present invention;

FIG. 22 is a perspective view illustrating a state in which the first cartridge transfer module is at a backward position located above the filter assembly holding portion according to the present invention;

FIG. 23 is a perspective view illustrating a state in which the first cartridge transfer module has been moved downward from the backward position according to the present invention;

FIGS. 24A and 24B are side views illustrating a state in which the first cartridge transfer module adjusts a height of a first lifting portion according to a height specification of a first cartridge according to the present invention;

FIG. 25 is a view illustrating a state of a preparing operation when the chemical filter is replaced;

FIG. 26 is a view illustrating a state in which the first cartridge is loaded in the first loading portion;

FIG. 27 is a view illustrating a state in which a housing transfer portion of the filter housing attachment/detachment module has been moved upward so that the filter housing is separated from the filter assembly;

FIG. 28 is a view illustrating a state in which a rotation portion of the second cartridge transfer module has been rotated to the first position;

FIG. 29 is a view illustrating a state in which the second lifting portion of the second cartridge transfer module has been moved downward so that a second gripper grips a top of the second cartridge;

FIG. 30 is a view illustrating a state in which the second lifting portion of the second cartridge transfer module has been moved upward so that the second cartridge is moved to a top of the filter assembly;

FIG. 31 is a view illustrating a state in which the rotation portion of the
5 second cartridge transfer module has been rotated to the second position;

FIG. 32 is a view illustrating a state in which the second lifting portion of the second cartridge transfer module has been moved downward from the second position so that the second cartridge is mounted on the second loading portion;

FIG. 33 is a view illustrating a state in which the second lifting portion of the
10 second cartridge transfer module has been moved upward from the second position;

FIG 34 is a view illustrating a state in which the rotation portion of the second cartridge transfer module has been rotated to the standby position and the first lifting portion of the first cartridge transfer module has been moved downward from the forward position so that a first gripper grips a top of the first cartridge;

FIG. 35 is a view illustrating a state in which the first lifting portion of the
15 first cartridge transfer module has been moved upward so that the first cartridge is moved to a top of the first loading portion;

FIG. 36 is a view illustrating a state in which a forward/backward transfer portion of the first cartridge transfer module has been moved backward so that the
20 first cartridge is moved to the backward position;

FIG. 37 is a view illustrating a state in which the first lifting portion of the first cartridge transfer module has been moved downward from the backward position so that the first cartridge is mounted on the filter assembly holding portion;

FIG. 38 is a view illustrating a state in which the first lifting portion of the
25 first cartridge transfer module has been moved upward from the backward position;

FIG. 39 is a view illustrating a state in which the forward/backward transfer portion of the first cartridge transfer module has been transferred to the forward position;

FIG. 40 is a view illustrating a state in which the housing transfer portion of the filter housing attachment/detachment module has been moved downward so that the filter housing is coupled from the filter assembly;

FIG. 41 is a view illustrating a state in which the second cartridge is unloaded from the second loading portion;

FIG. 42 is a plan view illustrating a first modified embodiment of the chemical filter replacement device according to the present invention;

FIG. 43 is a plan view illustrating a second modified embodiment of the chemical filter replacement device according to the present invention; and

FIG. 44 is a plan view illustrating a third modified embodiment of the chemical filter replacement device according to the present invention.

**** Description of Reference Numerals ****

1: chemical filter replacement device	2: filter assembly
10-1: first cartridge	10-2: second cartridge
20: filter housing	22: housing flange
23: fifth connection portion	30: filter head
31 to 34: first to fourth connection portions	36: head flange
37: cartridge insertion portion	40: O-ring
100: body cover	110: door
200: loading portion	210: first loading portion
211: first cartridge mount	220: second loading portion
221: second cartridge mount	230: chemical support

	300: filter assembly holding portion	310: head clamp
	311: first clamp	312: second clamp
	311a, 312a: coupling groove	311b, 312b: tilted surface
	320: clamp transfer portion	324: fixing groove
5	330: filter head mount	331: head support
	332: support portion	340: clamp fixing portion
	341: fixing protrusion	400: filter housing attachment/detachment module
	410: housing fixing portion	420: housing transfer portion
	430: housing fixing portion height adjustment portion	
10	500, 550-1: second cartridge transfer module	
	510: rotation-driving portion	520: rotation portion
	530: second lift-transfer portion	540: second lifting portion
	550: second gripper	560: second lifting portion height adjustment portion
	600, 600-1: first cartridge transfer module	610: first lift-transfer portion
15	620: first lifting portion	630: forward/backward transfer portion
	630-1: first forward/backward transfer portion	
	630-2: second forward/backward transfer portion	
	640: first gripper	650: first lifting portion height adjustment portion
	600-2, 600-3: cartridge transfer module	610-3: lift-transfer portion
20	620-3: first linear transfer portion	630-3: second linear transfer portion

[Modes of the Invention]

Hereinafter, components and operations of exemplary embodiments of the present invention will be described with reference to the attached drawings.

Referring to FIGS. 1 to 3, a chemical filter replacement device 1 according to the present invention includes a body cover 100 and a door 110 provided in front of the body cover 100.

The body cover 100 has a parallelepiped shape which may include a first
5 loading portion 210 on which a first cartridge 10-1 to be used to filtrate chemicals is loaded, a second loading portion 220 on which a second cartridge 10-2 which has been used to filtrate chemicals is loaded, a filter assembly holding portion 300, and cartridge replacement means 400, 500, and 600.

The cartridge replacement means 400, 500, and 600 include a pair of filter
10 housing attachment/detachment modules 400 provided on both sides of an intermediate part in a front-rear direction of the chemical filter replacement device 1. Also, the cartridge replacement means 400, 500, and 600 may include a single second cartridge transfer module 500 provided on the intermediate part in the rear of the chemical filter replacement device 1 and a pair of first cartridge transfer modules
15 600 provided on both sides in front of the chemical filter replacement device 1.

The first loading portion 210 accommodates the first cartridge 10-1 that is a new cartridge to be used to filtrate chemicals. The first loading portion 210 may include a first cartridge mount 211 on which the first cartridge 10-1 is mounted. A worker opens the door 110 provided on a front surface of the body cover 100 and
20 loads the first cartridge 10-1 in the first loading portion 210.

The second loading portion 220 accommodates the second cartridge 10-2 that is a cartridge which has been used to filtrate chemicals. The second loading portion 220 may include a second cartridge mount 221 on which the second cartridge 10-2 is mounted.

The second cartridge 10-2 is loaded on the second loading portion 220 by the second cartridge transfer module 500, and the worker collects and unloads the second cartridge 10-2 loaded on the second loading portion 220.

Referring to FIG. 25, the second loading portion 220 may include a chemical support 230 configured to accommodate and discharge chemicals dropped from the second cartridge 10-2 through one side when the second cartridge 10-2 is transferred, or the worker opens the door 110 and manually unloads the second cartridge 10-2. The chemical support 230 may include a flat panel portion 231 surrounded by a sidewall 231a and a tilted portion 232 configured to communicate with an open portion 231b formed in one side part of the sidewall 231a and to have sidewalls 232a on both sides are formed.

A filter assembly 2 is placed on the filter assembly holding portion 300. A plurality of pipes configured to supply chemicals to a process while the filter assembly 2 is placed are connected to the filter assembly 2. The chemicals which have flowed into the filter assembly 2 through pipes pass through a cartridge inside the filter assembly 2 while impurities are filtered out and then are supplied to a process device which needs chemicals.

When a replacement cycle of the cartridge arrives and is replaced as filtration of the chemicals is performed, a filter housing 20 is separated from the filter assembly 2 placed on the filter assembly holding portion 300 using the cartridge replacement means 400, 500, and 600, and the second cartridge 10-2 is separated from the filter assembly 2. Subsequently, the first cartridge 10-1 is coupled to the filter assembly 2 from which the second cartridge 10-2 is separated and the separated filter housing 20 is coupled to the filter assembly 2.

Referring to FIG. 4, a pair of such first loading portions 210, a pair of such filter assembly holding portions 300, and a pair of such second loading portions 220 may be provided at positions spaced apart bidirectionally.

5 The first loading portions 210, the filter assembly holding portions 300, and the second loading portions 220 are sequentially arranged at positions spaced at certain intervals apart in the rear of the door 110. The first loading portions 210 and the filter assembly holding portions 300 may be provided at positions spaced apart in a front-rear direction on a linear path A1, and the second loading portions 220 may be provided at positions A2 spaced apart toward one side in the rear of the filter
10 assembly holding portion 300.

The first loading portion 210 and the second loading portion 220 may be provided to be located within a range where a hand of the worker reaches on the basis of the door 110. As one embodiment, on the basis of the door 110, the first loading portion 210 is provided at a position spaced 80 mm apart therefrom, the filter
15 assembly holding portion 300 is provided at a position spaced 280 mm apart therefrom, and the second loading portion 220 is provided at a position spaced 468 mm apart therefrom. Accordingly, the worker may stretch his or her hand and manually load the first cartridge 10-1 in the first loading portion 210 or may manually unload the second cartridge 10-2 from the second loading portion 220.

20 The filter assembly 2 and components connected thereto will be described with reference to FIGS. 5 and 6. The filter assembly 2 includes a cartridge 10 configured to filtrate foreign substances included in chemicals, the filter housing 20 configured to accommodate the cartridge 10 therein, and a filter head 30 coupled to one open side of the filter housing 20.

The filter head 30 includes a first connection portion 31 into which chemicals supplied from a chemical supply portion (not shown) flow, a second connection portion 32 configured to discharge and supply chemicals which have passed through the cartridge 10 to the operation device, a third connection portion 33 configured to
5 discharge chemicals remaining in a space S2 between the cartridge 10 and an inner surface of the filter housing 20, and a fourth connection portion 34 configured to discharge chemicals remaining in an internal space S1 of the cartridge 10.

Also, the filter head 30 includes a cartridge insertion portion 37 into which one end of the cartridge 10 is inserted and fit and a head flange 36 extending radially
10 from a head body 38 having a concentric structure with the cartridge insertion portion 37.

The filter housing 20 includes a housing body 21 having a space in which the cartridge 10 is to be accommodated in a longitudinal direction, a housing flange 22 formed on one end to be pressed against the head flange 36 on the housing body 21,
15 and a fifth connection portion 23 formed on the other end of the housing body 21 and into which nitrogen gas (N₂), which is a dry air, or cleaning water D1 flows.

The head flange 36 and the housing flange 22 have a wedge shape in which tilted surfaces 36a and 22a formed on sides opposite facing surfaces (contact surfaces), respectively.

20 An O-ring 40 configured to maintain hermeticity is provided between the facing surfaces of the head flange 36 and the housing flange 22.

A first connection pipe L1 through which chemicals are supplied is connected to the first connection portion 31, and a first valve V1 configured to regulate chemicals flowing into the filter assembly 2 is provided on the first connection pipe
25 L1.

A second connection pipe L2 configured to supply chemicals to the operation device which needs chemicals is connected to the second connection portion 32, and a second valve V2 configured to regulate a flow of the chemicals through the second connection pipe L2 is provided on the second connection pipe L2.

5 A third connection pipe L3 and a fourth connection pipe L4 which are configured to discharge chemicals are connected to the third connection portion 33 and the fourth connection portion 34, respectively. A third valve V3 and a fourth valve V4 which are configured to regulate whether chemicals are drained through respective pipes are provided on the third connection pipe L3 and the fourth
10 connection pipe L4, respectively.

A fifth connection pipe L5 into which nitrogen gas or cleaning water flows is connected to the fifth connection portion 23, and a fifth valve V5 configured to regulate a flow inside the fifth connection pipe L5 is provided. A pressure sensor P configured to measure a pressure inside the filter assembly 2 when the chemical filter
15 is replaced may be connected to the fifth connection pipe L5.

A sixth connection pipe L6 that is a dry air supply line and a seventh connection pipe L7 that is a cleaning water supply line may be connected to the fifth connection pipe L5, and valves V6, V7, V8, and V9 configured to open or close flow paths of the sixth connection pipe L6 and the seventh connection pipe L7 may be
20 provided.

The filter assembly holding portions 300 are provided in a pair spaced apart from both sides, and a common vent line L8 communicating with outside air is connected to the fifth connection pipes L5 of the filter assemblies 2: 2-1 and 2-2 placed on the pair of filter assembly holding portions 300, respectively.

A bypass line L9 configured to selectively supply chemicals to any one of the pair of filter assemblies 2 is connected to the pair of filter assemblies 2, and a valve V10 configured to regulate a flow of chemicals through the bypass line L9 is provided.

5 Tenth and eleventh connection pipes L10 and L11 and valves V11 and V12 configured to open or close flow paths thereof are provided on the third connection pipe L3. When a large amount of flow is suddenly supplied to the first connection pipe L1 having a large size after filter replacement, a space between the third valve V3 and the third connection portion 33 that is a space of a medication discharge
10 portion of a filter and a space between the second connection portion 32 and the second valve V2 may be filled with air and chemicals may be supplied with the air in normal supply, and thus a use of the tenth and eleventh connection pipes L10 and L11 is discharging air by gradually filling chemicals from a bottom through the tenth and eleventh connection pipes L10 and L11 which have a relatively small size.

15 Also, a twelfth connection pipe L12 configured to supply cleaning water to a bottom of the device when the chemical filter is replaced and a valve V13 configured to open or close a flow path thereof are provided.

Operations of the plurality of connection pipes and valves when the chemical filter is replaced will be described below.

20 The filter assembly holding portion 300 will be described with reference to FIGS. 7 to 11.

The filter assembly holding portion 300 includes a head clamp 310 configured to clamp a part where the filter housing 20 and the filter head 30 are coupled.

The head clamp 310 includes a first clamp 311 and a second clamp 312 which are located on perimeters of the head flange 36 and the housing flange 22 to face each other and includes a clamp transfer portion 320 configured to transfer the first clamp 311 and the second clamp 312 in a direction to become closer to each other or in a direction to become farther away from each other.

The first clamp 311 and the second clamp 312 are spaced apart from each other and are moved by the clamp transfer portion 320 to become closer to each other or to become farther away from each other while facing each other. Coupling grooves 311a and 312a which have tilted surfaces 311b and 312b to be pressed against the tilted surfaces 36a and 22a of the head flange 36 and the housing flange 22 are formed on insides of the first clamp 311 and the second clamp 312 which face each other.

When the first clamp 311 and the second clamp 312 are moved to become closer to each other and become states shown in FIGS. 7 and 8, the tilted surfaces 311b and 312b of the first clamp 311 and the second clamp 312 are pressurized to be pressed against the tilted surfaces 36a and 22a of the head flange 36 and the housing flange 22, respectively, so that surfaces of the head flange 36 and the housing flange 22 which face each other are pressed against each other and hermeticity thereof is maintained by the O-ring 40.

When mutually corresponding parts of the head flange 36, the housing flange 22, and the coupling grooves 311a and 312a are formed to have a wedge shape, a force of restricting the head flange 36 and the housing flange 22 in the coupling grooves 311a and 312a may be increased so as to improve hermeticity maintenance performance even when a pressure caused by chemicals acts in the filter assembly 2.

The filter assembly holding portion 300 includes a filter head mount 330 on which the filter head 30 is mounted to allow the filter housing 20 to be located above and to allow the filter head 30 to be located below. The filter head mount 330 includes a head support 331 configured to come into contact with and support one
5 side surface of the filter head 30 and a support portion 332 extending downward from a bottom surface of the head support 331 and supported by the ground.

The filter assembly holding portion 300 includes a clamp locking means configured to fix a clamped position of the head clamp 310 to maintain a state in which the head flange 36 and the housing flange 22 are clamped. As one
10 embodiment, the clamp locking means may include a clamp fixing portion 340 including a fixing groove 324 formed in the clamp transfer portion 320 and a fixing protrusion 341 inserted into the fixing groove 324 while the head flange 36 and the housing flange 22 are clamped.

The clamp transfer portion 320 may be provided to be laterally movable back
15 and forth, and the clamp fixing portion 340 may be provided to be longitudinally movable back and forth.

In a state in which the head flange 36 and the housing flange 22 are clamped as shown in FIG. 7, the clamp fixing portion 340 is moved downward and the fixing protrusion 341 is inserted into the fixing groove 324 so that the head clamp 310 is
20 clamped and locked. When the clamp fixing portion 340 is moved upward as shown in FIG. 9 and the fixing protrusion 341 is located outside the fixing groove 324, the head clamp 310 is released from being clamped and locked.

Meanwhile, when the second cartridge 10-2 is separated from the filter assembly 2, a clamped and locked state is released and the first clamp 311 and the

second clamp 312 move in a direction to become farther away from each other due to the clamp transfer portion 320 so as to become a state shown in FIGS. 10 and 11.

The clamp transfer portion 320 includes a component like a linear motion (LM) guide or cylinder as an example and may be configured so that a component
5 configured to allow the first clamp 311 to be coupled thereto and transferred and a component configured to allow the second clamp 312 to be coupled thereto and transferred are separated so that the first clamp 311 and the second clamp 312 are movable by the clamp transfer portion 320 in opposite directions.

The filter housing attachment/detachment module 400 included in the
10 cartridge replacement means will be described with reference to FIGS. 12 to 14.

The filter housing attachment/detachment module 400 separates the filter housing 20 surrounding the second cartridge 10-2 from the filter assembly 2 or couples the filter housing 20 separated from the filter assembly 2 to allow the first cartridge 10-1 to be inserted therein.

15 To this end, the filter housing attachment/detachment module 400 includes a housing fixing portion 410 to which the filter housing 20 is fixed and a housing transfer portion 420 configured to move the housing fixing portion 410 in a vertical direction.

The housing fixing portion 410 may have a structure surrounding a body of
20 the filter housing 20 at two parts such as a top and a bottom of the filter housing 20 and may fix the filter housing 20.

The housing fixing portion 410 has one side coupled to the housing transfer portion 420, and the filter housing 20 may be moved upward from a state shown in FIG. 12 to a state shown in FIG. 13 or be moved downward in reverse by driving of
25 the housing transfer portion 420.

The filter housing attachment/detachment module 400 may further include a housing fixing portion height adjustment portion 430 configured to adjust a height of the housing fixing portion 410 according to a height specification of the filter housing 20. The housing fixing portion height adjustment portion 430 includes one
5 surface coupled to the housing transfer portion 420 and another surface in which a plurality of fastening holes 431 are formed at positions vertically spaced to allow fastening means, such as bolts or the like, for fastening the housing fixing portion 410 to be fastened. Accordingly, when a height of the filter housing 20 is low as shown in FIG. 14A, the housing fixing portion 410 may be fastened to a bottom of
10 the housing fixing portion height adjustment portion 430. When a height of a filter housing 20' is high as shown in FIG. 14B, the housing fixing portion 410 may be fastened to a top of the housing fixing portion height adjustment portion 430 so as to adjust a height of the housing fixing portion 410 to be adequate.

The second cartridge transfer module 500 included in the cartridge
15 replacement means will be described with reference to FIGS. 15 to 20.

The second cartridge transfer module 500 includes a rotation-driving portion 510 as a component configured to transfer the second cartridge 10-2 placed on the filter assembly holding portion 300 to the second loading portion 220, a rotation portion 520 which receives power of the rotation-driving portion 510 and is rotatable
20 bidirectionally among first positions P1-1 and P1-2 (refer to FIGS. 16 and 17) at which the filter assembly holding portion 300 is located, second positions P2-1 and P2-2 (refer to FIG. 18) at which the second loading portion 220 is located, and a standby position P0 (refer to FIG. 15) located between the second loading portions 220 located on both sides, a second lift-transfer portion 530 configured to vertically
25 move a second lifting portion 540 upward or downward from the first positions P1-1

and P1-2 or the second positions P2-1 and P2-2, and a second gripper 550 provided on the second lifting portion 540 and configured to grip the second cartridge 10-2.

The pair of filter assembly holding portions 300 and the pair of second loading portions 220 are provided at positions spaced apart bidirectionally. The
5 second cartridge transfer module 500 is provided as a single module and is configured to transfer the second cartridge 10-2 between the filter assembly holding portions 300 and the second loading portions 220 which are located on both sides.

The second cartridge transfer module 500 transfers the second cartridge 10-2 from the filter assembly holding portion 300 to the second loading portion 220 and
10 then returns to the standby position P0 located in the middle of the second loading portions 220 located on both sides.

The second cartridge transfer module 500 may further include a second lifting portion height adjustment portion 560 configured to adjust a height of the second lifting portion 540 according to a height specification of the second cartridge 10-2.
15 The second lifting portion height adjustment portion 560 is provided between the second lift-transfer portion 530 and the second lifting portion 540. When a height of the second cartridge 10-2 is low as shown in FIG. 20A, the second lifting portion 540 may be fastened to a bottom of the second lifting portion height adjustment portion 560. When a height of a second cartridge 10-2' is low as shown in FIG.
20 20B, the second lifting portion 540 may be fastened to a top of the second lifting portion height adjustment portion 560. Accordingly, a height of the second lifting portion 540 may be adjusted to be adequate.

The first cartridge transfer module 600 included in the cartridge replacement means will be described with reference to FIGS. 21 to 24.

The pair of first cartridge transfer modules 600 are components provided on both sides and configured to transfer the first cartridge 10-1 loaded on the first loading portion 210 to the filter assembly holding portion 300 and each include a first lift-transfer portion 610 configured to vertically move, up or down, a first lifting
5 portion 620, a forward/backward transfer portion 630 provided below the first lifting portion 620 and configured to move forward or backward, and a first gripper 640 provided on the forward/backward transfer portion 630 and configured to grip the first cartridge 10-1.

The forward/backward transfer portion 630 may include a first
10 forward/backward transfer portion 630-1 coupled to a bottom of the first lifting portion 620 and moved forward or backward along the first lifting portion 620 and a second forward/backward transfer portion 630-2 coupled to a bottom of the first forward/backward transfer portion 630-1, moved forward or backward along the first forward/backward transfer portion 630-1, and having a bottom to which the first
15 gripper 640 is coupled.

When the forward/backward transfer portion 630 is provided with two stages such as the first forward/backward transfer portion 630-1 and the second forward/backward transfer portion 630-2, while the first forward/backward transfer portion 630-1 has been transferred to one end of the first lifting portion 620, the
20 second forward/backward transfer portion 630-2 is transferred to one end of the first forward/backward transfer portion 630-1 so that the first gripper 640 may be transferred forward or backward between a forward position located above the first loading portion 210 as shown in FIG. 21 and a rearward position located above the filter assembly holding portion 300 as shown in FIG. 22 even when a front-rear
25 width of the forward/backward transfer portion 630 is not formed to be large.

The first cartridge transfer module 600 may further include a first lifting portion height adjustment portion 650 configured to adjust a height of the first lifting portion 620 according to a height specification of the first cartridge 10-1. The first lifting portion height adjustment portion 650 is provided between the first lift-transfer portion 610 and the first lifting portion 620. When a height of the first cartridge 10-1 is low as shown in FIG. 24A, the first lifting portion 620 may be fastened to a bottom of the first lifting portion height adjustment portion 650. When a height of a first cartridge 10-1' is low as shown in FIG. 24B, the first lifting portion 620 may be fastened to a top of the first lifting portion height adjustment portion 650. Accordingly, a height of the first lifting portion 620 may be adjusted to be adequate.

Hereinafter, a method of replacing a chemical filter according to the present invention will be described with reference to FIGS. 6 and 25 to 41.

When the chemical filter is to be replaced while chemicals are normally supplied as shown in FIG. 25, the worker confirms product information by inputting information such as a barcode, Quick Response (QR) code, radio-frequency identification (RFID), or the like of the first cartridge 10-1 to an input medium, removes a package, and then loads the first cartridge 10-1 on the first loading portion 210 as shown in FIG. 26. Also, when a filter replacement switch (not shown) included in the filter replacement device is operated, the cartridge replacement means 400, 500, and 600 automatically perform a filter replacement operation according to a set operation process.

In this case, prior to operations of the cartridge replacement means 400, 500, and 600, bypass-supply of chemicals is performed, supplying of chemicals to the second cartridge 10-2 that is a cartridge in the filter assembly holding portion 300 to

be replaced is stopped, and cleaning and drying operations with respect to the second cartridge 10-2 are performed.

That is, a tenth valve V10 is opened and chemicals are bypass-supplied to supply the chemicals only to the filter assembly 2-2 located on the other side, and the first valve V1 and the second valve V2 which are provided on both sides of the filter assembly 2-1 are closed to stop supplying of chemicals to the filter assembly 2-1 to be replaced. Also, chemicals remaining inside the filter assembly 2-1 are drained by opening the third valve V3 and the fourth valve V4 and at the same time the dry air is supplied to an inside of the filter assembly 2-1 by opening the fifth to seventh valves V5, V6, and V7.

Also, after the dry air is supplied for a set time, the seventh valve V7 is closed to stop supplying of the dry air. While the third to sixth valves V3, V4, V5, and V6 remain in an open state, the ninth valve V9 is opened to supply cleaning water to the inside of the filter assembly 2-1 so as to drain the chemicals and cleaning water. Here, the third and fourth valves V3 and V4 are opened or closed adequately so as to thoroughly clean the inside of the filter assembly 2-1 by the cleaning water.

After the cleaning water is supplied for a set time, supplying of the cleaning water is stopped and the dry air is supplied to the inside of the filter assembly 2-1 for the set time as described above.

Subsequently, supplying of the dry air and the cleaning water is stopped by closing the sixth to ninth valves V6, V7, V8, and V9 while maintaining an open state of the third valve V3, the fourth valve V4, and the fifth valve V5, and natural drainage is performed by communicating with outside air. When the set time has passed, all of the first to ninth valves are closed and it is confirmed through the

pressure sensor P whether pressure inside the filter assembly 2-1 is adequately relieved, and then a clamped state of the head clamp 310 is released after unlocking the clamp locking means.

Also, as shown in FIG. 27, the housing transfer portion 420 of the filter housing attachment/detachment module 400 is moved upward and separates the filter housing 20 from the filter assembly 2.

Subsequently, as shown in FIG. 28, the rotation portion 520 of the second cartridge transfer module 500 is rotated from the standby position P0 to a first position P1-1 on the filter assembly holding portion 300 by rotation-driving of the rotation-driving portion 510 in one direction. As shown in FIG. 29, the second lifting portion 540 of the second cartridge transfer module 500 is moved downward and the second gripper 550 grips a top of the second cartridge 10-2.

Also, as shown in FIG. 30, the second lifting portion 540 of the second cartridge transfer module 500 is moved upward and moves the second cartridge 10-2 to a top of the filter assembly holding portion 300. Subsequently, as shown in FIG. 31, the rotation portion 520 of the second cartridge transfer module 500 is rotated from the first position P1-1 to the second position P2-1 on the second loading portion 220 by rotation-driving of the rotation-driving portion 510 in an opposite direction.

Subsequently, as shown in FIG. 32, the second lifting portion 540 of the second cartridge transfer module 500 is moved downward and mounts the second cartridge 10-2 on the second loading portion 220. After the second lifting portion 540 of the second cartridge transfer module 500 is moved upward as shown in FIG. 33, the rotation portion 520 of the second cartridge transfer module 500 is rotated from the second position P2-1 to the standby position P0 by rotation-driving of the

rotation-driving portion 510 in an opposite direction and then stands by as shown in FIG. 34.

Also, at the same time, as shown in FIG. 34, the first lifting portion 620 of the first cartridge transfer module 600 is moved downward from the forward position on the first loading portion 210 and the first gripper 640 grips the top of the first cartridge 10-1. As shown in FIG. 35, the first lifting portion 620 of the first cartridge transfer module 600 is moved upward and moves the first cartridge 10-1 to the top of the first loading portion 210.

Subsequently, the forward/backward transfer portion 630 of the first cartridge transfer module 600 is moved backward and moves the first cartridge 10-1 to a rearward position on the filter assembly holding portion 300 as shown in FIG. 36, and then the first lifting portion 620 of the first cartridge transfer module 600 is moved downward from the rearward position and mounts the first cartridge 10-1 on the filter assembly holding portion 300 as shown in FIG. 37.

Also, the first lifting portion 620 of the first cartridge transfer module 600 is moved upward from the rearward position as shown in FIG. 38, and then the forward/backward transfer portion 630 of the first cartridge transfer module 600 is moved to and stands by at the forward position as shown in FIG. 39.

Subsequently, as shown in FIG. 40, the housing transfer portion 420 of the filter housing attachment/detachment module 400 is moved downward and the filter housing 20 is coupled to the filter assembly 2 and the head clamp 310 is clamped and locked.

When the above operation is finished, a preceding operation for normally supplying chemicals to the first cartridge 10-1 that is newly replaced in the filter assembly holding portion 300 is performed.

First, the fifth, sixth, and eighth valves V5, V6, and V8 are opened and dry air is supplied to the inside of the filter assembly 2 for a set time. Subsequently, the fifth, sixth, and eighth valves V5, V6, and V8 are closed and pressure inside the filter assembly 2 is measured for a set time through a pressure sensor P so as to check
5 whether a loss of power is present.

When the loss of power is present, a coupled state of the filter assembly 2 is confirmed and a necessary maintenance-repairing operation is performed. When the loss of power is not present, the fifth valve V5, the eleventh valve V11, and the twelfth valve V12 are opened, a small amount of chemicals is supplied to the inside
10 of the filter assembly 2 for a set time to remove air in a space between the third connection portion 33 and the third valve V3 which is a medication discharge portion space of the filter and air between the second connection portion 32 and the second valve V2, and then the fifth valve V5, the eleventh valve V11, and the twelfth valve V12 are closed.

15 Subsequently, while the fifth valve V5 is opened to allow a common vent line to communicate with outside air, the first valve V1 is opened so that chemicals are normally supplied for a set time and the first valve V1 is closed and the second valve V2 is opened so that an operation of removing bubbles is performed two or four times. When the operation of removing bubbles is finished, the first valve V1 and
20 the second valve V2 are opened and the fifth valve V5 and the tenth valve V10 are closed so that chemicals are normally supplied to the filter assemblies 2-1 and 2-2 on both sides.

After the operation of removing bubbles, an operation of cleaning a pipe and a bottom of the chemical filter replacement device 1 is performed. The sixth and
25 seventh valves V6 and V7 are opened while the fifth valve V5 is closed so that dry

air is supplied to the common vent line L8 to discharge chemicals stagnant in the pipe. A thirteenth valve V13 is opened and supplies cleaning water to the bottom of the chemical filter replacement device 1 so as to clean the bottom.

When the above operation is finished, as shown in FIG. 41, the worker
5 collects and unloads the second cartridge 10-2 loaded on the second loading portion 220 so that replacement of the chemical filter is finished.

In the above-described embodiment, it has been described as an example that the first loading portion 210 and the second loading portion 220 are separately formed and the first cartridge transfer module 600 and the second cartridge transfer
10 module 500 are separately formed while the second cartridge transfer module 500 is configured to be used by the two filter assemblies 2: 2-1 and 2-2 in common in order to reduce a front-rear space. However, the present invention may have a modification as follows.

Referring to FIG. 42, in a first modified embodiment of the present invention,
15 the first loading portion 210 and the second loading portion 220 are separately formed. When a front-rear space is adequate but a left-right space is inadequate or only one filter assembly is provided, a first cartridge transfer module 600-1 and a second cartridge transfer module 500-1 are separately formed while the first cartridge transfer module 600-1 and the second cartridge transfer module 500-1 may be
20 configured to move forward or backward and upward or downward like the first cartridge transfer module 600 in the above embodiment.

As another embodiment, when a left-right space is adequate but a front-rear space is inadequate, the components of FIG. 42 may be installed while being rotated clockwise by 90 degrees.

Referring to FIG. 43, in a second modified embodiment of the present invention, a pair of loading portions 200 on which the first cartridge 10-1 to be used to filtrate chemicals and the second cartridge 10-2 which has been used for filtrating chemicals are loaded and a pair of filter assembly holding portions 300 are provided on both sides and a cartridge transfer module 600-2 configured to transfer the filter assembly 2 is provided between the loading portions 200 and the filter assembly holding portions 300. The cartridge transfer module 600-2 may be configured to be rotated and moved upward or downward bidirectionally to be used by two filter assemblies in common like the second cartridge transfer module 500 of the above embodiment.

Referring to FIG. 44, in a third modified embodiment of the present invention, a pair of loading portions 200 on which the first cartridge 10-1 to be used to filtrate chemicals and the second cartridge 10-2 which has been used for filtrating chemicals are loaded and a pair of filter assembly holding portions 300 are provided on both sides and a cartridge transfer module 600-3 configured to transfer a filter assembly is provided between the loading portions 200 and the filter assembly holding portions 300. The cartridge transfer module 600-3 includes a lift-transfer portion 610-3, a first linear transfer portion 620-3, and a second linear transfer portion 630-3.

A gripper (not shown) configured to grip a cartridge is mounted on a bottom of the lift-transfer portion 610-3 to be moved upward or downward in a direction toward the ground in FIG. 44. The first linear transfer portion 620-3 is provided to transfer the lift-transfer portion 610-3 in a front-rear direction between the loading portions 200 and the filter assembly holding portions 300. The second linear transfer portion 630-3 is provided to transfer the lift-transfer portion 610-3 and the first linear transfer portion 620-3 in a left-right direction between the pair of loading

portions 200 and the pair of filter assembly holding portions 300 which are provided on both sides.

Meanwhile, as another modified embodiment of the present invention, when the first loading portion 210 and the second loading portion 220 are singularly provided and a space is seriously inadequate, only one cartridge transfer module like the above-described first cartridge transfer module 600 may be provided while one filter assembly 2 is present and only one cartridge transfer module like the above-described second cartridge transfer module 500 may be provided while two filter assemblies 2: 2-1 and 2-2 are present. In this case, it may be configured that the second cartridge 10-2 is discharged first and then the first cartridge 10-1 is loaded.

Also, in the present specification, although it has been described as an example that the forward/backward transfer portion 630 of the first cartridge transfer module 600 includes two stages of the first and second forward/backward transfer portions 630-1 and 630-2, the forward/backward transfer portion 630 may include a single stage and be configured to be driven forward or backward.

As described above, the present invention is not limited to the above-described embodiments and it is apparent that modifications may be made by one of ordinary skill in the art without departing from the technical concept of the present invention defined by the claims and the modifications are included in the scope of the present invention.

[CLAIMS]

[Claim 1]

A chemical filter replacement device comprising:

5 a filter assembly holding portion (300) on which a filter assembly (2) comprising a first cartridge (10-1) to be used to filtrate chemicals or a second cartridge (10-2) which has been used to filtrate chemicals, a filter housing (20) configured to accommodate the first cartridge (10-1) or the second cartridge (10-2) and vertically coupled, and a filter head (30) is mounted; and

10 cartridge replacement means configured to separate the filter housing (20) from the filter assembly (2) while the filter assembly (2) is placed on the filter assembly holding portion (300) and to couple the separated filter housing (20) to the filter assembly (2) when the second cartridge (10-2) is separated from the filter assembly (2) and the first cartridge (10-1) is coupled to the filter assembly (2) from which the second cartridge (10-2) is separated.

15 [Claim 2]

The chemical filter replacement device of claim 1, further comprising a first loading portion (210) on which the first cartridge (10-1) to be coupled to the filter assembly (2) is mounted and a second loading portion (220) on which the second cartridge (10-2) separated from the filter assembly (2) is mounted.

20 [Claim 3]

The chemical filter replacement device of claim 2, wherein the first loading portion (210) comprises a first cartridge mount (211) on which the first cartridge (10-1) is mounted, and

25 wherein the second loading portion (220) comprises a second cartridge mount (221) on which the second cartridge (10-2) is mounted.

[Claim 4]

The chemical filter replacement device of claim 2, wherein a pair of such first loading portions (210), a pair of such filter assembly holding portions (300), and a pair of such second loading portions (220) are provided at positions spaced apart
5 bidirectionally.

[Claim 5]

The chemical filter replacement device of claim 4, wherein a door (110) is provided in front of the first loading portions (210), and
wherein the first loading portions (210), the filter assembly holding portions
10 (300), and the second loading portions (220) are sequentially arranged at positions spaced at certain intervals apart backward from the door (110).

[Claim 6]

The chemical filter replacement device of claim 5, wherein the first loading portions (210) and the second loading portions (220) are provided to be located
15 within a range where a hand of a worker reaches on the basis of the door (110).

[Claim 7]

The chemical filter replacement device of claim 1, wherein the filter head (30) is coupled to one open end of the filter housing (20) and comprises a plurality of connection portions (31 to 34) formed to allow the chemicals to flow thereinto or
20 discharged therefrom.

[Claim 8]

The chemical filter replacement device of claim 1, wherein the filter assembly holding portion (300) comprises a head clamp (310) configured to clamp and couple the filter housing (20) and the filter head (30).

[Claim 9]

The chemical filter replacement device of claim 8, wherein a head flange (36) formed along a perimeter of one end of the filter head (30) and a housing flange (22) formed along a perimeter of one end of the filter housing (20) are coupled to each other while mutually facing surfaces thereof come into contact with each other, and

wherein the head clamp (310) pressurizes the facing surfaces of the head flange (36) and the housing flange (22) in a direction to be pressed against each other to perform clamping.

[Claim 10]

The chemical filter replacement device of claim 9, wherein the head flange (36) and the housing flange (22) have tilted-wedge-shaped surfaces opposite the mutually facing surfaces thereof, and

wherein the head clamp (310) comprises coupling grooves (311a), (312b) having tilted surfaces (311b), (312b), respectively, to be pressed against the tilted surfaces of the head flange (36) and the housing flange (22).

[Claim 11]

The chemical filter replacement device of claim 9, wherein the head clamp (310) comprises a first clamp (311) and a second clamp (312) which are located on perimeters of the head flange (36) and the housing flange (22) to face each other, and

wherein the head clamp (310) further comprises a clamp transfer portion (320) configure to transfer the first clamp (311) and the second clamp (312) in a direction to become closer to each other or in a direction to become farther away from each other.

[Claim 12]

The chemical filter replacement device of claim 11, wherein when the first clamp (311) and the second clamp (312) are transferred in the direction to become closer to each other, the head flange (36) and the housing flange (22) become a clamped state, and

5 wherein when the first clamp (311) and the second clamp (312) are transferred in the direction to become farther away from each other, the head flange (36) and the housing flange (22) become released from the clamped state.

[Claim 13]

The chemical filter replacement device of claim 9, further comprising a
10 clamp locking means configured to fix a position at which the head clamp (310) is clamped to maintain a state in which the head flange (36) and the housing flange (22) are clamped.

[Claim 14]

The chemical filter replacement device of claim 13, further comprising a
15 clamp transfer portion (320) configure to transfer the first clamp (311) and second clamp (312) in a direction to become closer to each other or in a direction to become farther away from each other, and

 wherein the clamp locking means comprises a clamp fixing portion (340) comprising a fixing groove (324) formed in the clamp transfer portion (320) and a
20 fixing protrusion (341) inserted into the fixing groove (324) while the head flange (36) and the housing flange (22) are clamped.

[Claim 15]

The chemical filter replacement device of claim 14, wherein the clamp transfer portion (320) is configured to be laterally movable back and forth, and

wherein the clamp fixing portion (340) is configured to be longitudinally movable back and forth.

[Claim 16]

The chemical filter replacement device of claim 15, wherein while the head flange (36) and the housing flange (22) are clamped, the clamp fixing portion (340) is moved downward and the fixing protrusion (341) is inserted into the fixing groove (324) so that the head clamp (310) is clamped and locked, and

wherein when the clamp fixing portion (340) is moved upward and the fixing protrusion (341) is located outside the fixing groove (324), the head clamp (310) is released from being clamped and locked.

[Claim 17]

The chemical filter replacement device of claim 1, wherein the cartridge replacement means comprises at least one filter housing attachment/detachment module (400) configured to separate the filter housing (20) surrounding the second cartridge (10-2) from the filter assembly (2) or to couple the filter housing (20) separated from the filter assembly (2) to surround the first cartridge (10-1).

[Claim 18]

The chemical filter replacement device of claim 17, wherein the filter housing attachment/detachment module (400) comprises a housing fixing portion (410) to which the filter housing (20) is fixed and a housing transfer portion (420) configured to vertically move the housing fixing portion (410).

[Claim 19]

The chemical filter replacement device of claim 18, wherein the filter housing attachment/detachment module (400) further comprises a housing fixing portion

height adjustment portion (430) configured to adjust a height of the housing fixing portion (410) according to a height specification of the filter housing (20).

[Claim 20]

The chemical filter replacement device of claim 2, wherein the cartridge
5 replacement means comprises a second cartridge transfer module (500) configured to transfer the second cartridge (10-2) placed on the filter assembly holding portion (300) to the second loading portion (220).

[Claim 21]

The chemical filter replacement device of claim 20, wherein the second
10 loading portion (220) is provided at a position spaced toward one side apart from a back of the filter assembly holding portion (300).

[Claim 22]

The chemical filter replacement device of claim 21, wherein the second
cartridge transfer module (500) comprises a rotation portion (520) configured to be
15 rotatable between a first position at which the filter assembly holding portion (300) is located and a second position at which the second loading portion (220) is located, a second lift-transfer portion (530) configured to vertically move a second lifting portion (540) upward or downward from the first position or the second position, and
a second gripper (550) provided in the second lifting portion (540) to grip the second
20 cartridge (10-2).

[Claim 23]

The chemical filter replacement device of claim 22, wherein a pair of such
filter assembly holding portions (300) and a pair of such second loading portions
(220) are provided at positions spaced apart bidirectionally, and

wherein the second cartridge transfer module (500) is provided as a single module and is configured to transfer the second cartridge (10-2) between the filter assembly holding portions (300) and the second loading portions (220) which are located on both sides.

5 [Claim 24]

The chemical filter replacement device of claim 23, wherein the second cartridge transfer module (500) transfers the second cartridge (10-2) from the filter assembly holding portion (300) to the second loading portion 220 and then returns to a standby position located in the middle of the second loading portions (220) located
10 on both sides.

[Claim 25]

The chemical filter replacement device of claim 22, wherein the second cartridge transfer module (500) further comprises a second lifting portion height adjustment portion (560) configured to adjust a height of the second lifting portion
15 (540) according to a height specification of the second cartridge (10-2).

[Claim 26]

The chemical filter replacement device of claim 2, wherein the cartridge replacement means comprises a first cartridge transfer module (600) configured to transfer the first cartridge (10-1) loaded on the first loading portion (210) to the filter
20 assembly holding portion (300).

[Claim 27]

The chemical filter replacement device of claim 26, wherein the first loading portion (210) and the filter assembly holding portion (300) are provided at positions spaced in front or behind on a linear path.

25 [Claim 28]

The chemical filter replacement device of claim 27, wherein the first cartridge transfer module (600) comprises a first lift-transfer portion (610) configured to vertically move, upward or downward, a first lifting portion (620), a forward/backward transfer portion (630) provided below the first lifting portion
5 (620) to move forward or backward, and a first gripper (640) provided on the forward/backward transfer portion (630) to grip the first cartridge (10-1).

[Claim 29]

The chemical filter replacement device of claim 28, wherein the forward/backward transfer portion (630) comprises a first forward/backward transfer
10 portion (630-1) coupled to a bottom of the first lifting portion (620) and moved forward or backward along the first lifting portion (620) and a second forward/backward transfer portion (630-2) coupled to a bottom of the first forward/backward transfer portion (630-1), moved forward or backward along the first forward/backward transfer portion (630-1), and having a bottom to which the
15 first gripper (640) is coupled.

[Claim 30]

The chemical filter replacement device of claim 28, wherein the first cartridge transfer module (600) further comprises a first lifting portion height adjustment portion (650) configured to adjust a height of the first lifting portion
20 (620) according to a height specification of the first cartridge (10-1).

[Claim 31]

The chemical filter replacement device of claim 2, wherein the second loading portion (220) comprises a chemical support (230) configured to accommodate chemicals dropped from the second cartridge (10-2) and to discharge

the chemicals through one side when the second cartridge (10-2) is transferred or the worker opens the door (110) and manually unloads the second cartridge (10-2).

[Claim 32]

The chemical filter replacement device of claim 2, wherein the cartridge
5 replacement means comprises a second cartridge transfer module (500-1) configured to transfer the second cartridge (10-2) placed on the filter assembly holding portion 300 to the second loading portion (220) and a first cartridge transfer module (600-1) configured to transfer the first cartridge (10-1) loaded on the first loading portion (210) to the filter assembly holding portion (300), and

10 wherein the second cartridge transfer module (500-1) and the first cartridge transfer module (600-1) are configured to be movable forward or backward and upward or downward.

[Claim 33]

The chemical filter replacement device of claim 1, wherein a pair of loading
15 portions (200) on which the first cartridge (10-1) and the second cartridge (10-2) are loaded and a pair of such filter assembly holding portions (300) are provided on both sides,

the chemical filter replacement device comprising a cartridge transfer module (600-2) configured to transfer the filter assembly (2) between the loading portions
20 (200) and the filter assembly holding portions (300), and

wherein the cartridge transfer module (600-2) is configured to be rotatable bidirectionally and movable upward or downward to be used by the two filter assemblies (2) in common.

[Claim 34]

The chemical filter replacement device of claim 1, wherein a pair of loading portions (200) on which the first cartridge (10-1) and the second cartridge (10-2) are loaded and a pair of such filter assembly holding portions (300) are provided on both sides,

5 the chemical filter replacement device comprising a cartridge transfer module (600-3) configured to transfer the filter assembly (2) between the loading portions (200) and the filter assembly holding portions (300), and

 wherein the cartridge transfer module (600-3) comprises a lift-transfer portion (610-3), a first linear transfer portion (620-3) configured to transfer the lift-transfer
10 portion (610-3) in a front-rear direction between the loading portions (200) and the filter assembly holding portions (300), and a second linear transfer portion (630-3) configured to transfer the lift-transfer portion (610-3) and the first linear transfer portion (620-3) in a right-left direction between the pair of loading portions (200) and the pair of filter assembly holding portions (300) which are provided on both
15 sides.

[Claim 35]

 The chemical filter replacement device of claim 1, wherein the filter head (30) comprises a first connection portion (31) into which chemicals flow, a second connection portion (32) through which chemicals which have passed through the first
20 cartridge (10-1) or the second cartridge (10-2) are discharged, a third connection portion (33) configured to discharge chemicals remaining in a space (S2) between the first cartridge (10-1) or the second cartridge (10-2) and an inner surface of the filter housing (20), and a fourth connection portion (34) configured to discharge chemicals remaining in an internal space (S1) of the first cartridge (10-1) or the
25 second cartridge (10-2), and

wherein the filter housing (20) comprises a fifth connection portion (23) configured to supply dry air or cleaning water to an inside of the filter housing (20).

[Claim 36]

The chemical filter replacement device of claim 35, wherein a pair of such
5 filter assembly holding portions (300) are provided to be spaced apart on both sides,
and

wherein a dry air supply line (L6), a cleaning water supply line (L7), and a
common vent line (L8) configured to communicate with outside air are connected to
the fifth connection portion (23) of the filter assembly (2) placed on each of the pair
10 of filter assembly holding portions (300).

[Claim 37]

The chemical filter replacement device of claim 35, wherein a bypass line
(L9) configured to selectively supply chemicals to any one of a pair of such filter
assemblies (2) is connected to the pair of filter assemblies (2).

15 [Claim 38]

The chemical filter replacement device of claim 1, wherein a pressure sensor
(P) configured to measure pressure inside the filter assembly (2) after replacement
with the first cartridge (10-1) is connected to the filter assembly (2).

[Claim 39]

20 A chemical filter replacement method comprising:

a) separating a filter housing (20) from a filter assembly (2); and

b) coupling, when a second cartridge (10-2) which has been used to filtrate
chemicals inside the filter assembly (2) is separated from the filter assembly (2) and
then a first cartridge (10-1) that is a new cartridge is coupled to the filter assembly

(2) from which the second cartridge (10-2) is separated, the separated filter housing (20) to the filter assembly (2).

[Claim 40]

The chemical filter replacement method of claim 39, wherein in operation b),
5 the second cartridge (10-2) is separated from the filter assembly (2) by driving of a second cartridge transfer module (500), and

wherein in operation b), the first cartridge (10-1) is coupled to the filter assembly (2), from which the second cartridge (10-2) is separated, by driving of a first cartridge transfer module module (600).

10 [Claim 41]

The chemical filter replacement method of claim 39, wherein in operation b), the second cartridge (10-2) separated from the filter assembly (2) is transferred from the filter assembly holding portion (300) to the second loading portion (220), and

15 wherein in operation b), the first cartridge (10-1) is transferred from the first loading portion (210) to the filter assembly holding portion (300).

[Claim 42]

The chemical filter replacement method of claim 40, wherein the second cartridge transfer module (500) transfers the second cartridge (10-2) from the filter assembly holding portion (300) to the second loading portion (220) through upward
20 or downward and rotational movement, and

wherein the first cartridge transfer module (600) transfers the first cartridge (10-1) from the first loading portion (210) to the filter assembly holding portion (300) through upward or downward and forward or backward movement.

[Claim 43]

The chemical filter replacement method of claim 41, wherein the first cartridge (10-1) is manually loaded in the first loading portion (210), and

wherein the second cartridge (10-2) loaded on the second loading portion (220) is manually unloaded.

5 [Claim 44]

The chemical filter replacement method of claim 39, further comprising, prior to operation a), draining chemicals inside the filter assembly (2) placed on the filter assembly holding portion (300) and cleaning and drying the inside of the filter assembly (2).

10 [Claim 45]

The chemical filter replacement method of claim 39, further comprising, after operation b), removing bubbles by repetitively supplying and draining to smoothly perform normal supplying of chemicals to the inside of the filter assembly (2) placed on the filter assembly holding portion (300).

15 [Claim 46]

The chemical filter replacement method of claim 45, further comprising, after the removing of the bubbles, cleaning a pipe and a bottom of a chemical filter replacement device.